University of Valencia

Department of Personality, Evaluation and Psychological Treatment

HEALTH PSYCHOLOGY, Ph.D.

Health in informal caregivers of people with Autism Spectrum Disorder: intervention effects

Salud en cuidadores informales de personas con Trastorno del Espectro Autista: efectos de la intervención

Dissertation

Presented by:

Nicolás Ruiz Robledillo

Promoter:

Dr. Luis Moya Albiol

Valencia, 2015

Acknowledgements/Agradecimientos

Gracias…

A mi director de tesis, el profesor Luis Moya Albiol. Gracias por creer en mí, siempre he sentido tu confianza incondicional hacía lo que hacía y podía llegar a ser, tu entusiasmo y tus palabras me han servido siempre de motivación. Gracias por todo.

A mis padres, por darme todo lo que tengo y ayudarme a ser todo lo que soy, aunque unas simples palabras no son suficientes para agradecerlo, intento demostrarlo con hechos día a día. Gracias por vuestro apoyo y confianza en mí, gracias por escucharme y transmitirme tanto, aunque haya sido en la distancia, siempre os he sentido muy cerca.

A mi hermano, por enseñarme tanto desde tan pequeño, por ser mi confidente y mi mentor en los quehaceres de la vida.

A Cristian, por estar siempre ahí, en los buenos y en los malos momentos. Tu apoyo ha sido siempre una inyección de moral necesaria. A mi primo Juan, por sus consejos y su sabiduría. A Nuria, por tener siempre unas palabras de cariño y aguantarme, aunque en la distancia, en los malos momentos. A Paula, por su confianza incondicional, gracias por creer siempre en mí.

A mis compañeros y amigos, Ángel, Patricia y Sara. Gracias por haber sido fieles testigos del desarrollo de esta tesis, por vuestras palabras de ánimo siempre que lo he necesitado y por el cariño y apoyo que me habeis brindado.

Al profesor Ricardo Canal, por enseñarme la esencia del autismo desde los ojos de un gran profesional. A mis compañeras y amigas de Salamanca; Blanca, Isi, Sara, Maite, Almu y María, por acogerme de forma incondicional y por aportarme vuestra alegría y profesionalidad en el trabajo con el autismo.

A la profesora Bárbara Figueiredo y a todo su equipo, por brindarme la oportunidad de integrarme en su unidad de investigación y apoyarme en todo momento.

Y por supuesto, a los cuidadores de las asociaciones APNAV y ASPALI, por colaborar con entusiasmo y dedicación en cada uno de nuestros proyectos. A pesar de los impedimentos, siempre han tenido una sonrisa y palabras de agradecimiento y confianza para mí. Gracias a ellos hoy en día creo mucho más en lo que hago. En especial a Amparo Fabra, por abrirnos las puertas de APNAV y mostrar en todo momento un gran interés por colaborar con nosotros.

Abbreviations

ANS=Autonomic Nervous System

AS=Asperger Syndrome

ASD=Autism Spectrum Disorder

AUCg=Area Under the Curve with respect to ground

AUCi=Area Under the Curve with respect to increase

CAR=Cortisol Awakening Response

CBT= Cognitive-Behavioral Therapy

Csal=Salivary cortisol

DSM-5=Diagnostic and Statistical Manual of Mental Disorders-5

DSM-IV=Diagnostic and Statistical Manual of Mental Disorders-IV

EDA=Electrodermal Activity

EI=Emotional Intelligence

HFA=High-Functioning Autism

HPA=Hypothalamic-Pituitary-Adrenal axis

MBP=Mindfulness-Based Program

BPT=Behavioral Parent Training

MCT=Multi-Component Treatment

Abreviaturas

AAF=Autismo de Alto Funcionamiento

AED=Actividad Electrodérmica

CAR=Respuesta Matutina de Cortisol (en sus siglas en inglés)

Eje HHA=Eje Hipotálamo-Hipofiso-Adrenal

IE=Inteligencia Emocional

SA=Síndrome de Asperger

SNA=Sistema Nervioso Autónomo

TEA=Trastorno del Espectro Autista

Table of contents

Acknowledgements

Abbreviations

Chapter 1

Introduction

The prevalence of autism spectrum disorder (ASD), characterized by difficulties in socialization, communication and restricted and repetitive interests and behaviors (American Psychiatric Association, 2013), has increased dramatically in recent decades (Elsabbagh et al., 2012). The symptomatology of the disorder and associated behavioral problems are generally associated with some level of disability. This makes it necessary for individuals with ASD to have caregivers to look after them (Ruiz-Robledillo and Moya-Albiol, 2012). Due to the early manifestation of the symptoms of ASD, the caring role is usually assumed by members of the close family, in the majority of cases, the parents (Davis and Carter, 2008; Hastings, 2003; Rivard, Terroux, Parent-Boursier and Mercier, 2014; Ruiz-Robledillo, Antón-Torres, González-Bono and Moya-Albiol, 2012; Schieve, Blumberg, Rice, Visser and Boyle, 2007). Caring for offspring with ASD entails coping with a range of challenges associated, directly or indirectly, with the caring role (Ruiz-Robledillo et al., 2012). This puts caregivers under chronic stress, which could have severe negative consequences for their health (De Andrés-García, Moya-Albiol and González-Bono, 2012; Lovell, Moss and Wetherell, 2012a; Ruiz-Robledillo et al., 2012). Indeed, compared with the general population, informal caregivers of people with ASD have been found to have more somatic symptoms, depression and anxiety and poorer quality of life (Allik, Larsson and Smedje, 2006; De Andrés-García et al., 2012; Ruiz-Robledillo et al., 2012; Singer and Floyd, 2006).

Chronic stress exposure has classically been related to serious negative health outcomes in several populations, including individuals with burnout or post-traumatic stress disorder, victims of intimate partner violence, and informal caregivers (Blasco-Ros, Sánchez-Lorente and Martínez, M., 2010; De Andrés-García et al., 2012; Mingote, Moreno and Gálvez, 2004; Sánchez-Lorente, Blasco-Ros and Martínez, 2012; Schnurr and Jankowski, 1999). The biological mechanisms involved in this health deterioration are believed to be alterations in the functioning of various physiological systems, two of the most important being the hypothalamic pituitary adrenal (HPA) axis and the autonomic nervous system (ANS) (Juster, McEwen and Lupien, 2010).

The functioning of the HPA axis has mostly been studied by measuring levels of cortisol, a hormone closely related to the stress response and responsible for various biological changes characteristic of this response (Dedovic, Duchesne, Andrews, Engert and Pruessner, 2009; Hellhammer, Wüst and Kudielka, 2009). Cortisol is a glucocorticoid secreted by suprarenal glands with a specific circadian rhythm of secretion, levels peaking at around 30 minutes after awakening (Clow, Hucklebridge, Stalder, Evans and Thorn, 2010). This rapid increase, called the cortisol awakening response (CAR), has shown to be one of the most reliable markers of the functioning of the HPA axis (Chida and Steptoe, 2009). The purpose of this adaptive response is understood to be to produce physiological changes to prepare the individual for coping with the challenges of the coming day, maintaining body homeostasis (Fries, Dettenborn and Kirschbaum, 2009).

Analysis of CAR has found it to be influenced by several demographic, physiologic and lifestyle factors, such as age, gender, phase of the menstrual cycle, and smoking, as well as some psychological and psychosocial factors (Chida and Steptoe, 2009; Fries et al., 2009). Further, CAR has been used in previous research as a reliable marker of health status in several populations, including people under high levels of chronic stress (Chida and Steptoe, 2009; Fries et al., 2009). In informal caregivers, results concerning the CAR have been mixed. Some studies have found higher CAR (Wahbeh, Kishiyama, Zajdel and Oken, 2008), while other studies found lower CAR (Bella, García and Spadari-Bratfisch, 2011; Seltzer et al., 2010) or no differences between caregivers and non-caregivers (Lovell et al., 2012a). These discrepancies could be due to factors not analyzed in these studies, including differences in the diagnoses of care recipients, other contextual factors or psychological traits of caregivers. In the case of caregivers of people with ASD, one study found a lower CAR in caregivers (Seltzer et al., 2010) and another no significant differences between caregivers and non-caregivers (Lovell et al., 2012a). However, these studies considered the full autism spectrum and did not consider autism severity of the care recipient.

The other main system involved in the stress response is ANS. The markers of its functioning in the context of stress are mainly electrodermal activity (EDA), as a measure of skin conductance response, and cardiovascular indicators. The evaluation of these markers has shown to be useful for understanding the alteration of the functioning of the ANS in chronically stressed populations (Boucsein, 2012; Thayer, Ahs, Fredrikson, Sollers, and Wager, 2012). In informal caregivers, a few studies have evaluated the functioning of the ANS in laboratory settings or in natural situations

(Gallagher and Whiteley, 2012; Gonçalves and Graça, 2011; González-Bono, De Andrés-García, Romero-Martínez and Moya-Albiol, 2013; Soares, 2009). In particular, caregivers of people with cancer were found to have a higher electrodermal response to acute stress than non-caregivers (Gonçalves and Graça, 2011), while no differences were found in caregivers of people with drug addiction (Soares, 2009). It is plausible that, as has been found in other biological markers of health, these inconsistent results are related to differences in the diagnosis of care recipient. In any case, no previous studies have been conducted analyzing electrodermal response to laboratory-induced acute stress in samples of caregivers of people with ASD.

Protective and risk factors for health

Previous research has shown severe health deterioration in informal caregivers of people with ASD, and the majority of studies have identified risk factors. In this regard, psychosocial variables and factors related to the care recipient are the most widely studied factors (Boyd, 2002; Davis and Carter, 2008; Lai and Oei, 2014; Lecavalier, Leone and Wiltz, 2006). Maladaptive coping and lower levels of social support have classically been associated with poorer health outcomes in this population (Boyd, 2002; Lai and Oei, 2014; Lovell, Moss and Wetherell, 2012b), while in relation to the care recipient, high severity of autistic symptomatology and a high frequency of behavioral problems have been directly associated with negative effects on the health status of caregivers (Huang et al., 2014; Lecavalier et al., 2006; Lovell, Moss and Wetherell, 2015; Ruiz-Robledillo et al., 2012). In contrast, there is a lack of studies analyzing protective variables. Specifically, although previous studies have evaluated psychological traits as protective factors against health deterioration in other samples, no previous studies have analyzed these types of variables in informal caregivers of people with ASD. Furthermore, no previous studies have employed biological markers in the evaluation of this type of factors and other contextual dimensions.

Recent research points to the importance of resilience for health protection in chronically stressed populations (Rutten et al., 2013). Although there is no consensus on its definition, resilience is related to coping effectively with stress without negative consequences, and to obtaining positive outcomes from stressful situations (Bayat, 2007). This ability has been associated with positive views of stress, successful adaptation to such situations, and protective effects against health deterioration in informal caregivers (Bayat, 2007; Fernández-Lansac and Crespo, 2011). A recent study found a positive association between resilience and adaptive psychological functioning in informal caregivers of people with dementia (Fernández-Lansac, Crespo, Cáceres and Rodríguez-Poyo, 2012). In informal caregivers of people with ASD, high resilience has been shown to provide caregivers with effective coping skills for managing stressful situations, and in turn, suffering less negative health outcomes (Bekhet, Johnson, & Zauszniewski, 2012). However, no previous studies have evaluated the effects of resilience on health status in this population employing both self-reported and biological markers of health.

Another potential protective factor of health is emotional intelligence (EI). Taking into account the high levels of negative affect that are characteristic of caregivers of people with ASD and the positive association between this type of affect and negative health consequences, it seems important to assess EI in this population (De Andrés-García et al., 2012; Singer and Floyd, 2006). EI is generally defined as the ability to identify and manage negative emotional states, and being able to enhance positive ones (Salovey, Mayer, Goldman, Turvey, & Palfai, 1995). It can be described in terms of three factors: attention, the tendency to pay attention to and think about emotions and feelings; clarity, the ability to understand one’s own emotional states; and repair, the ability to regulate one’s feelings, terminating negative emotions and/or prolonging positive ones (Fernández-Berrocal, Extremera and Ramos, 2004). Although EI has shown to be protective against health deterioration in several samples (Schutte, Malouff, Thorsteinsson, Bhullar, & Rooke, 2007), not all of the components of EI seem to have the same relationship with health outcomes. In particular, attention has been associated with poorer health, in contrast to clarity and repair, which have been related to positive health outcomes (Ciarrochi, Deane & Anderson, 2002; Extremera and Fernández-Berrocal, 2006; Extremera and Fernández-Berrocal, 2002). No previous studies have evaluated the role of EI in the care context, despite it being a variable that is closely related to emotional regulation and could be involved in the reduction of negative affect.

Regarding contextual variables, institutional support provided for both caregivers and care recipients has shown to be protective of health in caregivers of people with schizophrenia (González-Bono et al., 2013; González-Bono, De Andrés-García and Moya-Albiol, 2012). In these studies, caregivers without institutional support exhibited a blunted CAR and lower heart rate (HR) response to laboratory-induced stress compared to the responses in those with support. Moreover, care recipients of caregivers with institutional support exhibited high levels of autonomy and lower severity symptoms (González-Bono et al., 2013; Gónzalez-Bono et al., 2012). However, no attempt has been made to replicate these findings in samples of informal caregivers of people with ASD.

Psychotherapeutic interventions with informal caregivers

Even though health deterioration has been widely demonstrated in caregivers of people with ASD, few studies have analyzed the effects of psychotherapeutic interventions focused on improving health status in this population. Some studies have evaluated the indirect effects on caregiver status of interventions addressing the management of behavioral problems and autistic symptoms of care recipients. Such interventions have been found to have positive effects, reducing stress levels, in the majority of the cases (Drew et al., 2002; Salt et al., 2002; Smith, Groen and Wynn, 2000; Tonge et al., 2006). However, there has been relatively little research into the effects of interventions focused on teaching caregivers stress management skills and improving their health status. A meta-analysis of studies on group interventions in informal caregivers of people with developmental disabilities indicated that interventions based on cognitive-behavioral training reduced perceived stress and psychological dysfunction (Singer, Ethridge and Aldana, 2007). However, these studies did not consider intervention programs developed or adapted for a specific care context and did not evaluate more than one health variable.

Regarding new therapeutic approaches, such as mindfulness therapy, several studies have also reported good results family caregivers of people with ASD (Ferraioli and Harris, 2013; Singh et al., 2007; Singh et al., 2006). Specifically, one study demonstrated a positive effect on stress levels after a mindfulness intervention oriented to teaching four parents mindful skills for interacting with their children (Singh et al., 2007). A recent study has also shown positive results in the implementation of a mindfulness-based stress reduction program in this population, with reductions in stress, depression and anxiety (Dykens, Fisher, Taylor, Lambert and Miodrag, 2014). However, no biological markers of health were employed in any of these studies.

The main objectives and hypotheses of this Ph.D. work are summarized below:

1. To characterize the health status of a sample of family caregivers of people with Asperger Syndrome (AS)[1] *through self-reported health measures and cortisol awakening response (CAR) in comparison with a non-caregiver group. The secondary objective was to identify variables related to care recipients and to psychosocial and psychological traits of caregivers that were predictors of health status in caregivers.* It was hypothesized that parents of people with AS would take more medication and have poorer self-reported health than those in the control group (Allik et al., 2006). In addition, it was expected that they would have a lower CAR than controls (Bella et al., 2011; Gonzalez-Bono et al., 2011), although as noted above the results to date on this subject are inconclusive (Lovell et al., 2012a; Wahbeh et al., 2008). It was also expected that lower levels of social support, a greater use of maladaptive coping, and higher levels of negative affect and burden would be associated with poorer health in caregivers (Hastings et al., 2005; Khanna et al., 2011). Finally, it was hypothesized that caregivers with higher levels of resilience and EI would show fewer symptoms.

2. To investigate the association between resilience and health markers (both self-reported health and CAR) in family caregivers of people with ASD. The secondary objective was to identify possible associations between resilience, health and social support in this population. It was expected that highly resilient caregivers would have better perceived general health and lower morning cortisol levels (Cicchetti & Rogosch, 2007; Fernández-Lansac et al., 2012). Although no previous studies have analyzed the mediating role of social support in the association between resilience and health, it was hypothesized that social support would mediate this association.

3. To investigate the association between components of EI (attention, clarity and repair) and health markers (both self-reported health and CAR) in family caregivers of people with ASD. The secondary objective was to assess whether CAR was a mediator between EI and self-reported health. Overall, self-reported health was expected to be associated negatively with attention and positively with clarity and repair (Ciarrochi et al., 2002; Extremera & Fernandez-Berrocal, 2006). Though there were no previous data on this in caregivers, it was hypothesized that an altered HPA axis response would

---

[1] Note that this research was designed and the care recipients involved were diagnosed before the publication of the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders [DSM-5], but most if not all would probably be assigned a diagnosis of ASD under the new DSM criteria.

mediate the relationship between EI and caregivers' health, as suggested in a previous study conducted with students (Mikolajczak, Roy, Luminet, Fillée and Timary, 2007).

4. To contrast health complaints in groups of caregivers of people with high-functioning autism (HFA)[2] *who were and were not receiving institutional support, and a non-caregiver group, evaluating both self-reported health and CAR. The secondary objective was to explore variables that could modulate the effectiveness of institutional support in protecting the health of caregivers, considering burden and factors related to the functional status of the care recipient, such as dependence and autistic symptomatology.* It was hypothesized that non-supported caregivers would present more somatic symptoms and an altered CAR when compared to supported caregivers and non-caregivers (Allik et al., 2006; Tonge et al., 2006). Further, non-supported caregivers were expected to show higher levels of burden than supported caregivers (Salt et al., 2002). In addition, care recipients of non-supported caregivers were expected to show more severe autistic symptoms and higher levels of dependency than the offspring of supported caregivers. Finally, it was hypothesized that higher functional status and less severe symptoms in care recipients and lower levels of caregiver burden would be associated with higher CAR in caregivers (Seltzer et al., 2010).

5. To compare the stress response to a laboratory cognitive stressor in informal caregivers of people with ASD and non-caregivers through the analysis of EDA. The secondary objectives were to compare self-reported health and negative affect between caregivers and non-caregivers, and to analyze the association between electrodermal response, self-reported health and psychological responses to stress. Despite the lack of conclusive evidence from previous studies in caregivers, caregivers were expected to have lower electrodermal and higher psychological responses than non-caregivers, due to the high levels of negative affect in the former (Miquel, Fuentes, García-Merita and Rojo, 1999; Naveteur, Buisine and Gruzelier, 2005; Patrick 2008). In the light of previous research, it was expected that higher scores in anxiety, anger, and negative mood state responses would be related to lower EDA in both groups (Carrillo et al. 2001). Further, taking into account the previous research in this field, rates of somatic

---

[2] As pointed out in relation to objective 1, this research was designed and the care recipients involved were diagnosed before the publication of the DSM-5, but most if not all would probably be assigned a diagnosis of ASD under the new criteria.

symptoms were expected to be higher in participants with higher electrodermal response (Papousek, Schulter and Premsberger, 2002).

6. To analyze the effects of a mindfulness-based program (MBP) on mood state and health complaints through the use of self-reported measures and biological markers of stress, namely, afternoon cortisol levels and cortisol awakening response (CAR), in a sample of parents of individuals with ASD (caregivers) and parents of typically developing children (non-caregivers). The secondary objective was to analyze the efficacy of the program for improving health and negative mood in each group, comparing its impact on caregivers and non-caregivers. It was hypothesized that both caregivers and non-caregivers would show better mood (less anxiety, negative mood, and feelings of anger) (Lykins and Baer 2009), as well as lower afternoon cortisol levels (Lengacher et al. 2012), after each session of MBP. In addition, it was hypothesized that the health status of caregivers and non-caregivers would improve after the intervention program, together with some degree of normalization in morning cortisol levels (Bränström, Kvillemo and Akerstedt, 2013). Finally, it was hypothesized that these improvements in health and mood state would be more pronounced in caregivers than non-caregivers after the program, because caregivers are a chronically stressed population, and the MBP program is primarily focused on stress management. This hypothesis is in line with the results of previous research in which this type of program has been used with caregivers (Lengacher et al. 2012; Minor, Carlson, Mackenzie, Zernicke and Jones, 2006).

7. To assess the effectiveness of a CBT program in reducing burden, somatic symptoms and depression, and improving mood state in informal caregivers of people with ASD. It was hypothesized that caregivers would report a lower level of burden immediately after the intervention and would have fewer somatic and depressive symptoms after the intervention and at 1-month of follow-up (Bristol, Gallagher and Holt, 1993; Hastings and Beck, 2008; Salt et al., 2002). Furthermore, there was expected to be a significant reduction in negative mood states over the course of the whole intervention program.

References

Allik, H., Larsson, J.O., & Smedje, H. (2006). Health-related quality of life in parents of school-age children with Asperger syndrome or high-functioning autism. *Health and quality of life outcomes, 4* (1), 1-8.

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Washington, DC.

Bayat, M. (2007). Evidence of resilience in families of children with autism. *Journal of Intellectual Disability Research, 51* (9), 702-714.

Bekhet, A.K., Johnson, N.L., & Zauszniewski, J.A. (2012). Resilience in family members of persons with autism spectrum disorder: A review of the literature. *Issues in mental health nursing, 33* (10), 650-656.

Bella, G.P., Garcia, M.C., & Spadari-Bratfisch, R.C. (2011). Salivary cortisol, stress, and health in primary caregivers (mothers) of children with cerebral palsy. *Psychoneuroendocrinology, 36* (6), 834-842.

Blasco-Ros, C., Sánchez-Lorente, S., & Martinez, M. (2010). Recovery from depressive symptoms, state anxiety and post-traumatic stress disorder in women exposed to physical and psychological, but not to psychological intimate partner violence alone: a longitudinal study. *BMC psychiatry, 10* (1), 98.

Boucsein, W. (2012). Electrodermal activity. Springer.

Boyd, B.A. (2002). Examining the relationship between stress and lack of social support in mothers of children with autism. *Focus on Autism and Other Developmental Disabilities, 17* (4), 208-215.

Bränström, R., Kvillemo, P., & Akerstedt, T. (2013). Effects of mindfulness training on levels of cortisol in cancer patients. *Psychosomatics, 54* (2), 158–164.

Bristol, M.M., Gallagher, J.J. & Holt, K.D. (1993). Maternal depressive symptoms in autism: Response to psychoeducational intervention. *Rehabilitation Psychology, 38* (1), 3–10.

Carrillo, E., Moya-Albiol, L., González-Bono, E., Salvador, A., Ricarte, J., & Gómez-Amor, J. (2001). Gender differences in cardiovascular and electrodermal responses to public speaking task: the role of anxiety and mood states. *International Journal of Psychophysiology, 42* (3), 253–264.

Chida, Y., & Steptoe, A. (2009). Cortisol awakening response and psychosocial factors: a systematic review and meta-analysis. *Biological psychology, 80* (3), 265-278.

Ciarrochi, J., Deane, F. P., & Anderson, S. (2002). Emotional intelligence moderates the relationship between stress and mental health. *Personality and individual differences, 32* (2), 197-209.

Cicchetti, D., & Rogosch, F. A. (2007). Personality, adrenal steroid hormones, and resilience in maltreated children: A multilevel perspective. *Development and Psychopathology, 19* (3), 787–809.

Clow, A., Hucklebridge, F., Stalder, T., Evans, P., & Thorn, L. (2010). The cortisol awakening response: more than a measure of HPA axis function. Neuroscience & Biobehavioral Reviews, 35 (1), 97-103.

Davis, N.O., & Carter, A.S. (2008). Parenting stress in mothers and fathers of toddlers with autism spectrum disorders: Associations with child characteristics. *Journal of Autism and Developmental Disorders, 38* (7), 1278-1291.

De Andrés-García, S., Moya-Albiol, L., & González-Bono, E. (2012). Salivary cortisol and immunoglobulin A: responses to stress as predictors of health complaints reported by caregivers of offspring with autistic spectrum disorder. *Hormones and Behavior, 62* (4), 464-474.

Dedovic, K., Duchesne, A., Andrews, J., Engert, V., & Pruessner, J. C. (2009). The brain and the stress axis: the neural correlates of cortisol regulation in response to stress. *Neuroimage, 47* (3), 864-871.

Drew, A., Baird, G., Baron-Cohen, S., Cox, A., Slonims, V., Wheelwright, S., ... & Charman, T. (2002). A pilot randomised control trial of a parent training intervention for pre-school children with autism. *European Child & Adolescent Psychiatry, 11* (6), 266-272.

Dykens, E.M., Fisher, M.H., Taylor, J.L., Lambert, W., & Miodrag, N. (2014). Reducing distress in mothers of children with autism and other disabilities: a randomized trial. *Pediatrics, 134* (2), 454-463.

Elsabbagh, M., Divan, G., Koh, Y.J., Kim, Y.S., Kauchali, S., Marcín, C., ... & Fombonne, E. (2012). Global prevalence of autism and other pervasive developmental disorders. *Autism Research, 5* (3), 160-179.

Extremera, N., & Fernandez-Berrocal, P. (2002). Relation of perceived emotional intelligence and health-related quality of life of middle-aged women. *Psychological Reports, 91* (1), 47-59.

Extremera, N., & Fernández-Berrocal, P. (2006). Emotional intelligence as predictor of mental, social, and physical health in university students. *The Spanish Journal of Psychology, 9* (1), 45-51.

Fernández-Berrocal, P., Extremera, N., & Ramos, N. (2004). Validity and reliability of the Spanish modified version of the Trait Meta-Mood Scale. *Psychological Reports, 94* (3), 751-755.

Fernández-Lansac, V., & Crespo, M. (2011). Resiliencia, Personalidad Resistente y Crecimiento en Cuidadores de Personas con Demencia en el Entorno Familiar: Una Revisión. *Clínica y Salud, 22* (1), 21-40.

Fernández-Lansac, V., Crespo López, M., Cáceres, R., & Rodríguez-Poyo, M. (2012). Resiliencia en cuidadores de personas con demencia: estudio preliminar. *Revista Española de Geriatría y Gerontología, 47* (3), 102-109.

Ferraioli, S.J., & Harris, S.L. (2013). Comparative effects of mindfulness and skills-based parent training programs for parents of children with autism: Feasibility and preliminary outcome data. *Mindfulness, 4* (2), 89-101.

Fries, E., Dettenborn, L., & Kirschbaum, C. (2009). The cortisol awakening response (CAR): facts and future directions. *International Journal of Psychophysiology, 72* (1), 67-73.

Gallagher, S., & Whiteley, J. (2012). Social support is associated with blood pressure responses in parents caring for children with developmental disabilities. *Research in developmental disabilities, 33* (6), 2099-2105.

Gonçalves, T., & Graça, M. (2011). Variables fisiológicas y sobrecarga familiar en hijos de enfermos oncológicos. *Revista Argentina de Clínica Psicológica, 20* (3), 255–263.

González-Bono, E., De Andrés-García, S., & Moya-Albiol, L. (2011). The cortisol awakening response in caregivers of schizophrenic offspring shows sensitivity to patient status. *Anxiety, Stress, & Coping, 24* (1), 107-120.

González-Bono, E., de Andrés-García, S., Romero-Martínez, Á., & Moya-Albiol, L. (2013). Cardiovascular Response to Psychosocial Repeated Stress in Caregivers of Offspring with Schizophrenia. *The Spanish journal of Psychology, 16.*

Hastings, R.P. (2003). Child behaviour problems and partner mental health as correlates of stress in mothers and fathers of children with autism. *Journal of Intellectual Disability Research, 47* (4-5), 231-237.

Hastings, R.P., Kovshoff, H., Brown, T., Ward, N.J., Degli Espinosa, F., & Remington, B. (2005). Coping strategies in mothers and fathers of preschool and school-age children with autism. *Autism, 9* (4), 377-391.

Hastings, R., & Beck, A. (2008). Practitioner Review: Stress intervention for parents of children with intellectual disabilities. *Journal of Child Psychology and Psychiatry, 45* (8), 1338-1349.

Hellhammer, D.H., Wüst, S., & Kudielka, B.M. (2009). Salivary cortisol as a biomarker in stress research. *Psychoneuroendocrinology, 34* (2), 163-171.

Huang, C.Y., Yen, H.C., Tseng, M.H., Tung, L.C., Chen, Y.D., & Chen, K.L. (2014). Impacts of Autistic Behaviors, Emotional and Behavioral Problems on Parenting Stress in Caregivers of Children with Autism. *Journal of Autism and Developmental Disorders, 44* (6), 1383-1390.

Juster, R.P., McEwen, B.S., & Lupien, S.J. (2010). Allostatic load biomarkers of chronic stress and impact on health and cognition. *Neuroscience & Biobehavioral Reviews, 35* (1), 2-16.

Khanna, R., Madhavan, S.S., Smith, M. J., Patrick, J.H., Tworek, C., & Becker-Cottrill, B. (2011). Assessment of health-related quality of life among primary caregivers of children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 41* (9), 1214-1227.

Lai, W.W., & Oei, T.P.S. (2014). Coping in Parents and Caregivers of Children with Autism Spectrum Disorders (ASD): a Review. *Review Journal of Autism and Developmental Disorders*, 1-18.

Lecavalier, L., Leone, S., & Wiltz, J. (2006). The impact of behaviour problems on caregiver stress in young people with autism spectrum disorders. *Journal of Intellectual Disability Research, 50* (3), 172-183.

Lengacher, C.A., Kip, K.E., Barta, M., Post-White, J., Jacobsen, P.B., Groer, M., ... & Shelton, M.M. (2012). A pilot study evaluating the effect of mindfulness-based stress reduction on psychological status, physical status, salivary cortisol, and interleukin-6 among advanced-stage cancer patients and their caregivers. *Journal of Holistic Nursing, 30* (3), 170-185.

Lovell, B., Moss, M., & Wetherell, M. (2012a). The psychosocial, endocrine and immune consequences of caring for a child with autism or ADHD. *Psychoneuroendocrinology, 37* (4), 534-542.

Lovell, B., Moss, M., & Wetherell, M. (2012b).With a little help from my friends: Psyhological, endocrine and health corollaries of social support in parental caregivers of children with autism or ADHD. *Research in Developmental Disabilities, 33* (2), 682-687.

Lovell, B., Moss, M., & Wetherell, M. (2015). The psychophysiological and health corollaries of child problem behaviours in caregivers of children with autism and ADHD. *Journal of Intellectual Disability Research, 59* (2), 150-157.

Lykins, E.L.B., & Baer, R.A. (2009). Psychological functioning in a sample of long-term practitioners of mindfulness meditation. *Journal of Cognitive Psychotherapy, 23* (3), 226–241.

Mikolajczak, M., Roy, E., Luminet, O., Fillée, C., & de Timary, P. (2007). The moderating impact of emotional intelligence on free cortisol responses to stress. *Psychoneuroendocrinology, 32* (8), 1000-1012.

Mingote, J., Moreno, B., & Gálvez, M. (2004). Desgaste profesional y salud de los profesionales médicos: revisión y propuestas de prevención. *Medicina clínica, 123* (7), 265-270.

Minor, H.G., Carlson, L.E., Mackenzie, M.J., Zernicke, K., & Jones, L. (2006). Evaluation of a mindfulness-based stress reduction (MBSR) program for caregivers of children with chronic conditions. *Social Work in Health Care, 43* (1), 91-109.

Miquel, M., Fuentes, I., García-Merita, M., & Rojo, L. (1999). Habituation and sensitization processes in depressive disorders. *Psychopathology, 32* (1), 35–42.

Naveteur, J., Buisine, S., & Gruzelier, J. H. (2005). The influence of anxiety on electrodermal responses to distractors. *International Journal of Psychophysiology, 56* (3), 261–269.

Papousek, I., Schulter, G., & Premsberger, E. (2002). Dissociated autonomic regulation during stress and physical complaints. *Journal of Psychosomatic Research, 52* (4), 257–266.

Patrick, C.J. (2008). Psychophysiological correlates of aggression and violence: An integrative review. *Transactions of the Royal Society B, 363* (1503), 2543–2555.

Rivard, M., Terroux, A., Parent-Boursier, C., & Mercier, C. (2014). Determinants of Stress in parents of children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 44* (7), 1609-1620.

Ruiz-Robledillo, N., & Moya-Albiol, L. (2012). El cuidado informal: una visión actual. *Revista de Motivación y Emoción, 1,* 22-30.

Ruiz-Robledillo, N., Antón-Torres, P., González-Bono, E. & Moya-Albiol, L. (2012). Consecuencias del cuidado de personas con Trastorno del Espectro Autista sobre la salud de los cuidadores: estado actual de la cuestión. *Revista electrónica de Psicología Iztacala, 15* (4), 1571-1590.

Rutten, B.P.F., Hammels, C., Geschwind, N., Menne-Lothmann, C., Pishva, E., Schruers, K.,... & Wichers, M. (2013). Resilience in mental health: linking psychological and neurobiological perspectives. *Acta Psychiatrica Scandinavica, 128* (1), 3-20.

Salovey, P., Mayer, J.D., Goldman, S.L., Turvey, C., & Palfai, T.P. (1995). Emotional attention, clarity, and repair: Exploring emotional intelligence using the Trait

Meta-Mood Scale. In J. W. Pennebaker (Ed.), Emotion, Disclosure, & Health. Washington: American Psychological Association. Pp. 125-151.

Salt, J., Shemilt, J., Sellars, V., Boyd, S., Coulson, T., & Mc Cool, S. (2002). The Scottish Centre for autism preschool treatment programme II: the results of a controlled treatment outcome study. *Autism, 6* (1), 33-46.

Sánchez-Lorente, S., Blasco-Ros, C., & Martínez, M. (2012). Factors that contribute or impede the physical health recovery of women exposed to intimate partner violence: a longitudinal study. *Women's Health Issues, 22* (5), e491-e500.

Schieve, L.A., Blumberg, S.J., Rice, C., Visser, S.N., & Boyle, C. (2007). The relationship between autism and parenting stress. *Pediatrics, 119* (Supplement 1), S114-S121.

Schnurr, P.P., & Jankowski, M.K. (1999). Physical health and post-traumatic stress disorder: review and synthesis. *Seminars in Clinical Neuropsychiatry 4* (4), 295-304.

Schutte, N.S., Malouff, J.M., Thorsteinsson, E.B., Bhullar, N., & Rooke, S.E. (2007). A meta-analytic investigation of the relationship between emotional intelligence and health. *Personality and Individual Differences, 42* (6), 921-933.

Seltzer, M.M., Greenberg, J.S., Hong, J., Smith, L.E., Almeida, D.M., Coe, C., & Stawski, R.S. (2010). Maternal cortisol levels and behavior problems in adolescents and adults with ASD. *Journal of Autism and Developmental Disorders, 40* (4), 457-469.

Singer, G.H., & Floyd, F. (2006). Meta-analysis of comparative studies of depression in mothers of children with and without developmental disabilities. *American Journal on Mental Retardation, 111* (3), 155-169.

Singer, G.H., Ethridge, B.L., & Aldana, S.I. (2007). Primary and secondary effects of parenting and stress management interventions for parents of children with developmental disabilities: A meta-analysis. *Mental Retardation and Developmental Disabilities Research Reviews, 13* (4), 357-369.

Singh, N.N., Lancioni, G.E., Winton, A.S., Fisher, B.C., Wahler, R.G., Mcaleavey, K., ... & Sabaawi, M. (2006). Mindful parenting decreases aggression, noncompliance, and self-injury in children with autism. *Journal of Emotional and Behavioral Disorders, 14* (3), 169-177.

Singh, N.N., Lancioni, G.E., Winton, A.S., Singh, J., Curtis, W.J., Wahler, R.G., & McAleavey, K.M. (2007). Mindful parenting decreases aggression and increases social behavior in children with developmental disabilities. *Behavior Modification, 31* (6), 749-771.

Smith, T., Groen, A.D., & Wynn, J.W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. *American Journal on Mental Retardation, 105* (4), 269-285.

Soares, A.J. (2009). Variáveis Psicossociais e Reactividade Emocional em Cuidadores de Dependentes de Substâncias. Unpublished doctoral dissertation. University of Minho, Minho, Portugal.

Thayer, J.F., Åhs, F., Fredrikson, M., Sollers III, J.J., & Wager, T.D. (2012). A meta-analysis of heart rate variability and neuroimaging studies: implications for heart rate variability as a marker of stress and health. *Neuroscience and Biobehavioral Reviews, 36* (2), 747-756.

Tonge, B., Brereton, A., Kiomall, M., Mackinnon, A., King, N., & Rinehart, N. (2006). Effects on parental mental health of an education and skills training program for parents of young children with autism: A randomized controlled trial. *Journal of the American Academy of Child and Adolescent Psychiatry, 45* (5), 561-569.

Wahbeh, H., Kishiyama, S.S., Zajdel, D., & Oken, B.S. (2008). Salivary cortisol awakening response in mild Alzheimer disease, caregivers, and noncaregivers. *Alzheimer Disease & Associated Disorders, 22* (2), 181-183.

Chapter 2

Study 1: Self-reported health and cortisol awakening response in parents of people with asperger syndrome: The role of trait anger and anxiety, coping and burden

Published in: Ruiz-Robledillo, N[1]., & Moya-Albiol, L[1]. (2013). Self-reported health and cortisol awakening response in parents of people with asperger syndrome: The role of trait anger and anxiety, coping and burden. *Psychology and Health, 28* (11), 1246-1264.

[1] Department of Psychobiology, University of Valencia

Introduction

Asperger syndrome (AS) is a diagnosis included among the autistic spectrum disorders (ASDs) characterized by difficulties in communication, social interaction problems, repetitive patterns of behavior and restricted interests (APA, 2000). Caring for offspring with a developmental disability, like AS, puts parents under considerable stress for a long period of time. This situation as the primary caregivers produces serious consequences for their health. Indeed, caregivers of people with AS have been reported to have poorer physical and emotional states, more bodily pain, less vitality and poorer self-perceived general health and social functioning than the general population (Allik, Larsson, & Smedje, 2006; Khanna et al., 2011). Caregivers have also been found to suffer higher levels of anxiety and depression that frequently reach clinical levels (Barker et al., 2011). Further, the impact of the diagnosis on the health of caregivers is greater in women, who have more clinical symptoms immediately after the diagnosis of their child and one year later (Taylor & Warren, 2012).

Nevertheless, few studies have used biological markers of health, such as cortisol awakening response (CAR), to analyze the health of family caregivers of people with ASD, most studies having focused on classic autism and not AS. CAR is an indicator of the activity of the hypothalamic–pituitary–adrenal (HPA) axis, which is the main endocrine system involved in stress response (Fries, Dettenborn, & Kirschbaum, 2009). It is characterized by increased levels of cortisol from waking to approximately 30 min later. It has been proposed that an increase of at least 2.5 nmol/l is a normal rise (Wust, Federenko, Hellhammer, & Kirschbaum, 2000). This response may be altered in individuals undergoing chronic stress, such as those with a diagnosis of post-traumatic stress disorder, burnout or informal caregivers (de Vught et al., 2005; Moya-Albiol, Serrano, & Salvador, 2010; Wessa, Rohleder, Kirschbaum, & Flor, 2006). In relation to this, although results remain inconsistent, abnormalities in this response could indicate involvement of the HPA axis that results in adverse health outcomes for the individuals affected.

To the best of our knowledge, no studies have analyzed CAR in caregivers of people with AS. On the other hand, this marker has been studied in caregivers of people with classic autism or the broader spectrum. In one study, the authors analyzed the CAR and proinflammatory biomarkers, interleukin-6 (IL-6) and C-reactive protein (CRP) in a sample of caregivers of people with autism. It was found that CRP levels were indeed abnormal in individuals affected by the chronic stressor, with elevated concentrations in caregivers compared to controls, but CAR did not differ between the groups (Lovell, Moss, & Wetherell, 2012). On the other hand, similar research conducted with parents of people with ASD produced different results. In this case, cortisol levels in caregivers were found to be lower than in the comparison group and morning cortisol levels were related to the behavioral problems of care recipients (Seltzer et al., 2010). In line with this, the results obtained in previous studies with other samples of caregivers are also mixed. For example, a lower CAR has been found in caregivers of people with a diagnosis of schizophrenia (Gónzalez-Bono, De Andres-García, & Moya-Albiol, 2011) or cerebral palsy (Bella, García, & Spadari-Bratfisch, 2011). In contrast, caregivers of people with dementia have been found to have higher CAR than controls (de Vught et al., 2005; Wahbeh et al., 2008).

The health complaints of family caregivers may be influenced by several factors that buffer the consequences of care on their quality of life. Behavioral problems associated with the disorder seem to be one of the best predictors of burden and health complaints in caregivers (Lecavalier, Leone, & Volker, 2006). In addition, the effects of caring on the health of caregivers may be influenced by several psychosocial variables, notably, coping and social support. Specifically, active and problem-focused coping strategies were shown to have a dampening effect on the negative consequences of caring; whereas the use of avoidant and emotion-focused coping strategies is associated with poorer health in caregivers (Hastings et al., 2005; Higgins, Bailey, & Pearce, 2005). Adaptive coping also increases the positive effects of a care situation, such as resilience or hardiness (Smith, Seltzer, Tager-Flusberg, Greenberg, & Carter, 2008). The results concerning social support are, however, less consistent. Some researchers have observed that higher levels of social support were linked to lower levels of stress in caregivers (Renty & Roeyers, 2007), but others did not detect any relationship between social support and stress (Manning, Wainwright, & Bennett, 2011).

A few studies have examined the role of emotional variables, such as negative affect or emotional intelligence, on the health and well-being of family caregivers of people with AS (Benson & Karlof, 2009; Smith, Seltzer, & Greenberg, 2011; Smith et al., 2010; Totsika, Hastings, Emerson, Lancaster, & Berridge, 2011). They show that caregivers suffer more burden, anxiety and depressive symptoms than the general population (Totsika et al., 2011), and more often experience negative emotional states, such as anger (Benson & Karlof, 2009). Classically, this kind of negative emotion, which could be categorized within the spectrum of negative affect, was linked with greater levels of stress and poorer health in university employees, students and the general population (Watson, 1988; Watson & Pennebaker, 1989). So far, however, these variables have not been analyzed as potential risk factors in the development of increased burden and poorer health in caregivers of people with ASD.

The main aim of this study was to examine the health status (self-reported health and CAR) in a group of family caregivers of people with AS in comparison with anon-caregiver control group. Given that previous research has mostly considered caregivers of people with autism or ASD, we considered it important to perform a study focusing specifically on caregivers of people with AS, as the characteristics and peculiarities of this disorder may mean that it has different implications for health to classic autism or the broader spectrum. We used several different measures of health, including self-reported somatic symptoms, medication consumption and CAR. In addition, the study aimed to identify which variables (including characteristics of the care recipient, burden, negative affect, coping, social support, emotional intelligence and resilience) modulate the effects of care on caregiver health. It was hypothesized that parents of people with AS would take more medication and have poorer self-reported health than the control group (Allik et al., 2006). In addition, we expected to find lower CAR compared to controls (Bella, Garcia, & Spadari-Bratfisch, 2011; Gonzalez-Bono, De Andrés-García, & Moya-Albiol, 2011), although as noted above the results to date on this subject are inconclusive (Lovell et al., 2012; Wahbeh et al., 2008). We also supposed that lower levels of social support, a greater use of maladaptive coping and higher levels of negative affect and burden would be associated with worse health in caregivers (Hastings et al., 2005; Khanna et al., 2011). Finally, we hypothesized that caregivers with lower levels of resilience and emotional intelligence would show more symptoms.

Method

Participants and procedure

The sample was composed of 107 participants: 53 parents of relatives with a diagnosis of AS (33 females and 20 males) and 54 parents of age-matched typically developing children (32 females and 22 males). The control group was selected considering the socio-demographic characteristics of the caregivers. The ages of the offsprings with AS ranged from 7 to 29 years (M= 15, SD = 3.98).

Caregivers were mainly recruited from members of an association of relatives of people with AS in the region of Valencia (ASPALI). Patients of the association were diagnosed with AS by clinical staff following the DSM-IV-R criteria. Firstly, a meeting was held with caregivers to explain the aim of the research and the criteria for participation, namely being both a first-degree relative and the main caregiver of an individual with AS. Secondly, an interview was scheduled for relatives who were selected and wished to participate in the study. A similar meeting and interviews were held for candidates for the control group. The criteria for participating as a control did not take care of any ill relatives over the previous two years, and having no offspring with ASDs or any other chronic health problems.

In these interviews, researchers collected general information and administered a battery of questionnaires for evaluating health and psychological traits. In addition, they gave instructions on collecting saliva at home (providing eight Salivettes) for the measurement of the salivary cortisol (Csal). Then, a further meeting was scheduled to collect the saliva samples. In the case of caregivers of people with AS only, a second interview was conducted to collect data on the socio-demographic characteristics and status of the care recipient.

Variables and measurement instruments

Self-reported health and burden

For medication use, participants were asked to list all their medications, including the type of medication consumed, categorized as: anxiolytic; antidepressant; both anxiolytic and antidepressant; and other types.

Self-reported health was assessed using the Somatic Symptom Scale (ESS-Sandin & Chorot, 1995). This instrument is composed of 96 items referring to the condition of diverse symptoms grouped in nine subscales: immunological, respiratory, cardiovascular, neurosensory, gastrointestinal, dermatological, genital-urinary, muscular and reproductive female system. A global index of symptoms can be calculated from the sum of all the subscales. Reliability coefficients ranged from .79 to .84.

Caregiver burden was assessed by the Zarit caregiver burden scale (Zarit, Reever, & Bach-Peterson, 1980). This scale touches on specific aspects of the caregiver’s life and perceptions of physical and psychological health, as well as economic and social issues. The most frequently used version was administered, namely, the 22-item version with responses rated on a five-point Likert scale – from ‘never’ to ‘nearly always’. The total score of this scale is the sum of the scores of all the items and enables respondents to be classified according to their degree of burden. The reliability coefficient is .92.

Cortisol awakening response (CAR)

Saliva for assessing Csal was collected using a Salivette (Sarstedt, Rommersdolf, Germany). The samples were frozen at -20 °C until analysis by radioimmunoassay using Coat-to-Count C kits (DPC, Siemens Medical Solutions Diagnostics). Samples were measured in duplicate and all those from the same participant were included in the same assay. For reproducibility, the coefficient of variation between duplicates was required to be 68%. Assay sensitivity was, 5 ng/dl. The intra and inter-assay coefficients of variation were 2.8 and 5.3%, respectively. All values are expressed in nmol/l. The CAR was calculated as the average salivary cortisol level over two consecutive days at waking and 30, 45 and 60 min later. In addition, participants were asked to take note of the time of saliva collection, their level of energy, their expectations about the day and other variables such as consumption of stimulants or alcohol the day before, any smoking the day before and the number of hours of sleep they had. The participants were instructed to abstain from eating, drinking stimulants (such as tea, coffee or alcohol), brushing their teeth or smoking between waking up and taking the last of the saliva samples. Subjects who consumed antipsychotics or any other drug or substance that could alter the levels of cortisol were excluded. In the analysis, we controlled for other potential confounders that could affect cortisol levels, such as age, body max index (BMI), sex, phase of the menstrual cycle, medication consumption, use of cigarettes, source of income or stressful life events.

Stressful life events

Incidence of stressful life events was assessed by the EAE-G (the Spanish ‘Escala General de Apreciación al Estrés’, Fernández-Seara, 1992). This scale evaluates the incidence of any stressful events that have taken place throughout the life of each subject, considering four themes: health, relationships, lifestyle and work and financial issues.

Psychosocial variables (coping and social support)

Coping was evaluated by the Coping Orientations to Problems Experienced (COPE, Carver, Scheier, & Weintraub, 1989) scale, a self-report questionnaire with 15 subscales describing different coping strategies (seeking social support, religion, humor, alcohol drug use, planning and active coping, abandonment of coping efforts, focus on and venting of emotions, acceptance, denial, restraint coping, concentrated efforts to solve the situation, personal growth, positive reinterpretation, disengagement activities and escape). For this study, six coping styles were calculated following the guidelines of the Spanish version of Crespo and Cruzado (1997): behavioural-oriented problem coping; cognitive-oriented problem coping; behavioral escape; cognitive escape; emotional coping; and substance use. For all subscales, the reliability coefficients are above .75.

Social support was measured with the Medical Outcomes Study Social Support Survey (MOS-SSS, Sherbourne & Stewart, 1991). The survey is a 20-item scale with five response categories (1 – never; 5 – always) for each item. It has one question to measure structural support (number of close friends and relatives) and four other subscales: emotional/informational support; affection; tangible support; and positive interaction .For all subscales, the reliability coefficients are above .91.

Negative affect (anxiety trait, depression and anger)

Trait anxiety was evaluated using the Spanish version of the State-Trait Anxiety Inventory (STAI, Spielberger, Gorusch, Lushene, Vagg, & Jacobs, 1983). This inventory is composed of 20 items and responses ranked on a four-point Likert scale. Individual differences in anxiety proneness are assessed in terms of how often feelings of anxiety are experienced. The reliability coefficient of this instrument is .86.

Depression symptomatology was evaluated using the Beck Depression Inventory (BDI: Beck and Steer, 1993). This questionnaire consists of 21 self-report items that refer to emotional, cognitive and somatic aspects of depression mood. Each item response is ranked on a four-point Likert scale that evaluates the intensity and severity of the symptom. This instrument has a reliability coefficient of .83.

Anger was assessed using the Spanish version of the State-Trait Anger Expression Inventory (STAXI)-II (Miguel-Tobal, Casado, Cano-Vindel, & Spielberger, 2001). Both trait anger and anger expression were assessed. The questionnaire is composed of 49items distributed into six subscales: two for trait anger (temperament and angry reaction with 20 as a maximum score) and four for the expression of anger (expression-in, expression-out, control-in, and control-out, all with a maximum score of 24). A general index of anger expression (IAE) may be calculated from the latter four scales. Responses on all scales are ranked using a four-point Likert scale from 0 (almost never) to 3 (almost always). The reliability coefficients ranged from .65 to .86.

Emotional intelligence and resilience

Emotional intelligence was assessed using the shortened Spanish version of the Trait Meta-Mood Scale (Fernández-Berrocal, Extremera, & Ramos, 2004). Responses to the24 items are rated on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The scale has three subscales: attention to feelings, referring to awareness of one's mood; clarity of feelings, the perceived ability to discriminate between moods; and mood repair, the perceived ability to regulate one's emotional states. Scores on each subscale range from 5 to 40 points as a maximum. The reliability coefficients of all the scores are above .85.

Brief Resilient Coping Scale (BRCS, Sinclair & Wallston, 2004) was used to analyze the level of resilience in participants. The instrument is composed of four items with a five-point Likert scale designed to evaluate the ability of the individual to cope with stress in an adaptive manner. The reliability coefficient of this instrument is .69.

Dependency level, functional status and degree of autistic symptomatology of care recipient

A Spanish version of the Barthel Index (Baztán, Pérez del Molino, Alarcón, & San Cristóbal, 1993) was used to evaluate care recipient dependence. This instrument measures10 items of disability based on daily activities (personal hygiene, bathing, feeding, getting on and off the toilet, ascending and descending stairs, dressing, controlling bowel and bladder). Higher scores on the Barthel Index indicate less dependency.

The overall activity of the care recipient was evaluated using the Global Assessment Scale (Endicott, Spitzer, Fleiss, & Cohen, 1976) with a reliability coefficient of .91.The scale provides a single score ranging from 1 (severity of symptoms and risk of suicide attempt) to 100 (lack of symptoms).

The degree of autism of the care recipient was also assessed with the Autism Quotient (AQ) created by Baron-Cohen, Hoekstra, Knickmeyer, and Wheelwright (2006). This questionnaire is composed of 50 items rated on a four-point Likert scale from A (completely agree) to D (completely disagree), and has a reliability coefficient higher than .76. A higher score indicates a higher degree of autism with a maximum of 50. Authors proposed this instrument as a screening of severity of autistic symptoms, not as a diagnosis tool.

Statistical analysis

For the analysis of the frequencies of the socio-demographic characteristics and medication consumption, chi-square statistics were used, it having previously been found (using the Kolmogorov–Smirnov statistic $p<.001$) that the frequencies were normally distributed. With ‘group’ and ‘sex’ as between-subject factors in both cases, univariate ANOVAs were performed for anthropometric variables (age and BMI) and univariate ANCOVA with appropriate covariates for psychological variables (anxiety trait, anger trait, depressive symptoms and resilience). For subscales of psychosocial variables (coping styles and social support); emotional intelligence and self-reported health (somatic symptoms), MANCOVA was performed, again with ‘group’ and ‘sex’ as between-subjects factors and appropriate covariates. For burden and characteristics of the care recipient (dependency level, autistic symptomatology and global activity), one way ANOVAs were used with ‘sex’ only as a between-subject factor for caregivers. Lastly, for Csal, ANCOVA was performed for repeated measurements of ‘time’ (0´, 30´, 45´ and 60´) with ‘group’ and ‘sex’ as between-subject factors and appropriate covariates. The Greenhouse-Geisser correction for degrees of freedom and Bonferroni correction for multiple contrasts were used. Post hoc analyses were carried out using T-tests (in the case of a significant group effect).

The area under the curve (AUC) for Csal was estimated with the widely used trapezoidal rule (Pruessner, Kirschbaum, Meinlschmid, & Hellhamer, 2003a; Stalder, Evans, Hucklebridge, & Clow, 2010) and taking as a reference the initial levels of cortisol upon waking. A hierarchical regression model (stepwise method) was employed to determine the factors predicting self-reported health (total somatic symptoms) and CAR for the whole sample and for the group of caregivers.

All statistical analyses were performed using SPSS 17.0, considering as significant any $p<.05$, while a probability lower than .07 was considered to indicate a trend to significance (marginal effect). The values of the descriptive are expressed as mean and standard deviation (M, SD, respectively).

Results

Sample characterisation

There was a significant effect of 'group' $F(1,103)=5.645$, $p<.05$ and the interaction 'group*sex' F(1,103 =7.858, $p<.01$ for age, men in the control group being younger than the caregivers and control women. There was a significant difference between groups in educational level χ^2 (9, N=107)=22.180, $p<.01$. Most of the individuals in the control group had university qualifications while basic school education predominated in the experimental group. For this reason, these variables were included as covariates in subsequent analysis when appropriate. On the other hand, no significant differences were found between groups in BMI, marital status, phase of the menstrual cycle in the case of women, cigarette consumption and source of income or stressful life events.

Sex differences in variables referring to caregiver care were analyzed. A significant effect of 'sex' $F(1, 50)=4.757$, $p<.05$ in years of care was found with women dedicating more years to caring. On the other hand, there were no significant differences in hours per week caring or parenting (biological or adoptive). When characteristics of the patient were analyzed, no differences were found between male and female caregivers in sex, age, autistic symptomatology, dependency level or global activity of the offspring.

Anthropometric and socio-demographic variables (M, SD) for the group and the sex of the participants and patients are summarized in Table 1.

Table 1. Results of univariate ANOVAs and the χ^2 statistics for anthropological and socio-demographic variables in caregivers and controls, stratified by sex (*p < .05).

		Caregiver Women (n=33)	Caregiver Men (n=22)	Control Women (n=32)	Control Men (n=22)
Age*		44.54±6.08	46.10±3.95	45±5.06	40.59±5.73
BMI		25.55±4.42	28.03±4.92	25.85±5.15	27.79±2.80
Marital Status	**Single**	1(3%)		1 (3.1%)	1 (4.5%)
	Married	27 (81.8%)	17 (85%)	27 (84.4%)	21 (95.5%)
	Divorced	4 (12.1%)	3 (15%)	2 (6.3%)	
	Widowed	1 (3%)		2 (6.3%)	
Phase of the menstrual cycle	**Luteal**	6 (18.2%)		8 (25.8%)	
	Follicular	21 (63.6%)		14 (45.2%)	
	Amenorrhea	6 (18.2%)		9 (29%)	
Educational Level*	**Basic**	15 (45.5%)	6 (30%)	7 (21.9%)	3 (13.6%)
	Advanced	6 (18.2%)	7 (35%)	4 (12.5%)	2 (9.1%)
	University	10 (30.3%)	5 (25%)	21 (65.6%)	16 (72.7%)
	Others	2 (6.1%)	2 (10%)		1 (4.5%)
Use of cigarettes	**Yes**	7 (21.2%)	6 (30%)	11 (34.4%)	3 (13.6%)
	No	26 (78.8%)	14 (70%)	21 (65.6%)	19 (86.4%)
Source of income	**Pension**			1 (3.1%)	
	Job	23 (69.7%)	13 (65%)	26 (81.3%)	18 (81.8%)
	Unemployment benefit	1 (3%)	14 (20%)	2 (6.3%)	1 (4.5%)
	Others	9 (27.3%)	3 (15%)	3 (9.4%)	3 (13.6%)
Stressful life events		15.84±6.19	13.80±5.41	13.87±4.91	12.31±6
Years of care*		14.84±4.78	11.95±4.43		
Hours per week caregiving	**< 24 hours**	2 (6.1%)	4 (21.1%)		
	24 to 72 hours	25 (75.8%)	14 (73.7%)		
	> 72 hours	6 (18.2%)	1 (5.3%)		

Parenting	**Biological**	28 (87.5%)	16 (80%)
	Adoptive	4 (12.5%)	4 (20%)
Characteristics of patient			
Age		15.53 ± 4.48	14.30 ± 2.97
Sex	**Male**	31 (93.8%)	20 (90%)
	Female	2 (6.3%)	2 (10%)
Dependency Level (Barthel Index)		92.50 ± 10.12	94.47 ± 9.55
Autism Quotient (AQ)		33.06 ± 5.92	33.25 ± 5.03
Global Activity		49.68 ± 11.77	46.50 ± 7.45

Psychological reports

No significant effects for the interaction ‘group*sex’ were found in psychosocial variables, negative affect, emotional intelligence, resilience or health indicators. For psychosocial variables, there was a significant effect of ‘group’ in ‘behavior escape’ F(1,101)=11.792, p<.001, $\eta^2_{partial}$=.105, caregivers using this coping style more often than controls. With regards to social support, the factor ‘group’ was statistically significant in all subscales: ‘structural support’ F(1,101)=7.026, p<.01, $\eta^2_{partial}$=.066; ‘emotional support’ F(1,101)=17.825, p<.000, $\eta^2_{partial}$=.151; ‘instrumental support’ F(1,101)=8.492, p<.01, $\eta^2_{partial}$=.078; ‘positive social interaction’ F(1,101)=14.020, p<.000, $\eta^2_{partial}$=.123; ‘affective support’ F(1,101)=9.572, p<.01, $\eta^2_{partial}$=.087; and the global index of social support F(1,101)=16.198, p<.000, $\eta^2_{partial}$=.139. In this case, caregivers showed lower levels of social support in all dimensions.

The factor ‘group’ proved to be significant in the three components of negative affect. Caregivers showed higher levels of trait anxiety F(1,101)=22.713, p<.000, $\eta^2_{partial}$=.184; depressive symptoms F(1,101)=17.064, p<.000, $\eta^2_{partial}$=.145; and both internal and external anger expression [F(1,101)=5.414, p<.05, $\eta^2_{partial}$=.051 and F(1, 101)=11.995, p<.01, $\eta^2_{partial}$=.106, respectively]. Furthermore, they had less internal and external control of anger [F(1,101)=5.141, p<.05, $\eta^2_{partial}$=.048; and F(1,101)=5.420, p<.05, $\eta^2_{partial}$=.051, respectively].

In emotional intelligence, a trend to statistical significance for the factor ‘group’ was found in mood repair F(1,101)=3.570, p<.06, $\eta^2_{partial}$=.034. Caregivers showed less ability to regulate negative emotions compared to the control group. No significant differences were found for resilience.

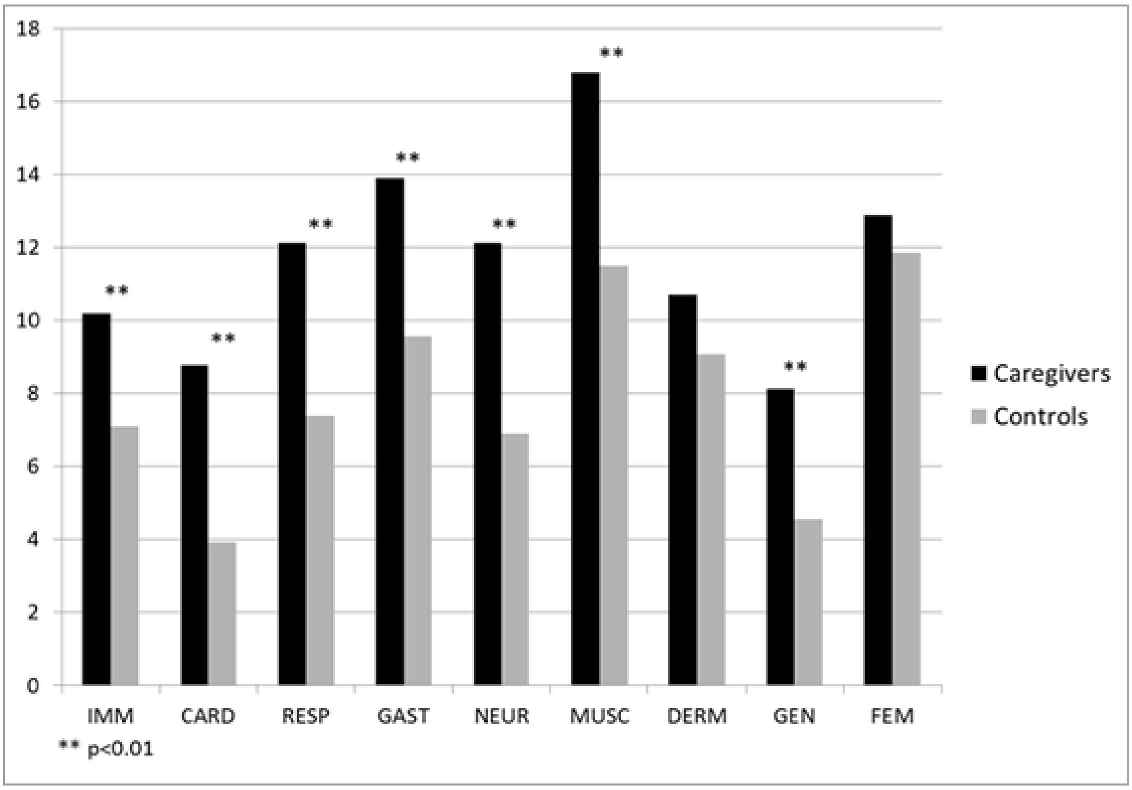
When analyzing variables of caring, women reported having more feelings of burden than men F(1,51)=3.853, p<.05, $\eta^2_{partial}$ =.073.

Health indicators

A significant effect of the interaction ‘group*sex’ was found in medication use $\chi 2$ (3,107)=10.17, p<.05, female caregivers consuming more medication than their male counterparts and controls. Nevertheless, no significant differences were found between groups when analyzing the type of medication consumed.

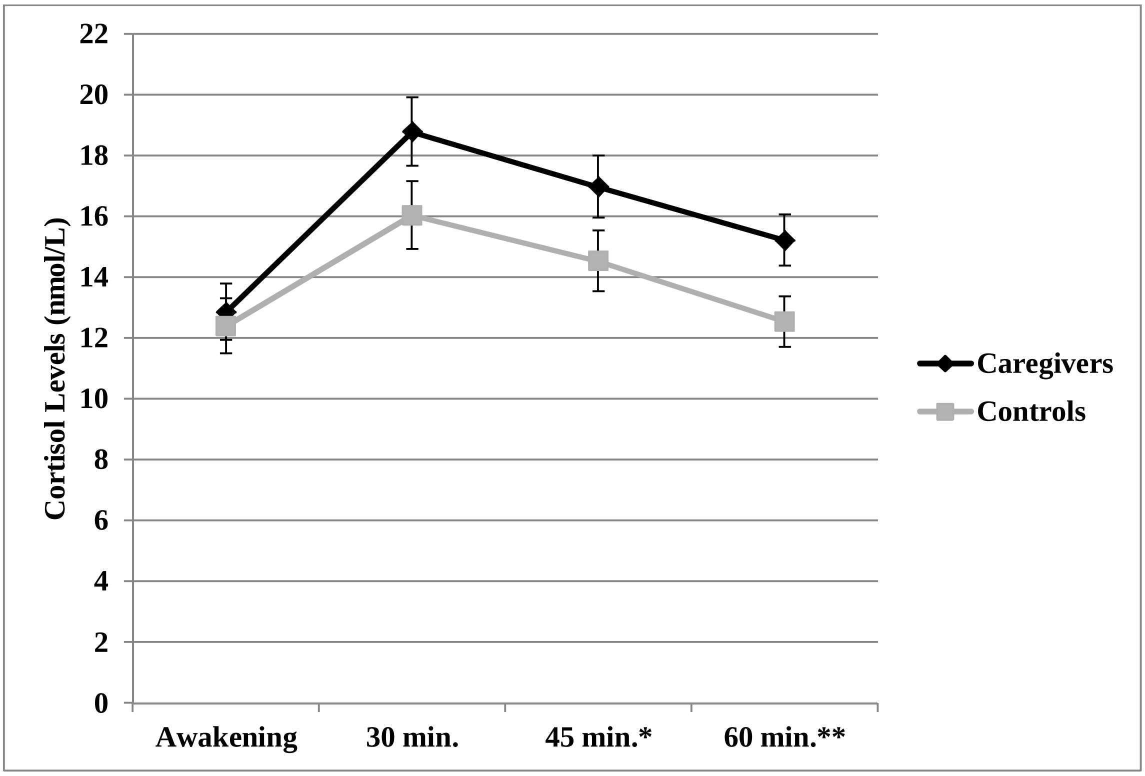
Although there were no significant effects for the interaction 'group*sex' in somatic symptoms, the factor 'group' was statistically significant in all systems evaluated, except dermatological and reproductive female systems: immunological F(1,101)=11.543, $p<.01$, $\eta^2_{partial}=.103$; cardiovascular F(1,101)=12.970, $p<.000$, $\eta^2_{partial}=.114$; respiratory F(1,101)=10.432, $p<.01$, $\eta^2_{partial}=.094$; gastrointestinal F(1,101)=7.151, $p<.01$, $\eta^2_{partial}=.066$; neurosensory F(1,101)=8.990, $p<.01$, $\eta^2_{partial}=.082$; muscular F(1,101)=8.593, $p<.01$, $\eta^2_{partial}=.078$; genital-urinary F(1,101)=10.320, $p<.01$, $\eta^2_{partial}=.093$;and total symptoms scale F(1,101)=19.213, $p<.000$, $\eta^2_{partial}=.160$. Caregivers showed more symptoms in all subscales, which indicate that they have poorer health (Figure 1).

Figure 1. Results of MANCOVA for differences between caregivers and non-caregivers in somatic symptoms (INM, immunological; CARD, cardiovascular; RESP, respiratory; GAST, gastrointestinal; NEUR, neurosensory; MUSC, muscular; DERM, dermatological; GEN, genital-urinary; and FEM, female reproductive system).



Regarding Csal levels, the average values for the total sample were 12.66 ± 6.38 nmol/l immediately after waking and 17.52 ± 7.84 nmol/l 30 min later, meaning an average increase of 4.85 ± 6.98 nmol/l. In caregivers, Csal levels increased from 12.65 ± 7.44 nmol/l after waking to 18.70 ± 8.33 nmol/l, 30 min later, that is, an increase of 6.05 ± 8.56 nmol/l. In non-caregivers, the values rose from 12.67 ± 5.20 after waking to 16.35 ± 7.23 nmol/l after 30 min, an increase of 3.68 ± 4.75 nmol/l. No differences were found between groups in levels of energy, expectations about the day, consumption of stimulants or alcohol the day before saliva collection, hours of sleep or phase of the menstrual cycle (Figure 2).

Figure 2. Results of repeated measures ANOVA for salivary cortisol levels on waking and 30, 45 and 60 min later for caregivers and non-caregivers (*p < .05, **p < .01; differences were significant only when negative affect was included as a covariate).



Regarding the magnitude of the response (CAR), in the unadjusted data, differences between groups were not found to be statistically significant. In the ANCOVA analysis, educational level, age and descriptive variables did not affect morning cortisol levels. Nevertheless, after including the negative affect as a covariate, the interaction ‘time*group’ F(2.019,191.778)=2.961, $p<.05$, $\eta^2_{partial}=.030$, was significant.

Furthermore, a main effect of the factor ‘group’ was also observed F(1, 95)=4.151, $p<.05$, $\eta^2_{partial}=.042$. Post hoc analysis identified a marginal effect in measure 2 ($p<.06$) and a significant effect in measure 3 ($p<.05$) and 4 ($p<.01$). In the AUC, there were no differences between groups after controlling for educational level, age and descriptive variables. When negative affect was included as a covariate, however, the effect of the group was significant for AUC F(1,95)=4.530, $p<.05$, $\eta^2_{partial}=.046$. These results indicate a higher magnitude of cortisol response in the caregivers than the controls when controlling for negative affect.

Hierarchical regression model

Hierarchical stepwise regression analyses were performed to identify the relationships between psychological variables and self-reported health and CAR. These analyses have been performed for the whole sample and for caregivers separately. For self-reported health, the dimension of total somatic symptoms of the ESS-R was the dependent variable, while for CAR, the dependent variable was AUC.

For somatic symptoms in the total sample, trait anxiety was entered as a significant predictor in the first step ($\beta=.759$, $p<.000$), and the model explained 57% of variance. Step 2 included behavioral-oriented problem coping ($\beta=.186$, $p<.01$) and this significantly increased the percentage of variance explained to 60% (change in $R^2=.34$, $p<.01$). Finally, depression symptomatology was included in the last step ($\beta=.282$, $p<.01$) with another significant increase (change in $R^2=.24$, $p<.01$), the model explaining 62% of variance. In the case of CAR, only cognitive-oriented problem coping was a significant predictor of the AUC ($\beta=.204$, $p<.05$), the model explaining 3% of the variance.

For somatic symptoms in caregivers, in the first step, trait anxiety was the only significant predictor ($\beta=.681$, $p<.000$) and at this stage the model explained 46% of the variance. In Step 2, the style of cognitive-oriented coping to the problem was included ($\beta=.283$, $p<.01$) and this significantly increased the percentage of variance explained to 54% (change in R2=.077, $p<.009$). With the addition of burden in the third step ($\beta=.255$, $p<.05$), the percentage of variance explained increased significantly again (change in

R2=.048, p<.05) reaching 59%. The final step included anger temperament (β=.215, p<.05) and variance explained again rose significantly (change in R2=.039, p<.05) to 63% of the variance of the total somatic symptoms in caregivers. The final model combines anxiety trait, cognitive coping, burden and anger temperament as modulator variables of health in caregivers. All the variables (except anger temperament) maintained a positive association with the dependent variable – indicating that higher trait anxiety together with a cognitive-oriented problem coping style and higher levels of burden were associated with worse health in caregivers. However, in the case of anger temperament, there was a negative association with symptoms, a higher score in this factor seeming to protect the caregiver's health. No significant predictors were found when regression analyses were performed with the magnitude of Csal response (AUC) as a dependent variable in this group.

Discussion

Our results show that caregivers are less healthy in all the evaluated dimensions and have more symptoms in most of the physiological systems evaluated in self-reported measures of health. These results are in the line with previous studies carried out in caregivers of people with ASD (De Andrés-García, González-Bono, & Moya-Albiol, 2012). In addition, female caregivers used more medication than their male counterparts and controls. Although in the unadjusted data there were no significant differences in CAR, when we controlled for components of negative affect (anxiety, depression, and anger), caregivers showed higher levels of cortisol at 30, 45 and 60 minutes after waking. In addition, the AUC was higher for caregivers than controls when these variables were included as covariates. That is, our results show that parents of people with ASDs have larger increases in cortisol after waking than parents of typically developing children.

Analyzing cortisol levels, all subjects together showed a mean increase of 4.85 nmol/l in cortisol levels from awakening to 30 min later, an increase that is above the lower limit described in the literature for a normal rise, considered to be an increase of at least 2.5 nmol/l (Wust et al., 2000). When analyzing each group separately, both caregivers and non-caregivers showed an increase in absolute terms equal to or greater than this threshold (2.5 nmol/l). These results contrast with those obtained in studies analyzing caregivers of people with other illnesses, such as parents of individuals with schizophrenia (González-Bono et al., 2011) or cerebral palsy (Bella et al., 2011). Our results are, however, similar to those obtained with samples of caregivers of people with ASDs (Lovell et al., 2012).

The fact that differences between groups appeared when negative affect was controlled for could have several explanations. A dysregulation of HPA axis, a consequence of chronic stress, may cause the secretion of abnormal levels of cortisol. This anomaly in cortisol production could trigger hypercortisolemia, a pathology associated with various different disorders including depression, chronic insomnia and trait anxiety (Buckley & Schatzberg, 2005; Gillespie & Nemeroff, 2005, Lai & Wan, 2009). In this regard, significant differences between groups appeared only when controlling for negative affect, showing that negative emotions have a significant effect on CAR. This link has been shown previously, negative affect being associated with a greater morning rise in cortisol levels in healthy subjects (Polk, Cohen, Doyle, Skoner, & Kirschbaum, 2005). Negative moods, such as depression and anxiety, are also associated in the literature with higher levels of morning cortisol (Pruessner, Hellhammer, Pruessner, & Lupien, 2003b). These results could be a consequence of caring producing high levels of negative emotions, creating a trait negative affect in caregivers that could dysregulate the HPA axis. Another possibility is related to the anticipation of care demands, which might generate higher morning cortisol levels and a lower recovery to basal levels in caregivers. This pattern has been demonstrated in other groups of individuals undergoing chronic stress, for example, teachers with high levels of burnout (Pruessner & Hellhammer, 1999).

For the total sample, components of negative affect and behavioral-oriented problem coping were found to be significant predictors of somatic symptoms. In line with this, it has been previously demonstrated that negative affect, specifically anxiety and depression components, is associated with several somatic health complaints in the general population (Haug, Mykletun, & Dahl, 2004; Kroenke, 2003). These results should be considered for detecting psychological factors, such as negative affect and coping, which play a key role in the onset and development of somatic diseases. Nevertheless, the main aim of our study was to identify possible psychological predictors of health in caregivers. In relation to this, we note that we obtained similar results regarding negative affect in the caregiver group, the main predictor of somatic symptoms also seeming to be trait anxiety. Accordingly, an anxiogenic perception of caring could be one of the main factors in the deterioration of health. Anxiogenic perception probably causes a greater perception of burden and so increases the levels of perceived stress and the number and severity of the symptoms. In this way, a negative perception of the situation may be related to burden and poorer health.

Behavioral-oriented problem coping for the whole sample and cognitive-oriented problem coping for caregivers were also associated with a greater number of symptoms. These styles of coping are related to efforts to reduce and manage the stressor behaviorally and cognitively with the objective of solving the problems underlying the stress. The use of this type of coping predicted poorer health in participants. In this regard, confronting permanent problems such as chronic illness in the case of caregivers has been related to reduced well-being and an increase in psychological distress (Wrosch, Scheier, Miller, Schulz, & Carver, 2003). Disengagement or escape coping can be an adaptive form of effective self-regulation (Wrosch & Scheier, 2003). The same research group found that both engagement and disengagement coping were related to low levels of depression and high levels of well-being in parents of children with cancer (Wrosch et al., 2003). In this case, control of the different aspects of the situation may be related to the adaptive consequences of the use of each type of coping style. In chronic stress situations, such as taking care of a relative with AS, perceived control of the situation may modulate the coping efforts of caregivers. A study carried out with caregivers of people with ASDs showed that the type of coping strategies used by parents depends on the level of control they feel over the situation (Schmidt, Dalbosco, & Alves, 2007). In our study, avoidant coping strategies may benefit caregivers, as they use this coping style more frequently than controls. This style is characterized by carrying out distracting activities that enable the caregiver to avoid the stressor, namely, the care situation (Crespo & Cruzado, 1997). Its effectiveness has been demonstrated in respite care interventions implemented for caregivers, an intervention based on removing the caregiver from the source of the stress (Garcés, Carretero, Ródenas, & Alemán, 2010). Caregivers in our study probably perceive the care situation as uncontrollable, and for this reason an active coping style was linked with poorer health.

Further, anger temperament is negatively associated with the number of symptoms. A tendency to experience feelings of anger produces fewer symptoms and preserves the health of caregivers. While it may seem contradictory, it is likely that those caregivers who express anger are those who know how to recognize, express and to some extent manage anger, as opposed to those subjects with lower scores in this area. This hypothesis would explain the negative relationship with number of symptoms, anger management and expression having classically been associated with an improvement in well-being (Phillips, Henry, Hosie, & Milne, 2006). Other variables, such as social support, emotional intelligence, resilience and the characteristics of the care recipient were not significant predictors of health in caregivers, yet differences between groups were found in some of these factors.

With regard to social support, there were differences between groups in all types of support. Caregivers reported less structural and perceived social support than controls. Recent studies found that parents with high levels of social support report higher levels of positive mood and less psychological distress, negative mood and depressive symptoms (Benson & Karlof, 2009; Bromley, Hare, Davison, & Emerson, 2004; Pottie, Cohen, & Ingram, 2009). Lower levels of social support may foster higher levels of negative affect in caregivers. With regard to emotional intelligence, caregivers seem to have more difficulties regulating negative emotions than parents in the control group, and this fact may also be related to the increased levels of negative emotion in caregivers. Although there is evidence in literature that caregivers of people with autism have higher levels of resilience (Bayat, 2007), we did not find any differences between groups for this variable.

Functional impairment of the care recipient was not associated with poorer health in caregivers. The severity of symptoms among people with AS is likely to be lower than in other disorders of the spectrum; but the burden on parents is, nevertheless, high. These results are in line with findings obtained in studies where behavioral problems were found to prevail over autistic symptoms (Allik et al., 2006). Such behavioural problems may be one of the precursors to a greater burden on caregivers when taking into account that the functioning of the patient is relatively stable.

Although this study entails an advance in the comprehension of health affection in caregivers of people with AS, some limitations of the study should be taken into account in interpreting the results. The cross-sectional character of the study makes it difficult to establish causality in the results. Furthermore, the fact that the sample was composed of caregivers of people with AS restricts the conclusions to this type of diagnosis. Indeed, it would be interesting to compare these results with others obtained in caregivers of people with other diagnoses of the spectrum, such as classic autism or non-specified pervasive developmental disorder. In addition, somatic symptoms reported by caregivers should be backed by other objective measures of medical outcomes. That is, while our study does provide objective information about health status, through the use of a biological marker of health (CAR), it would be helpful to consider a wider range of biological indicators of health to further explore the effects of caring on health.

In the light of our results, specific interventions taking into account the moderating factors mentioned could be developed for caregivers of people with AS. Specifically, strategies could be implemented in an attempt to change negative perceptions of the situation of care, and adjust expectations to the objective level of functioning of the person receiving care (thus decreasing the frustration and anger that providing care can generate). Secondly, it is important to provide caregivers with mechanisms to regulate negative emotions and increase positive ones by promoting a vision of care as an opportunity for personal growth and the development of positive skills that enhance their well-being and quality of life and, in turn, their own health. Finally, caregivers should be taught adaptive coping strategies, as well as increased social and institutional support being provided for families.

References

Allik, H., Larsson, J.O., & Smedje, H. (2006). Health-related quality of life in parents of school- age children with Asperger syndrome or high-functioning autism. *Health and Quality of Life Outcomes, 4* (1), 1–8.

American Psychiatric Association. (2000). Diagnostic and statistical manual of mental disorders: DSM-IV (4th ed.). Washington (DC): American Psychiatric Association.

Barker, E.T., Hartley, S.L., Seltzer, M.M., Floyd, F.J., Greenberg, J.S., & Orsmond, G.I. (2011). Trajectories of emotional well-being in mothers of adolescents and adults with autism. *Developmental Psychology, 47* (2), 551–561.

Baron-Cohen, S., Hoekstra, R.A., Knickmeyer, R., & Wheelwright, S. (2006). The Autism Spectrum Quotient (AQ)-Adolescent Version. *Journal of Autism and Developmental Disorders, 36* (3), 343–350.

Bayat, M. (2007). Evidence of resilience in families of children with autism. *Journal of Intellectual Disability Research, 51* (9), 702–714.

Baztán, J.J., Pérez del Molino, J., Alarcón, T., San Cristóbal, E., Izquierdo, G., & Manzarbeitia, J. (1993). Índice de Barthel: Instrumento válido para la valoración funcional de pacientes con enfermedad cerebrovascular [Barthel Index: A valid instrument for functional assessment of patients with cerebrovascular disease]. *Revista Española de Geriatria y Gerontologia, 28,* 32–40.

Beck, A.T., & Steer, R.A. (1993). Beck depression inventory. manual. San Antonio, TX: The Psychological Corporation.

Bella, G.P., Garcia, M.C., & Spadari-Bratfisch, R.C. (2011). Salivary cortisol, stress, and health in primary caregivers (mothers) of children with cerebral palsy. *Psychoneuroendocrinology, 36* (6), 834–842.

Benson, P.R., & Karlof, K.L. (2009). Anger, stress proliferation, and depressed mood among parents of children with ASD: A longitudinal replication. *Journal of Autism and Developmental Disorders, 39* (2), 350–362.

Bromley, J., Hare, D.J., Davison, K., & Emerson, E. (2004). Mothers supporting autistic spec- trum disorders: Social support, mental health status, and satisfaction with services. *Autism, 8* (4), 409–423.

Buckley, T.M., & Schatzberg, A.F. (2005). On the interactions of the hypothalamic-pituitary- adrenal (HPA) axis and sleep: Normal HPA axis activity and circadian rhythm, exemplary sleep disorders. *The Journal of Clinical Endocrinology & Metabolism, 90* (5), 3106–3114.

Carver, C.S., Scheier, M.F., & Weintraub, J.K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology, 56,* 267–283.

Crespo, M., & Cruzado, J.A. (1997). La evaluación del afrontamiento: adaptación española del cuestionario COPE con una muestra de estudiantes universitarios [Assessment of coping: Spanish adaptation of COPE Questionnaire in a sample of university students]. *Análisis y Modificación de Conducta, 23,* 797–832.

De Andrés-García, S., Moya-Albiol, L., & González-Bono, E. (2012). Salivary cortisol and immunoglobulin A: Responses to stress as predictors of health complaints reported by caregivers of offspring with autistic spectrum disorder. *Hormones & Behavior, 62* (4), 464–474.

de Vught, M.E., Nicolson, N.A., Aalten, P., Lousberg, R., Jolle, J., & Verhey, F. R. (2005). Behavioural problems in dementia patients and salivary cortisol patterns in caregivers. *Journal of Neuropsychiatry and Clinical Neuroscience, 17* (2), 201–207.

Endicott, J., Spitzer, R.L., Fleiss, J.L., & Cohen, J. (1976). The global assessment scale: A procedure for measuring overall severity of psychiatric disturbance. *Archives of General Psychiatry, 33* (6), 766–771.

Fernández Seara, J.L. (1992). EAE: escalas de apreciación del estrés: manual [EAE: Stress rating scales: Manual]. Madrid, SA: TEA Ediciones.

Fernández-Berrocal, P., Extremera, N., & Ramos, N. (2004). Validity and reliability of the Spanish modified version of the Trait Meta-Mood Scale. *Psychological Reports, 94* (3), 751–755.

Fries, E., Dettenborn, L., & Kirschbaum, C. (2009). The cortisol awakening response (CAR): Facts and future directions. *International Journal of Psychophysiology, 72* (1), 67–73.

Garcés, J., Carretero, S., Ródenas, F., & Alemán, C. (2010). A review of programs to alleviate the burden of informal caregivers of dependent persons. *Archives of Gerontology and Geriatrics, 50* (3), 254–259.

Gillespie, C.F., & Nemeroff, C.B. (2005). Hypercortisolemia and depression. *Psychosomatic Medicine, 67* (1), 26–28.

Gonzalez-Bono, E., De Andrés-García, S., & Moya-Albiol, L. (2011). The cortisol awakening response in caregivers of schizophrenic offspring shows sensitivity to patient status. *Anxiety, Stress & Coping*, *24* (1), 107–120.

Hastings, R.P., Kovshoff, H., Brown, T., Ward, N.J., Espinosa, F.D., & Remington, B. (2005). Coping strategies in mothers and fathers of preschool and school-age children with autism. *Autism, 9* (4), 337–391.

Haug, T.T., Mykletun, A., & Dahl, A.A. (2004). The association between anxiety, depression and somatic symptoms in a large population: the HUNT-II study. *Psychosomatic Medicine, 66* (1), 845–851.

Higgins, D.J., Bailey, S.R., & Pearce, J.C. (2005). Factors associated with functioning style and coping strategies of families with a child with an autism spectrum disorder. *Autism, 9* (2), 125–137.

Khanna, R., Madhavan, S.S., Smith, M.J., Patrick, J.H., Tworek, C., & Becker-Cottrill, B. (2011). Assessment of health-related quality of life among primary caregivers of children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 41* (9), 1214–1227.

Kroenke, K. (2003). Patients presenting with somatic complaints: Epidemiology, psychiatric comorbidity and management. *International Journal of Methods in Psychiatric Research, 12* (1), 34–43.

Lai, C.-L. J. & Wan, K.-Y. K. (2009). Trait anxiety accentuates the cortisol awakening response. Bioinformatics and Biomedical Engineering. ICBBE 2009. 3rd International Conference, Peking.

Lecavalier, L., Leone, S., & Wiltz, J. (2006). The impact of behaviour problems on caregiver stress in young people with Autism Spectrum Disorders. *Journal of Intellectual Disability Research, 50* (3), 172–183.

Lovell, B., Moss, M., & Wetherell, M. (2012). The psychosocial, endocrine and immune consequences of caring for a child with autism or ADHD. *Psychoneuroendocrinology, 37* (4), 534–542.

Manning, M.M., Wainwright, L., & Bennett, J. (2011). The double ABCX model of adaptation in racially diverse families with a school-age child with Autism. *Journal of Autism and Developmental Disorders, 41* (3), 320–331.

Miguel-Tobal, J.J., Casado, M.I., Cano-Vindel, A., & Spielberger, C.D. (2001). Inventario de Expresión de Ira Estado-Rasgo: STAXI-2. Madrid: TEA Ediciones.

Moya-Albiol, L., Serrano, M.A., & Salvador, A. (2010). Job satisfaction and cortisol awakening response in teachers scoring high and low burnout. *Spanish Journal of Psychology, 13* (2), 629–636.

Phillips, L.H., Henry, J.D., Hosie, J.A., & Milne, A.B. (2006). Age, anger regulation and well-being. *Aging & Mental Health, 10* (3), 250–256.

Polk, D.E., Cohen, S., Doyle, W.J., Skoner, D.P., & Kirschbaum, C. (2005). State and trait affect as predictors of salivary cortisol in healthy adults. *Psychoneuroendocrinology, 30* (3), 261–272.

Pottie, C.G., Cohen, J., & Ingram, K.M. (2009). Parenting a child with autism: Contextual factors associated with enhanced daily parental mood. *Journal of Pediatric Psychology, 34* (4), 419–429.

Pruessner, J.C., Kirschbaum, C., Meinlschmid, G., & Hellhammer, D.H. (2003a). Two formulas for the computation of the area under the curve represent measures of total hormone concentration vs. time-dependent change. *Psychoneuroendocrinology, 28* (7), 916–931.

Pruessner, M., Hellhammer, D.H., Pruessner, J.C., & Lupien, S.J. (2003b). Self-reported depressive symptoms and stress levels in healthy young men: Associations with the cortisol response to awakening. *Psychosomatic Medicine, 65* (1), 92–99.

Pruessner, J.C., & Hellhamer, D.H. (1999). Burnout, perceived stress, and cortisol responses to awakening. *Psychosomatic Medicine, 61* (2), 197–204.

Renty, J., & Roeyers, H. (2007). Individual and marital adaptation in Men with Autism spectrum disorder and their spouses: The role of social support and coping strategies. *Journal of Autism and Developmental Disorders, 37* (7), 1247–1255.

Sandín, B., & Chorot, P. (1995). Escala de Síntomas Somáticos-Revisada (ESS-R). Madrid: Universidad Nacional de Educación a Distancia (UNED).

Schmidt, C., Dalbosco, D., & Alves, C. (2007). Coping strategies of mothers of autistic children: dealing with behavioural problems and emotions. *Psicología Reflexao i Critica, 20* (1), 124–131.

Seltzer, M.M., Greenberg, J.S., Hong, J., Smith, L.E., Almeida, D.M., Coe, C., & Stawski, R.S. (2010). Maternal cortisol levels and behavior problems in adolescents and adults with ASD. *Journal of Autism and Developmental Disorders, 40* (4), 457–469.

Sherbourne, C.D., & Stewart, A.L. (1991). The MOS social support survey. Social *Science and Medicine, 32*, 705–714.

Sinclair, V.G., & Wallston, K.A. (2004). The development and psychometric evaluation of the Brief Resilient Coping Scale. *Assessment, 11* (1), 94–101.

Smith, L.E., Hong, J., Seltzer, M.M., Greenberg, J.S., Almeida, D.M., & Bishop, S.L. (2010). Daily experiences among mothers of adolescents and adults with Autism Spectrum Disorder. *Journal of Autism and Developmental Disabilities, 40* (2), 167–178.

Smith, L.E., Seltzer, M.M., & Greenberg, J.S. (2011). Daily health symptoms of mothers of adolescents and adults with fragile X syndrome and mothers of adolescents and adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 40* (2), 167–178.

Smith, L.E., Seltzer, M., Tager-Flusberg, H., Greenberg, J.S., & Carter, A.S. (2008). A comparative analysis of well-being and coping among mothers of toddlers and mothers of adolescents with ASD. *Journal of Autism and Developmental Disorders, 38* (5), 876–889.

Spielberger, C.D., Gorusch, R.L., Lushene, R., Vagg, P.R., & Jacobs, G.A. (1983). Manual for the state-trait anxiety inventory. Palo Alto, CA: Consulting Psychologists Press.

Stalder, T., Evans, P., Hucklebridge, F., & Clow, A. (2010). State associations with the cortisol awakening response in healthy females. *Psychoneuroendocrinology, 35* (8), 1245–1252.

Taylor, J.L., & Warren, Z. (2012). Maternal depressive symptoms following Autism spectrum diagnosis. *Journal of Autism and Developmental Disorders, 42* (7), 1411–1418.

Totsika, V., Hastings, R.P., Emerson, E., Lancaster, G.A., & Berridge, D.M. (2011). A population-based investigation of behavioural and emotional problems and maternal mental health: associations with autism spectrum disorder and intellectual disability. *Journal of Child Psychology and Psychiatry, 52* (1), 91–99.

Wahbeh, H., Shirley, S., Kishiyama, M.A., Daniel, Z., Barry, S., & Oken, M.D. (2008). Salivary cortisol awakening response in mild Alzheimer disease, caregivers, and non-caregivers. *Alzheimer Disease and Associated Disorders, 22* (2), 181–183.

Watson, D., & Pennebaker, J.W. (1989). Health complaints, stress, and distress: Exploring the central role of negative affectivity. *Psychological Review, 96* (2), 234–254.

Watson, D. (1988). Intraindividual and interindividual analyses of positive and negative affect: Their relation to health complaints, perceived stress, and daily activities. *Journal of Personality and Social Psychology, 54* (6), 1020–1030.

Wessa, M., Rohleder, N., Kirschbaum, C., & Flor, H. (2006). Altered cortisol awakening response in posttraumatic stress disorder. *Psychoneuroendocrinology, 31* (2), 209–215.

Wrosch, C., Scheier, M.F., Miller, G.E., Schulz, R., & Carver, C.S. (2003). Adaptive self-regulation of unattainable goals: Goal disengagement, goal reengagement, and subjective wellbeing. *Personality and Social Psychology Bulletin, 29* (12), 1494–1508.

Wrosch, C., & Scheier, M.F. (2003). Personality and quality of life: The importance of optimism and goal adjustment. *Quality of Life Research, 12* (1), 59–72.

Wust, S., Wolf, J., Hellhammer, D.H., Federenko, I., Schommer, N., & Kirschbaum, C. (2000).The cortisol awakening response-normal values and confounds. *Noise & Health, 2* (7), 79–88.

Zarit, S.H., Reeves, K.E., & Bach-Peterson, J. (1980). Relatives of the impaired elderly: Correlates of feelings of burden. *Gerontologist, 20*, 649–654.

Chapter 3

Study 2: Highly resilient coping entails better perceived health, high social support and low morning cortisol levels in parents of children with autism spectrum disorder

Published in: Ruiz-Robledillo, N[1]., De Andrés-García, S[1]., Pérez-Blasco, J[2]., González-Bono, E[1]., & Moya-Albiol, L[1]. (2014). Highly resilient coping entails better perceived health, high social support and low morning cortisol levels in parents of children with autism spectrum disorder. *Research in Developmental Disabilities*, *35* (3), 686-695.

[1] Department of Psychobiology, University of Valencia

[2] Department of Evolutionary and Educational Psychology, University of Valencia

Introduction

Negative consequences for the health of caregivers of offspring with developmental disabilities, such as autism spectrum disorder (ASD) have been widely documented (Lovell, Moss, & Wetherell, 2012a; Ruiz-Robledillo & Moya-Albiol, 2013; Ruiz-Robledillo, González-Bono, & Moya-Albiol, 2014). Indeed, informal caregivers of people with ASD suffer more depression, anxiety, somatic symptoms, and social dysfunction than the general population (De Andrés-García, Moya-Albiol, & González-Bono, 2012; Khanna et al., 2011; Lee, 2013). Although the majority of studies have evaluated the health affection of caregivers, new studies are becoming interested in the positive adaptation to the care situation. Thus, some caregivers show an ability to cope effectively with the stress of a care situation (Cohen, Colantonio, & Vernich, 2002; Gaugler, Kane, & Newcomer, 2007) and are described as resilient.

The term resilience is broadly used to explain the positive adaptation of individuals to stressful situations (Bonanno, 2012); however, there is a lack of homogeneity in its conceptualization. Consequently, the definition is not unanimous among studies, although there is a growing trend to understand resilience as a dynamic process, an ability to bounce back or recover effectively from stressful situations (Smith, Tooley, Christopher, & Kay, 2010). This definition refers to resilience as a way of coping with stress in an adaptive manner. More specifically, resilience in a care context has been defined as the ability shown by caregivers to bounce back from the stress derived from a care situation. In this sense, resilience in caregivers is configured by specific skills that promote a successful adaptation to a care situation without health being affected (Fernández-Lansac, Crespo-López, Cáceres, & Rodríguez-Poyo, 2012; Lin, Rong, & Lee, 2013). For this reason, resilience is not a static or unchanging ability and caregivers can be helped to increase levels of resilience. Resilience entails coping effectively with the stress without negative consequences, while obtaining positive outcomes from stress situations. This process, in turn, increases the ability to cope with stress successfully (Bayat, 2007). Indeed, resilient caregivers have recognized positive changes in several life domains; some have even adopted a positive overview of the caring process (Fernández-Lansac & Crespo, 2011). These positive outcomes have been replicated in several families with disabilities, independently of the type of disease (Heiman, 2002). In families with a member affected with an ASD, caring has even been considered an opportunity for personal growth by some caregivers (Bayat, 2007; Phelps, McCammon, Wuensch, & Golden, 2009). Analyzing the profiles of these resilient caregivers would enable the detection of those aspects that should be considered for establishing effective intervention programs (Bekhet, Jhonson, & Zauszniewski, 2012a; Gardiner & Iarocci, 2012). This would enormously help thousands of caregivers who respond negatively and suffer consequent deteriorations in their health.

Although resilience has been demonstrated to be a protective factor in the stress adaptation process, few studies have analyzed these positive effects in health (Nygren et al., 2005; Smith, Hong, et al., 2010). Previous research in stressed elderly, unemployed people, or diabetic patients has reported a preventive effect of resilience on health complaints. Furthermore, highly resilient individuals are often involved in activities promoting health (Perna et al., 2012; Sojo & Guarino, 2011; Yi, Vitaliano, Smith, Yi, & Weinger, 2008). In a care context, highly resilient caregivers of people with Alzheimer's disease present lower levels of stress perception, depression, and anxiety (Fernández-Lansac et al., 2012), although high levels of resilience does not entail the total absence of psychopathology. In other samples of caregivers, such as caregivers of people with a stroke or with a terminally ill, higher resilience has been associated with lower levels of anxiety and depression (Nabors et al., 2013; Tang et al., 2013).

Social support is one of the most analyzed variables related to resilience and health in caregivers of people with developmental disabilities (Boyd, 2002; Gallagher & Whiteley, 2012; Lovell, Moss, & Wetherell, 2012b). In this sense, social support has been associated with better cardiovascular and endocrine functioning, less anxiety and depression, and fewer somatic symptoms (Gallagher & Whiteley, 2012; Khanna et al., 2011; Lovell et al., 2012b). Indeed, social support has been characterized as a resilience factor that could buffer the consequences of caring on health in caregivers of people with ASD (Boyd, 2002). However, no studies have evaluated the association between resilience and social support, taking into account that resilient caregivers may have better social functioning and could benefit from more social support than low resilience caregivers (Wilks & Croom, 2008). Although social support has been related with several health outcomes in caregivers (Boyd, 2002), no studies have tested the possible mediating role of this variable in the relationship between resilience and health.

To the best of our knowledge, no studies have used biological markers of health to analyze the protective effects of resilience coping in caregivers of people with ASD.

Such a study would produce more objective information than self-reported health (in which subjective perception is involved) and could verify the obtained results in previous studies conducted with caregivers. One reliable and very used biological marker of health is the cortisol awakening response (CAR).It is an index of the activity of the hypothalamic-pituitary-adrenal (HPA) axis, which is the major endocrine system involved in stress response (Fries, Dettenborn, & Kirschbaum, 2009). CAR is characterized by increased levels of cortisol from awakening to approximately 30 min later, and the authors propose an increase of 2.5 nmol/l for a normal rise (Wust, Federenko, Hellhammer, & Kirschbaum, 2000). This response could be altered in individuals undergoing chronic stress, such as people with a diagnosis of post-traumatic stress disorder, burnout, or informal caregivers (de Vught et al., 2005; Moya-Albiol, Serrano, & Salvador, 2010; González-Bono, De Andrés-García, & Moya-Albiol, 2011). In this sense, although results are contradictory, abnormalities in this response could indicate an affection of the HPA axis that implies adverse health outcomes for individuals. The effects of resilience in CAR are inconclusive. In one study in which authors compared CAR between mistreated and non-mistreated children, high levels of resilience were related to low morning cortisol levels in non-mistreated group. In the case of mistreated children, this relationship appeared to be attenuated (Cicchetti & Rogosch, 2007). Authors explained this result such as the consequence of the lack of adaptation to stress exposure in low resilience children. Although no more studies have been carried out in this line, the relationship between CAR and variables of the resilience coping cluster, such as optimism or social support, has been analyzed (Ozbay, Johnson, Dimoulas, Morgan, & Charney, 2007; Lai et al., 2005; Lovell et al., 2012b). For optimism, high optimistic individuals showed lower morning cortisol levels compared to lower optimistic individuals, after controlling for other potential confounds (Lai et al., 2005). In this study, authors demonstrated that optimism but not pessimism was related to lower morning cortisol levels, suggesting that positive variables have also an impact on the functioning of the HPA. With regard to social support, it seems that this factor could have an effect on stress response dampening the over-functioning of HPA axis in stress conditions. Authors named this effect such as stress resilience, and consisted in maintain the HPA functioning in an optimal range while stress exposure. Several studies have pointed out this issue, demonstrating a negative relationship between social support and cortisol secretion (Ozbay et al., 2007). However, one study carried out with caregivers of people with ASD found a positive relationship between social support and CAR (Lovell et al., 2012b). In this study, authors only found a positive relationship between social support and CAR, but not with levels of cortisol, such as in the previous cited studies. In this regard, probably resilience could have a higher effect on morning cortisol levels compared to CAR.

The lack of studies evaluating the possible psychosocial mediators and biological correlates underlying the association between resilience and health outcomes in parents of people with ASD makes it necessary to carry out new studies exploring this relationship. The present study is focused on evaluating the association between resilience and health outcomes in parents of people with ASD. For this purpose, both self-reported health and CAR will be analyzed. It is expected to find better perceived general health and lower morning cortisol levels in highly resilient caregivers (Cicchetti & Rogosch, 2007; Fernández-Lansac et al., 2012). Furthermore, it also aims to analyze the relationship between resilience, health and social support. Although no previous studies have analyzed the mediating role of social support in the association between resilience and health, we hypothesized that social support will mediate the relationship between both variables.

Materials and methods

Participants and procedure

The sample was composed of 67 parents of people with a diagnosis of an autism spectrum disorder (27 men and 40 women). Caregivers were mainly recruited from members of two associations of relatives of people with ASD. Firstly, a meeting was conducted with caregivers to explain the aim of the research and the criteria for participation (being a first-degree family member of an ASD patient with a clinical diagnosis; living at home with the patient; and being the main provider of first-needs for at least two years before the study). Researchers obtained general information about the subjects and administrated a battery of questionnaires for evaluating health. Moreover, they gave the instructions for collecting saliva at home (eight Salivettes) in order for the area under the curve of salivary cortisol to be later measured (Csal). A new meeting was scheduled to collect the saliva samples and carry out a second interview to evaluate dependency levels, and the autistic and socio-demographic characteristics of the care recipients.

All participants participated voluntarily in the study, and informed consent following the ethical norms of human research (Helsinki Declaration) was obtained from all participants. Descriptive data for all caregivers is summarized in Table 1

Variables and measurement instruments

Cortisol awakening response (CAR)

Csal was collected using a Salivette (Sarstedt, Rommersdolf, Germany). The samples were frozen at 20 8C until analysis by radioimmunoassay. The reactives used for Csal were count-a-count cortisol (DPC, Siemens Medical Solutions Diagnostics). The samples were measured in duplicate and all those belonging to the same participant were included in the same assay. The coefficient of variation inter-duplicate maximum considered for the repetition of the determination was set at 8%. Assay sensitivity was 0.5 ng/dl. The coefficients of intra and inter-assay variation were 2.8 and 5.3% respectively. All values are expressed in nmol/l. The CAR was calculated as an average salivary cortisol level over two consecutive days at waking and 30, 45, and 60 min later. In addition, participants were asked to take note of the time of saliva collection, level of energy, expectations about the day, and other variables such as consumption of stimulants or alcohol the day before, any smoking the day before, and the number of hours of sleep. Participants were instructed to abstain from eating, drinking stimulants (such as tea, coffee, or alcohol), brushing their teeth, or smoking before taking saliva samples. Subjects who consumed antipsychotics or any other drug or substance that could alter the levels of cortisol were excluded. Other potential confounds that could affect cortisol levels, such as age, body mass index (BMI), gender, phase of the menstrual cycle, and use of cigarettes, were statistically controlled.

Self-reported health

Perceived general health was assessed with a shorter 28-item version of the General Health Questionnaire (GHQ-28) designed by Goldberg and Hillier (1979). The items are scored on a 4-point Likert scale from 0 (better than usual) to 3 (worse than usual). The items are divided into four scales (somatic symptoms, anxiety and insomnia, social dysfunction, and severe depression) and results were given in total score of perceived general health, all of which have a Cronbach’s a higher than 0.92.

Table 1. Mean and standard deviation (SD), and frequency and percentage in demographic characteristics, care status, and characteristics of care recipient in all participants – and high, medium, and low resilience caregivers. (*p<.05; **p<.01).

Variable/characteristics		**N=67**	**High-resilience caregivers (N=21)**	**Medium-resilience caregivers (N=17)**	**Low-resilience caregivers (N=29)**
Gender*	**Male**	27 (40.3%)	13 (48.1%)	4 (14.8%)	10 (37%)
	Female	40 (59.7%)	8 (20%)	13 (32.5%)	19 (47.5%)
Age		45.46 ± 6.56	46.85 ± 5.21	45.52 ± 4.90	44.41 ± 8.12
Body mass index (BMI)		26.88 ± 4.92	27.26 ± 4.70	27.43 ± 5.99	26.28 ± 4.47
Phases of menstrual cycle	**Luteal**	17 (42.5%)	5 (29.4%)	4 (23.5%)	8 (47.1%)
	Follicular	14 (35%)	0 (0%)	6 (42.9%)	8 (57.1%)
	Amenorrhea	9 (22.5%)	3 (33.3%)	3 (33.3%)	3 (33.3%)
Marital status	**Single**	2 (3%)	0 (0%)	0 (0%)	2 (100%)
	Married	58 (86.6%)	17 (29.3%)	16 (27.6%)	25 (43.1%)
	Divorced	6 (9%)	4 (66.7%)	1 (16.7%)	1 (16.7%)
	Widowed	1 (1.5%)	0 (0%)	0 (0%)	1 (100%)
Educational level	**Basic**	21 (31.3%)	3 (14.3%)	8 (38.1%)	10 (47.6%)
	Advanced	17 (25.4%)	7 (41.2%)	3 (17.6%)	7 (41.2%)
	University	26 (38.8%)	10 (38.5%)	6 (23.1%)	10 (38.5%)
	Others	3 (4.5%)	1 (33.3%)	0 (0%)	2 (66.7%)
Source of income	**Pension**	18 (26.9%)	4 (22.2%)	4 (22.2%)	10 (55.6%)
	Job	43 (64.2%)	13 (30.2%)	13 (30.2%)	17 (39.5%)
	Unemployed	0 (0%)	0 (0%)	0 (0%)	0 (0%)
	Others	6 (9%)	4 (66.7%)	0 (0%)	2 (33.3%)
Use of cigarettes	**Yes**	16 (23.9%)	3 (18.8%)	4 (25%)	9 (56.3%)
	No	51 (76.1%)	18 (35.3%)	13 (25.5%)	20 (39.2%)
Stressful life events		12.83 ± 6.60	13.23 ± 6.45	13.41 ± 7.34	12.20 ± 6.44

Care status					
Years of evolution of care		12.31 ± 5.34	12.11 ± 6.14	12.37 ± 4.96	12.41 ± 5.11
Time weekly caring (h)		52.87 ± 39.51	51.14 ± 44.92	43.08 ± 23.12	59.86 ± 42.69
Care burden index		36.04 ± 15.58	32.42 ± 14.40	40.88 ± 15.62	35.82 ± 16.14
Worried about the patient's future**		8.61 ± 2.13	7.45 ± 2.72	9.65 ± 0.78	8.84 ± 1.81
Suffering about the disease		5.25 ± 4.05	4.52 ± 3.89	5.88 ± 4.16	5.41 ± 4.15
Characteristics of patient					
Diagnosis of patient	**Autism**	27 (40.3%)	6 (22.2%)	8 (29.6%)	13 (48.1%)
	Asperger	40 (59.7%)	15 (37.5%)	9 (22.5%)	16 (40%)
Gender	**Male**	59 (88.1%)	21 (35.6%)	13 (22%)	25 (42.4%)
	Female	8 (11.9%)	0 (0%)	4 (50%)	4 (50%)
Age		14 ± 4.78	14.85 ± 4.50	13.75 ± 4.91	13.51 ± 4.97
Dependency level (Barthel index)		86.07 ± 17.43	89.87 ± 13.26	86.40 ± 13.19	83.27 ± 21.52
Autism quotient (AQ)		31.86 ± 5.90	31.95 ± 5.17	34 ± 4.92	30.62 ± 6.68

Resilience

The Brief Resilient Coping Scale (BRCS, Sinclair & Wallston, 2004) was used to analyze the level of resilience in participants. The instrument is composed of four items with a five-point Likert scale designed to evaluate the ability of the individual to cope with stress in an adaptive manner. Items on the measure include: ‘‘(1) I look for creative ways to alter difficult situations. (2) Regardless of what happens to me, I believe I can control my reactions. (3) I believe I can grow in positive ways by dealing with difficult situations. (4) I actively look for ways to replace the losses I encounter in life.’’ The reliability coefficient of this instrument is .69.

Social support

Social support was measured with the Medical Outcomes Study Social Support Survey (MOS-SSS, Sherbourne & Stewart, 1991). The survey is a 20-item scale with five response categories (1 – never; 5 – always) for each item. It has one question to measure structural support (number of close friends and relatives) and four other subscales: emotional/informational support; affection; tangible support; and positive social interaction. A global score could be obtained with the sum of the four subscales. For all subscales, the reliability coefficients are above .91

Stressful life events

Stressful life events were analyzed by the ‘‘Escala de Acontecimientos Estresantes General’’ EAE-G (Stressful Life Events General form) (Fernández Seara, 1992). This scale is composed of 53 items which evaluate the incidence of different stressful events that have taken place throughout the life of each subject. Stressful life events in this instrument are grouped in four themes: health, relationships, lifestyle, and labour and economic issues. The reliability coefficient in the Spanish population is .83.

Burden

Burden for the caregivers was evaluated using the Caregiver Burden Inventory (CBI) created by Zarit, Reever, and Bach-Peterson (1980). This instrument is composed of 22 items ranked on a 5-point Likert scale from 0 (never) to 4 (nearly always) with a maximum score of 88. The reliability coefficient is 0.92. The items are related to health, social, and personal lifestyle, and interpersonal relationships of patients with functional and behavioral disabilities. According to these domains, caregivers express their burden feelings with the higher scores representing a greater burden.

Status of care recipient

To evaluate the level of offspring dependence, caregivers answered the Barthel Index (Mahoney & Barthel, 1965) referring to patient. This questionnaire covers 12 different basic activities such as eating, showering, and urinating (among others) with a Cronbach's a higher than 0.87. Higher scores in this questionnaire reveal a greater degree of independence by the care recipient with a maximum score of 100.

The degree of autism of the care recipient was also assessed with the Autism Quotient (AQ) created by Baron-Cohen, Hoekstra, Knickmeyer, and Wheelwright (2006). This questionnaire was answered by caregivers and is composed of 50 items ranged on a 4-point Likert scale with a reliability coefficient higher than 0.76. A higher score indicates a higher degree of autism with a maximum of 50.

Statistical analysis

Spearman correlations were employed to analyze the relationships between resilience and health variables and social support. For controlling the possible confounding effects of the socio-demographic variables of caregivers and offspring in these relationships, partial correlations were conducted. Linear regression analyses were employed to determine the prediction of resilience on health indicators. As a confirmatory and clarifying analysis of the association between resilience and CAR, participants were divided into three groups based on their scores on resilience (high (N=21), medium (N=17) and low resilience (N=29) caregivers). For this purpose, author instructions for the employed resilience measure were applied (Sinclair & Wallston, 2004). ANCOVA of repeated measures of 'moment' (0´, 30´, 45´, and 60´) with 'group' as between-subject factor was performed to analyze differences between groups in the four analyzed moments of CAR. Although the categorization of the sample based on a continuous variable has been shown to be controversial, this analysis was performed to complement and reinforce the correlation and regression analyses. Greenhouse–Geisser adjustments for degree of freedom and Bonferroni adjustments for multiple contrasts were applied. The area under the curve with respect to the ground (AUCg CAR) and with respect to the increase (AUCi CAR) was calculated from CAR samples to capture the total amount of cortisol levels across the selected CAR time points (Pruessner, Kirschbaum, Meinlschmid, & Hellhamer, 2003).Bootstrapping was applied to test the indirect effect of resilience on perceived general health through the mediation of social support. Bootstrapping is a non-parametric technique employed to test mediation models. This method in small samples has been shown to be more advantageous than other traditional methods, such as linear regression or the Sobel test (Preacher & Hayes, 2008). All statistical analyses were performed using SPSS 21.0 software, considering any p<.05 as significant. The descriptive values are expressed as mean and standard deviation (M, SD, respectively).

Results

Relationships between resilience, self-reported health, CAR and social support

In the case of self-reported health, resilience showed negative correlations with somatic symptoms, anxiety, and insomnia and perceived general health (for all, p<.05). With regard to CAR, resilience showed negative correlations with Csal for the four analyzed moments and for AUCg (for all p<.001). For social support, high scores in resilience were related to high levels of emotional, tangible, positive social interaction, and the global index of social support (for all p<.05). When the confounding variables referring to caregivers and offspring were controlled, the same pattern of associations was found except for those regarding to self-reported health. When variables of the caregivers were controlled, no association was found between resilience and somatic symptoms and severe depression, although the relationship between resilience and perceived general health maintained the significance (p<.05). For controlled variables regarding the functionality of the offspring, the association between resilience and severe depression and affection revealed significant (p<.01). The full pattern of correlations is summarized in Table 2.

Table 2. Correlations between analyzed variables

		Resilience[a]	Resilience[b]	Resilience[c]
General Health Questionnaire	**Somatic symptoms**	-.280*	-.237	-.315*
	Anxiety and insomnia	-.234*	-.213	-.320**
	Severe depression	-.193	-.231	-.348**
	Social dysfunction	.015	-.089	-.113
	Perceived general health	-.297*	-.273*	-.353**
CAR	**Csal at awakening**	-.495**	-.473**	-.454**
	Csal at 30 minutes post awakening	-.616**	-.537**	-.531**
	Csal at 45 minutes post awakening	-.487**	-.459**	-.480**
	Csal at 60 minutes post awakening	-.442**	-.433**	-.427**
	AUCi	-.035	-.011	-.064
	AUCg	-.635**	-.568**	-.571**
Social Support	**Structural support**	-.084	-.130	-.104
	Emotional/Informational support	.386**	.335**	.425**
	Affection	.229	.216	.282*
	Tangible support	.274*	.260*	.250*
	Positive social interaction	.451**	.406**	.476**
	Global index of social support	.394**	.359**	.426**

[a] Spearman correlations between resilience and health variables (GHQ and CAR) and social support.

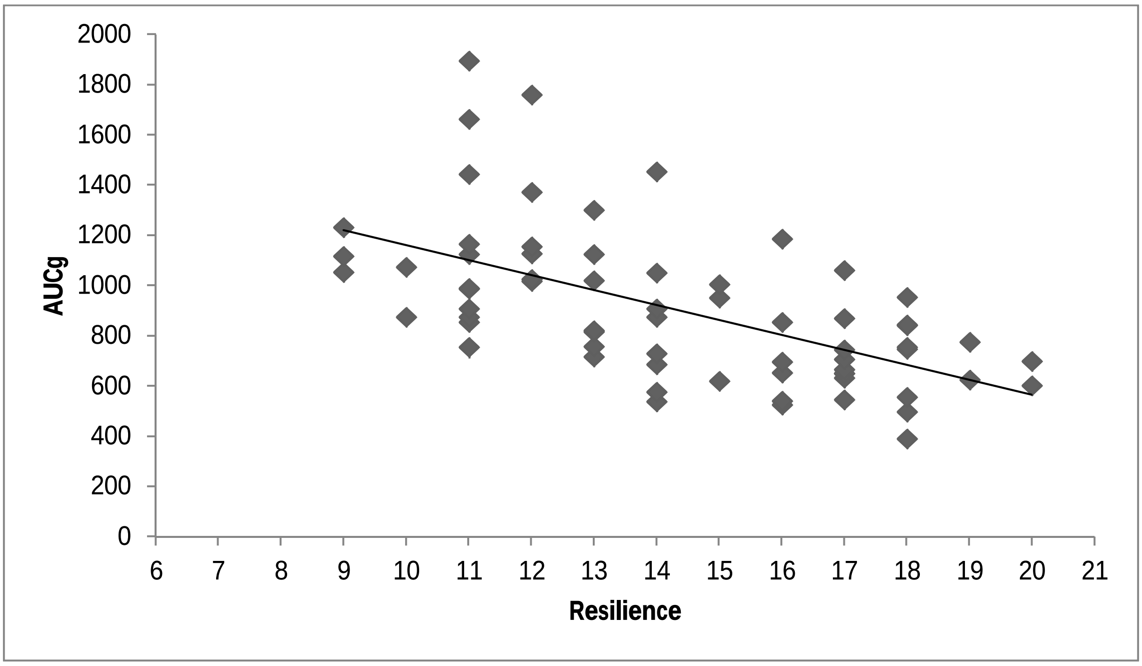
[b] Partial correlations between resilience and health variables and social support. The controlled variables are the socio-demographics of caregivers (gender, age, BMI, cigarette use, and phase of the menstrual cycle).

[c] Partial correlations between resilience and health variables and social support. The controlled variables are variables for the care recipient (severity of autistic symptoms, and dependency level of the offspring).

Prediction of resilience on self-reported health and CAR

With the aim of analyzing the prediction ability of resilience on self-reported health and CAR, regression analyses were conducted separately for each variable. In the case of total perceived general health, the model was significant F(1,65)=6.696, p<.01 (β=.306, p<.01) explaining 10% of the variance. For AUCg, resilience was also a significant predictor F(1,65)=33.789, p<.0001 (β=.585, p<.0001) explaining 33% of variance (Figure 1). No significant effects of resilience on AUCi were found.

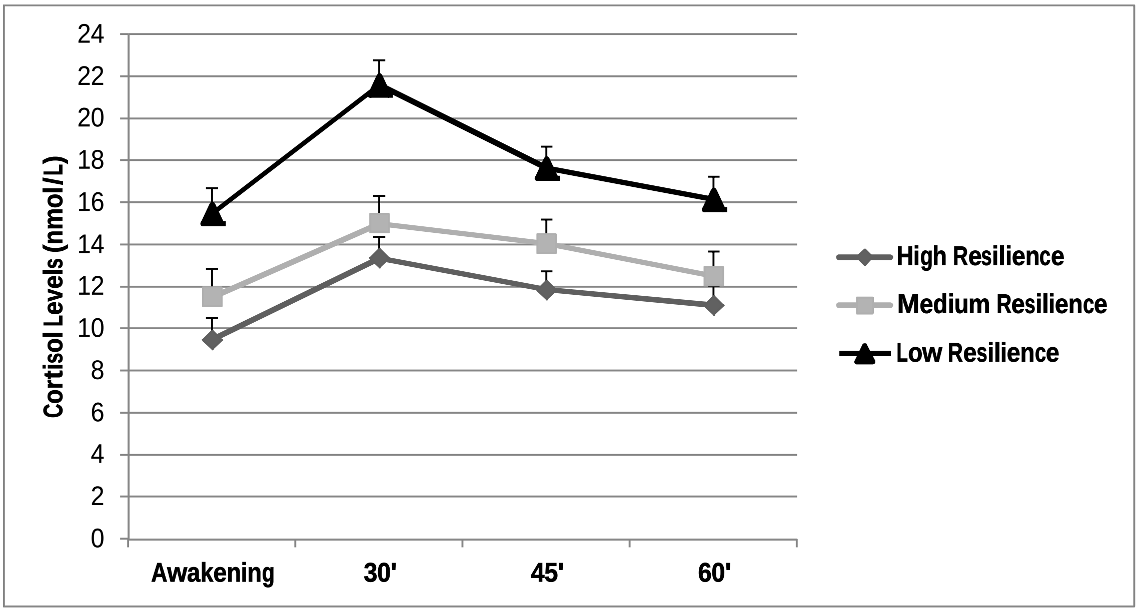
Figure 1. Resilience as a predictor of AUCg.



Differences between high, medium and low resilience caregivers in self-reported health and CAR

To evaluate differences in the whole CAR depending on the scores in resilience, differences between high, medium, and low resilience caregivers in the four moments of the CAR were analyzed. Taking into account the differences between groups in gender [$\chi^2(2,N=67)=6.469$, $p<.05$), this variable has been included as a covariate in the analyses. In the case of Csal, a main effect of the factor ‘‘group’’ was found $F(2,63)=15.731$, $p<.0001$, $\eta^2_{partial}=.33$. Post hoc analyses revealed differences between low resilience caregivers and medium and high resilience caregivers ($p<.01$). In this case, the former presented higher levels of morning cortisol levels than the other two groups (Figure 2).

Figure 2. Csal levels at awakening and 30, 45 and 60 min later for high, medium and low resilience caregivers.



The mediation effect of social support

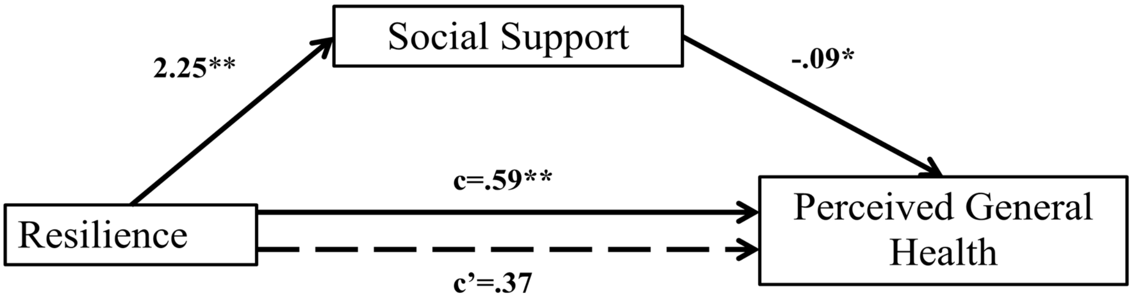
Social support was tested as a mediator of the association between resilience and total perceived general health. Mediation analysis revealed that the total effect of resilience on perceived general health was significant B=.59, SE=.21, p<.01. Resilience, in turn, predicted social support B=2.25, SE=.66, p<.01. The mediator variable, social support, predicted perceived general health B=.09, SE=.03, p<.05. The examination of the indirect effect of resilience on perceived general health, through the social support effect, revealed a significant mediation (indirect effect =.22; 95% CI for bias correct indirect effect: lower level =.51, upper level =.05). When social support was introduced in the model as a mediator, the association between resilience and perceived general health did not reach statistical significance (B=.37, SE=.22, p>.09), suggesting the mediating effect of social support in that association. Overall, the model (F(2,63)=7.5234, p<.01) predicts 17% of perceived general health in caregivers.

The same model was tested introducing AUCg as a dependent variable but no significant mediating results were found.

In order to analyze which specific factors of social support could mediate the association between resilience and social support, it has been analyzed each subscale of social support separately. Two factors of the social support were significant mediators, emotional/informational support and positive social interaction. Regard to emotional/informational support, this factor showed a significant direct effect on perceived general health (B=.18, SE=.08, p<.05). Resilience also significantly predicted emotional/informational support (B=.99, SE=.31, p<.01). The indirect effect was =.18; 95% CI for bias correct indirect effect: lower level =.43, upper level =.02. When emotional support was introduced in the model as a mediator, the association between resilience and perceived general health did not reach statistical significance (B=.41, SE=.22, p>.06), suggesting the mediating effect of emotional support in that association. Overall, the model (F(2,63)=6.5071, p<.01) predicts 15% of perceived general health.

With regard to positive social interaction, this factor also showed a significant direct effect on perceived general health (B=.36, SE=.17, p<.05). Resilience also significantly predicted positive social interaction (B=.56, SE=.14, p<.001). The indirect effect was =.20; 95% CI for bias correct indirect effect: lower level =.48, upper level =.02. When positive social interaction was introduced in the model as a mediator, the association between resilience and perceived general health did not reach statistical significance (B=.38, SE=.22, p>.09), suggesting the mediating effect of positive social interaction in that association. Overall, the model (F(2,63)=6.3664, p<.01) predicts 14% of perceived general health (Figure 3).

Figure 3. Representation of the relationships between the predicting variable, resilience, the mediator variable, social support, and the criterion variable, perceived general health. The numerical values correspond to the unstandarized regression coefficients (p <.01, *p <.05).**



Discussion

Our results showed that resilient coping is a protective factor for health complaints in caregivers of people with ASD, as has been previously found (Bekhet, Johnson, & Zauszniewski, 2012b). As described before (Fernández-Lansac et al., 2012; Nabors et al., 2013; Tang et al., 2013), higher scores in resilience have been associated with less anxiety, insomnia, depression and somatic symptoms in caregivers. Moreover, our results provide a biological insight through the use of biological health markers such as CAR. Resilience has shown a negative relationship with all the measures of CAR and with AUCg. Furthermore, this association maintained statistical significance after controlling for the possible confounding effects of the sociodemographic variables of the caregivers and offspring. These results have been confirmed when the whole CAR has been analyzed – dividing caregivers into three groups based on resilience scores. In this case, all the groups show a normal increase from awakening to 30 min later, with all groups exceeding 2.5 nmol/l, the criterion proposed by the authors for a normal rise (Wust et al., 2000). Nevertheless, highly resilient caregivers showed lower Csal levels than low resilience caregivers. These results could indicate a compromised ability by low resilience caregivers to bounce back from the stress derived from caring.

Indeed, it has been postulated that resilient individuals have an ability to keep the hypothalamic-pituitary-adrenal axis in an optimal range of functioning – with an effective adaptation of this axis to the stressful situation (Ozbay et al., 2007). A lack of adaptation of this axis in low resilience caregivers could be an explanation of the higher morning cortisol levels in this group. These results are in line with previous studies conducted with mistreated and non-mistreated children (Cicchetti, 2010; Cicchetti & Rogosch, 2007). In these studies, the authors found a negative relationship between resilience and morning cortisol levels. The same results were found for other resilient variables such as optimism or social support (Ozbay et al., 2007; Lai et al., 2005). In the care context, a possible explanation of these results could be in the perceived demands of the care situation. One of the hypotheses for explaining high levels of morning cortisol levels in caregivers could be the anticipation of care demands, as has been found in previous studies conducted with caregivers of people with ASD (Ruiz-Robledillo & Moya-Albiol, 2013; Ruiz-Robledillo et al., 2014). This anticipation hypothesis has been corroborated in several chronically stressed samples (Fries et al., 2009). These results have been found in more than just the clinical population. One study in this line, carried out with working mothers, found a higher average of morning cortisol levels in those mothers with high stress perception. This greater increase in cortisol levels was more pronounced on workdays than non-workdays, when the upcoming demands are higher (Hibel, Mercado, & Trumbell, 2012). Low resilience caregivers could perceive the demands associated with the care situation to be more threatening and this could lead to increased secretion of morning cortisol (Fries et al., 2009). Thus, although higher morning cortisol secretion is needed to enhance several physiological mechanisms for coping with the upcoming demands and could be adaptive, prolonged exposure at higher levels could have several negative consequences for the health of caregivers (Lindfors & Lundberg, 2002).

With regard to the association between resilience and social support, it has been previously described that social support is closely related to resilience, protecting the health of people undergoing chronic stress (Gallagher & Whiteley, 2012; Lovell et al., 2012b; Ozbay et al., 2007; Ozbay, Fitterling, Charney, & Southwick, 2008). However, in our study, social support mediates the association between resilience and self-reported health. It is probably the case that greater resilience enables individuals to look for social support in an effective manner. At the same time, the availability of social support could be higher in resilient caregivers, since they may maintain better social networks and therefore have greater social support. Hence, high resilience caregivers could have an ability to maintain and look for new social support resources, and in turn, this behavior could reinforce resilience (Lovell et al., 2012b; Wilks & Croom, 2008). Previous studies have found that high levels of perceived social support were related to effective cardiovascular habituation to stress in laboratory settings, an ability that authors have related to resilient stress coping (Howard & Hughes, 2012). Regard to other biological markers of health, such as CAR, social support has been associated to an adaptive CAR in caregivers of people with ASD (Lovell et al., 2012b). In contrast, low levels of social support were related to exaggerated neuroendocrine and cardiovascular responses to laboratory stress (Ozbay et al., 2007). As explained before, probably those caregivers with higher levels of social support could perceive less stressful the care situation, exhibiting lower levels of symptoms compared to caregivers with lower perceived social support (Lovell et al., 2012b). When specific types of social support were evaluated, positive social interaction and emotional/informational support were significant mediators of the association between resilience and self-reported health. Positive social interaction refers to the availability of other people for fun activities. This personal resource could be an indicator of the social functioning of the resilient caregiver and, at the same time, their involvement in a social context through participation in leisure activities with others. Hence, having the social resources to do several leisure activities could be an escape of the stressor focus for the caregiver. Respite interventions (time when the caregiver is far away from the stressor focus, in this case, the patient) has been one of the most effective interventions in reducing stress perception and health complaints in caregivers (Garcés, Carretero, Ródenas, & Alemán, 2010). Furthermore, social participation could maintain a beneficial social support network, avoiding the social isolation typical of informal caregivers (Heiman & Berger, 2008). This fact could be directly related with the other mediator of social support, emotional/informational support. In this sense, the availability of an extended social network could be an important resource for emotional/informational support. This type of support could provide valuable information about several aspects of the care situation, while provides an opportunity for emotional discharge.

Although social support mediated the association between resilience and perceived general health, this effect was not found in CAR. In this regard, probably the subjective perception of social support of caregivers could explain this result. It has been demonstrated that different mechanisms are involved in the association between perceived and real received social support and health outcomes (Uchino, 2009). Probably, perceived social support could have a higher effect on self-perceived health compared to CAR. In this sense, CAR is more objective and stable indicator than self-reported health, and changes in this marker could require an effect more prolonged in time. In this sense, a previous study has found a significant association between institutional support and CAR in caregivers of people with ASD (Ruiz-Robledillo et al., 2014). In this study, caregivers were receiving institutional support for at least one year before the study. This type of support was not subjective, it was a formal support provided by institutional organization. Results of this study showed that those caregivers without support presented a blunted CAR compared with those were receiving it. These results could demonstrate that formal support prolonged in time compared to perceived social support could has higher effects modulating CAR.

Conclusions

Some limitations have to be considered in the present study. Firstly, the health complaints analyzed in this study are self-reported. This entails the perception of caregivers about their own health being a subjective indicator. In this sense, a more exhaustive analysis of health, including medical reports, is needed due to the relevance of the results. However, the inclusion of CAR, a biological marker of health, corroborates health affection shown by caregivers in an objective manner. Although the cross-sectional character of the study makes it difficult to establish causality between resilience and health domains, this study presents several contributions to the study of resilience in caregivers of people with ASD. The fact that highly resilient caregivers present fewer health complaints than low resilience caregivers indicates the importance of having an ability to effectively bounce back from stress with the aim of avoiding health dysfunctions. Given that a care situation is unchangeable and long-lasting, it is necessary to discover the levels of resilience in caregivers in order to prevent negative health outcomes. In clinical practice, it would be beneficial to know the level of resilience in caregivers with a recently diagnosed patient with the aim of establishing groups of low resilience caregivers at risk of suffering several health complaints. At this point, several interventions could be implemented in order to increase resilience in caregivers, and therefore, their ability to bounce back from the stress effectively. In this regard, the association between resilience, social support and health has to be taken into account in the development of therapeutic approaches. Fundamentally, those types of social support that have demonstrated mediate the association between resilience and health (positive social interaction and emotional/informational support).Conclusions of the study show that the availability of a social network entails better health outcomes in caregivers, through sharing leisure activities and informational and emotional support. Probably, these effects are more related with self-perceived health, and future studies should evaluate the long term effects of social support on CAR.

References

Baron-Cohen, S., Hoekstra, R.A., Knickmeyer, R., & Wheelwright, S. (2006). The Autism Spectrum Quotient (AQ)-Adolescent Version. *Journal of Autism and Developmental Disorders, 36* (3), 343–350.

Bayat, M. (2007). Evidence of resilience in families of children with autism. *Journal of Intellectual Disability Research, 51* (9), 702–714.

Bekhet, A.K., Jhonson, N.L., & Zauszniewski, J.A. (2012a). Effects of resilience of caregivers of persons with autism spectrum disorder: The role of positive cognitions. *Journal of the American Psychiatric Nurses Association, 18* (6), 337–344.

Bekhet, A.K., Jhonson, N.L., & Zauszniewski, J.A. (2012b). Resilience in family members of persons with autism spectrum disorder: A review of the literature. *Issues in Mental Health Nurses, 33* (10), 650–656.

Bonanno, G.A. (2012). Uses and abuses of the resilience construct: Loss, trauma, and health-related adversities. *Social Science and Medicine, 74* (5), 753–756.

Boyd, B.A. (2002). Examining the relationship between stress and lack of social support in mothers of children with autism. *Focus on Autism and Other Developmental Disabilities, 17* (4), 208–215.

Cicchetti, D. (2010). Resilience under conditions of extreme stress: A multilevel perspective. *World Psychiatry, 9* (3), 145–154.

Cicchetti, D., & Rogosch, F.A. (2007). Personality, adrenal steroid hormones, and resilience in maltreated children: A multilevel perspective. *Development and Psychopathology, 19* (3), 787–809.

Cohen, C., Colantonio, A., & Vernich, L. (2002). Positive aspects of caregiving: Rounding out the caregiver experience. *International Journal of Geriatric Psychiatry, 17* (2), 184–188.

De Andrés-García, S., Moya-Albiol, L., & González-Bono, E. (2012). Salivary cortisol and immunoglobulin A: Responses to stress as predictors of health complaints reported by caregivers of offspring with autistic spectrum disorder. *Hormones & Behavior, 62* (4), 464–474.

de Vught, M.E., Nicolson, N.A., Aalten, P., Lousberg, R., Jolle, J., & Verhey, F.R. (2005). Behavioral problems in dementia patients and salivary cortisol patterns in caregivers. *Journal of Neuropsychiatry and Clinical Neuroscience, 17* (2), 201–207.

Fernández Seara, J.L. (1992). EAE: escalas de apreciación del estrés: manual. Madrid: TEA Ediciones SA.

Fernández-Lansac, V., & Crespo, M. (2011). Resilience, hardiness and growth in dementia patients' family caregivers: A review. *Clínica y Salud, 22* (1), 21–40.

Fernández-Lansac, V., Crespo, M., Cáceres, R., & Rodríguez-Poyo, M. (2012). Resiliencia en cuidadores de personas con demencia: un estudio preliminar. *Revista Española de Geriatría y Gerontología, 47* (3), 102–109.

Fries, E., Dettenborn, L., & Kirschbaum, C. (2009). The cortisol awakening response (CAR): Facts and future directions. *International Journal of Psychophysiology, 72* (1), 67–73.

Gallagher, S., & Whiteley, J. (2012). Social support is associated with blood pressure responses in parents caring for children with developmental disabilities. *Research in Developmental Disabilities, 33* (6), 2099–2105.

Garcés, J., Carretero, S., Ródenas, F., & Alemán, C. (2010). A review of programs to alleviate the burden of informal caregivers of dependent persons. *Archives of Gerontology and Geriatrics, 50* (3), 254–259.

Gardiner, E., & Iarocci, G. (2012). Unhappy (and happy) in their own way: A developmental psychopathology perspective on quality of life for families living with developmental disability with and without autism. *Research in Developmental Disabilities, 33* (6), 2177–2192.

Gaugler, J.E., Kane, R.L., & Newcomer, R. (2007). Resilience and transitions from dementia caregiving. *Journal of Gerontology: Psychological Sciences, 62* (1), 38–44.

Goldberg, D.P., & Hillier, V. (1979). A scaled version of the general health questionnaire. *Psychological Medicine, 9* (1), 139–145.

González-Bono, E., De Andrés-García, S., & Moya-Albiol, L. (2011). The cortisol awakening response in caregivers of schizophrenic offspring shows sensitivity to patient status. *Anxiety, Stress and Coping, 24* (1), 107–120.

Heiman, T. (2002). Parents of children with disabilities: Resilience, coping, and future expectations. *Journal of Developmental and Physical Disabilities, 14* (2), 159–171.

Heiman, T., & Berger, O. (2008). Parents of children with Asperger syndrome or with learning disabilities: Family environment and social support. *Research in Developmental Disabilities, 29* (4), 289–300.

Hibel, L.C., Mercado, E., & Trumbell, J.M. (2012). Parenting stressors and morning cortisol in a sample of working mothers. *Journal of Family Psychology, 26* (5), 738–746.

Howard, S., & Hughes, B.M. (2012). Benefit of social support for resilience-building is contingent on social context: Examining cardiovascular adaptation to recurrent stress in women. *Anxiety, Stress and Coping, 25* (4), 411–423.

Khanna, R., Madhavan, S.S., Smith, M.J., Patrick, J.H., Tworek, C., & Becker-Cottrill, B. (2011). Assessment of health-related quality of life among primary caregivers of children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 41* (9), 1214–1227.

Lai, J.C., Evans, P.D., Ng, S.H., Chong, A.M., Siu, O.T., Chan, C.L., ... & Chan, C.C. (2005). Optimism, positive affectivity, and salivary cortisol. *British Journal of Health Psychology, 10* (4), 467–484.

Lee, J. (2013). Maternal stress, well-being, and impaired sleep in mothers of children with developmental disabilities: A literature review. *Research in Developmental Disabilities, 34* (11), 4255–4273.

Lin, F.Y., Rong, J.R., & Lee, T.Y. (2013). Resilience among caregivers of children with chronic conditions: A concept analysis. *Journal of Multidisciplinary Healthcare, 6*, 323–333.

Lindfors, P., & Lundberg, U. (2002). Is low cortisol release an indicator of positive health? *Stress and Health, 18* (4), 153–160.

Lovell, B., Moss, M., & Wetherell, M. (2012). The psychosocial, endocrine and immune consequences of caring for a child with autism or ADHD. *Psychoneuroendocrinology, 37* (4), 534–542.

Lovell, B., Moss, M., & Wetherell, M. (2012). With a little help from my friends: Psychological, endocrine and health corollaries of social support in parental caregivers of children with autism or ADHD. *Research in Developmental Disabilities, 33* (2), 682–687.

Mahoney, F.I., & Barthel, D.W. (1965). Functional evaluation: The Barthel Index. *Maryland State Medical Journal, 14,* 61–65.

Moya-Albiol, L., Serrano, M.A., & Salvador, A. (2010). Job satisfaction and cortisol awakening response in teachers scoring high and low burnout. *Spanish Journal of Psychology, 13* (2), 629–636.

Nabors, L.A., Kichler, J.C., Brassell, A., Thakkar, S., Bartz, J., & Pangallo, J. (2013). Factors related to caregiver state anxiety and coping with a child’s chronic illness. *Families, Systems and Health, 31* (2), 171–180.

Nygren, B., Alex, L., Jonsen, E., Gustafson, Y., Norberg, A., & Lundman, B. (2005). Resilience, sense of coherence, purpose in life and self-transcendence in relation to perceived physical and mental health among the oldest old. *Aging and Mental Health, 9* (4), 354–362.

Ozbay, F., Johnson, D.C., Dimoulas, E., Morgan, C.A., Charney, D., & Southwick, S. (2007). Social support and resilience to stress: From neurobiology to clinical practice. *Psychiatry, 4* (5), 35–40.

Ozbay, F., Fitterling, H., Charney, D., & Southwick, S. (2008). Social support and resilience to stress across the life span: A neurobiological framework. *Current Psychiatry Reports, 10* (4), 304–310.

Perna, L., Mielck, A., Lacruz, M., Emeny, R., Holle, R., Breitfelder, A., & Ladwig, K. H. (2012). Socioeconomic position, resilience, and health behaviour among elderly people. *International Journal of Public Health, 57* (2), 341–349.

Phelps, K., McCammon, S., Wuensch, K., & Golden, J. (2009). Enrichment, stress, and growth from parenting an individual with an autism spectrum disorder. *Journal of Intellectual and Developmental Disability, 34* (2), 133–141.

Preacher, K.J., & Hayes, A.F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40* (3), 879–891.

Pruessner, J.C., Kirschbaum, C., Meinlschmid, G., & Hellhammer, D.H. (2003). Two formulas for the computation of the area under the curve represent measures of total hormone concentration versus time-dependent change. *Psychoneuroendocrinology, 28* (7), 916–931.

Ruiz-Robledillo, N., & Moya-Albiol, L. (2013). Self-reported health and cortisol awakening response in parents of people with Asperger syndrome: The role of trait anger and anxiety, coping and burden. *Psychology and Health, 28* (11), 1246–1264.

Ruiz-Robledillo, N., González-Bono, E., & Moya-Albiol, L. (2014). Lack of institutional support entails disruptions in cortisol awakening response in caregivers of people with high functioning autism. *Journal of Health Psychology, 19* (12), 1586-1596.

Sherbourne, C.D., & Stewart, A.L. (1991). The MOS social support survey. *Social Science and Medicine, 32,* 705–714.

Sinclair, V.G., & Wallston, K.A. (2004). The development and psychometric evaluation of the Brief Resilient Coping Scale. *Assessment, 11* (1), 94–101.

Smith, B.W., Tooley, E.M., Christopher, P.J., & Kay, V.S. (2010). Resilience as the ability to bounce back from stress: A neglected personal resource? *Journal of Positive Psychology, 5* (3), 166–176.

Smith, L.E., Hong, J., Seltzer, M.M., Greenberg, J.S., Almeida, D.M., & Bishop, S. (2010). Daily experiences among mothers of adolescents and adults with ASD. *Journal of Autism and Developmental Disorders, 40* (2), 167–178.

Sojo, V., & Guarino, L. (2011). Mediated moderation or moderated mediation: Relationship between length of unemployment, resilience, coping and health. *Spanish Journal of Psychology, 14* (1), 272–281.

Tang, S.T., Huang, G.H., Wei, Y.C., Chang, W.C., Chen, J.S., & Chou, W.C. (2013). Trajectories of caregiver depressive symptoms while providing end-of-life care. *Psychooncology, 22* (12), 2702–2710.

Uchino, B.N. (2009). Understanding the links between social support and physical health: A life-span perspective with emphasis on the separability of perceived and received support. *Perspectives on Psychological Science, 4* (3), 236–255.

Wilks, S., & Croom, B. (2008). Perceived stress and resilience in Alzheimer’s disease caregivers: Testing moderation and mediation models of social support. *Aging & Mental Health, 12* (3), 357–365.

Wust, S., Federenko, I., Hellhammer, D.H., & Kirschbaum, C. (2000). Genetic factors, perceived chronic stress, and the free cortisol response to awakening. *Psychoneuroendocrinology, 25* (7), 707–720.

Yi, J.P., Vitaliano, P.P., Smith, R.E., Yi, J.C., & Weinger, K. (2008). The role of resilience on psychological adjustment and physical health in patients with diabetes. *British Journal of Health Psychology, 13* (2), 311–325.

Zarit, S.H., Reever, K.E., & Bach-Peterson, J. (1980). Relatives of the impaired elderly: Correlates of feelings of burden. *Gerontologist, 20*, 649–654.

Chapter 4

Study 3: Emotional intelligence modulates cortisol awakening response and self-reported health in caregivers of people with autism spectrum disorders.

Published in: Ruiz-Robledillo, N[1]., & Moya-Albiol, L[1]. (2014). Emotional intelligence modulates cortisol awakening response and self-reported health in caregivers of people with autism spectrum disorders. *Research in Autism Spectrum Disorders, 8* (11), 1535-1543.

[1] Department of Psychobiology, University of Valencia

Introduction

Caring for offspring with autism spectrum disorders (ASDs) has been related to negative consequences for the caregivers’ health (Ruiz-Robledillo & Moya-Albiol, 2013). Specifically, high numbers of somatic symptoms, depression, anxiety and poorer self-perceived general health have been described in this population (Ruiz-Robledillo & Moya-Albiol, 2013). Caregiving is a source of chronic stress and, as a consequence, may lead to alterations in autonomic, endocrine and immune function (De Andrés-García, Moya-Albiol & González-Bono, 2012; Lovell, Moss & Wetherell, 2012a; Ruiz-Robledillo & Moya-Albiol, 2013).

Previous studies have demonstrated that the health of caregivers of people with ASDs is affected by caregiving. Many studies have analyzed factors that could enhance these effects, such as the severity of autistic symptoms and behavioral problems of the care recipient (Barker et al., 2011; Davis & Carter, 2008) or other psychosocial variables, including social support or coping (Hastings et al., 2005; Lovell, Moss & Wetherell, 2012b). In contrast, relatively little attention has been paid to psychological trait variables in caregivers that could protect against these negative effects on their health. However, recent research has pointed to several trait variables of caregivers that could minimize the impact of caregiving on their health. Specifically, positive variables such as resilience, hardiness or personal growth have been reported to have a positive effect, preventing health impairment in samples of caregivers (Phelps, McCammon, Wuensch, & Golden, 2009; Ruiz-Robledillo, De Andrés-García, Pérez-Blasco, González-Bono & Moya-Albiol, 2014; Weiss, 2002). Nevertheless, other positive factors that could protect caregivers’ health have yet to be evaluated, and these include emotional intelligence.

Emotional intelligence (EI) is defined as the ability of individuals to identify and manage their own emotions (Salovey, Mayer, Goldman, Turvey, & Palfai, 1995). Generally, three processes are included in EI: attention, the tendency to pay attention and think about emotions and feelings; clarity, the ability to understand one's own emotional states; and repair, the ability to regulate one's feelings, terminating negative emotions and/or prolonging positive ones. As emotions have been classically related to health status in several populations (Consedine & Moskowitz, 2007), EI could be a protective factor against health impairment. The few studies that have analyzed the association between EI and health have reported a positive relationship between these variables (Ciarrochi, Deane & Anderson, 2002; Extremera & Fernández-Berrocal, 2002; Extremera & Fernández-Berrocal, 2006; Martins, Ramalho & Morin, 2010; Schutte, Malouff, Thorsteinsson, Bhullar, & Rooke, 2007). Moreover, a meta-analysis demonstrated the protective effects of EI overall on several health domains, namely mental, psychosomatic and physical health (Schutte et al., 2007). However, the relationship with health outcomes seems to be different analyzing each component of EI separately (Ciarrochi et al., 2002; Extremera & Fernández-Berrocal, 2006). Specifically, in a sample of students, clarity and repair were related to better quality of life and psychological functioning, whereas attention to feelings was associated with poorer quality of life and psychological functioning (Ciarrochi et al., 2002). These different relationships were also found in studies conducted in other populations, for instance, middle-aged women (Extremera & Fernández-Berrocal, 2002).

Further, while the relationship between EI and self-reported health has been studied, to our knowledge, no studies have analyzed the association between EI and biological markers of health, such as the cortisol awakening response (CAR) in samples of informal caregivers. CAR is a measure of the activity of the hypothalamic–pituitary–adrenal (HPA) axis, which is the major endocrine system involved in stress response (Fries, Dettenborn, & Kirschbaum, 2009). Typically, levels of cortisol increase from awakening to approximately 30 min later, it having been proposed that an increase of 2.5 nmol/l is normal (Wust, Federenko, Hellhammer, & Kirschbaum, 2000). This response is modulated by several socio-demographic and psychosocial factors, including age, gender, phase of the menstrual cycle, smoking habit, and body mass index (Fries et al., 2009). Furthermore, CAR has shown to be altered under chronic stress, as in the case of people with a diagnosis of post-traumatic stress disorder or burnout, and also informal caregivers (De Vught et al., 2005; Moya-Albiol, Serrano & Salvador, 2010; Ruiz-Robledillo & Moya-Albiol, 2013; Ruiz-Robledillo et al., 2014). In relation to this, abnormalities in CAR could indicate altered HPA axis activity that, in turn, would imply adverse health outcomes. In this regard, only two studies have assessed the effect of EI as a mediator between stress and health outcomes (Mikolajczak, Roy, Luminet, Fillée & de Timary, 2007; Salovey et al., 2002). In the earlier study, high clarity and attention predicted lower cortisol reactivity to acute stress in a general population (Salovey et al., 2002), and in the second study, high EI overall was related to lower evening cortisol secretion in response to acute laboratory stress (Mikolajczak et al., 2007). However, both studies considered non-chronically stressed populations and analyzed evening cortisol but not CAR.

There is a lack of data on the potential protective effects of EI on health of caregivers of people with ASDs and, to our knowledge, no previous studies in this field have considered both self-reported and biological markers. In this context, the main aims of the present study consisted of assessing the association between components of EI (attention, clarity and repair) and both self-reported health and CAR. Overall, we expected self-reported health to be associated negatively with attention and positively with clarity and repair (Ciarrochi et al., 2002; Extremera and Fernández-Berrocal, 2006). The secondary aim was to assess whether CAR was a mediator between EI and self-reported health. Though there were no previous data on this in caregivers, we hypothesized that an altered HPA axis response would mediate the relationship between EI and caregivers' health as has been suggested in a previous study conducted with students (Mikolajczak et al., 2007).

Methods

Participants and procedure

The study was performed in Alicante and Valencia, two cities in the Region of Valencia (Spain). Caregivers were mainly recruited from members of two associations of relatives of people with ASDs: Asociación Valenciana de Padres de Personas con Autismo (APNAV) and Asociación Asperger Alicante (ASPALI). First, a meeting was conducted with caregivers to explain the aim of the research and the criteria for participation (being mother/father of an individual with a clinical diagnosis of an ASD (patients were diagnosed with ASD by clinical staff of the aforementioned associations following the DSM-IV-R criteria); living at home with the care recipient; and having been the primary caregiver (that is, the person with the greatest responsibility for the daily care and rearing of the child) for at least two years before the study). Of a total of 150 caregivers who attended, 68 parents of people with a diagnosis of ASD (26 men and 42 women) agreed to participate and met selection criteria. At this meeting, we conducted the first interview to collect general information about the participants and administered a battery of questionnaires for evaluating health and other trait variables. In addition, we gave instructions for collecting saliva at home (eight Salivettes) for subsequent laboratory measurements and calculation of salivary cortisol (Csal) (see procedure below). A new meeting was scheduled to collect the saliva samples of the participants and carry out a second interview to assess the level of dependence of the care recipients and record their diagnosis, autistic severity, and socio-demographic characteristics (age, gender), as well as collect data on the parent's caregiving status (years of care, time spent caring per week, whether the caregiving was shared) and variables that could affect their cortisol levels (see Table 1).

The study was approved by the ethical committee of the University of Valencia. All participants participated voluntarily in the study and gave informed consent before inclusion in line with the ethical principles for research involving humans of the Declaration of Helsinki. Descriptive data for all caregivers are summarized in Table 1.

Table 1. Characteristics of the caregivers and their caring role.

Variable/characteristics		N=68
Gender	**Male**	26 (38.2%)
	Female	42 (61.8%)
Age		45.04 ± 6.31
Body mass index (kg/m^2)		27.13 ± 4.96
Phase of menstrual cycle (among the women)	**Luteal**	17 (40.5%)
	Follicular	15(35.7%)
	Amenorrhea	10 (23.8%)
Marital status	**Single**	2 (2.9%)
	Married	60 (88.2%)
	Divorced	5 (7.4%)
	Widowed	1 (1.5%)
Smoker	**Yes**	16 (23.5%)
	No	52 (76.5%)
Level of education	**Primary**	23 (33.8%)
	Secondary	19(27.9%)
	University	25 (36.8%)
	Other	1 (1.5%)
Source of income	**Pension**	15 (22.1%)
	Earnings from employment	46 (67.6%)
	Other	7 (10.3%)
Care status		
History of care (years)		12.04 ± 5.52
Time spent caring per week (hours)		54.41 ± 41.02

Shared care	**Yes**	58 (85.3%)
	No	10 (14.7%)
Diagnosis of care recipient	**Autism**	29 (42.6%)
	Asperger	39 (57.4%)
Gender of care recipient	**Male**	60 (88.2%)
	Female	8 (11.8%)
Age of care recipient		13.77 ± 4.82
AQ		31.88 ± 5.66
Barthel Index (level of independence)		84.46 ± 17.36

Variables and measurement instruments

Emotional intelligence

EI was assessed using the shortened, validated and adapted Spanish version of the Trait Meta-Mood Scale (TMMS-24; Fernández-Berrocal, Extremera, & Ramos, 2004). Responses to the 24 items are rated on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The scale is composed of three 8-item subscales: attention to feelings, referring to awareness of one's mood; clarity of feelings, the self-perceived ability to discriminate between moods; and mood repair, the self-perceived ability to regulate one's emotional states. Scores on each subscale range from 8 to a maximum of 40 points. The reliability coefficients of all of the subscales are above 0.85. In the Spanish version, test–retest correlations were satisfactory: r = 0.60 for attention, r=0.70 for clarity and r=0.83 for repair.

Cortisol awakening response (CAR)

Samples for Csal measurements were collected using Salivette tubes (Sarstedt, Rommelsdorf, Germany). Participants were instructed to store the samples in a freezer at home until the collection of the samples by the researchers. On arrival at the laboratory, the samples were maintained frozen at −20 °C until analysis by radioimmunoassay using a cortisol Coat-A-Count kit (DPC, Siemens Medical Solutions Diagnostics). All samples were measured in duplicate in the same assay. Assay sensitivity was 0.5 ng/dl. The criterion for measurement repeatability was an inter-duplicate coefficient of variation ≤8%. The coefficients of intra and inter-assay variation were 2.8 and 5.3% respectively. All values are expressed in nmol/l.

The CAR was calculated as the average salivary cortisol level over two consecutive days at waking and 30, 45, and 60 min later. In order to ensure proper collection of saliva samples, we trained participants in the procedure they should follow and gave them a diary to record information related to various factors that could alter or modify cortisol secretion. Specifically, participants were asked to record the following: time of awakening, time of saliva collection, level of energy on a scale of 1 (low)–10 (high), expectations about the day, consumption of stimulants, alcohol or smoking the day before, the number of hours they had slept and sleep quality on a scale of 1 (very poor)–10 (very good). Further, they were instructed to abstain from eating, drinking stimulants (such as tea, coffee, or alcohol), brushing their teeth, and smoking from waking until they had taken the last of the saliva samples for that day. They were excluded if they reported consuming antipsychotics or any other drug or substance that is known to alter the levels of cortisol. As mentioned above, in the interview during the first meeting, data were collected on other potential confounders that could affect cortisol levels, such as age, body mass index (BMI), gender, phase of the menstrual cycle and smoking status, to control for these factors in the statistical analysis.

Self-reported health

Self-perceived general health was assessed with the shorter 28-item Spanish validated version (Lobo, Pérez-Echevarría, & Artal, 1986) of the General Health Questionnaire (GHQ-28) designed by Goldberg & Hillier (1979). The items are scored on a four-point Likert scale from 0 (better than usual) to 3 (worse than usual). Scores were summed for four subscales: somatic symptoms, anxiety and insomnia, social dysfunction, and severe depression, and results were also expressed as a total score for self-perceived general health. All subscales had a Cronbach's α of greater than 0.92. In the Spanish version, authors obtained indices of sensitivity and specificity above 75% when using this scale in different patient groups.

Status of care recipient

To evaluate the level of independence of the care recipient, caregivers completed the Spanish version (adapted by Baztán et al., 1993) of the Barthel Index (Mahoney & Barthel, 1965) referring to their offspring. This instrument assesses the performance of 12 basic activities of daily living such as eating, showering, and bladder control (among others). The Cronbach's α was higher than 0.87 for all items. Higher scores in this questionnaire indicate a greater degree of independence of the care recipient with a maximum score of 100. Based on the obtained scores, care recipients could be classified as follows: 0–20 totally dependent, 21–60 severely dependent, 61–90 moderately dependent, 91–99 slightly dependent or 100 independent.

The degree of autism of the care recipient was also assessed with the Autism Spectrum Quotient (AQ) created by Baron-Cohen, Hoekstra, Knickmeyer, and Wheelwright (2006), completed by caregivers. This questionnaire is composed of 50 items rated on a four-point Likert scale and had a reliability coefficient of 0.76. A higher score indicates a higher degree of autism with a maximum of 50. Although the severity of autism was established by clinical staff of the associations in the diagnosis of the care recipient, we considered it important to assess the subjective perception of the severity of autistic symptoms from the point of view of the caregivers. Furthermore, this assessment could be useful for complementing and reinforcing the official clinical diagnosis.

Statistical analysis

Spearman's coefficients were calculated to analyze the association between EI and both self-reported health and CAR. Linear regression analyses were employed to assess the predictive power of EI on health status. As a confirmatory and clarifying analysis of the association between EI and CAR, participants were divided into two groups based on their scores on EI components (attention, clarity and repair) by cluster analysis. Repeated measures ANOVA was performed to assess differences between the groups at each ‘time point’ CAR was measured (0′, 30′, 45′, and 60′) with ‘group’ as the between-subject factor. t-Tests were then used to identify differences in self-reported health between groups. Although the categorization of samples based on a continuous variable is controversial, this analysis was performed to complement and reinforce the correlation and regression analyses. Greenhouse–Geisser adjustments to degrees of freedom were applied as appropriate. For CAR measurements, the areas under the curve with respect to the ground (AUCg CAR) and with respect to the increase (AUCi CAR) were calculated to capture the total amount of cortisol and the total cortisol response in both cases over the studied time period (Pruessner, Kirschbaum, Meinlschmid, & Hellhammer, 2003; Pruessner, Hellhammer, Pruessner, & Lupien, 2003). Bootstrapping was used to assess the indirect effect of EI on self-perceived general health through the mediation of CAR. This is a non-parametric technique employed to test models of mediation. In small samples, it has been shown to have advantages over other traditional methods, such as linear regression or the Sobel test (Preacher & Hayes, 2008). All statistical analyses were performed using SPSS (version 21.0), considering $p < 0.05$ to be significant. The descriptive results are expressed as mean and standard deviation (M and SD, respectively).

Results

Correlation patterns between the variables analyzed

The correlation patterns of self-reported health subscale scores and CAR with components of EI are summarized in Table 2. Attention showed a positive relationship with scores on all of the self-reported health subscales (p <.05), while clarity was only correlated with the score for somatic symptoms and total score for self-perceived general health, in both cases negatively (p <.05). No significant correlations were found between repair and any of the self-reported health scores. Unlike attention, clarity and repair were negatively associated with CAR (p <.05).

Table 2. Correlation patterns between analyzed variables (*p <.05; **p<.01).

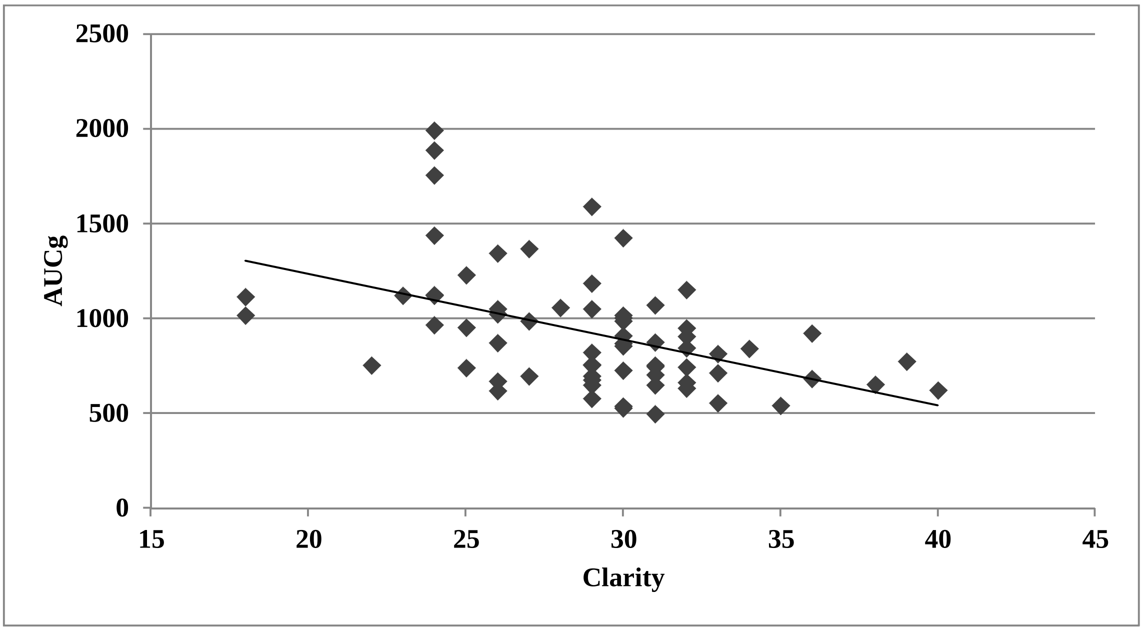
		Emotional Intelligence		
		Attention	**Clarity**	**Repair**
General Health Questionnaire	**Somatic Symptoms**	.263*	-.366**	-.211
	Anxiety and Insomnia	.488**	-167	-.207
	Social Dysfunction	.379**	-.135	-.050
	Severe Depression	.383**	-.123	-.132
	Perceived General Health	.406**	-.249*	-.208
Cortisol Awakening Response (CAR)	**Csal at awakening**	.097	-.232*	-.302*
	Csal at 30 min post awakening	-024	-.473**	-.361**
	Csal at 45 min post awakening	-.025	-.493**	-.200
	Csal at 60 min post awakening	.042	-.449**	-.213
	AUCi	-.087	-.207	.023
	AUCg	.037	-.499**	-.317**

Regression analyses

Regression analyses were conducted separately to evaluate the predictive ability of components of the EI on each dependent variable (total self-perceived general health, CAR AUCi and CAR AUCg). To control for the possible confounders, hierarchical regression analyses were used, introducing in the first step variables related to caregivers (gender, age, phase of the menstrual cycle, body mass index, and smoking status), in the second step the variables describing the characteristics of the offspring and caregiving (severity of the autistic symptoms and level of independence of care recipient and hours spent caregiving and years of evolution of care), and finally, components of the EI.

In the first regression model built with total self-perceived health as the dependent variable, only the attention component of EI was found to be significant (β=0.391, p<.01), and the final model was significant (F(12,64)=2.498, p<.01), explaining the 22% of variance. Regarding the analyses conducted with CAR AUCi as the dependent variable, a variable concerning the characteristics of the offspring (Barthel Index) was found to be significant (β=0.286, p<.05); however, the final model was not significant (F(12,64)=1.130, p>.10). Lastly, in the model conducted with CAR AUCg as a dependent variable, only clarity was significant (β=−0.395, p<.01). In this case, the final model was not significant (F(12,64) = 1.710, p >.10) (Figure 1).

Figure 1. Clarity as a predictor of AUCg for cortisol awakening response (CAR).

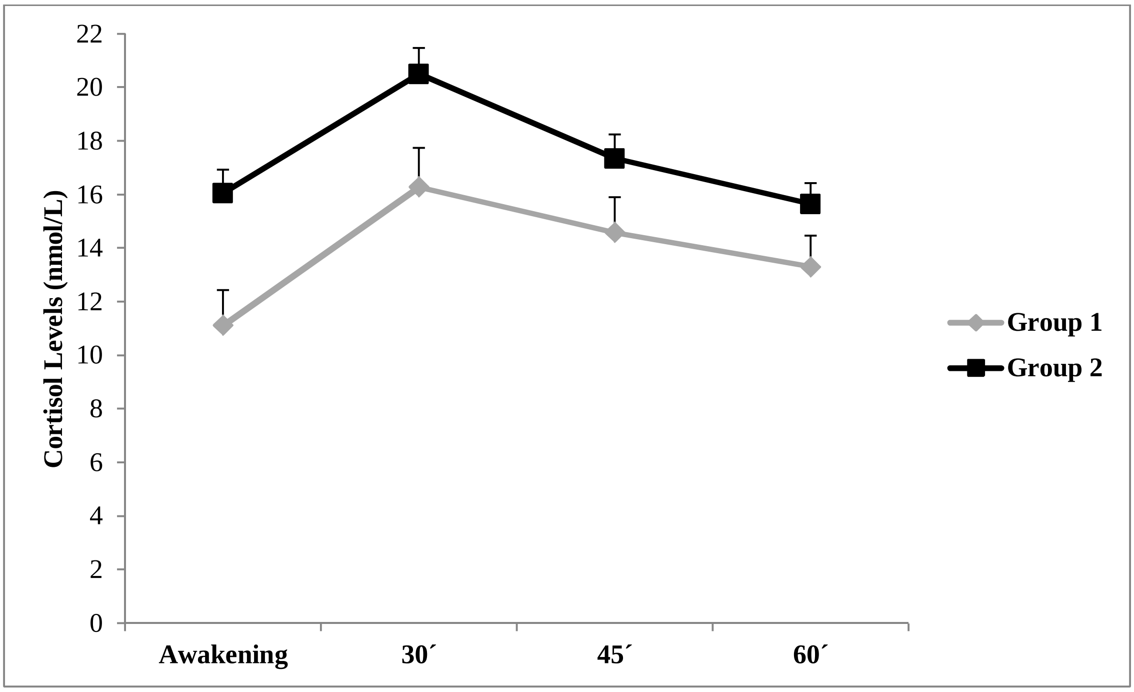


Cluster analyses and differences between groups

Caregivers were divided into two groups by cluster analysis based on their EI scores, in order to analyze differences in CAR and self-reported health. Group 1 (N=47) was characterized by low scores in attention ($\overline{X}$=23.10, SD=3.95) and high scores in clarity ($\overline{X}$=29.93, SD=3.86) and repair ($\overline{X}$=28.65, SD=4.57), whereas group 2 (N=21) was characterized by high scores in attention ($\overline{X}$=30.42, SD=4.46) and low scores in clarity ($\overline{X}$=27.14, SD=4.61) and repair ($\overline{X}$=24.66, SD=5.02).

For CAR, a main effect was found for group (F(1,66)=8.151, p<.01), Csal lower being for group 1 than group 2. Regarding self-reported health, significant differences were found in all of the subscales: somatic symptoms (t=−2.718, p<.01), anxiety and insomnia (t=−4.153, p<.0001), social dysfunction (t=−2.611, p<.05), severe depression (t=−2.800, p<.01) and total self-perceived general health (t=−2.843, p<.01). For all subscales, group 1 had lower levels of symptoms than group 2 (Figure 2).

Figure 2. Csal levels at awakening and 30, 45 and 60 min later for group 1 (caregivers with low scores in attention and high scores in clarity and repair) and group 2 (caregivers with high scores in attention and lower scores in clarity and repair) (*p<.01 refers to a main effect of group).



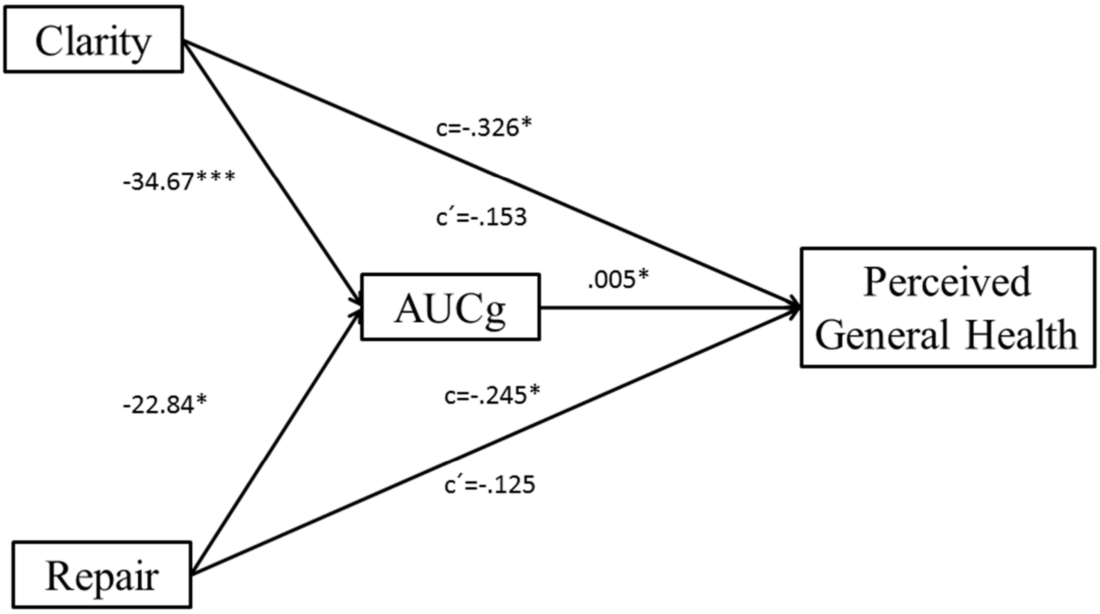
Mediation analyses

We explored whether CAR had a mediating effect on the association between EI and self-reported health. Each component of the EI was evaluated as an independent variable, with each AUC (AUCi and AUCg) of the CAR as a mediator variable, and with total self-perceived general health as a dependent variable. No mediating effects were found with AUCi as a mediator, while AUCg was found to have a significant role as a mediator, but only with clarity and repair as independent variables.

In the case of clarity, the total effect of this component on self-perceived general health was significant (B=−0.3268, SE=0.1424, p<.05). Clarity, in turn, predicted AUCg (B=−34.67, SE=8.07, p<.0001), and the mediator variable, AUCg, predicted self-perceived general health (B =0.005, SE=0.0021, p<.05). The examination of the indirect effect of clarity on self-perceived general health, through the AUCg effect, revealed significant mediation (indirect effect =−0.1737, bias-corrected 95% CI for the indirect effect: lower level =−0.34, upper level =−0.04). When AUCg was introduced in the model as a mediator, the association between clarity and self-perceived general health did not reach statistical significance (B=−0.153, SE=0.1556, p>.10), suggesting the mediating effect of AUCg in that association. Overall, the model (F(2,65)=5.6773, p<.01) predicted 12% of the variance in self-perceived general health.

Regarding repair, mediation analysis revealed a significant total effect on self-perceived general health (B=−0.2455, SE=0.1220, p<.05). In turn, repair predicted AUCg (B=−22.84, SE=7.23, p<.01). As noted above, the mediator variable, AUCg, predicted self-perceived general health. The examination of the indirect effect of repair on self-perceived general health, through the AUCg effect, also revealed a significant mediation (indirect effect =−0.1200, bias-corrected 95% CI for the indirect effect: lower level=−0.29, upper level=−0.02). When AUCg was introduced in the model as a mediator, the association between clarity and self-perceived general health did not reach statistical significance (B=−0.1255, SE=0.1254, p>.10), suggesting that AUCg does have a mediating effect in that association. Overall, the model (F(2,67)=5.6969, p<.01) predicted 12% of the variance in self-perceived general health in caregivers (Figure 3).

Figure 3. Representation of the relationships between the predicting variables, clarity and repair, the mediator variable, AUCg, and the criterion variable, perceived general health. The numerical values correspond to the unstandarized regression coefficients (*p < .0001, *p<.05).**



Discussion

To our knowledge, this study is the first to analyze the association between EI and health outcomes in caregivers of people with ASDs. Although previous research has demonstrated the protective effects of EI on stress perception and health outcomes in various populations (Extremera & Fernández-Berrocal, 2006; Martins et al., 2010; Schutte et al., 2007), no studies had analyzed this association in caregivers of people with ASDs. Previous data indicated that EI could have a protective effect on health, but that this might not be true for all components of EI (Ciarrochi et al., 2002 and Extremera & Fernández-Berrocal, 2002). In our study, clarity of feelings was correlated with fewer somatic symptoms and better self-perceived general health, while attention to feelings was associated with more symptoms and poorer self-perceived general health. On the other hand, no association was found between mood repair and self-reported health.

The relationship between attention to feelings and health has previously been studied in terms of the insensitivity hypothesis (Ciarrochi et al., 2002), which proposes that some individuals, though aware of the negative emotions in life, have an ability to repress thoughts about these feelings or suppress this type of emotion. These individuals suffer from less health problems because they pay less attention about negative feelings. Other authors proposed a similar explanation (Ruiz-Robledillo & Moya-Albiol, 2013) for the protective effect against health disruption that was provided by an escape coping style in caregivers of individuals with ASD. Such a protective effect is especially relevant in the care context under study, given the high levels of negative emotions generated by caring for people with ASD (De Andrés-García et al., 2012; Ruiz-Robledillo & Moya-Albiol, 2013). That is, considering that caregivers in general, and those caring for individuals with an ASD in particular, tend to have a higher prevalence of negative than positive emotions, it could be detrimental for their health to pay attention to their own feelings.

On the other hand, clarity being associated with a lower level of symptoms indicates that different mechanisms are involved in the association between health and different aspects of EI. Specifically, in contrast to the effect of high levels of attention, caregivers with high clarity scores may suffer from less negative health consequences as they perceive care demands as less stressful, identify emotional responses better, and regulate negative emotional states.

In analyzing CAR, we also observed that associations differed depending on the component of EI considered. In this case, clarity and repair were related to lower levels of Csal, but no association was found between attention and CAR. As suggested earlier, it is reasonable to suppose that caregivers who pay greater attention to feelings are more attentive to their symptoms. This would be consistent with the positive association of attention with self-reported health but not with CAR (Ciarrochi et al., 2002), this response being a more stable, reliable and objective measure, and it is plausible that clarity and repair components have more influence modulating this objective response than attention.

Although the association between EI and CAR has not been investigated, some studies have assessed the effects of EI on cortisol secretion under laboratory-induced stress. Individuals with high EI have been observed to have a lower cortisol response to stress than those with low EI (Mikolajczak et al., 2007; Salovey et al., 2002). Specifically, in one study, clarity was related to lower cortisol response, but this association was not found for attention or repair (Salovey et al., 2002). Authors proposed that individuals with high EI could cope better with stress, employing more adaptive coping strategies than those with low EI (Mikolajczak et al., 2007).

Considering our results in cluster analysis, the association seems to depend on the levels of each of the components of EI. Caregivers with moderate attention and higher clarity and repair benefit from better health outcomes and lower morning cortisol levels. In relation to this, authors have previously postulated that CAR depends on caregivers' anticipation of care demands (Ruiz-Robledillo and Moya-Albiol, 2013; Ruiz-Robledillo et al., 2014). Such an anticipation of care demands could promote high levels of negative affect, such as depression, anxiety or anger. These types of emotions have been classically related to higher CAR (Polk, Cohen, Doyle, Skoner, & Kirschbaum, 2005; and Pruessner et al., 2003). Together with the poor ability of some caregivers to identify and regulate these emotions, anticipation could explain the high morning cortisol levels and poorer health in this group. In the care context, caregivers with a moderate level of attention to feelings and high clarity and repair could cope with the associated stress in an adaptive manner, modulating the negative emotional effects of chronic stress. In turn, this would be reflected in low morning cortisol levels and a small number of symptoms, two closely related variables, high morning cortisol levels having been associated with a large number of symptoms (Lindfors & Lundberg, 2002). Mediation analyses confirm this idea. In this case, only CAR AUCg mediated the association of clarity and repair with self-perceived general health. As this measure refers to the Csal levels and not the Csal response (which is described by AUCi), this finding implies that caregivers with lower clarity and repair have high Csal levels and this could explain their poorer general health compared to caregivers with high levels of these components of EI.

Although our study advances our understanding of the association between EI and health outcomes in caregivers of people with ASDs, some limitations should be recognized. The main limitation is the cross-sectional nature of the study, which means that we are unable to draw definitive conclusions about causality. Furthermore, other variables, such as negative affect and coping, should be evaluated in future studies to assess whether they modulate the association between EI and health outcomes. In particular, the relatively large differences between caregivers in the hours dedicated to caring per week could affect the results, influencing the impact of the caregiving task on their health. Further, the lack of control group composed of caregivers of people with another type of disability prevents the generalization of our results. Future studies with other samples of informal caregivers are necessary to confirm our findings. Nevertheless, our study provides useful new data to help us understand the consequences of caring for people with ASDs for the health status of caregivers. Specifically, the results indicate that clarity and repair components of EI could be protective factors against negative health effects in this population. In contrast, the attention component seems to be a risk factor for a larger number of symptoms.

These findings should be taken into account for the development of psychotherapeutic interventions. Such interventions should teach caregivers specific strategies to reduce negative emotional states and the possible pathological attention to feelings, avoiding rumination. In particular, besides cognitive strategies to reduce rumination (such as stopping thinking), strategies focused on increasing positive affect (scheduling pleasant activities or capitalizing on positive events, for example) could be useful to avoid the negative effects of greater attention to feelings in caregivers. In addition, training caregivers in emotional recognition could be useful, given the strong association between this factor and positive health results. Finally, various strategies for reducing negative emotional states, such as relaxation techniques and cognitive restructuring, as well as strategies for increasing positive affect, are essential elements in skills training in this population. Intervention programs focused on these areas could be very useful for reducing health disruption in caregivers, and future studies should explore the effectiveness of these psychotherapeutic strategies for improving caregivers' health.

Our results not only have implications for the treatment of health disruption in caregivers, but also for the prevention of these negative outcomes. Assessment of the different components of EI could provide valuable information about caregivers' risk of suffering health problems in the future. Indeed, should the findings of our study be confirmed, assessing the level of EI in caregivers at the time of the diagnosis of the care recipient would identify those particularly at-risk of health deterioration, namely, those with low levels of clarity and repair and higher attention to feelings. The implementation of prevention strategies employing the aforementioned techniques in such groups of at-risk caregivers might considerably reduce the medical and other healthcare costs associated with caregiving for caregivers themselves, health systems and society as a whole.

References

Barker, E.T., Hartley, S.L., Seltzer, M.M., Floyd, F.J., Greenberg, J.S., & Orsmond, G.I. (2011). Trajectories of emotional well-being in mothers of adolescents and adults with autism. *Developmental Psychology, 47* (2), 551–561.

Baron-Cohen, S., Hoekstra, R.A., Knickmeyer, R., & Wheelwright, S. (2006). The Autism Spectrum Quotient (AQ) – Adolescent version. *Journal of Autism and Developmental Disorders, 36* (3), 343–350.

Baztán, J.J., Pérez del Molino, J., Alarcón, T., San Cristóbal, E., Izquierdo, G., & Manzarbeitia, J. (1993). Índice de Barthel: Instrumento válido para la valoración funcional de pacientes con enfermedad cerebrovascular [Barthel index: A valid instrument for functional assessment of patients with cerebrovascular disease]. *Revista Española de Geriatría y Gerontología, 28,* 32–40.

Ciarrochi, J.V., Deane, F.P., & Anderson, S. (2002). Emotional intelligence moderates the relationship between stress and mental health. *Personality and Individual Differences, 32* (2), 197–209.

Consedine, N.S., & Moskowitz, J.T. (2007). The role of discrete emotions in health outcomes: A critical review. *Applied and Preventive Psychology, 12* (2), 59–75.

Davis, N.O., & Carter, A.S. (2008). Parenting stress in mothers and fathers of toddlers with autism spectrum disorders: Associations with child characteristics. *Journal of Autism and Developmental Disorders, 38* (7), 1278–1291.

De Andrés-García, S., Moya-Albiol, L., & González-Bono, E. (2012). Salivary cortisol and immunoglobulin A: Responses to stress as predictors of health complaints reported by caregivers of offspring with autistic spectrum disorder. *Hormones & Behavior, 62* (4), 464–474.

De Vught, M.E., Nicolson, N.A., Aalten, P., Lousberg, R., Jolle, J., & Verhey, F.R. (2005). Behavioral problems in dementia patients and salivary cortisol patterns in caregivers. *Journal of Neuropsychiatry and Clinical Neuroscience, 17* (2), 201–207.

Extremera, N., & Fernández-Berrocal, P. (2002). Relation of perceived emotional intelligence and health-related quality of life of middle-aged women. *Psychological Reports, 91* (1), 47–59.

Extremera, N., & Fernández-Berrocal, P. (2006). Emotional intelligence as predictor of mental, social, and physical health in university students. *Spanish Journal of Psychology, 9* (1), 45–51.

Fernández-Berrocal, P., Extremera, N., & Ramos, N. (2004). Validity and reliability of the Spanish modified version of the Trait Meta-Mood Scale. *Psychological Reports, 94* (3), 751–755.

Fries, E., Dettenborn, L., & Kirschbaum, C. (2009). The cortisol awakening response (CAR): Facts and future directions. *International Journal of Psychophysiology, 72* (1), 67–73.

Goldberg, D.P., & Hillier, V. (1979). A scaled version of the general health questionnaire. *Psychological Medicine, 9* (1), 139–145.

Hastings, R.P., Kovshoff, H., Brown, T., Ward, N.J., Espinosa, F.D., & Remington, B. (2005). Coping strategies in mothers and fathers of preschool and school-age children with autism. *Autism, 9* (4), 377–391.

Lindfors, P., & Lundberg, U. (2002). Is low cortisol release an indicator of positive health? *Stress and Health, 18* (4), 153–160.

Lobo, A., Pérez-Echevarría, M.J., & Artal, J. (1986). Validity of the scaled version of the General Health Questionnaire (GHQ-28) in a Spanish population. *Psychological Medicine, 16* (1), 135–140.

Lovell, B., Moss, M., & Wetherell, M.A. (2012a). The psychosocial, endocrine and immune consequences of caring for a child with autism or ADHD. *Psychoneuroendocrinology, 37* (4), 534–542.

Lovell, B., Moss, M., & Wetherell, M. A. (2012b). With a little help from my friends: Psychological, endocrine and health corollaries of social support in parental caregivers of children with autism or ADHD. *Research in Developmental Disabilities, 33* (2), 682–687.

Mahoney, F.I., & Barthel, D.W. (1965). Functional evaluation: The Barthel index. *Maryland State Medical Journal, 14,* 61–65.

Martins, A., Ramalho, N., & Morin, E. (2010). A comprehensive meta-analysis of the relationship between emotional intelligence and health. *Personality and Individual Differences, 49* (6), 554–564.

Mikolajczak, M., Roy, E., Luminet, O., Fillée, C., & de Timary, P. (2007). The moderating impact of emotional intelligence on free cortisol responses to stress. *Psychoneuroendocrinology, 32* (8–10), 1000–1012.

Moya-Albiol, L., Serrano, M.A., & Salvador, A. (2010). Job satisfaction and cortisol awakening response in teachers scoring high and low burnout. *Spanish Journal of Psychology, 13* (2), 629–636.

Phelps, K.W., McCammon, S.L., Wuensch, K.L., & Golden, J.A. (2009). Enrichment, stress, and growth from parenting an individual with an autism spectrum disorder. *Journal of Intellectual & Developmental Disability, 34* (2), 133–141.

Polk, D.E., Cohen, S., Doyle, W. J., Skoner, D. P., & Kirschbaum, C. (2005). State and trait affect as predictors of salivary cortisol in healthy adults. *Psychoneuroendocrinology, 30* (3), 261–272.

Preacher, K.J., & Hayes, A.F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40* (3), 879–891.

Pruessner, J.C., Kirschbaum, C., Meinlschmid, G., & Hellhammer, D.H. (2003). Two formulas for the computation of the area under the curve represent measures of total hormone concentration versus time-dependent change. *Psychoneuroendocrinology, 28* (7), 916–931.

Pruessner, M., Hellhammer, D.H., Pruessner, J.C., & Lupien, S.J. (2003). Self-reported depressive symptoms and stress levels in healthy young men: Associations with the cortisol response to awakening. *Psychosomatic Medicine, 65* (1), 92–99.

Ruiz-Robledillo, N., De Andrés-García, S., Pérez-Blasco, J., González-Bono, E., & Moya-Albiol, L. (2014). Highly resilient coping entails better perceived health, high social support and low morning cortisol levels in parents of children with autism spectrum disorder. *Research in Developmental Disabilities, 35* (3), 686–695.

Ruiz-Robledillo, N., González-Bono, E., & Moya-Albiol, L. (2014). Lack of institutional support entails disruptions in cortisol awakening response in caregivers of people with high functioning autism. *Journal of Health Psychology, 19* (12), 1586-1596.

Ruiz-Robledillo, N., & Moya-Albiol, L. (2013). Self-reported health and cortisol awakening response in parents of people with Asperger syndrome: The role of trait anger and anxiety, coping and burden. *Psychology and Health, 28* (11), 1246–1264.

Ruiz-Robledillo, N., & Moya-Albiol, L. (2013). Lower electrodermal activity to acute stress in caregivers of people with autism spectrum disorder: An adaptive habituation to stress. Journal of Autism and Developmental Disorders. (in press)

Salovey, P., Mayer, J.D., Goldman, S.L., Turvey, C., & Palfai, T.P. (1995). Emotional attention, clarity and repair: Exploring emotional intelligence using the Trait Meta-Mood Scale. In J.W. Pennebaker (Ed.), Emotion, disclosure, and health (pp. 125–154). Washington: American Psychological Association.

Salovey, P., Stroud, L.R., Woolery, A., & Epel, E.S. (2002). Perceived emotional intelligence, stress reactivity, and symptom reports: Further explorations using the Trait Meta-Mood Scale. *Psychology and Health*, *17* (5), 611–627.

Schutte, N.S., Malouff, J.M., Thorsteinsson, E.B., Bhullar, N., & Rooke, S.E. (2007). A meta-analytic investigation of the relationship between emotional intelligence and health. *Personality and Individual Differences, 42* (6), 921–933.

Weiss, M.J. (2002). Harrdiness and social support as predictors of stress in mothers of typical children, children with autism, and children with mental retardation. *Autism, 6* (1), 115–130.

Wust, S., Federenko, I., Hellhammer, D.H., & Kirschbaum, C. (2000). Genetic factors, perceived chronic stress, and the free cortisol response to awakening. *Psychoneuroendocrinology, 25* (7), 707–720.

Chapter 5

Study 4: Lack of Institutional Support Entails Disruption in Cortisol Awakening Response in Caregivers of People with High-Functioning Autism

Published in: Ruiz-Robledillo, N[1]., González-Bono, E[1]., & Moya-Albiol, L[1]. (2014). Lack of institutional support entails disruption in cortisol awakening response in caregivers of people with high-functioning autism. *Journal of Health Psychology, 19* (12), 1586-1596.

[1] Department of Psychobiology, University of Valencia

Introduction

Caring for a relative with a chronic mental illness, such as autism spectrum disorder (ASD), entails serious consequences for the health and quality of life of the caregiver (De Andrés-García, Moya-Albiol & González-Bono, 2012). In early stages of the care process, such as the moment of the diagnosis, these consequences may be especially significant (Avdi, Griffin & Brough, 2000). However, a recent meta-analysis showed that several intervention programs could diminish these negative consequences in this population (Singer, Ethridge & Aldana, 2007).This study has demonstrated that specific therapeutic programs reduce perceived stress and burden and so diminish health complaints. However, the variety of intervention programs makes it necessary to analyze the results according to each type of treatment. Programs can be categorized into two types: first, those focused on the management of care recipient symptomatology; and second, multi-program interventions focused on improving both caregiver and offspring symptoms.

Interventions focused on care recipient symptomatology are based on Behavioral Parent Training (BPT). This intervention consists in teaching caregivers how to manage the behavioral problems and autistic symptomatology of their offspring. When the effectiveness of this type of intervention on parental stress is analyzed, the results are non-homogeneous. In two studies, the stress perception of caregivers fell after intervention (Drew et al., 2002; Smith, Groen & Wynn, 2000). Nevertheless, treatment had no effect on parental stress in another study (Jocelyn, Casiro, Beattie, Bow, & Kneisz, 1998).

Studies based on a multi-component approach focused on care recipient and caregiver symptomatology are more frequent (Bristol, Gallagher, & Holt, 1993; Salt et al., 2002; Tonge et al., 2006). These types of interventions called Multi-Component Treatment (MCT) combine BPT and Cognitive Behavioral Treatment (CBT) and/or other support services. CBT interventions teach caregivers various skills for coping with stress effectively, thereby reducing the impact of caregiving and lessening health complaints at the same time. Other treatment strategies, such as counselling or mutual help groups, are usually included in this type of intervention. Previous research in this line has demonstrated the effectiveness of this type of therapeutic approach for lessening health complaints and reducing stress perception in caregivers of people with ASD (Bristol et al., 1993; Salt et al., 2002; Tonge et al., 2006).

A recent meta-analysis has proven that MCT programs are more effective in reducing stress and health complaints in parents of people with developmental disabilities than BPT or CBT interventions alone (Singer et al., 2007). The effect size of these types of BPT or CBT interventions was 0.25 and 0.34, respectively, compared to 0.89 for the MCT programs. However, this study did not include other non-structured therapeutic programs, such as the case of an email discussion group program, which have also shown positive effects in this population (Huws, Jones, & Ingledew, 2001). These results were similar to those obtained in another meta-analysis carried out in family caregivers of older adults (Sörensen, Pinquart & Duberstein, 2002). In this case, multi-component interventions produced more beneficial effects than other intervention strategies alone (such as psychoeducational or psychotherapeutic programs). Fundamentally, these effects were more pronounced in burden and well-being (for which MCT interventions showed an effect size of 0.65 and 0.74).

Although the effectiveness of these interventions is well established, no studies have employed biological markers of health for analyzing the effects of these therapeutic programs on caregivers of people with ASD. In studies with samples of individuals undergoing chronic stress, the cortisol awakening response (CAR) was one of the most studied biological markers of health (González-Bono, De Andrés-García & Moya-Albiol, 2011; Moya-Albiol, Serrano and Salvador, 2010). CAR is an index of the activity of the hypothalamic–pituitary–adrenal (HPA) axis, the major endocrine system implicated in stress response (Fries, Dettenborn & Kirschbaum, 2009). This response is characterized by increases in levels of cortisol from awakening to approximately 30 minutes later in a range of 38 to 75 per cent (Wust, Federenko, Hellhammer & Kirschbaum, 2000). Although results are non-homogeneous, abnormalities in CAR have been found in caregivers of people with ASD (Lovell, Moss & Wetherell, 2012a, 2012b; Seltzer et al., 2010). The relevance of the behavioral problems of the care recipient on the magnitude of the CAR in caregivers to people with ASD was previously indicated (Seltzer et al., 2010). In this case, more frequent behavioral problems in offspring were related to a blunted CAR in caregivers. Moreover, social support is demonstrated to have a positive effect on CAR in this population (Lovell et al., 2012b).

To our knowledge, no studies including CAR have analyzed the effects of institutional support on the health of caregivers of people with ASD by an MCT intervention. Only in caregivers of people with schizophrenia have the authors analyzed differences in CAR when institutional support was offered to the offspring – but not to caregivers (González-Bono et al., 2011). Results of this study demonstrated that non-supported caregivers show a buffered CAR when compared with supported caregivers and non-caregivers.

To address this gap in the literature, the aim of this study was to contrast health complaints in two groups of caregivers of people with high-functioning autism (HFA) (those receiving and those not receiving institutional support) in comparison with a non-caregiver group. For this purpose, self-reported health and CAR were evaluated. It was hypothesized that non-supported caregivers would present more somatic symptoms and an altered CAR when compared to supported caregivers and non-caregivers (Allik, Larsson & Smedje, 2006; Tonge et al., 2006). The study also aimed to explore variables that could modulate the effectiveness of institutional support on the health of caregivers, such as burden or variables referring to the offspring. Accordingly, burden and factors related to the functionality of the care recipient, such as dependence and autistic symptomatology, were evaluated. We expected that non-supported caregivers would show higher levels of burden than supported caregivers (Salt et al., 2002). In addition, we expected that care recipients of non-supported caregivers would show higher autistic symptoms and dependency levels when compared to the offspring of supported caregivers. Finally, we hypothesized that a higher functionality of care recipients and lower levels of burden and symptoms would be associated with higher CAR in caregivers (Seltzer et al., 2010).

Method

Participants and procedure

Participants in the study consisted of three groups: caregivers of a child with HFA with institutional support (n=12); caregivers of a child with HFA without institutional support (n=12); and non-caregivers (n=12). Offspring were clinically diagnosed with HFA by clinical staff. Groups were formed with parents of both genders.

Caregivers were mainly recruited from members of an association of relatives of people with ASD in the Spanish region of Valencia (Asociación Asperger Alicante (ASPALI)). When the study was undertaken, supported caregivers had been receiving institutional support for at least 1 year. To receive this support, parents had to make an application to the association. The non-caregiver group was composed of parents of age-matched typically developing children. Selected participants were interviewed after indicating that they wished to participate in the study. Socio-demographic and health-related variables of the participants are summarized in Table 1.

During the interviews, researchers obtained general information about the participants and administrated a battery of questionnaires to evaluate self-reported health, burden and variables referring to the offspring. Moreover, researchers gave instructions for collecting saliva at home (using eight Salivettes®; Sarstedt, Rommersdolf, Germany) to measure the salivary CAR. A new appointment was made to collect these saliva samples. The CAR was calculated as an average salivary cortisol level over two consecutive days at waking and 30, 45 and 60 minutes later. In addition, participants were asked to take note of the time of saliva collection, level of energy, expectations about the day and other variables such as consumption of stimulants, alcohol the day before, smoking the day before and the number of hours slept. Participants signed an informed consent, and the experiment was performed in accordance with the Helsinki Declaration and approved by the ethics committee of the University of Valencia.

Institutional support

Institutional support was provided by the association of relatives of persons with HFA (ASPALI). Support provided by this association was an MCT based on the following: psychoeducation about the HFA; mutual help parent groups; legal support (legal advice about the economic and social resources for families of people diagnosed with HFA); psychological support for families (through parent schools, a psychologist from the association providing therapeutic tools and counselling for cognitive behavioral orientation to reduce stress and psychological complaints in caregivers); psychological treatment for the offspring (behavioral interventions focused on improving social and communication deficits); occupational therapy for the offspring (training in daily activities); and a leisure program (staff from the association organizing various leisure, cultural and social activities with the affected people). At the same time, this program included respite interventions for families (1 day a week and 15 days in summer).

Instruments

Self-reported health was assessed using the nine subscales of the Somatic Symptom Scale–Revised (ESS-R; Sandín & Chorot, 1995): immunological, respiratory, cardiovascular, neurosensory, gastrointestinal, dermatological, genital-urinary, muscular and female reproductive system. Depression symptomatology was evaluated by the Beck Depression Inventory (BDI; Beck & Steer, 1993). Caregiver burden was evaluated using Zarit's Caregiver Burden Scale (Zarit, Reeves & Bach-Peterson, 1980).

Dependency levels and autistic symptomatology of care recipient. A Spanish version of the Barthel Index (Baztán et al., 1993) was used to evaluate the functionality and autonomy of care recipients. This instrument and adapted versions have been shown to be reliable questionnaires for evaluating dependency levels and the functioning of daily life skills of persons with developmental disabilities (Esbensen, Bishop, Seltzer, Greenberg, & Taylor 2010; Maenner et al., 2013). Furthermore, it was demonstrated to be a significant predictor of health complaints in caregivers of people with ASD (De Andrés-García et al., 2012). The Autism Questionnaire for Adolescents (adolescent AQ) consisted of 50 items that quantify autistic traits. The higher the score, the greater the severity of the symptoms. This is an adapted version of the autism spectrum coefficient for children and adolescents aged 9 to 16 years (Baron-Cohen, Hoekstra, Knickmeyer & Wheelwright, 2006) and is designed to be completed by parents or caregivers.

CAR. Salivary cortisol (Csal) was collected using a Salivette. The samples were frozen at −20°C until analysis by radioimmunoassay. The commercial kit used for Csal was Coat-a-Count Cortisol (DPC, Siemens Medical Solutions Diagnostics). The samples were measured in duplicate, and all those belonging to the same participant were included in the same assay. The coefficient of variation inter-duplicate maximum considered for the repetition of the determination was set at 8 per cent. Assay sensitivity was 0.5 ng/dL. The coefficients of intra- and inter-assay variation were 2.8 and 5.3 per cent, respectively. All values are expressed in nmol/L. The CAR was calculated as an average salivary cortisol level over two consecutive days at waking and 30, 45 and 60 minutes later. The area under the curve (AUC) for Csal was estimated with the widely used trapezoid formula (De Andrés-García et al., 2012; Pruessner, Kirschbaum, Meinlschmid & Hellhammer, 2003), taking as a reference the initial levels of cortisol upon awakening.

For the analysis of the frequencies of the socio-demographic variables, chi-square statistics were used. For Csal, analyses of variance (ANOVAs) of repeated measurements of ‘moment’ (0′, 30′, 45′ and 60′) with ‘group’ as between-subject factors were performed (having previously established that they are normally distributed, using the Kolmogorov–Smirnov statistic $p<.001$). Greenhouse–Geisser adjustments for degree of freedom were employed. Bonferroni adjustments for multiple contrasts were applied. Post hoc analyses were carried out using the T-test (the effect of group). Univariate ANOVAs were performed with between-subject factors ‘group’ for age, health variables (body mass index (BMI), somatic symptoms, depressive symptomatology and AUC for Csal levels), burden and variables referring to offspring (dependency level and autistic symptomatology). Spearman correlation was used to analyze relationships between variables. Fisher’s Z was employed to compare the pattern of relationships between analyzed variables in supported and non-supported caregivers. Linear regression models were performed to carry out mediation analysis.

Results

Sample characterization

No differences between supported and non-supported caregivers and between caregivers and non-caregivers were found in gender, age, BMI, marital status, use of cigarettes, educational level, phase of menstrual cycle and hours per week spent caring. Differences between supported and non-supported caregivers appeared in gastrointestinal symptoms, $F(2,33)=5.027$, $p<.05$, $\eta^2_{partial}=.234$. Non-supported caregivers presented more symptoms than supported caregivers ($p<.05$).

Concerning care recipient functionality, the offspring of supported caregivers showed lower levels of dependency in daily activity skills than those of non-supported caregivers, $F(1,21)=5.073$, $p<.05$, $\eta^2_{partial}=.195$. Nevertheless, no differences were found in the autistic symptomatology of care recipients or burden.

Table 1. Socio-demographic and health-related variables of supported caregivers, non-supported caregivers and non-caregivers.

		Supported caregivers (n=12)	**Non-supported caregivers (n=12)**	**Non-caregivers (n=12)**
Gender	**Women**	7 (58.3%)	9 (75%)	8 (66.7%)
	Men	5 (41.7%)	3 (25%)	4 (33.3%)
Age		45.75 ± 3.16	45.41 ± 3.52	44.33 ± 5.80
BMI		27.67 ± 4.32	26.09 ± 5.44	27.03 ± 5.93
Marital status	**Single**	0 (0%)	0 (0%)	1 (8.3%)
	Married	11 (91.7%)	9 (75%)	10 (83.3%)
	Divorced	1 (8.3%)	3 (25%)	1 (8.3%)
Phases of the menstrual cycle	**Luteal**	0 (0%)	2 (22.2%)	3 (42.9%)
	Follicular	6 (85.7%)	5 (55.6%)	3 (42.9%)
	Amenorrhea	1 (14.3%)	2 (22.2%)	1 (14.3%)
Use of cigarettes	**Yes**	3 (25%)	4 (33.3%)	5 (41.7%)
	No	9 (75%)	8 (66.7%)	7 (58.3%)
Educational Level	**Basic**	6 (50%)	3 (25%)	1 (8.3%)
	Advanced	4 (33.3%)	1 (8.3%)	1 (8.3%)
	University	2 (16.7%)	7 (58.3%)	9 (75%)
	Others	0 (0%)	1 (8.3%)	1 (8.3%)
Years of evolution of care		15.58 ± 5.07	11.91 ± 3.80	
Time caring per week (hours/week)		55.08 ± 42.27	52.50 ± 43.71	
Age of care recipient		16.33 ± 3.89	14.31 ± 3.17	
Gender of care recipient	**Women**	0	1 (8.3%)	
	Men	12 (100%)	11 (91.7%)	

Caregivers versus non-caregivers

For somatic symptoms, there was an effect of the factor ‘group’ in respiratory, F(2,33)=6.291, p<.01, $\eta^2_{partial}$=.276, gastrointestinal, F(2,33)=5.027, p<.05, $\eta^2_{partial}$=.234; genital-urinary, F(2,33)=6.876, p<.01, $\eta^2_{partial}$=.294; and total symptoms, F(2,33)=5.678, p<.01, $\eta^2_{partial}$=.256. For all subscales, caregivers presented more symptoms than non-caregivers. With regard to depressive symptomatology, there was a significant effect of the ‘group’, F(2,33)=7.391, p<.01, $\eta^2_{partial}$=.309. Post hoc analysis indicated that caregivers reported more depressive symptoms than non-caregivers (p < .05). Results are summarized in the Table 2.

Table 2. Mean (SD) for somatic and depressive symptoms, burden, dependency level, and autistic symptomatology of care recipient for supported caregivers, non-supported caregivers and non-caregivers. (*p<.05; **p<.01)

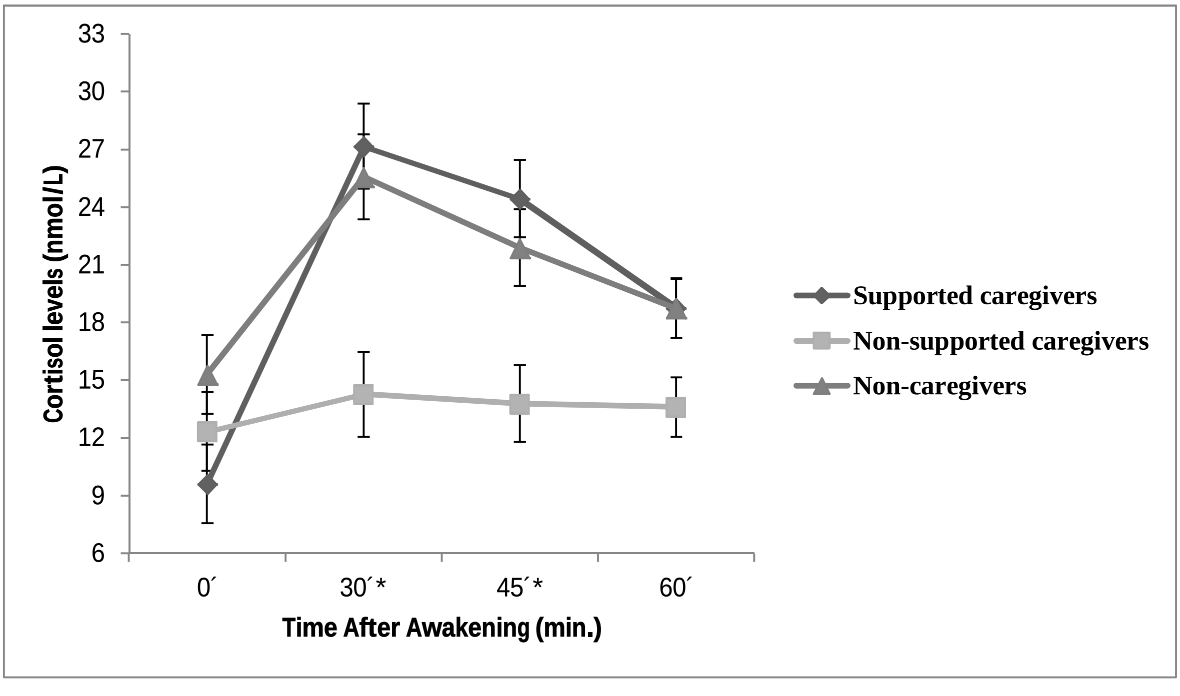
	Supported caregivers.1 (n=12)	**Non-supported caregivers.2 (n=12)**	**Non-caregivers.3 (n=12)**	***Differences between groups***
Immunological symptoms	9.08 (4.50)	11.66 (4.99)	7.25 (4.33)	
Cardiovascular symptoms	8.58 (5.08)	8.33 (7.15)	3.75 (3.51)	
Respiratory symptoms**	11.91 (6.97)	14.50 (7.17)	5.75 (3.93)	1,2 > 3
Gastrointestinal symptoms*	12 (5.15)	18.66 (7.25)	10.58 (7.36)	1 > 2,3 2 > 3
Neurosensory symptoms	11.41 (8.81)	13.08 (8.84)	7.33 (5.97)	
Muscular symptoms	16.66 (8.65)	16.50 (5.43)	12.83 (6.36)	
Dermatological symptoms	11.41 (6.73)	12.75 (9.39)	9.08 (6.33)	
Genital-urinary symptoms**	7.41 (3.26)	9.41 (6.40)	2.75 (3.10)	1,2 > 3
Reproductive female system symptoms	8.33 (8.07)	9.25 (10.92)	8.83 (9.97)	
Total symptoms**	95.66 (44.09)	109.91 (40.04)	59.33 (27.66)	1,2 > 3
Depressive symptoms**	9.33 (6.32)	12.50 (8.39)	2.83 (2.79)	1,2 > 3
Burden	33.91 (16.12)	40.83 (15.63)		
Variables referred to care recipient				
Dependency level*	97.72 (4.67)	89.37 (11.43)		1 > 2
Severity of autistic symptoms	30.83 (6.67)	34.66 (4.55)		

CAR

In supported caregivers, Csal levels increased from 9.61 ± 5.20 nmol/L to 27.16 ± 10.09 nmol/L after awakening and to 17.55 ± 6.09 nmol/L (182.62% increase) 30 minutes later. In non-supported caregivers, the values oscillated from 12.32 ± 9.73 nmol/L after awakening to 14.27 ± 4.89 nmol/L 30 minutes later with an increase of 1.95 ± 7.67 nmol/L (15.82% increase). In non-caregivers, Csal levels after awakening increased from 15.30 ± 5.30 nmol/L to 25.58 ± 7.13 nmol/L with an increase of 10.28 ± 3.87 nmol/L (67.18% increase). No differences between groups were found in levels of energy, expectations about the day, consumption of stimulants or alcohol the day before saliva collection, sleep hours, or menstrual cycle.

For CAR, there was a significant effect of the 'moment*group' interaction, F(4.583,75.619)=9.197, p<.000, $\eta^2_{partial}$=.358. Post hoc analysis showed that at 30 and 45 minutes after awakening, non-supported caregivers showed lower levels of Csal compared to other groups (p<.01). In addition, there was a main effect of the 'group', F(2,33)=5.253, p<.01, $\eta^2_{partial}$=.241, showing non-supported caregivers with lower levels of Csal than supported caregivers and non-caregivers (p<.05) (see Figure 1).

Figure 1. Csal levels at awakening and 30, 45 and 60 minutes later for supported caregivers, non-supported caregivers and non-caregivers. Csal: salivary cortisol. *p < .05.



When analyzing the AUC of the Csal response, an effect of the ‘group’ was found, $F(2,33)=17.286$, $p<.000$, $\eta^2_{partial}=.512$. Post hoc analysis indicated that caregivers with support had higher AUC when compared with the other groups (for both cases $p<.01$).

Relationship between CAR, self-reported health, burden and care recipient functionality in caregivers

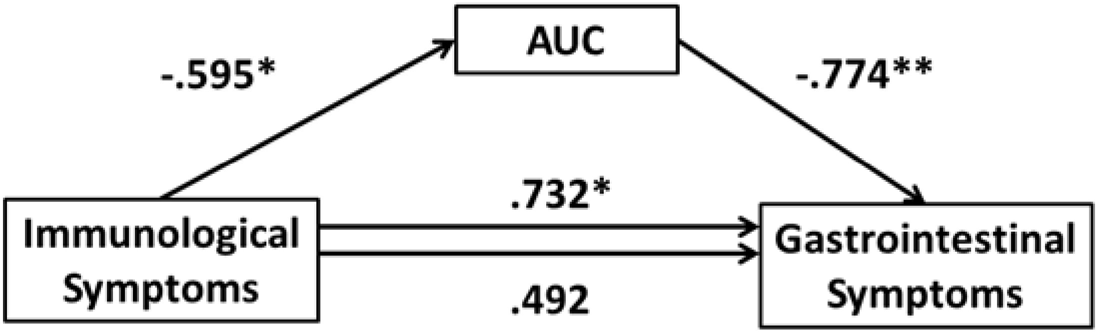
Correlations between CAR and self-reported measures. To analyze the relationship between CAR and self-reported variables (burden, somatic symptoms, depressive symptomatology and care recipient functionality), correlation analysis was carried out for each group separately. In the case of supported caregivers, a positive correlation was found between AUC and burden ($r=.608$, $p<.05$), showing that those caregivers with more burden had a higher magnitude of Csal response In non-supported caregivers, a lower AUC was related to high levels of immunological, gastrointestinal and total symptoms ($r=-.767$, $p<.01$; $r=-.830$, $p<.01$; $r=-.601$, $p<.05$, respectively). For burden, a negative relationship was found with AUC ($r=-.594$, $p<.05$).

Fisher’s Z statistic was used to compare the pattern of correlations between AUC and self-reported measures in supported and non-supported caregivers. This statistic was classically employed to test the hypothesis that correlations in two samples are equal or significantly different. The pattern of correlations between immunological and gastrointestinal symptoms with AUC was significantly different between groups ($Z=-3.09$, $p<.01$ for immunological symptoms and $Z=-3.22$, $p<.01$ for gastrointestinal symptoms). In the case of burden, the correlation pattern also differed ($Z=2.94$, $p<.01$).

Correlations between burden and care recipient functionality with somatic symptoms. In non-supported caregivers, high levels of burden entail suffering more immunological and gastrointestinal symptoms ($r=.546$, $p<.06$; $r=.553$, $p<.06$, respectively). For variables of the offspring, high dependency levels for care recipients were related to more cardiovascular and respiratory symptoms in this group ($r=-.819$, $p<.001$; $r=-.598$, $p<.05$, respectively). No significant relationships were found in supported caregivers. The Fisher’s Z statistic revealed that the correlation between the dependency level of the care recipient and cardiovascular symptoms was different between supported and non-supported caregivers ($Z=-2.63$, $p<.01$).

Mediation analysis in non-supported caregivers. Mediation analysis was carried out with the aim of analyzing the role of CAR in the generation of somatic symptoms in caregivers (Baron and Kenny, 1986). In supported caregivers, no significant mediation was found. However, a significant mediation of the AUC of Csal response between immunological and gastrointestinal symptoms was obtained in non-supported caregivers (see Figure 2). In this case, mediation was obtained through linear regression analysis, as proposed by the authors. The three conditions proposed are therefore accomplished: first, immunological symptoms have a significant relationship with the mediator, in this case, the AUC of Csal response. Second, the AUC of Csal response predicts gastrointestinal symptoms. Third, immunological symptoms have a significant relationship with gastrointestinal symptoms, although both variables are not significantly related when the AUC of Csal response is included in the equation regression model. The final model of the mediation, F(2,11)=11.154, p<.01, explained 65 per cent of the variance of gastrointestinal symptoms (see Figure 2).

Figure 2. Representation of the relationships between the predicting variable, immunological symptoms, the mediator variable, AUC of the Csal response, the criterion variable and gastrointestinal symptoms. AUC: area under the curve. The numerical values correspond to the standardized regression coefficients (p<.01, *p<.05).**



Discussion

Results obtained in self-reported health and in CAR showed that access to institutional support has beneficial effects on the health status of caregivers of people with HFA. Non-supported caregivers reported more gastrointestinal symptoms and a buffered CAR response when compared to supported caregivers and non-caregivers. Non-supported caregivers presented a blunted CAR with an increase of 1.95 nmol/L

(15.82%), which is lower than the 2.5 nmol/L proposed as a criterion for a normal rise (Wust et al., 2000). However, supported caregivers presented a normal response, similar to that observed in non-caregivers, both being higher than 2.5 nmol/L. Although in supported caregivers, the AUC of the Csal response was higher than in the other two groups, cortisol levels were similar to those obtained in non-caregivers. This greater increase in supported caregivers could be explained by the anticipation of the care demands. Previous studies have shown a higher increase in CAR in people with high perceived upcoming demands (Fries et al., 2009). This increase could be an adaptive response of the HPA axis, taking into account that caregivers have to deal every day with challenges associated with the care situation (Ludlow, Skelly & Rohleder, 2012) and that the Csal levels are similar to those obtained in non-caregivers. It is therefore important to adjust care demands with the aim of maintaining cortisol levels in an optimal range. Institutional support probably has this effect. The fact that this response is only present in supported caregivers – while non-supported caregivers showed a blunted response – could indicate a lack of this adaptive response in the latter group.

For specifically somatic symptoms, caregivers showed higher levels of respiratory, gastrointestinal, genital-urinary and total symptoms than non-caregivers. These results are in line with previous studies, in which worse perceived general health in caregivers of people with ASD than in non-caregivers were described (Allik et al., 2006; De Andrés-García et al., 2012). However, our results show that institutional support for both caregivers and offspring may modulate the onset and development of health complaints. These results are consistent with previous studies carried out in the same population (Drew et al., 2002; Tonge et al., 2006), although our data enable the quantification of this reduction in health complaints with a biological marker. Indeed, there is a deregulation of the HPA axis only in non-supported caregivers – as characterized by a blunted CAR. When compared with caregivers of other illnesses, only one study showed that objective symptoms of schizophrenic patients were significantly different between supported and non-supported caregivers (González-Bono et al., 2011), although this symptomatology and CAR were not associated. Whereas institutional support in the mentioned study was exclusively provided to care recipients, in our study, both parents and offspring received institutional support. In light of these results, we can postulate that the treatment of a care recipient integrated in the multi-component program offered by the association (in interaction with an intervention for parents) is potentially beneficial for both parties.

Results regarding the modulating effects of care recipient functionality on health complaints of caregivers are non-homogeneous (Allik et al., 2006; Lecavalier, Leone & Wiltz, 2006). In our study, no differences between groups were found in the case of autistic symptomatology. Autistic symptoms are probably more specific for each individual and less controllable for the interventions in comparison with the dependency level. Daily activity training for the offspring included in the multi-component program showed an important effect in this case, with care recipients of the non-supported caregivers being more dependent than those of supported caregivers. Dependency level, but not severity of the autistic symptomatology of the offspring, was related to higher somatic symptoms. The fact that this relationship was only significant in the case of non-supported caregivers indicates the relevance of considering the effects of therapeutic programs on the functionality of the care recipient – as well as the effects on caregiver health.

Burden and dependency level of the care recipient were associated with self-reported health and CAR in caregivers. As previously reported (Smith et al., 2000), non-supported caregivers presented higher burden, and this factor was differently related to CAR in supported and non-supported caregivers. In supported caregivers, high burden predisposed to a high magnitude of CAR, whereas in non-supported caregivers, the relationship was inversed. A deregulation of this axis in the case of non-supported caregivers could be a consequence of high burden. Thus, CAR showed the typical response frequently reported in individuals undergoing chronic stress with an affected HPA axis (Fries et al., 2009). Only in the case of non-supported caregivers was high burden associated with a high frequency of immunological and gastrointestinal symptoms. However, a highly dependent offspring entails suffering more cardiovascular and respiratory symptoms in non-supported caregivers. These different relationships suggest that two different psychobiological mechanisms are involved: burden, as a subjective stressor, entails suffering higher endocrine and immune symptoms. However, the functional status of the care recipient, as an objective stressor, is related with autonomic symptoms.

Mediation analysis showed a relevant effect for the functioning of the HPA axis in gastrointestinal symptoms. Psychological stress is involved in the functioning of the digestive system through the affection of the immune system (Mayer, 2000). Digestive systems reflect a larger component of the immune system and are strongly related to the immune response (O'Malley, Quigley, Dinan, & Cryan, 2011). A decrease in gastrointestinal microflora in stressed individuals was described, and the authors proposed the effects of higher cortisol levels and immune dysfunction as the main causes (Knowles, Nelson & Palombo, 2008). Although few studies have been conducted with human samples, it was demonstrated that stress processes have a negative effect on the digestive system, probably mediated by the disturbance of the immune system and alterations in cortisol levels.

Clinical implications and limitations

Our findings reinforce the relevance of institutional support through multi-component interventions in improving the health of family caregivers. This type of intervention could be an optimal approach when compared with interventions offered only to caregivers or offspring. Although this study extends prior research and provides evidence of the helpfulness of institutional support, it is not free from methodological limitations. The design was cross-sectional and non-experimental. The lack of information about caregivers before the intervention makes it difficult to address causality in the results. The absence of information about why non-supported caregivers acceded to intervention program could limit the obtained results. This fact, together with the sample size, limits the power of the predictions. Finally, the behavioral problems of care recipient, intelligence quotient, or social competence should have been carefully evaluated in detail. Further research with larger samples and experimental designs is necessary to identify alternative explanations and factors that modulate the beneficial effects of the intervention programs.

References

Allik, H., Larsson, J.O. & Smedje, H. (2006). Health-related quality of life in parents of school-age children with Asperger syndrome or high-functioning autism. *Health and Quality of Life Outcomes, 4* (1), 1–8.

Avdi, E., Griffin, C. & Brough, S. (2000). Parents' constructions of the 'Problem' during assessment and diagnosis of their child for an autistic spectrum disorder. *Journal of Health Psychology, 5* (2), 241–254.

Baron-Cohen, S., Hoekstra, R.A., Knickmeyer, R., & Wheelwright, S. (2006). The Autism Spectrum Quotient (AQ)-Adolescent Version. *Journal of Autism and Developmental Disorders, 36* (3), 343–350.

Baron, R.M. & Kenny, D.A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology, 51* (1), 173–182.

Baztán, J.J., Pérez del Molino, J., Alarcón, T., San Cristóbal, E., Izquierdo, G., & Manzarbeitia, J. (1993). Índice de Barthel: Instrumento válido para la valoración funcional de pacientes con enfermedad cerebrovascular [Barthel Index: A valid instrument for functional assessment of patients with cerebrovascular disease]. *Revista Española de Geriatria y Gerontologia, 28*, 32–40.

Beck, A.T., & Steer, R.A. (1993). Beck depression inventory. manual. San Antonio, TX: The Psychological Corporation.

Bristol, M.M., Gallagher, J.J. & Holt, K.D. (1993). Maternal depressive symptoms in autism: Response to psychoeducational intervention. *Rehabilitation Psychology, 38* (1), 3–10.

De Andrés-García, S., Moya-Albiol, L., & González-Bono, E. (2012). Salivary cortisol and immunoglobulin A: Responses to stress as predictors of health complaints reported by caregivers of offspring with autistic spectrum disorder. *Hormones & Behavior, 62* (4), 464–474.

Drew, A., Baird, G., Baron-Cohen, S., Cox, A., Slonims, V., Wheelwright, S., ... & Charman, T. (2002). A pilot randomised control trial of a parent training intervention for pre-school children with autism. *European Child & Adolescent Psychiatry, 11* (6), 266-272.

Esbensen, A.J., Bishop, S., Seltzer, M.M., Greenberg, J.S., & Taylor, J.L. (2010). Comparisons between individuals with autism spectrum disorders and individuals with Down syndrome in adulthood. *American Journal on Intellectual and Developmental Disabilities, 115* (4), 277-290.

Fries, E., Dettenborn, L., & Kirschbaum, C. (2009). The cortisol awakening response (CAR): Facts and future directions. *International Journal of Psychophysiology, 72* (1), 67–73.

González-Bono, E., De Andrés-García, S., & Moya-Albiol, L. (2011). The cortisol awakening response in caregivers of schizophrenic offspring shows sensitivity to patient status. *Anxiety, Stress & Coping*, *24* (1), 107–120.

Huws, J.C., Jones, R.S., & Ingledew, D.K. (2001). Parents of children with autism using an email group: A grounded theory study. *Journal of Health Psychology, 6* (5), 569-584.

Jocelyn, L.J., Casiro, O.G., Beattie, D., Bow, J., & Kneisz, J. (1998). Treatment of children with autism: a randomized controlled trial to evaluate a caregiver-based intervention program in community day-care centers. *Journal of Developmental & Behavioral Pediatrics, 19* (5), 326-334.

Knowles, S.R., Nelson, E.A., & Palombo, E.A. (2008). Investigating the role of perceived stress on bacterial flora activity and salivary cortisol secretion: a possible mechanism underlying susceptibility to illness. *Biological Psychology, 77* (2), 132-137.

Lecavalier, L., Leone, S., & Wiltz, J. (2006). The impact of behaviour problems on caregiver stress in young people with Autism Spectrum Disorders. *Journal of Intellectual Disability Research, 50* (3), 172–183.

Lovell, B., Moss, M., & Wetherell, M. (2012a). The psychosocial, endocrine and immune consequences of caring for a child with autism or ADHD. *Psychoneuroendocrinology, 37* (4), 534–542.

Lovell, B., Moss, M., & Wetherell, M. (2012b). With a little help from my friends: Psychological, endocrine and health corollaries of social support in parental caregivers of children with autism or ADHD. *Research in Developmental Disabilities, 33* (2), 682–687.

Ludlow, A., Skelly, C. & Rohleder, P. (2012). Challenges faced by parents of children diagnosed with autism spectrum disorder. *Journal of Health Psychology, 17* (5), 702–711.

Maenner, M.J., Smith, L.E., Hong, J., Makuch, R., Greenberg, J.S., & Mailick, M.R. (2013). Evaluation of an activities of daily living scale for adolescents and adults with developmental disabilities. *Disability and Health Journal, 6* (1), 8-17.

Mayer, E.A. (2000). The neurobiology of stress and gastrointestinal disease. *Gut, 47* (6), 861-869.

Moya-Albiol, L., Serrano, M.Á., & Salvador, A. (2010). Job satisfaction and cortisol awakening response in teachers scoring high and low on burnout. *The Spanish Journal of Psychology*, 13 (02), 629-636.

O'Malley, D., Quigley, E.M., Dinan, T.G., & Cryan, J.F. (2011). Do interactions between stress and immune responses lead to symptom exacerbations in irritable bowel syndrome?. *Brain, behavior, and Immunity, 25* (7), 1333-1341.

Pruessner, J.C., Kirschbaum, C., Meinlschmid, G., & Hellhammer, D.H. (2003). Two formulas for the computation of the area under the curve represent measures of total hormone concentration vs. time-dependent change. *Psychoneuroendocrinology, 28* (7), 916–931.

Salt, J., Shemilt, J., Sellars, V., Boyd, S., Coulson, T., & Mc Cool, S. (2002). The Scottish Centre for autism preschool treatment programme II: the results of a controlled treatment outcome study. *Autism, 6* (1), 33-46.

Sandín, B., & Chorot, P. (1995). Escala de Síntomas Somáticos-Revisada (ESS-R). Madrid: Universidad Nacional de Educación a Distancia (UNED).

Seltzer, M.M., Greenberg, J.S., Hong, J., Smith, L.E., Almeida, D.M., Coe, C., & Stawski, R.S. (2010). Maternal cortisol levels and behavior problems in adolescents and adults with ASD. *Journal of Autism and Developmental Disorders, 40* (4), 457–469.

Singer, G.H., Ethridge, B.L., & Aldana, S.I. (2007). Primary and secondary effects of parenting and stress management interventions for parents of children with developmental disabilities: A meta-analysis. *Mental Retardation and Developmental Disabilities Research Reviews, 13* (4), 357-369.

Smith, T., Groen, A.D., & Wynn, J.W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. *American Journal on Mental Retardation, 105* (4), 269-285.

Sörensen, S., Pinquart, M., & Duberstein, P. (2002). How effective are interventions with caregivers? An updated meta-analysis. *The Gerontologist, 42* (3), 356-372.

Tonge, B., Brereton, A., Kiomall, M., Mackinnon, A., King, N., & Rinehart, N. (2006). Effects on parental mental health of an education and skills training program for parents of young children with autism: A randomized controlled trial. *Journal of the American Academy of Child & Adolescent Psychiatry, 45* (5), 561-569.

Wüst, S., Federenko, I., Hellhammer, D.H., & Kirschbaum, C. (2000). Genetic factors, perceived chronic stress, and the free cortisol response to awakening. *Psychoneuroendocrinology, 25* (7), 707-720.

Zarit, S.H., Reeves, K.E., & Bach-Peterson, J. (1980). Relatives of the impaired elderly: Correlates of feelings of burden. *Gerontologist, 20*, 649–654.

Chapter 6

Study 5: Lower Electrodermal Activity to Acute Stress in Caregivers of People with Autism Spectrum Disorder: An Adaptive Habituation to Stress

Published in: Ruiz-Robledillo, N[1]., & Moya-Albiol, L[1]. (2015). Lower Electrodermal Activity to Acute Stress in Caregivers of People with Autism Spectrum Disorder: An Adaptive Habituation to Stress. *Journal of Autism and Developmental Disorders, 45* (2), 576-588.

[1] Department of Psychobiology, University of Valencia

Introduction

Caring for a relative with a diagnosis of an autism spectrum disorder (ASD) entails being under chronic stress, with marked consequences for the health and well-being of the caregiver (Khanna et al., 2011; Ruiz-Robledillo & Moya-Albiol, 2013). Parents of people with ASD suffer higher levels of stress and report poorer health than those of people without developmental disabilities (Estes et al., 2009, 2013; Smith, Seltzer & Greenberg, 2012). Several characteristics of the offspring such as behavioral problems, autistic symptomatology and age have been related to psychological functioning in caregivers (Davis and Carter, 2008; Hastings, 2002; Smith, Seltzer, Tager-Flusberg, Greenberg, & Carter, 2008). Various studies have employed biological markers of stress for analyzing caregivers’ health. In particular, with this approach, behavioral problems of offspring have been found to be related to altered diurnal secretion of cortisol in caregivers. It seems that daily challenges associated with caring for people with an ASD could affect body homeostasis in the caregivers (Seltzer et al., 2010). In particular, these daily challenges suppose a threat to allostasis (a set of processes that allow organisms to maintain homeostasis while adapting to the demands of the environment). One major system involved in the processes of allostasis is the autonomic nervous system (ANS) (McEwen, 2007). Previous research on diverse physiological markers in samples of people under chronic stress has shown alterations in the functioning of this system (Chida and Hamer, 2008). Therefore, caring for a relative with an ASD could alter the activity of the ANS and so modulate the stress response and health of caregivers.

One of the most studied psychophysiological markers of the functioning of the ANS is the skin conductance (Boucsein, 2012). Skin conductance is a non-invasive measure of psychophysiological changes in electrodermal activity (EDA). It is an indicator of the sympathetic activity of the ANS (Kreibig, 2010) that is associated with emotion, cognition, and affection (Critchley, 2002). EDA measures have been widely used as a clinical sign of stress-related psychophysiological disorders (Hugdahl, 1995) and, in particular, tonic and phasic components of EDA have been studied (Boucsein, 2012). Tonic EDA, as indicated by skin conductance level (SCL), can be defined as the baseline level of sympathetic nerve activity, while phasic EDA is conceptualized as short-lasting changes elicited by a specific stimulus on the absence of a specific external stimulus. In this latter case, the number of non-specific skin conductance responses

(NSCRs) is the measure most studied in the literature. This is expressed as a rate per minute (usually between 1 and 3 responses while subjects are at rest and measured as a rapid change in SCL with an amplitude greater than or equal to 0.02 μs within a 1.0–3.0 s latency window).

Research in various populations has analyzed EDA in response to laboratory acute stressors such as stressful films (Lensvelt-Mulders & Hettema, 2001), the Stroop task (Moya-Albiol et al., 2001) and electric shocks (Boucsein, 2012). Gender differences in EDA have been reported (Boucsein, 2012). In neutral conditions, men usually have higher levels of EDA than women (Martínez-Selva, Gómez-Amor, Olomos, Navarro, & Román, 1987); however, in some situations, such as the threat of an electric shock, women may be more responsive to environmental conditions (Venables & Mitchell, 1996). Studies that have analyzed this marker in response to acute stress in laboratories have also demonstrated differences between genders, showing men to have higher EDA than women (Carrillo et al., 2001). In caregivers, these differences have been replicated (Thompson et al., 2004). To the best of our knowledge, however, only two studies have been carried out in informal caregivers. Caregivers of people with cancer were shown to have stronger EDA in response to emotional stimuli than non-caregivers (Gonçalves & Graça, 2011), whereas no significant differences were found considering caregivers of people with drug addiction (Soares, 2009).

Although some studies have analyzed EDA in caregivers, none of them have evaluated the effects of high levels of negative affect, produced by the chronic stress situation, on EDA (Chida & Hamer, 2008). It is known that caregivers of people with ASD suffer high levels of anxiety, depression and anger, and this is probably a consequence of the chronic care situation (De Andrés-García et al., 2012). These types of emotion, which could be categorized within the spectrum of negative affect, have been traditionally linked with various types of health complaints (Billings, Folkman, Acree & Tedlie, 2000). The biological mechanism underlying the impact of negative affect on health remains unclear, but results reflect an alteration in the functioning of the immune and autonomic nervous systems (Salovey, Detweiler, Steward & Rothman, 2000). Although the influence of negative affect on health has been described previously, few studies have employed biological markers of emotionality, such as EDA, to understand the relationship between the variables included in the negative affect spectrum and health. Regarding depression, low levels of SCL have been related to sleep disturbances and a tendency to depression in children (El-Sheikh & Arsiwalla, 2011). Similar results were found in studies carried out with samples of people with depressive symptomatology. Indeed, depression has classically been related to blunted EDA in laboratory settings (Miquel, Fuentes, García-Merita & Rojo, 1999; Thorell, Kjellman & D´Elia, 1987). This effect has been attributed to inhibitory mechanisms in the information processing of the central nervous system (Boucsein, 2012). An association between high anxiety (a second component of negative affect) and blunted EDA has also been reported (Naveteur, Buisine & Gruzelier, 2005; Naveteur & Roy, 1990; Wilken, Smith, Tola & Mann, 2000). This effect was explained in terms of the habituation process and coping abilities (Naveteur et al., 2005). Specifically, it was proposed that individuals with high trait anxiety have more resources to cope with stressors and present greater habituation as a protecting mechanism for resisting the prolonged activation. Moreover, high trait anger (another component of negative affect) has also been related to blunted EDA (Fowles, 2000; Scarpa & Raine, 1997). A recent review pointed out a trend to a diminished EDA response to stressors in individuals with high impulsive-aggressive behavior (Patrick, 2008).

Hence, although there is evidence of an association between EDA and components of negative affect, few studies have examined the relationship between specific health domains and EDA, pain being the principal factor analyzed (Peters & Schmidt, 1991). Greater EDA has been described in patients with chronic pain in laboratory settings (Bonnet & Naveteur, 2006). Regarding symptoms, reduced EDA responses to high levels of stress and excessive EDA responses to moderate stress in stressful laboratory situations (Papousek, Schulter & Premsberger, 2002) have been related to many gastrointestinal complaints. Moreover, EDA was found to be positively related to the physical health domain and negatively related to social functioning in university students (Juárez, Castro & Scarpeta, 2005).

New studies using EDA as an indicator of ANS activity in response to stress are required in chronically stressed individuals to fill the gap in the literature. This is particularly relevant in caregivers of people with ASD, and may help us understand the biological mechanism underlying the consequences of care for health. A preliminary aim of this study was to check whether caregivers of ASD offspring present more severe self-reported somatic symptoms and a predominant negative affect characterized by higher depression, trait anger and trait anxiety, compared to non-caregiver group as previously described (De Andrés-García et al., 2012). In this preliminary aim, it was supposed the existence of gender differences in somatic symptoms and negative affect, as previously found (Ruiz-Robledillo & Moya-Albiol, 2013). In addition, it aimed to validate the stressor employed as valid and effective in eliciting increases in EDA and psychological responses (changes in state anxiety, anger and mood), in the whole sample and for each group separately following previous studies using similar protocols (Moya-Albiol, Salvador, Costa, Martínez-Sanchís & González-Bono, 2003; Moya-Albiol et al., 2001; Moya-Albiol, Salvador, González-Bono, Martínez-Sanchís & Costa, 2001). The main aim was to compare EDA and psychological responses (changes in anxiety, mood and anger) to an acute mental stressor between caregivers of people with ASD and non-caregivers (parents of age-matched typically-developing children). In this case, the possible differences between genders were also checked. For this purpose, EDA and psychological responses to the stressor were evaluated before (pre) and after (post) the stressor. Despite the lack of conclusive evidence from previous studies in caregivers, we expected to find lower EDA and higher psychological responses in caregivers than non-caregivers, due to the high levels of negative affect in the former (Miquel et al. 1999; Naveteur et al., 2005; Patrick, 2008). With regard to gender differences, we expect to find lower EDA and higher psychological responses in women compared to men (Carrillo et al., 2001; Thompson et al., 2004). In addition, the study analyzed the relationship between EDA and psychological responses (mood, anxiety and anger) in the two groups. In the light of previous research, we expected that higher scores in anxiety, anger, and negative mood state responses would be related to lower EDA in both groups (Carrillo et al., 2001; Miguel-Tobal et al., 2001). The last aim was to analyze whether EDA response was related to self-reported somatic symptoms in the two groups. Taking into account the previous research in this field, we expected to find higher rates of somatic symptoms in participants with higher EDA (Papousek et al., 2002).

Methods

Participants

The sample was composed of 64 participants: 30 caregivers (parents of patients with ASD, 16 women and 14 men) and 34 non-caregivers (parents of age-matched typically developing children, 20 women and 14 men). Caregivers were recruited from an association of relatives of individuals with ASD in Valencia (APNAV).Couples or participants caring for the same person did not included in the sample. Offspring of the association members were clinically diagnosed with an ASD by clinical staff following the DSM-IV-R criteria. Firstly, meetings were held to explain the aim of the research and the inclusion criteria. To be eligible for the caregiver group, individuals had to be parent of a patient with an ASD, be their primary caregiver, and have lived in the same home as them for at least two years before the study. An interview was programmed for relatives who were selected and wished to participate in the study. The non-caregiver group was composed of parents of healthy offspring who had not provided special care for any ill relative for at least 2 years before the start of the experiment. This group was recruited using advertisements and flyers, as well as by word of mouth. Participation was voluntary, all participants signing an informed consent that followed ethical norms for human research (Helsinki Declaration), and approval was obtained from the official local ethics committee.

Procedure

The participants were instructed to abstain from eating, drinking stimulants (such as tea, coffee, or alcohol), or smoking during the two-hour period before arriving at the laboratory. The experimental procedure was performed between 4:00 and 7:00 pm, and each session lasted approximately two and a half hours. After the participants arrived, the anthropometric variables (age, weight, and height) were measured and compliance with the instructions was confirmed. Participants were conducted to the stress room. This room was sound-attenuated, temperature-controlled (21 ± 2 °C), and light-constant during all sessions. Electrodes were attached and participants were encouraged to make themselves comfortable and be relaxed. After a few minutes of habituation, Baseline signals were recorded for 10 min. Just before starting the Baseline period, participants completed psychological questionnaires for the evaluation of psychological responses (pre-stress anxiety, anger and mood). General information regarding the stress stimuli and the evaluation of their performance during the Stressor was then provided to the participants. After giving Instructions (2 min), the Anticipatory period began (5 min) and during which participants remained silent. When the Anticipatory period finished, participants were exposed to a psychosocial stressor consisting of a session of 20 min in front of a committee of two men and three women performing a set of cognitive tasks (Stroop test, mirror-drawing test and arithmetic tasks). During the Stressor period (20 min), a video camera was switched on to heighten the evaluative threat by simulating a recording, as suggested in previous studies (Dickerson & Kemeny, 2004). Immediately after completing this Stressor, physiological measurements continued to be recorded during the Recovery period (10 min).When participants had completed questionnaires for the evaluation of psychological responses (post-stress anxiety, anger and mood), they returned to the first room. Finally, the participants completed personality batteries and were interviewed to collect data on other individual characteristics. In the case of caregivers, the researchers also conducted an interview regarding the characteristics of the care recipient and the status of the caregiver.

Materials

Negative Affect

Trait anxiety was evaluated by the trait component of the Spanish version of the State-Trait Anxiety Inventory (STAI, Spielberger, Gorusch, Lushene, Vagg, & Jacobs, 1983; Seisdedos, 1982). The trait component is composed of 20 items ranked on a four-point Likert scale and evaluates individual differences in anxiety proneness measured by how often feelings of anxiety are experienced. The reliability coefficient is 0.86.

Depressive symptomatology was evaluated by the Beck Depression Inventory (BDI, Beck & Steer, 1993). This questionnaire consists of 21 self-report items that refer to emotional, cognitive, and somatic aspects of depression mood. Each item is ranked on a four-point Likert scale and evaluates intensity and severity of symptoms with a reliability coefficient of .83.

Trait anger was assessed using the trait component of the Spanish adaptation of State-Trait Anger Expression Inventory, STAXI-2 (Miguel-Tobal, Casado, Cano-Vindel, & Spielberger, 2001). Both trait anger and anger expression were assessed. The questionnaire was composed of 49 items distributed into six subscales: two for trait anger (temperament and angry reaction), and four for the expression of anger (expression-in, expression-out, control-in, and control-out). An overall measure of total anger expression index (AEI) may be calculated from the latter four scales. The reliability coefficients of the scales ranged from 0.65 to 0.86.

Psychological Responses

State anxiety was evaluated using the state component of the Spanish version of the State-Trait Anxiety Inventory (STAI, Spielberger, Gorusch, Lushene, Vagg, & Jacobs, 1983; Seisdedos, 1982). The state component is composed of 20 items ranked by means of a 4-point Likert scale from 1 (nothing) to 4 (plenty) examining how participants feel at that moment. The reliability coefficient is 0.62.

Mood was evaluated using the abbreviated version of Profile of Mood States (POMS), developed by Fuentes, Balaguer, Meliá & García-Merita, (1995). It is composed of 29 items grouped in five subscales to describe the following factors: tension, depression, cholera, vigor and fatigue. The tension factor is defined as an increase in muscle-skeletal tension, and depression refers to a depressed mood accompanied by feelings of personal inadequacy, while the cholera factor represents a mood of anger and antipathy towards others, vigor a state of vigor and energy and fatigue a mood of inertia and low energy. A total score was also obtained by summing scores on all but the vigor scale. The higher the total score, the worse the mood. The Cronbach's α of this instrument is higher than 0.80.

A state component of the Spanish version of the State-Trait Anger Expression Inventory, STAXI-2 (Miguel-Tobal et al., 2001) was employed for measuring state anger. It contains 15 items ranked on a 4-point Likert scale and distributed into three subscales: feelings, verbal, and physical expression of anger. The Cronbach's alpha ranged from 0.67 to 0.89.

Somatic Symptoms

Somatic symptoms were assessed with the Spanish revised version of the Somatic Symptoms Scale (ESS-R) created by Sandín & Chorot (1995). This instrument lists symptoms over the last 2 years and is composed of 80 items that are focused on complaints of the immunological, cardiovascular, respiratory, gastrointestinal, neurosensory, muscular, dermatological, and genitourinary systems, as well as female reproductive system symptoms. A total score for symptoms is calculated. Each scale is composed of 10 items scored on a 5-point Likert scale from 0 (never) to 4 (more than five times in the last 2 years) with reliability coefficients ranging from 0.79 to 0.84.

Dependency Level, Functional Status, and Degree of Autistic Symptomatology of Care Recipient

A Spanish version of the Barthel Index (Baztán et al., 1993) was used to evaluate care recipient dependence. This instrument measures 10 items of disability based on daily activities (personal toilet, bathing, feeding, getting on and off the toilet, ascending and descending stairs, dressing, controlling bowel and bladder). Higher scores on the Barthel Index indicate less dependency.

The global activity of the care recipient was evaluated using the Global Assessment Scale (Endicott, Spitzer, Fleiss, & Cohen, 1976) with a reliability coefficient of 0.91. This instrument is a rating scale for evaluating the overall functioning of a subject during a specified time period on a continuum from psychological or psychiatric sickness to health. The scale provides a single score ranging from 1 (severe symptoms and risk of suicide attempt) to 100 (lack of symptoms).

The degree of autism of the care recipient was also assessed with the Autism Quotient (AQ) created by Baron-Cohen, Hoekstra, Knickmeyer, and Wheelwright (2006). This questionnaire is composed of 50 items ranged on a 4-point Likert scale from A (completely agree) to D (completely disagree) with a reliability coefficient greater than 0.76. A higher score indicates a higher degree of autism with a maximum of 50. Authors proposed this instrument as a screening of severity of autistic symptoms, not as a diagnosis tool.

Electrophysiological Recording

Following the guidelines of the Society of Psychophysiological Research (Boucsein et al., 2012; Fowles et al., 1981), two Ag/AgCl electrodes (TSD203) with a 6-mm diameter contact area were used to measure the SCL. Adhesive collars were used to hold the electrodes on the middle phalanges of the fore and ring fingers on the non-dominant hand. Hypoallergenic gel was used as a contact medium between the skin and electrode. A skin conductance module (GSR100C) amplified the electrical signal with a constant voltage of <0.5 V. In all cases, hygienic routines and guidelines for reducing the risk of disease transmission in the laboratory were followed during the procedure (Putnam, Johnson & Roth, 1992).

The SCL module was a part of a physiological recording system composed of 16 modules (BIOPAC Systems, Inc, Santa Barbara, CA 93117). This system was connected to a signal pre-amplifier UIM150 (Universal Interface Module) and this in turn was connected to a computer equipped with data acquisition hardware (MP150) and data storage software (AcqKnowledge 4.2 for Windows).

Data Reduction and Analysis

The physiological recording system registered 1,000 data points per second for each variable. As the duration of each period was different and could vary somewhat from one subject to another, the means were obtained for the Baseline, Instruction, Anticipatory, Stressor, and Recovery periods using Acqknowledge software. Any artifact-free changes in SCL greater than or equal to than 0.05 μΩ and within a 1.0- to 3.0-s latency window were considered responses. SCL was expressed in μΩ.

The interaction of the group and gender differences in negative affect and somatic symptoms was examined using one-way ANOVAs. Repeated measurements of ‘period’ (Baseline, Instruction, Anticipatory, Stressor, and Recovery); within-subject factors and ‘group’ (caregivers and non-caregivers); and ‘gender’ (men and women) between-subject factors were performed for EDA (SCL and NSCRs). Greenhouse-Geisser corrections for degrees of freedom were applied. For psychological responses, ANOVAs for repeated measurements (pre-stressor and post-stressor) were used with ‘group’ and ‘gender’ as between-subject factors. Post-hoc analyses were carried out using univariate ANOVAs to analyze the effect of ‘group*gender’ and ‘group*gender*period’ interactions. Bonferroni corrections for multiple comparisons were applied when a significant interaction effect was found in conducted ANOVAs. To control for potential differences in negative affect (anxiety, depression and anger traits), ANCOVA analysis was performed using values as covariates when appropriate.

Change scores in psychological responses were obtained as the difference between post-stressor and pre-stressor scores. For SCL, the area under the curve (AUC) was calculated following the trapezoidal rule (Kudielka, Buske-Kirschbaum, Hellhammer & Kirschbaum, 2004). Total AUC of the SCL was calculated for all the evaluated periods (baseline, instructions, anticipatory, stressor and recovery). The partial AUC of the stressor was calculated to analyze the magnitude of the SCL increases from Baseline to the Stressor period. Similarly, the partial anticipatory AUC of the SCL was calculated as the increase in SCL from Baseline to the Anticipatory period. Spearman correlation tests were carried out to examine relationships among EDA, psychological responses and somatic symptoms. Fisher's Z statistic was employed to compare the pattern of relationships between variables analyzed in caregivers and non-caregivers. All statistical analyses were performed with SPSS 17.0 for Windows. The alpha level was set at 0.05. Data is expressed as Mean ± SD.

Results

Sample Characterization

Groups did not differ in age, body mass index (BMI), marital status, phase of the menstrual cycle, educational level, smoking habit (cigarettes), or source of income. In caregivers no gender differences were found in years of caring or hours per week caring. Anthropometric and socio-demographic variables (M ± SD) for caregivers and non-caregivers (considering men and women separately) are summarized in Table 1.

Are There Differences Between Caregivers and Non-caregivers in Somatic Symptoms and Negative Affect?

In the case of components of the negative affect; trait anxiety, depressive symptomatology, and AEI the group factor proved to be significant [$F(1,60)=16.693$, $p<.000$, $\eta^2_{partial}=.218$; $F(1,60)=23.295$, $p<.000$, $\eta^2_{partial}=.280$ and $F(1,60)=7.083$, $p<.01$, $\eta^2_{partial}=.106$, respectively]. Caregivers showed more severe negative affect with higher scores than non-caregivers in all these psychological dimensions. No significant differences between groups were found in trait anger ($p>.10$).

With regard to somatic symptoms, a significant effect for the 'group' factor was obtained in immunological and muscular symptoms [$F(1,60)=4.255$, $p<.05$, $\eta^2_{partial}=.066$; $F(1,60)=3.575$, $p<.06$, $\eta^2_{partial}=.056$, respectively]. Caregivers had poorer health in the sense that they had more symptoms than non-caregivers in these systems. A significant effect for the 'group*gender' interaction was only found in the case of gastrointestinal symptoms $F(1,60)=4.579$, $p<.05$, $\eta^2_{partial}=.071$. Post-hoc analysis showed that female caregivers reported more gastrointestinal symptoms than male caregivers and female non-caregivers (for all $p<.05$). No differences between groups were found in cardiovascular, respiratory, gastrointestinal, neurosensory, dermatological, genitourinary or female reproductive symptoms ($p>.10$).

Table 1 Anthropometric and socio-demographic variables in caregivers and non-caregivers men and women (M ± SD)

		Female Caregiver (n=16)	**Male Caregiver (n=14)**	**Female Non-caregiver (n=20)**	**Male Non-caregiver (n=14)**
Age		45.62 ± 7.89	46.35 ± 6.18	45.50 ± 5.09	41.07 ± 4.08
BMI		25.53 ± 4.28	29.19 ± 4.97	25.71 ± 5.71	27.90 ± 2.91
Marital Status	**Single**	1 (6.3%)	0 (0%)	1 (5%)	0 (0%)
	Married	13 (81.3%)	14 (100%)	17 (85%)	14 (100%)
	Divorced	2 (12.5%)	0 (0%)	0 (0%)	0 (0%)
	Widowed	0 (0%)	0 (0%)	2 (10%)	0 (0%)
Phases of the menstrual cycle	**Follicular**	7 (43.8%)		8 (40%)	
	Luteal	5 (31.3%)		7 (35%)	
	Amenorrhea	4 (25%)		5 (25%)	
Educational Level	**Primary**	4 (25%)	3 (21.4%)	2 (10%)	0 (0%)
	Secondary	3 (18.8%)	6 (42.9%)	3 (15%)	2 (14.3%)
	Higher	9 (56.3%)	5 (35.7%)	15 (75%)	11 (78.6%)
	Others	0 (0%)	0 (0%)	0 (0%)	1 (7.1%)
Smoking habit	**Yes**	4 (25%)	4 (28.6%)	7 (35%)	3 (21.4%)
	No	12 (75%)	10 (71.4%)	13 (65%)	11 (78.6%)
Source of income	**Pension**	0 (%)	0 (0%)	1 (5%)	0 (0%)
	Work	13 (81.3%)	11 (78.6%)	15 (75%)	11 (78.6%)
	Unemployment benefit	0 (%)	1 (7.1%)	1 (5%)	1 (7.1%)
	Others	3 (18.8%)	2 (14.3%)	3 (15%)	2 (14.3%)
Number of children at home	**1 child**	5 (31.3%)	5 (35.7%)	5 (25%)	6 (42.9%)
	2 children	9 (56.3%)	9 (64.3%)	11 (55%)	7 (50%)
	3 children	2 (12.5%)	0 (0%)	4 (20%)	1 (7.1%)

Care status					
Years of evolution of care since the definitive diagnosis of ASD of the care recipient		12.03 ± 6.84	10.03 ± 5.31		
Hours per week caregiving	**< 24 hours**	3 (18.8%)	4 (28.6%)		
	24 to 72 hours	4 (25%)	6 (42.9%)		
	> 72 hours	9 (56.3%)	4 (28.6%)		
Shared care of the care recipient with another person	**Yes**	11 (68.8%)	13 (92.9%)		
	No	5 (31.3%)	1 (7.1%)		
Parenting	**Biological**	15 (93.8%)	13 (92.9%)		
	Adoptive	1 (6.3%)	1 (7.1%)		
Characteristics of the care recipient					
Gender of the offspring	**Male**	14 (87.5%)	12 (85.7%)	10 (58.8%)	7 (70%)
	Female	2 (12.5%)	2 (14.3%)	7 (41.2%)	3 (30%)
Age of the offspring		14 ± 6.47	12.21 ± 5.01	13.70 ± 7.35	9 ± 6.30
Diagnosis of the offspring	**Autism**	16 (100%)	13(92.9%)		
	Asperger	0 (0%)	1 (7.1%)		
Autism Quotient (AQ)		30.06 ± 5.54	30.35 ± 6.58		
Global Activity		56.56 ± 15.78	50.71 ± 18.99		
Independence		79.21 ± 22.26	79.80 ± 14.84		

Was the Stressor Effective for Eliciting Changes in EDA and Psychological Responses in Caregivers and Non-caregivers?

When the whole sample was analyzed, the stressor proved to be effective for eliciting the expected results since for EDA the factor ‘period’ was significant for all subjects in NSCRs and SCL [$F(2.585,162.874)=50.605$, $p<.000$, $\eta^2_{partial}=.445$ and $F(1.862,117.323)=32.985$, $p<.000$, $\eta^2_{partial}=.344$, respectively]. In particular, the NSCRs were higher in the Instruction period and lower in the Recovery period than in all other periods (for all $p<.0001$). For SCL, post hoc analysis showed differences for Baseline and Stressor compared to the other periods (for all $p<.0001$). Specifically, there was a significant increase from Baseline to Instruction and Stressor periods. Moreover, post stressor levels were higher than those in the Baseline period.

The stressor was also effective at triggering psychological responses. That is, the factor ‘period’ proved to be significant for anxiety $F(1,63)=36.648$, $p<.0001$, $\eta^2_{partial}=.368$; vigor $F(1,63)=6.704$, $p<.01$, $\eta^2_{partial}=.096$; cholera $F(1,63)=6.259$, $p<.05$, $\eta^2_{partial}=.090$; fatigue $F(1,63)=16.707$, $p<.0001$, $\eta^2_{partial}=.210$; tension $F(1,63)=40.647$, $p<.0001$, $\eta^2_{partial}=.392$ and total mood $F(1,63)=27.926$, $p<.0001$, $\eta^2_{partial}=.307$. Participants showed higher anxiety, cholera, fatigue, and tension but lower vigor after the stressor. In the case of feelings, verbal, and physical expression of anger and depression, the stressor did not have an effect ($p>.10$).

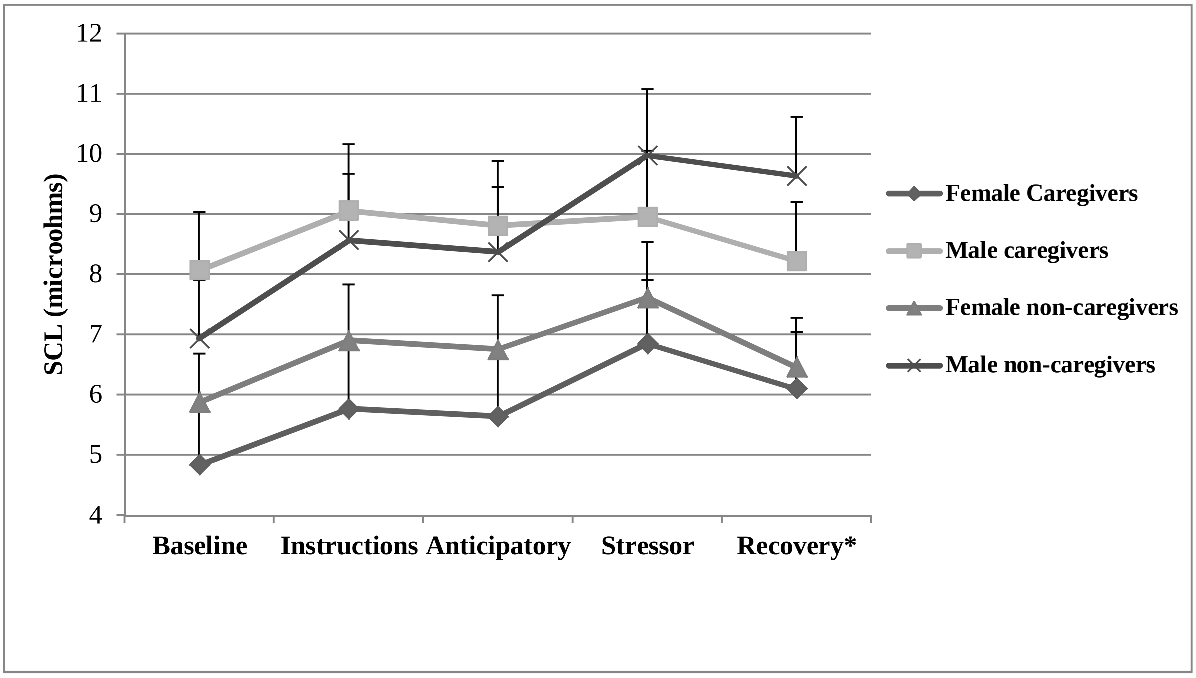
To analyze the effectiveness of the stressor in eliciting sympathetic nerve responses in each group, EDA was analyzed separately for caregivers and non-caregivers. For caregivers, an effect of the factor ‘period’ was significant for both SCL and NSCRs [$F(1.991,57.747)=12.537$, $p<.0001$, $\eta^2_{partial}=.302$ and $F(2.370,68.721)=22.465$, $p<.0001$, $\eta^2_{partial}=.437$, respectively]. There was an increase from the Baseline to the other periods, with the SCL being higher in the Stressor period than in the Anticipatory and Recovery periods (for all $p<.01$). Further, the NSCRs was higher in the Instruction and lower in the Recovery period than in all other periods ($p < .05$). For non-caregivers, a significant effect of the factor period was also found in SCL and NSCRs [$F(1.760,58.084)=21.328$, $p<.0001$, $\eta^2_{partial}=.393$ and $F(2.652,87.504)=28.456$, $p<.0001$, $\eta^2_{partial}=.463$, respectively]. Differences between periods were the same as in the case of caregivers (for all $p<.01$).

Changes in psychological responses to stress in each group were also evaluated separately. In the group of caregivers, the factor period proved to be significant only for anxiety and tension [F(1,29)=13.054, p<.001, $\eta^2_{partial}$=.310; F(1,29)=18.744, p<.0001, $\eta^2_{partial}$=.393, respectively]. Caregivers presented higher levels after the stressor. No significant effects of the factor "period" were found for the other components of psychological responses (p>.10). In the case of non-caregivers, a significant effect of the factor period was found in anxiety F(1,33)=25.173, p<.0001, $\eta^2_{partial}$=.433, vigor F(1,33)=5.858, p<.05, $\eta^2_{partial}$=.151, cholera F(1,33)=9.947, p<.01, $\eta^2_{partial}$=.232, fatigue F(1,33)=24.148, p<.0001, $\eta^2_{partial}$=.423, tension F(1,33)=22.879, p<.0001, $\eta^2_{partial}$=.409, total mood F(1,33)=36.612, p<.0001, $\eta^2_{partial}$=.497 and feelings of anger F(1,33)=4.400, p<.05, $\eta^2_{partial}$=.118. Participants obtained higher scores in all evaluated dimensions, except for vigor, after the task (Table 2). No significant effects for the factor "period" were found in the case of depression or verbal and physical anger (p>.10).

Are There Differences Between Caregivers and Non-caregivers in EDA and Psychological Responses to the Stressor?

In SCL, the 'group*period' and 'group*gender*period' interactions were significant [F (2.036,122.179)=3.313, p<.05, $\eta^2_{partial}$=.052 and F(2.036,122.179)=9.621, p<.0001, $\eta^2_{partial}$=.138, respectively]. Although a significant effect of the 'group*period' was found for SCL, post hoc analyses did not reach statistical significance. However, post hoc analysis for the 'group*gender*period' interaction revealed that female caregivers had lower SCLs than male non-caregivers only in the Recovery period F(3,60)=2.914, p<.05, $\eta^2_{partial}$=.127 (Figure 1). Analyzing the magnitude of the response by means of the total AUC, significant effects were observed for the factor 'group' and for the 'group*gender' interaction [F(1,60)=5.559, p<.05, $\eta^2_{partial}$=.085 and F(1,60)=8.596, p<.01, $\eta^2_{partial}$=.125, respectively]. Caregivers showed a lower magnitude of total AUC than non-caregivers. Specifically, the differences were between female (p<.05) and male (p<.01) caregivers compared to male non-caregivers. In the case of partial AUC of the stressor, the factor 'group' and the 'group*gender' interaction proved to be significant [F(1,60)=4.803, p<.05, $\eta^2_{partial}$=.074 and F(1,60)=5.785, p<.05, $\eta^2_{partial}$=.088, respectively]. Caregivers showed a lower magnitude of response (AUC) than non-caregivers. When the interaction was analyzed, male caregivers proved to have lower levels of SCL than male non-caregivers (p<.05).

***Figure 1.* SCL during *Baseline, Instructions, Anticipatory, Stressor* and *Recovery* periods for group (caregivers and non-caregivers) and gender (men and women) (*p<.05)**



No significant differences were found in NSCRs between groups (p>.10).

Due to differences in baseline negative affect (depressive symptomatology, trait anxiety and anger) covariate analysis was performed to assess the effect of these variables on SCL and NSCRs. The ‘period*group*gender’ interaction for SCL was significant (1.984,113.097)=9.843, p<.0001, $\eta^2_{partial}$=.147. Differences were obtained in Baseline F(3,57)=3.292, p<.05, $\eta^2_{partial}$=.148, Instruction F(3,57)=3.141, p<.05, $\eta^2_{partial}$=.142, Anticipatory F(3,57)=3.289, p<.05, $\eta^2_{partial}$=.148 and Recovery F(3,57)=3.574, p<.05, $\eta^2_{partial}$=.158, periods. Post-hoc analyses indicated that male caregivers had higher SCLs than female caregivers at Baseline, Instruction and Anticipatory periods (p<.05). Furthermore, female caregivers presented lower SCLs at Recovery than male non-caregivers (p<.05). No significant differences in NSCRs were found after covariate analysis of the negative affect.

In the case of psychological responses to stress, a main effect for ‘group’ was found in depression subscale and total mood [F(1,60)=3.942, p<.05, $\eta^2_{partial}$=.062; F(1,60)= 4.584, p<.05, $\eta^2_{partial}$=.071, respectively]. Caregivers obtained higher scores for depression and worse total mood than non-caregivers. For state anger, a main effect of ‘group’ was also found F(1,60)=5.381, $p<.05$, $\eta^2_{partial}=.082$ with caregivers showing stronger feelings of anger than non-caregivers. No significant effects of “group” were found for the other psychological response variables. The ‘group*gender’ interaction proved to be significant only in the case of cholera (F(1,60)=4.732, $p<.05$, $\eta^2_{partial}=.073$) with women who were caregivers obtaining higher scores on this subscale than those who were not ($p<.05$). The “period*group” or “period*group*gender” interactions were not significant for any of the psychological response factors ($p>.10$).

Table 2. Differences in scores for psychological responses (anxiety, anger and mood state) before the stressor (pre) and after the stressor (post) between caregivers and non-caregivers (*Differences refer to a main effect of group, p<.05).

	Caregivers (n=30)		**Non-caregivers (n=34)**	
	Pre	**Post**	**Pre**	**Post**
Anxiety	17.13±7.12	24.17±10.81	13.85±7.02	21.21±9.95
Depression*	1.53±2.75	1.80±3.33	0.35±0.88	0.76±1.93
Vigor	10.33±6	9.57±6.30	12.97±5.67	11.59±6.09
Cholera	0.87±1.52	1.30±3.45	0.29±0.79	1.53±2.65
Fatigue	2.70±2.60	3.47±3.66	1.44±1.94	3.24±3.01
Tension	4.03±2.55	7.57±4.62	3.44±2.69	6.15±4.10
Total mood*	98.80±8.71	104.56±14.94	89.62±17.41	97.14±18.49
Physical expression of anger	5.06±0.36	5.16±0.64	5.17±0.62	5.32±1.19
Verbal expression of anger	5.30±0.98	5.50±1.30	5.23±0.78	5.17±0.57
Feelings of anger*	5.63±1.32	5.96±1.88	5.08±0.28	5.32±0.76

Is There a Relationship Between EDA and Psychological Responses to Stress? Is this Relationship Different in Caregivers and Non-caregivers?

For the caregiver group, total AUC was positively related to the tension change score ($r=.403$, $p<.05$). In addition, a larger partial AUC of the stressor was related to a greater response in anxiety ($r=.370$, $p<.05$) and tension ($r=.466$, $p<.01$). Finally, the partial anticipatory AUC correlated positively with change scores in anxiety ($r=.428$, p<.01), depression (r=.402, p<.01), cholera (r=.468, p<.01), tension (r=.452, p<.01) and total mood (r=.357, p<.05). For the non-caregiver group, no significant relationships were found between SCL and change scores of psychological states (p>.10).

For total AUC, the relationship with tension differed between the groups (Z=2.32, p<.05). In the case of the partial AUC of the stressor, relationships (Fisher's Z) with change score tension (Z=2.62, p<.01) were different. The pattern of correlations between partial anticipatory AUC and change scores of anxiety (Z=1.81, p<.06), tension (Z=2.18, p<.05), and total mood (Z=1.96, p<.05) were also different in the two groups.

Is There a Relationship Between EDA and Somatic Symptoms? Is this Relationship Different in Caregivers and Non-caregivers?

For somatic symptoms, in the case of caregivers, total AUC was positively related to muscular (r=.557, p< .001), gastrointestinal (r=.389, p<.05), and female reproductive symptoms (r=.388, p<.05), as well as total symptoms (r=.429, p<.01). The partial AUC of the stressor was related to muscular (r=.434, p<.01) and total symptoms (r=.340, p<.06). In non-caregivers, total AUC was only related to muscular symptoms (r=−.360, p<.05) and the partial AUC of the stressor to reproductive female symptoms (r=−.347, p<.05).

Fisher's Z statistic was employed to compare the pattern of relationships in caregivers and non-caregivers. The pattern of correlations between total AUC and muscular symptoms (Z=3.81, p<.001), female reproductive system (Z=2.73, p<.01), and total symptoms (Z=2.41, p<.01) differed between groups. In caregivers, a larger AUC was related to higher levels of muscular, female reproductive system, and total somatic symptoms. However, in the case of non-caregivers, a larger AUC was only related to fewer muscular symptoms. Considering the partial AUC of the stressor, the pattern of relationship with muscular symptoms was also different (Z=2.96, p<.01). In the case of partial anticipatory AUC and muscular symptoms, the pattern of correlation between these two variables was again different (Z=2.83, p<.01). The pattern of correlations between these two variables in each group was the same as for the total AUC.

Discussion

Our results suggest that caregivers of people with ASD have a weaker EDA response to acute cognitive stress than non-caregivers. Nevertheless, the stressor was effective in eliciting EDA and psychological responses in all subjects. The highest number of NSCRs was produced in the Instruction period, which reflects the onset of the anticipation of stress. This indicates emotional reactions when addressing the situation. In caregivers, anxiety increased significantly from Baseline to Recovery. -The same pattern was observed in non-caregivers; for whom vigor, cholera, fatigue, and anger subscales also increased significantly after the stressor.

The blunted reactivity in caregivers could be due to diverse appraisal processes of the stressor (Lazarus, 1991) as these may modulate psychophysiological responses (Roseman & Smith, 2001). It is probable that caregivers feel the situation to be less threatening than non-caregivers. This fact could be explained by processes related to habituation to stress. Laboratory studies in have demonstrated that EDA is the best marker for analyzing the emotional habituation process in humans (Boucsein, 2012). In this sense, caregivers of people with ASDs have to cope with a range of daily stressors associated with their caring role, such as behavioral problems and other autistic symptoms (Smith et al., 2010). This situation repeated every day could produce stress habituation in caregivers, dampening their emotional response and changing their perception of the stressor. That is, the stressor is probably perceived as less threatening in this population than in non-caregivers because stress habituation has reduced their sympathetic nerve and psychological responses. This supports the hypothesis that caregivers have a dampened emotional response to stress. Nevertheless, this blunted EDA could also be the consequence of the more severe negative affect reported in caregivers.

Although proneness to anxiety has traditionally been related to higher EDA (Birket-Smith, Hasle & Jensen, 1993), recent results are not unanimous. Indeed, individuals with high anxiety trait have shown reduced EDA response to laboratory stressors (Naveteur, Buisine & Gruzelier, 2005). Similar results have been obtained in depressed people (Mardaga & Hansenne, 2009; Schwerdtfeger & Rosenkaimer, 2011).

Results on EDA seem to be dependent on the diagnosis of the care recipient. In particular, there were no differences in caregivers of people with drug addiction (Soares, 2009), but those of people with cancer reported higher EDA than non-caregivers (Gonçalves & Graça, 2011). Care recipient characteristics and methodological considerations may explain the discrepancies between studies. ASD have specific characteristics which make these disorders quite different from the two aforementioned health problems. Furthermore, we employed a cognitive stressor whereas an emotional stressor has been used in the other studies.

As in previous studies, women exhibited lower EDA than men (Carrillo et al., 2001; Moya-Albiol et al., 2013). In addition, female caregivers presented a more adaptive SCL recovery than male non-caregivers, and all caregivers had lower magnitude of SCL response than male non-caregivers. These results point out the relevance of considering the effect of gender together with caring as different psychophysiological mechanisms that are probably involved in the sympathetic nerve responses to stress.

With regard to the relationship between EDA and psychological responses, only in caregivers was the magnitude of SCL response related to high anxiety and mood states. These results were found when considering the entire AUC; but especially in the case of the anticipatory response to stress, a specific period which has previously been pointed out as relevant when measuring sympathetic nerve responses to acute stress (González-Bono et al., 2002). In non-caregivers, psychological and sympathetic nerve responses are dissociated because there is no relationship between these states. Moreover, as has been previously reported, caregivers presented higher scores in negative affect (depressive symptomatology, trait anxiety, and anger expression) than non-caregivers (De Andrés-García et al., 2012). In the case of self-reported health, caregivers report a higher frequency of symptoms than non-caregivers, especially related to the immunological and muscular systems.

The analyses of the associations between EDA and somatic symptoms showed a different pattern for caregivers and non-caregivers. Whereas a higher EDA was related to poorer health in caregivers, the opposite association was found in non-caregivers. A chronic stressful situation such as caring for offspring with ASD could modulate the relationship between emotional responses and health. Moreover, highly responsive caregivers presented a higher frequency of symptoms than less responsive caregivers. In the context of caring as a chronic stress situation, this predisposition could be detrimental for the health of caregivers. Nevertheless, the aforementioned hyporeactivity could have protective effects in caregivers. To present a lower responsivity than the normal population could entail developing a capacity for controlling emotional responses, which in turn would maintain an adaptive body homeostasis. The finding of dampened EDA in individuals with high trait anxiety supports this hypothesis (Naveteur et al., 2005). It was proposed that such a capacity could be an adaptive process to reduce disruption, including health complaints, caused by high levels of chronic activation. That is, to be constantly in a state of alert could have negative consequences for health when individuals are undergoing chronic stress. For this reason, EDA may be a good marker for studying the link between autonomic stress and health in caregivers.

Although a habituation process is a plausible explanation of the results, alternative interpretations have to be addressed. Caregivers of people with autism could show high levels of resilience (Bayat, 2007). Dealing every day with the challenges of care, they would probably develop an adaptive ability to cope with the stressors. This, in turn, would explain the low EDA exhibited by caregivers, who would be “braver” coping with the stress than non-caregivers. However, no measures of resilience have been analyzed in this study.

Though the present study advances our comprehension of the biological mechanism of stress response in caregivers of people with ASD, various limitations have to be considered. Firstly, it is cross-sectional research, which means that causality cannot be established. In this sense, longitudinal studies are needed to explore how variables of the caregivers and those of the care recipient could determine changes in stress response, specifically in EDA responding to acute stress. Other variables, such as resilience and coping styles should also be evaluated to analyze the protective effects of these factors on the attenuated EDA exhibited by caregivers. In addition, other biological markers of the health of the autonomic nervous system, such as heart rate variability, need to be considered in future research. This would enable an analysis of the stress response in caregivers with a comprehensive perspective, reinforcing the results obtained in this study.

Conclusions

Caregivers had lower EDA than non-caregivers, probably because of a habituation mechanism that could protect their health. In any case, caregivers seem to have less ability to cope with the stressors. Although it might be an adaptive way to protect themselves, this situation could also have disruptive consequences.

Hyporeactivity could be detrimental to the ability of caregivers to cope with various daily stressors, and not only with those associated with caring. If caregivers lose the ability to cope with daily stress they will perform poorly; biological and psychological responses originating from stressors are necessary to deal effectively with environmental demands. For this reason, a hyporeactive physiological system could reduce their adaptive ability, while protecting caregivers from health problems. These findings suggest that emotional and stress management interventions should be implemented especially in the early stages of the diagnosis of the care recipient. These types of interventions are based on the idea that people under chronic stress have high levels of negative emotions due to a deficit in emotional and stress regulation abilities. Teaching caregivers strategies to cope with stress effectively could be expected to reduce negative emotions, stress perception, and health complaints. Future studies should include the evaluation of the effectiveness of specific therapeutic programs on stress perception and emotion in caregivers through the use of biological markers.

References

Baron-Cohen, S., Hoekstra, R.A., Knickmeyer, R., & Wheelwright, S. (2006). The autism spectrum quotient (AQ)—adolescent version. *Journal of Autism and Developmental Disorders, 36* (3), 343–350.

Bayat, M. (2007). Evidence of resilience in families of children with autism. *Journal of Intellectual Disability Research, 51*(9), 702–714.

Baztán, J.J., Pérez del Molino, J., Alarcón, T., San Cristóbal, E., Izquierdo, G., & Manzarbeitia, J. (1993). Índice de Barthel: Instrumento válido para la valoración funcional de pacientes con enfermedad cerebrovascular. *Revista Española de Geriatria y Gerontologia, 28,* 32–40.

Beck, A.T., & Steer, R.A. (1993). Beck depression inventory. Manual. San Antonio, TX: The Psychological Corporation.

Billings, D., Folkman, S., Acree, M., & Tedlie, J. (2000). Coping and physical health during caregiving: The roles of positive and negative affect. *Journal of Personality and Social Psychology, 79* (1), 131–142.

Birket-Smith, M., Hasle, N., & Jenses, H.H. (1993). Electrodermal activity in anxiety disorders. *Acta Psychiatrica Scandinavica, 88* (5), 350–355.

Bonnet, A., & Naveteur, J. (2004). Electrodermal activity in low back pain patients with and without co-morbid depression. *International Journal of Psychophysiology, 59* (1), 37–44.

Bonnet, A., & Naveteur, J. (2006). Electrodermal responses to words in chronic low back pain patients: A comparison between pain descriptors, other emotional words, and neutral words. *The Clinical Journal of Pain, 22* (8), 686–691.

Boucsein, W. (2012). Electrodermal activity. New York: Plenum Press.

Boucsein, W., Fowles, D.C., Grimnes, S., Ben-Shakhar, G., Roth, W.T., Dawson, M.E., & Filion, D.L (2012). Publication recommendations for electrodermal measurements. SPR ad hoc committee for electrodermal measures. *Psychophysiology, 49* (8), 1017–1034.

Carrillo, E., Moya-Albiol, L., González-Bono, E., Salvador, A., Ricarte, J., & Gómez-Amor, J. (2001). Gender differences in cardiovascular and electrodermal responses to public speaking task: the role of anxiety and mood states. *International Journal of Psychophysiology, 42* (3), 253–264.

Chida, Y., & Hamer, M. (2008). Chronic psychosocial factors and acute physiological responses to laboratory-induced stress in healthy populations: A quantitative review of 30 years of investigations. *Psychological Bulletin, 134* (6), 829–885.

Critchley, H.D. (2002). Electrodermal responses: What happens in the brain. *Neuroscientist, 8* (2), 132–142.

Davis, N.O., & Carter, A.S. (2008). Parenting stress in mothers and fathers of toddlers with autism spectrum disorders: Associations with child characteristics. *Journal of Autism and Developmental Disorders, 38* (7), 1278–1291.

De Andrés-García, S., Moya-Albiol, L., González-Bono, E. (2012). Salivary cortisol and immunoglobulin A: Responses to stress as predictors of health complaints reported by caregivers of offspring with autistic spectrum disorder. *Hormones and Behavior, 62* (4), 464–474.

Dickerson, S.S., & Kemeny, M.E. (2004). Acute stressors and cortisol responses: A theoretical integration and synthesis of laboratory research. *Psychological Bulletin, 130* (3), 355–391.

El-Sheikh, M., & Arsiwalla, D.D. (2011). Children’s sleep, skin conductance level and mental health. *Journal of Sleep Research, 20* (2), 326–337.

Endicott, J., Spitzer, R.L., Fleiss, J.L., & Cohen, J. (1976). The global assessment scale: A procedure for measuring overall severity of psychiatric disturbance. *Archives of General Psychiatry, 33* (6), 766–771.

Estes, A., Munson, J., Dawson, G., Koehler, E., Zhou, X.H., & Abbott, R. (2009). Parenting stress and psychological functioning among mothers of preschool children with autism and developmental delay. *Autism, 13* (4), 375–387.

Estes, A., Olson, E., Sullivan, K., Greenson, J., Winter, J., Dawson, G., & Munson, J. (2013). Parenting-related stress and psychological distress in mothers of toddlers with autism spectrum disorders. *Brain and Development, 35* (2), 133–138.

Fowles, D.C. (2000). Electrodermal hyporeactivity and antisocial behavior: Does anxiety mediate the relationship? *Journal of Affective Disorders, 61* (3), 177–189.

Fowles, D.C., Christie, M.J., Edelberg, R., Grings, W.W., Lykken, D.T., & Venables, P.H. (1981). Committee report. Publication recommendations for electrodermal measurements. *Psychophysiology, 18* (3), 232–239.

Fuentes, I., Balaguer, I., Meliá, J. & García-Merita, M. (1995). Forma abreviada del Perfil de Estados de Ánimo (POMS). In E. Cantón (Ed.), Libro de Actas del V Congreso Nacional de Psicologia de la Actividad Física y el Deporte. Valencia, Spain: Universitat de Valéncia.

Gonçalves, T., & Graça, M. (2011). Variables fisiológicas y sobrecarga familiar en hijos de enfermos oncológicos. *Revista Argentina de Clínica Psicológica, 20* (3), 255–263.

González-Bono, E., Moya-Albiol, L., Salvador, A., Carrillo, E., Ricarte, J., & Gómez-Amor, J. (2002). Anticipatory autonomic response to a public speaking task in women: the role of trait anxiety. *Biological Pshychology, 60* (1), 37–49.

Hastings, R.P. (2002). Parental stress and behaviour problems of children with developmental disability. *Journal of Intellectual and Developmental Disability, 27* (3), 149–160.

Hugdahl, K. (1995). Psychophysiology: The mind-body perspective. United States: Harvard University Press.

Juárez, F., Castro, G., & Scarpeta, D. (2005). Oscilaciones en la actividad electrodérmica y en el flujo sanguíneo periférico y estado de salud. *Psicología y Salud, 15* (2), 285–294.

Khanna, R., Madhavan, S.S., Smith, M.J., Patrick, J.H., Tworek, C., & Becker-Cottrill, B. (2011). Assessment of health-related quality of life among primary caregivers of children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 41* (9), 1214–1227.

Kirschbaum, C., Pirke, K.M., & Hellhammer, D.H. (1993). The ‘Trier Social Stress Test’ a tool for investigating psychobiological stress responses in a laboratory setting. *Neuropsychobiology, 28* (1–2), 76–81.

Kreibig, S. D. (2010). Autonomic nervous system activity in emotion: A review. *Biological Psychology, 84* (3), 394–421.

Kudielka, B.M., Buske-Kirschbaum, A., Hellhammer, D.M., & Kirschbaum, C. (2004). Differential heart rate reactivity and recovery after psychosocial stress (TSST) in healthy children, younger adults and elderly adults: The impact of age and gender. *International Journal of Behavioral Medicine, 11* (2), 116–121.

Lazarus, R.S. (1991). Emotion and adaptation. New York: Oxford University Press.

Lensvelt-Mulders, G., & Hettema, J. (2001). Genetic analysis of autonomic reactivity to psychologically stressful situations. *Biological Psychology, 58* (1), 25–40.

Mardaga, H., & Hansenne, M. (2009). Autonomic aspect of emotional response in depressed patients: Relationships with personality. *Clinical Neurophysiology, 39* (4), 209–216.

Martínez-Selva, J.M., Gómez-Amor, J., Olomos, E., Navarro, N., & Román, F. (1987). Sex and menstrual cycle differences in the habituation and spontaneous recovery of the electrodermal orienting reaction. *Personality and Individual Differences, 8* (2), 211–217.

McEwen, B.S. (2007). Physiology and neurobiology of stress and adaptation: Central role of the brain. *Physiological Review, 87* (3), 873–904.

Miguel-Tobal, J.J., Casado, M.I., Cano-Vindel, A., & Spielberger, C.D. (2001). Inventario de Expresión de Ira Estado-Rasgo: STAXI-2. Madrid: TEA Ediciones.

Miquel, M., Fuentes, I., García-Merita, M., & Rojo, L. (1999). Habituation and sensitization processes in depressive disorders. *Psychopathology, 32* (1), 35–42.

Moya-Albiol, L., De Andrés-García, S., Sanchis-Calatayud, M. V., Sariñana-González, P., Ruiz-Robledillo, N., Romero-Martínez, A., González-Bono, E. (2013). Psychophysiological responses to cooperation: The role of outcome and gender. *International Journal of Psychology, 48* (4), 542–550.

Moya-Albiol, L., Salvador, A., Costa, R., Martínez-Sanchís, S., & González-Bono, S. (2003). Psychophysiological responses to acute stress in two groups of healthy women differing in fitness. *Psicothema, 15* (4), 563–568.

Moya-Albiol, L., Salvador, A., Costa, R., Martínez-Sanchis, S., González-Bono, E., Ricarte, J., et al. (2001). Psychophysiological responses to the Stroop Task after a maximal cycle ergometry in elite sportsmen and physically active subjects. *International Journal of Psychophysiology, 40* (1), 47–59.

Moya-Albiol, L., Salvador, A., González-Bono, S., Martínez-Sanchís, S., & Costa, R. (2001). The impact of exercise on hormones is related to autonomic reactivity to a mental task. *International Journal of Stress Management, 8* (3), 215–229.

Naveteur, J., Buisine, S., & Gruzelier, J.H. (2005). The influence of anxiety on electrodermal responses to distractors. *International Journal of Psychophysiology, 56* (3), 261–269.

Naveteur, J., & Roy, J.C. (1990). Electrodermal activity of low and high trait anxiety subjects during a frustrative video game. *Journal of Psychophysiology, 4* (3), 221–227.

Nilsson, B.M., Hultman, C.M., & Wiessel, F.A. (2006). Niacin skin-flush response and electrodermal activity in patients with schizophrenia and healthy controls. *Prostaglandins Leukotrienes and Essential Fatty Acids, 74* (5), 339–346.

Papousek, I., Schulter, G., & Premsberger, E. (2002). Dissociated autonomic regulation during stress and physical complaints. *Journal of Psychosomatic Research, 52* (4), 257–266.

Patrick, C.J. (2008). Psychophysiological correlates of aggression and violence: An integrative review. *Transactions of the Royal Society B, 363* (1503), 2543–2555.

Peters, M.L., & Schmidt, J.M. (1991). Psychophysiological responses to repeated acute pain stimulation in chronic low back pain patients. *Journal of Psychosomatic Research, 35* (1), 59–74.

Putnam, L.E., Johnson, R, Jr, & Roth, W.T. (1992). Guidelines for reducing the risk of disease transmission in the psychophysiology laboratory. SPR ad hoc committee on the prevention of disease transmission. *Psychophysiology, 29* (2), 127–141.

Roseman, I.J., & Smith, C.A. (2001). Appraisal theory: Overview, assumptions, varieties, controversies. In K. R. Scherer, A. Schorr, T. Johnstone (Ed.), Appraisal processes in emotion: Theory, methods. research (pp. 3–19). New York: Oxford University Press.

Ruiz-Robledillo, N., & Moya-Albiol, L. (2013). Self-reported health and cortisol awakening response in parents of people with asperger syndrome: The role of trait anger and anxiety, coping and burden. *Psychology and Health, 28* (11), 1246–1264.

Salovey, P., Detweiler, J., Steward, W., & Rothman, A. (2000). Emotional states and physical health. *American Psychologist, 55* (1), 110–121.

Sandín, B., & Chorot, P. (1995). Escala de Síntomas Somáticos-Revisada (ESS-R). Madrid: Universidad Nacional de Educación a Distancia (UNED).

Scarpa, A., & Raine, A. (1997). Psychophysiology of anger and violent behavior. *Psychiatric Clinics of North America, 20* (2), 375–394.

Schwerdtfeger, A., & Rosenkaimer, A.K. (2011). Depressive symptoms and attenuated physiological reactivity to laboratory stressors. *Biological Psyhology, 87* (3), 430–438.

Seisdedos, N. (1982). STAI: Inventario de Ansiedad Estado-Rasgo [State-Trait Anxiety Inventory]. Madrid: TEA Ediciones.

Seltzer, M.M., Greenberg, J.S., Hong, J., Smith, L.E., Almeida, D.M., Coe, C., & Stawski, R.S. (2010). Maternal cortisol levels and behavior problems in adolescents and adults with ASD. *Journal of Autism and Developmental Disorders, 40* (4), 457–469.

Smith, L.E., Hong, J., Seltzer, M.M., Greenberg, J.S., Almeida, D.M., & Bishop, S.L. (2010). Daily experiences among mothers of adolescents and adults with Autism Spectrum Disorder. *Journal of Autism and Developmental Disabilities, 4* (2), 167–178.

Smith, L.E., Seltzer, M.M., & Greenberg, J.S. (2012). Daily health symptoms of mothers of adolescents and adults with fragile x syndrome and mothers of adolescents and adults with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 42* (9), 1836–1846.

Smith, L.E., Seltzer, M.M., Tager-Flusberg, H., Greenberg, J.S., & Carter, A.S. (2008). A comparative analysis of well-being and coping among mothers of toddlers and mothers of adolescents with ASD. *Journal of Autism and Developmental Disorders, 38* (5), 876–889.

Soares, A.J. (2009). Variáveis Psicossociais e Reactividade Emocional em Cuidadores de Dependentes de Substâncias. Unpublished doctoral dissertation. University of Minho, Minho, Portugal.

Spielberger, C.D., Gorusch, R.L., Lushene, R., Vagg, P.R. & Jacobs, G.A. (1983). Manual for the state-trait anxiety inventory. Consulting Psychologists Press.

Thompson, R. L., Lewis, S. L., Murphy, M. R., Hale, J. M., Blackwell, P. H., Acton, G. J., ... & Bonner, P.N. (2004). Are there sex differences in emotional and biological responses in spousal caregivers of patients with Alzheimer's disease? *Biological Research for Nursing, 5* (4), 319–330.

Thorell, L.H., Kjellman, B., & D'Elia, G. (1987). Electrodermal activity in relation to diagnostic subgroups and symptoms of depressive patients. *Acta Psychiatrica Scandinavica, 76* (6), 693–701.

Venables, P.H., & Mitchell, D.A. (1996). The effects of age, sex and time of testing on skin conductance activity. *Biological Psychology, 43* (2), 87–101.

Wilken, J.A., Smith, B.D., Tola, K., & Mann, M. (2000). Trait anxiety and prior exposure to non-stressful stimuli: effects on psychophysiological arousal and anxiety. *International Journal of Psychophysiololgy, 37* (3), 233–242.

Chapter 7

Study 6: A Mindfulness-Based Program Improves Health in Caregivers of People with Autism Spectrum Disorder: a Pilot Study

Published in: Ruiz-Robledillo, N[1]., Sariñana-González, P[1]., Pérez-Blasco, J[2]., González-Bono, E[1]., & Moya-Albiol, L[1]. (in press). A Mindfulness-Based Program Improves Health in Caregivers of People with Autism Spectrum Disorder: a Pilot Study. *Mindfulness.*

[1] Department of Psychobiology, University of Valencia

[2] Department of Evolutionary and Educational Psychology, University of Valencia

Introduction

The negative consequences of caring for a relative with a diagnosis of autism spectrum disorder (ASD) have been widely described in previous research (De Andrés-García, Moya-Albiol & González-Bono, 2012; Ruiz-Robledillo, González-Bono & Moya-Albiol, 2014; Ruiz-Robledillo & Moya-Albiol, 2013). Caring for such a relative is associated with high levels of burden, depression, anxiety, and poorer self-perceived general health (Ruiz-Robledillo & Moya-Albiol, 2013). Although previous research has highlighted this issue, few studies have assessed the effectiveness of psycho-therapeutic intervention programs in reducing self-perceived stress and health complaints in caregivers. Most studies reported to date have implemented educational interventions for training parents how to manage the behavioral problems of offspring (Singer, Ethridge & Aldana 2007). However, there is some evidence that behavioral-cognitive or multi-component programs oriented to caregivers have positive results, reducing depressive symptomatology and self-perceived stress (Kirkham, 1993; Nixon & Singer, 1993). That is, although this type of intervention could benefit caregivers, little is known about the efficacy of new therapeutic approaches, such as mindfulness interventions, in caregivers of people with ASD.

Mindfulness interventions have been implemented with excellent results in diverse samples of informal caregivers (Birnie, Garland, & Carlson 2010; Franco, Sola & Justo, 2010; Oken et al., 2010). To our knowledge, only three studies have analyzed the effects of mindfulness interventions in caregivers of people with ASDs (Ferraioli & Harris, 2012; Singh et al., 2006, 2007). Moreover, only one of them analyzed stress and overall health in caregivers, showing an improvement in both outcome measures at the end of the program (Ferraioli & Harris, 2012). In the other two studies, only variables related to the care recipient were evaluated and it was found that a mindfulness intervention for parents reduced disruptive behavior in offspring.

Further, few studies have employed biological markers to analyze the benefits of this type of intervention and most of these studies have been carried out with cancer patients and their caregivers (Bränström, Kvillemo & Akerstedt, 2013; Carlson, Speca, Faris & Patel, 2007). In cancer patients, mindfulness interventions have been observed to have a modifying effect by producing a decrease in morning cortisol levels in patients with high initial levels and an increase in morning cortisol in patients with lower initial levels (Bränström et al. 2013). With regard to pro-inflammatory biomarkers, a progressive reduction in Th1 cytokine levels was found over 1 year of participation in this type of intervention (Carlson et al. 2007). In caregivers of people with cancer, the participation in a mindfulness-based stress reduction (MBSR) program reduced cortisol and interleukin-6 levels (Lengacher et al. 2012).

As well as showing a benefit in clinical samples, mindfulness interventions have been reported to produce increases in positive affect and reductions in anger, rumination, depression, and anxiety in the general population (Keng, Smoski & Robins, 2011). These results indicate that mindfulness interventions are very useful in both clinical and non-clinical samples, reducing health complaints and increasing positive affect. However, this type of intervention has shown to be particularly effective in several samples of people under chronic stress conditions, such as chronic disease, burnout, or caring for people with chronic conditions (Goodman & Schorling 2012; Merkes, 2010; Minor, Carlson, Mackenzie, Zernicke, & Jones, 2006). Some authors have proposed an improvement in coping with the stressors and an increase in trait mindfulness as main explanations of the positive effects of this intervention in chronically stressed populations (Hölzel et al., 2011; Shapiro, Carlson & Astin, 2006).

To our knowledge, no studies have investigated the effects of mindfulness interventions on health in caregivers of people with ASDs using biological markers. As each chronic psychological disorder has its own characteristics and differently affects caregivers, it is necessary to assess the effects of mindfulness programs in this specific population. Biological markers of stress provide objective evidence of the effectiveness of psychological interventions for minimizing health complaints. Their use could reinforce previously obtained results in studies employing self-reported measures, which may be more subjective and less reliable than biological indicators.

Given this, we aimed to analyze the effects of a mindfulness-based program (MBP) on mood state and health complaints through the use of self-reported measures and biological markers of stress, namely afternoon cortisol and cortisol awakening response (CAR), in a sample of parents of individuals with ASDs (caregivers) and parents of typically developing children (non-caregivers). In addition, the efficacy of the program for improving health and negative mood in each group was analyzed comparing caregivers and non-caregivers. We hypothesized that both caregivers and non- caregivers would show better mood (less anxiety, negative mood, and feelings of anger) (Lykins & Baer 2009), as well as lower afternoon cortisol levels (Lengacher et al. 2012), after each evaluated session of MBP. In addition, we hypothesized that the health status of caregivers and non-caregivers would improve after the intervention program, together with an adjustment in morning cortisol levels (Bränström et al. 2013). Finally, we hypothesized that these improvements in health and mood state would be more pronounced in caregivers than non-caregivers after the program. We expected to find this greater improvement in health in caregivers, taking into account that they are a chronically stressed population, and the MBP program is primarily focused on stress management. This hypothesis is in line with the results of a previous research in which this type of program has been used with caregivers (Lengacher et al. 2012; Minor et al. 2006).

Method

Participants

The sample was composed of 13 participants: six parents of adolescents with a diagnosis of ASD (one man and five women) and seven parents of age-matched typically developing adolescents (seven women). The inclusion criteria for the experimental group were as follows: being a first-degree relative of an individual with a clinical diagnosis of an ASD (all participants were in fact parents of the care recipient), living at home with the care recipient, and being the main caregiver for at least 2 years before the study. The inclusion criteria for the parents of the control group were having healthy offspring with no chronic illnesses and not having been caregivers to any ill relative or exposed to other chronically stressful situations in the previous 2 years.

All participants participated voluntarily in the study and completed an informed consent form in accordance with the ethical standards of human research (Declaration of Helsinki).

Procedure

Caregivers were mainly recruited from members of an association of relatives of people with ASD. Firstly, a meeting was conducted with caregivers to explain the aim of the research and the criteria for participation. In this meeting, participants were informed about the contents and procedure of the MBP. After indicating that they wished to participate in the study, selected participants were interviewed to obtain information about the demographic variables and information about their caregiving status (years of caregiving since the definitive diagnosis of their son/daughter, hours per week caregiving), care recipient characteristics (severity of autistic symptoms and dependency level), and caregiver burden. A similar meeting and interviews were held for candidates for the control group, in which data were collected for the same variables except those referring to care status.

Mindfulness-Based Program

The intervention program was run in a group format with nine sessions: first, eight consecutive fortnightly sessions were applied, and then an interval between the eighth and the last session of 2 weeks. The contents of the program in each session are explained below. During the first session, participants were introduced to the contents and the dynamics of the program, the principles underlying the automatic pilot were explained, and a short meditation was conducted. Homework for that week was practicing mindful activity, mindful eating, and short breath meditation. In the second session, participants practiced body scan mediation and discussed dealing with barriers and the principles of the cognitive model of mindfulness. Homework for that week was practicing body scan meditation, mindful activity, and mindful eating. The third session was employed to underline the importance of recalling pleasant events and of differentiating between thoughts and facts, and to practice breathing meditation. Alternate body scan practice with breath mediation and record agreeable events were exercises recommended for practicing at home. In the fourth session, long sitting meditation was practiced and topics concerning stress, reactivity, and parenting were introduced for discussion. Homework was alternate the practice of sitting meditation and lake meditation and 3 min of breath meditation at fixed times. In the fifth session, nature sound meditation was practiced and discussion was established about acceptance and tolerance. Homework for that week was alternate sounds landscape, the lake meditation and sitting meditation, and 3-min breathing at fixed times and in difficult times. The sixth session was dedicated to explaining walking meditation and discussing the concepts of emotional debt and spaciousness. Homework for that week was the same as that of the past session, including the practice of walking meditation. The seventh session included metta and mountain meditation and discussion of compassion, self-compassion, and self-care. The practice of each type of meditation and metta meditation was the homework for that week. Furthermore, each participant addressed a self-care plan with all of the skills learned during the intervention. In the eighth session, a general review was conducted of the program's contents with short metta and body scan meditations. The last session was based on the practice of metta meditation and meditation without object, as well as closure of the program. As has been indicated, several exercises were prescribed to participants to practice between sessions and the use of these exercises was recapped in each session. All sessions lasted approximately 2 h and were conducted between 4:00 and 7:00 pm to control for diurnal variations in cortisol secretion (Dickmeis, 2009). This MBP was developed and applied by a specialist and experienced therapist in mindfulness approach interventions since 8 years ago approximately. In this regard, a psychotherapist has been trained in the application of the MBSR program and other types of meditation such as Vipasana meditation. As a specialist, she is a recognized mindfulness therapist from different national and international mindfulness-specialized associations. She has taught several mindfulness courses for clinicians and for patients with chronic conditions, bereaved people, or breastfeeding mothers (Pérez-Blasco, Viguer & Rodríguez, 2013).

Evaluation Procedure

During the program, mood states, self-reported health, and salivary cortisol (Csal) were evaluated at the time of three sessions: session 1 (pre-treatment), session 5 (mid-treatment), and session 9 (post-treatment). The methodology of the evaluation of Csal measures consisted in the collection of five saliva samples (two samples before the session, "pre" and "pre2," and single samples immediately after the session, "post," and 15 and 30 min later). For the analysis, the mean of the first two Csal measurements (pre and pre2) was employed. In addition, each participant completed three mood questionnaires (to assess anxiety, anger, and mood; see below) before and after the aforementioned sessions. Finally, self- reported health (depressive symptomatology, somatic symptoms, and self-perceived general health) was also evaluated after each of these sessions. Before each measurement of biological samples, participants were called by telephone and instructed to abstain from eating, drinking stimulants (such as tea, coffee, or alcohol), brushing their teeth, or smoking during the 2-h period before the session. The procedure in the evaluation process during the intervention is summarized in Table 1.

Table 1. Evaluation times during the application of the MBSR program

	Pre-treatment				**Mid-treatment**				**Post-treatment**
Time	**Pre-evaluation**				**Pre-evaluation**				**Pre-evaluation**
15’ before session	*Mood Profiles* -STAI-S -POMS -STAXI-2 Cortisol sample pre-1				*Mood Profiles* -STAI-S -POMS -STAXI-2 Cortisol sample pre-1				*Mood Profiles* -STAI-S -POMS -STAXI-2 Cortisol sample pre-1
5’ before session	Cortisol sample pre-2				Cortisol sample pre-2				Cortisol sample pre-2
2 hours	**SESSION 1**	**SESSION 2**	**SESSION 3**	**SESSION 4**	**SESSION 5**	**SESSION 6**	**SESSION 7**	**SESSION 8**	**SESSION 9**
	Post-evaluation				**Post-evaluation**				**Post-evaluation**
0’ after session	*Mood Profiles* -STAI-S -POMS -STAXI-2 Cortisol sample post-3				*Mood Profiles* -STAI-S -POMS -STAXI-2 Cortisol sample post-3				*Mood Profiles* -STAI-S -POMS -STAXI-2 Cortisol sample post-3
15’ after session	Cortisol sample post-4				Cortisol sample post-4				Cortisol sample post-4
30’ after session	*Health status* -ESS-R -GHQ -BDI Cortisol sample post-5				*Health status* -ESS-R -GHQ -BDI Cortisol sample post-5				*Health status* -ESS-R -GHQ -BDI Cortisol sample post-5

Measures

Mood Profiles

State anxiety was evaluated using the Spanish version of the State-Trait Anxiety Inventory (STAI-S) (Spielberger, Gorusch, Lushene, Vagg & Jacobs, 1983). This inventory is composed of 20 items ranked on a four-point Likert scale from 1 (nothing) to 4 (plenty) examining how participants feel at that moment. The reliability coefficient is 0.62.

Secondly, mood was evaluated using the abbreviated version of the Profile of Mood States (POMS), developed by Fuentes, Balaguer, Meliá and García-Merita, (1995). This version is composed of 29 items grouped in five subscales: tension, depression, anger, vigor, and fatigue. The total score was also calculated by summing scores on all subscales and subtracting the vigor scale. The higher the total score, the worse the mood. Cronbach’s alpha of this instrument is higher than 0.80.

Lastly, a Spanish version of the State-Trait Anger Expression Inventory-2 (STAXI-2) (Miguel-Tobal, Casado, Cano-Vindel & Spielberger, 2001) was used for measuring state anger. It contains 15 items ranked on a four-point Likert scale and distributed into three subscales: feelings, verbal, and physical expression of anger. Cronbach’s alpha ranged from 0.67 to 0.89.

Self-reported Health

Somatic symptoms were assessed with the Spanish revised version of the Somatic Symptoms Scale (ESS-R) created by Sandín and Chorot (1995). This instrument lists referred symptoms over the last 2 years and is composed of 80 items focused on immunological, cardiovascular, respiratory, gastrointestinal, neurosensory, muscular, dermatological, and genital-urinary complaints, as well as female reproductive system complaints in the case of women. The total score of symptoms is also provided. Each scale is composed of ten items ranked on a five-point Likert scale from 0, “never,” to 4, “more than five times in the last 2 years,” with reliability coefficients ranging from 0.79 to 0.84.

Perceived general health was assessed with a shorter 28-item version of the General Health Questionnaire (GHQ-28) designed by Goldberg and Hillier (1979).

Responses are scored on a four-point Likert scale from 0, “better than usual,” to 3, “worse than usual.” The items are grouped into four scales: somatic symptoms, anxiety and insomnia, social dysfunction, and severe depression, and there is also a total score of self-perceived general health, all having Cronbach’s alpha higher than 0.92.

Depressive symptomatology was evaluated by the Beck Depression Inventory (BDI, Beck & Steer 1993). This questionnaire consists of 21 self-report items that refer to emotional, cognitive, and somatic aspects of depression mood. Each item is ranked on a four-point Likert scale and evaluates intensity and severity of symptoms with a reliability coefficient of 0.83.

Cortisol Measures

Salivette tubes and a dental cotton roll (Sarstedt, Rommelsdorf, Germany) were employed to collect saliva samples for both afternoon cortisol and CAR. In both cases, participants were instructed to abstain from eating, drinking, smoking, or brushing their teeth before collecting the samples, as noted above. Moreover, in the case of samples of CAR, participants were instructed how to store saliva samples and record the exact time of saliva collection. CAR was assessed on two consecutive days using four saliva samples. Researchers provided verbal and written instructions about the details concerning the collection of the first saliva sample immediately after awakening and subsequent samples 30, 45, and 60 min later (samples 1, 2, 3, and 4, respectively). To encourage and assess adherence to the sampling protocol, participants were asked to complete a time sheet recording when they woke up and when they collected the saliva samples. The CAR was calculated as an average salivary cortisol level at each of the time points over two consecutive days. In addition, participants were asked to take note of their level of energy, expectations about the day, and other variables such as consumption of stimulants or alcohol the day before, any smoking the day before, and their number of hours of sleep.

All saliva samples were frozen at −20 °C immediately on arrival at the laboratory and were subsequently analyzed by radioimmunoassay (RIA), using a cortisol Coat-A-Count kit (DPC-Siemens Medical Solutions Diagnostics) which has a 1.0 nmol/L sensitivity and morning reference values of between 1.38 and 57.66 nmol/L. All samples were analyzed in duplicate, and the samples of the same subject were included in the same assay. Although the variation co- efficient necessary for replication was set at 8 %, the maximum intra- and inter-assay variation coefficients obtained were 4.3 and 5.2, respectively.

Care Status

Caregivers' feelings of burden were evaluated using the Zarit Burden Inventory (ZBI) created by Zarit, Reever and Bach-Peterson (1980). This instrument is composed of 22 items ranked on a five-point Likert scale from 0 (never) to 4 (nearly always) with a maximum score of 88. The reliability coefficient is 0.92. The items are related to health, social and personal life, and interpersonal relationships in the context of caring for individuals with functional and behavioral problems. Higher scores indicate a higher burden.

The degree of autism of the care recipient was also assessed; for this, we used the Autism Spectrum Quotient (AQ) developed by Baron-Cohen, Hoekstra, Knickmeyer and Wheelwright, (2006). This questionnaire was answered by caregivers and is composed of 50 items ranged on a four-point Likert scale with a reliability coefficient higher than 0.76. A higher score indicates a higher degree of autism with a maximum of 50.

Data Analysis

For the analysis of the frequencies of the socio-demographic variables, chi-squared statistics were used. Mann-Whitney U tests were performed to explore differences between caregivers and non-caregivers in demographic and anthropometric variables (age and body mass index) and factors potentially related to cortisol levels (medication, alcohol, tobacco, and psychoactive substance consumption before saliva collection). Due to the small sample size, non-parametric Friedman tests were conducted in order to analyze differences in afternoon Csal levels from pre-session to 0, 15, and 30 min post-session. This type of analysis was also employed to analyze differences in self-reported health measures between pre-, mid-, and post-treatment. Post hoc analyses were con- ducted with the Wilcoxon signed-rank test, with Bonferroni adjustments for multiple comparisons. The Wilcoxon signed-rank test was also employed to analyze differences between pre- and post-session scores on the mood questionnaires. For self-reported health and mood profiles, change scores were calculated: in the case of self-reported health, change scores were calculated as the scores post-treatment minus those pre- treatment, while change scores for mood profiles were calculated as the scores post-session minus those pre-session. The magnitude of the afternoon Csal response was estimated by the area under the curve with respect to the increase (AUCi), which was calculated using the trapezoid formula as previously described (Pruessner, Kirschbaum, Meinlschmid & Hellhammer, 2003). The Mann-Whitney U test was also employed to analyze differences between groups in the AUCi of Csal and change scores. Data analyses were carried out using SPSS 21.0 software (IBM SPSS), and p values ≤0.05 were considered significant. Values in the tables are expressed as mean ± SD.

Results

No differences were found between groups in socio- demographic variables. Descriptive data for all participants and for each group are summarized in Table 2.

With regard to the CAR, Csal responses from awakening to 30 min later for all participants were 3.80 nmol/L in the pre- treatment, 5.07 nmol/L in the mid-treatment, and 3.32 nmol/L in the post-treatment measurements. All of the responses were within the range proposed as normal (2.5 nmol/L), and no differences were found between pre, mid-, and post-treatment.

Table 2. Mean and standard deviation (SD) and frequency and percentage in demographic characteristics, in caregivers, non-caregivers, and total sample.

Variable/characteristics		**Caregivers (N=6)**	**Non-caregivers (N=7)**	**Total sample (N=13)**
Gender	**Male**	1 (16.7%)	0 (0%)	1 (7.7%)
	Female	5 (83.3%)	7 (100%)	12 (92.3%)
Age		44.33 ± 5.24	48 ± 2.70	46.30 ± 4.32
Body mass index (BMI)		25.48 ± 6.65	24.24 ± 5.21	24.81 ± 5.69
Phases of the menstrual cycle	**Luteal**	4 (80%)	2 (28.6%)	6 (46.2%)
	Follicular	0 (0%)	2 (28.6%)	2 (15.4%)
	Amenorrhea	1 (20%)	3 (42.9%)	4 (30.8%)
Marital status	**Married**	6 (100%)	4 (66.7%)	10 (83.3%)
	Widowed	0 (0%)	2 (33.3%)	2 (16.7%)
Educational level	**Basic**	1 (16.7%)	0 (0%)	1 (8.3%)
	Advanced	1 (16.7%)	0 (0%)	1 (8.3%)
	University	4 (66.7%)	6 (100%)	10 (83.3%)
Source of income	**Pension**	1 (16.7%)	0 (0%)	1 (8.3%)
	Job	3 (50%)	6 (100%)	9 (75%)
	Others	2 (33.3%)	0 (0%)	2 (16.7%)

Use of cigarettes	**Yes**	2 (33.3%)	0 (0%)	2 (16.7%)
	No	4 (66.7%)	6 (100%)	10 (83.3%)
Care status				
Years of evolution of care		10 ± 6.98		
Time weekly caring (h)		30.44 ± 34.92		
Care burden index		49.33 ± 21.15		
Characteristics of patient				
Diagnosis of patient	**Autism**	4 (66.7%)		
	Asperger	2 (33.3%)		
Gender	**Male**	4 (66.7%)		
	Female	2 (33.3%)		
Age		15 ± 6.48		
Autism quotient (AQ)		29.83 ± 5.26		

Does Each Evaluated MBP Session Affect Mood Disturbances and Csal? Are the Effects More Pronounced in Caregivers?

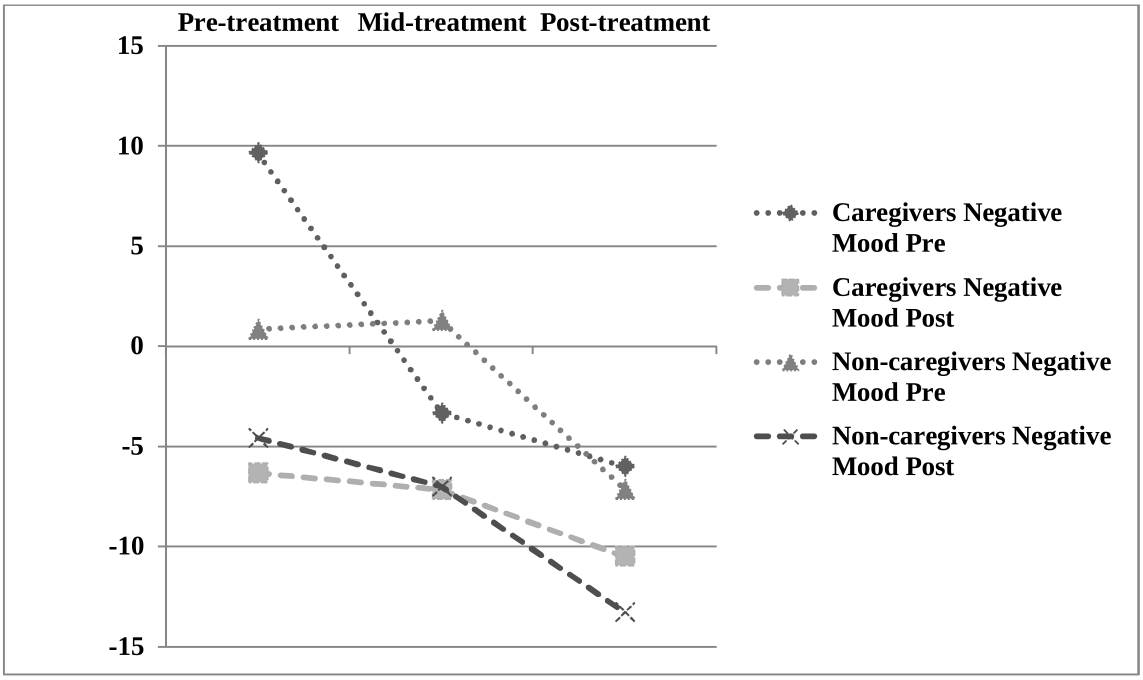
In order to analyze the effectiveness of the evaluated sessions of the program (pre-, mid, and post-treatment) in reducing mood disturbances and Csal levels, analyses were conducted with the whole sample and for each group separately.

Analyzing the whole sample, significant changes were found in afternoon Csal from pre- to post-session at all time points evaluated [χ2 (3)=27.324, p=0.0001; χ2 (3)=30.879, p=0.0001; and χ2 (3)=21.000, p=0.0001, pre-, mid-, and post-treatment, respectively]. Post hoc analysis was conducted using the Wilcoxon signed-rank tests with Bonferroni adjustments applied, considering results significant at p<0.008. There were significant differences between Csal levels pre- session and 0 min post-session (Z=−2.903, p=0.004; Z=−3.110, p=0.002; and Z=−3.041, p=0.002, pre-, mid-, and post-treatment, respectively), 15 min post-session (Z=−3.059, p=0.002; Z=−3.180, p=0.001; and Z=−3.110, p=0.002, pre-, mid-, and post-treatment), and 30 min post- session (Z=−3.061, p=0.002; Z=−3.180, p=0.001; and Z=−2.970, p=0.003, pre-, mid-, and post-treatment, respectively). In all cases, Csal levels were higher pre-session than 0, 15, and 30 min post-session. Regarding mood profiles, significant changes from pre- to post-session were found in the pre-treatment session for anxiety (Z=−2.944, p=0.003), feelings of anger (Z=−2.070, p=0.038), depression (Z=−2.032, p=0.42), cholera (Z=−2.060, p=0.039), fatigue (Z=−3.101), tension (Z=−2.321, p=0.020), and total mood

(Z=−2.516, p=0.012). Mid-treatment, changes from pre- to post-session were found for anxiety (Z=−2.121, p=0.034), feelings of anger (Z=−2.121, p=0.034), fatigue (Z=−2.657, p=0.008), tension (Z=−2.532, p=0.011), and total mood (Z=−2.345, p=0.019). Finally, post-treatment, changes were found in cholera (Z = −2.060, p = 0.039), fatigue (Z = −1.992, p=0.046), and total mood (Z=−2.555, p=0.011). For all of the evaluated variables, post-session scores were lower than pre-session scores.

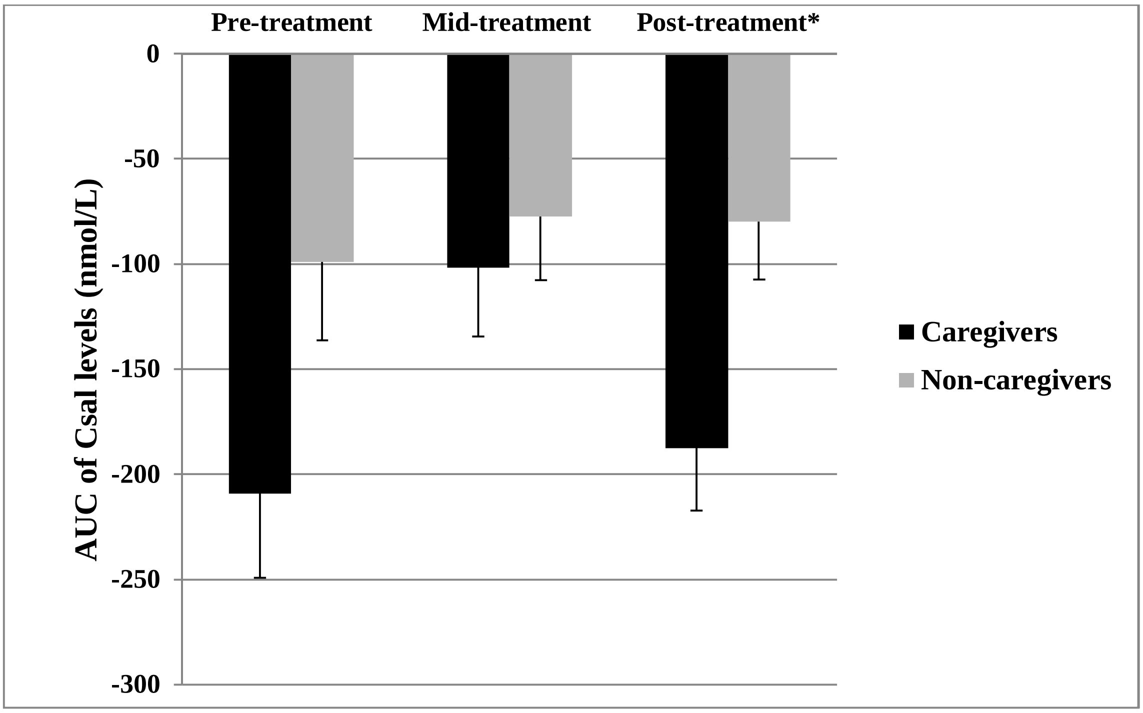
As noted above, the same analyses were conducted in each group separately. For caregivers, differences in afternoon Csal were found for all evaluated sessions [χ2 (3)=15.235, p=0.002; χ2 (3)=14.667, p=0.002; and χ2 (3)=13.881, p=0.003, pre-, mid-, and post-treatment, respectively]. However, no significant effects were found in the post hoc analyses. In the case of mood profiles, pre-treatment, there were reductions in anxiety (Z=−2.201, p=0.028), fatigue (Z=−2.226, p=0.026), tension (Z=−2.023, p=0.043), and total negative mood (Z=−2.023, p=0.043), while reductions were found mid-treatment in anxiety (Z=−2.060, p=0.039), tension (Z=−2.214, p=0.027), and total negative mood (Z=−1.997, p=0.043) and post-treatment session only in anxiety (Z=−2.201, p=0.028). For non-caregivers, differences in afternoon Csal were also found for all sessions evaluated [χ2 (3)=12.176, p=0.007; χ2 (3)=16.355, p=0.001; and χ2 (3)=8.732, p=0.033, pre-, mid-, and post-treatment, respectively], but again, differences did not reach significance in the post hoc analyses. For mood profiles, anxiety (Z=−1.992, p=0.046) and fatigue (Z=−2.226, p=0.026) showed a significant reduction in the pre-treatment session and only anxiety also showed a significant reduction post-treatment (Z=−2.201, p=0.028), while no significant changes were found in any mood state mid-treatment (Figure 1).

Figure 1. Negative mood (POMS Total Score) pre and post session in pre, mid and post-treatment for caregivers and non-caregivers.



With the aim of comparing the magnitude of the reductions in negative mood and afternoon Csal between caregivers and non-caregivers, change scores for mood profiles and AUCs of the afternoon Csal levels were compared between groups. No differences were found in any of the mood profile change scores. On the other hand, differences were found in AUCs of the afternoon Csal levels post-treatment (U=5, p=0.022), with caregivers presenting a greater reduction in Csal than non-caregivers (Fig. 2).

Figure 2. AUC of afternoon Csal levels in pre, mid and post-treatment for caregivers and non-caregivers. (*p<.05).



Does the Whole MBP Program Affect Health? Are the Effects More Pronounced in Caregivers?

As in the previous case, differences in self-reported health between evaluated sessions have been analyzed in the whole sample and for each group separately. In the total sample, significant changes were found in depressive symptomatology [$\chi 2$ (2)=15.854, p=0.0001]. Again, post hoc analysis was conducted using the Wilcoxon signed-rank tests with Bonferroni adjustments applied, in this case p<0.016 being considered significant. There were significant differences between pre- and mid-treatment (Z=−2.538, p=0.011) and between pre- and post-treatment (Z=−2.937, p=0.003), with higher rates of depressive symptomatology pre-treatment than either mid- or post-treatment.

Regarding somatic symptoms, differences were found in immunological [$\chi 2$ (2)=6.682, p=0.035], cardiovascular [$\chi 2$ (2)=8.667, p=0.035], gastrointestinal [$\chi 2$ (2)=12.400, p=0.002], neurosensory [$\chi 2$ (2)=6.711, p=0.035], muscular [$\chi 2$ (2)=16.044, p=0.0001], dermatological [$\chi 2$ (2)=15.116, p=0.001], female reproductive system [$\chi 2$ (2)=13.613, p=0.001], and total [$\chi 2$ (2)=14.596, p=0.001] symptoms. Post hoc analysis showed differences between pre- and mid- treatment for gastrointestinal (Z=−2.398, p=0.016), muscular (Z=−2.762, p=0.006), neurosensory (Z=−2.555, p=0.11), dermatological (Z=−2.946, p=0.003), and total (Z=−2.491, p=0.013) symptoms. Differences between pre- and post- treatment were found in muscular (Z=−3.065, p=0.002), gastrointestinal (Z=−2.807, p=0.005), dermatological (Z = −2.823, p = 0.005), female reproductive system (Z=−2.536, p=0.011), and total (Z=−2.981, p=0.003) symptoms. Only in the case of cardiovascular (Z=−2.588, p=0.010) and total (Z=−2.551, p=0.011) symptoms were differences also found between mid- and post-treatment. For all of the symptoms evaluated, participants reported higher levels of symptoms pre-treatment than either mid- or post- treatment. In the case of cardiovascular and total symptoms, participants also reported higher levels of symptoms mid-treatment than post-treatment.

For self-perceived general health, significant differences were observed in somatic symptoms [χ2 (2)=14.609, p=0.001], anxiety and insomnia [χ2 (2)=18.426, p=0.000], social dysfunction [χ2 (2)=15.048, p=0.001], and severe depression [χ2 (2)=6.333, p=0.042]. Post hoc analyses identified differences between pre- and mid-treatment in somatic symptoms (Z=−2.556, p=0.011), anxiety and insomnia (Z=−3.186, p=0.001), social dysfunction (Z=−2.824, p=0.005), and self-perceived general health (Z=−2.812, p=0.005). Differences were also found between pre- and post-treatment in somatic symptoms (Z=−3.076, p=0.002), anxiety and insomnia (Z=−3.045, p=0.002), social dysfunction (Z=−2.814, p=0.005), and self-perceived general health (Z=−3.045, p=0.002).

Conducting the same analyses in caregivers alone, differences were found in depressive symptomatology [χ2 (2)=10.182, p=0.006], as well as in immunological [χ2 (2)=6.091, p=0.048], cardiovascular [χ2 (2)=5.818, p=0.050], gastrointestinal [χ2 (2)=6.636, p=0.036], neurosensory [χ2 (2)=7.636, p=0.022], muscular [χ2 (2)=7.000, p=0.030], dermatological [χ2 (2)=9.238, p=0.010], and female reproductive system [χ2 (2)=8.000, p=0.018] symptoms. In the case of self-perceived general health, significant differences were found in somatic symptoms [χ2 (2)=7.000, p=0.030], anxiety and insomnia [χ2 (2)=6.522, p=0.038], and social dysfunction [χ2 (2)=9.333, p=0.009]. For non-caregivers, differences were found in depressive symptomatology [χ2 (2)=6.000, p=0.05], as well as gastrointestinal[χ2 (2)=7.630, p=0.022], muscular [χ2 (2)=10.320, p=0.006], dermatological [χ2 (2)=7.923, p=0.019], female reproductive system [χ2 (2)=7.111, p=0.029], and total [χ2 (2)=11.308, p=0.004] symptoms. Factors of self-perceived general health, namely somatic symptoms [χ2 (2)=9.818, p=0.007], anxiety and insomnia [χ2 (2)=12.333, p=0.002], social dysfunction [χ2 (2)=6.333, p=0.042], and self-perceived general health [χ2 (2)=11.083, p=0.004] also showed significant differences. However, no significant differences were found in post hoc analyses in either of the two groups (Table 3).

As with mood states, change scores for self-reported health measures were compared between caregivers and non- caregivers. Change scores for respiratory (U=5, p=0.041), neurosensory (U=3, p=0.015), and total (U=7, p=0.05) symptoms were different between groups, being higher in caregivers than non-caregivers.

Table 3. Scores (mean and standard deviation) in self-reported health (depressive symptomatology, somatic symptoms, and perceived general health) in pre, mid, and post-treatment for caregivers and non-caregivers separately

	Pre-treatment		**Mid-treatment**		**Post-treatment**	
	Caregivers	**Non-caregivers**	**Caregivers**	**Non-caregivers**	**Caregivers**	**Non-caregivers**
Depressive symptomatology	10.33 ± 5.35	7.85 ± 9.37	3.83 ± 2.85	2.42 ± 3.40	3.33 ± 3.32	0.71 ± 0.75
Somatic Symptoms						
Immunological	11.50 ± 5.31	6.50 ± 4.72	5.33 ± 3.07	5 ± 4.09	2.83 ± 1.94	4.16 ± 4.62
Respiratory	13.16 ± 4.99	6.16 ± 3.43	6 ± 4.14	5.66 ± 4.45	4.50 ± 4.96	5.66 ± 7.55
Cardiovascular	8 ± 4.93	3.16 ± 2.99	4.16 ± 5.49	3.50 ± 3.39	2 ± 3.52	1.83 ± 2.85
Gastrointestinal	15.83 ± 7.49	10.16 ± 10.96	9 ± 4	5 ± 4.69	6.33 ± 5.88	5 ± 6.78
Neurosensory	16.16 ± 5.77	5.33 ± 3.07	7.16 ± 6.73	3.50 ± 3.39	6.66 ± 6.12	4.83 ± 5.03
Genital-urinary	13 ± 5.44	4.83 ± 5.11	5.33 ± 6.31	6.50 ± 7.39	3.83 ± 5.56	3.83 ± 4.30
Muscular	20.33 ± 4.27	13.33 ± 7.99	9.33 ± 8.18	10 ± 8.29	8 ± 7.15	6.66 ± 4.08
Dermatological	11.83 ± 4.95	6.33 ± 7.73	4.50 ± 4.63	3.50 ± 6.65	4.83 ± 5.45	5.16 ± 7.54
Female reproductive	13.33 ± 10.50	14.50 ± 8.06	6.33 ± 6.77	10 ± 7.77	4 ± 6.03	6.33 ± 6.34
Total symptoms	123.16 ± 28.75	70.33 ± 34.93	57.16 ± 35.14	52.66 ± 31.42	43 ± 31.65	43.50 ± 37.90
Perceived general health						
Somatic symptoms	6.33 ± 3.72	6.28 ± 5.15	3.66 ± 2.94	2.85 ± 2.19	1.66 ± 2.06	2.57 ± 1.71
Anxiety and insomnia	6.50 ± 4.03	8.42 ± 5.41	1.50 ± 0.83	1.85 ± 2.03	1.16 ± 1.16	1.85 ± 2.19
Social dysfunction	5.33 ± 3.38	6.42 ± 2.99	3 ± 2	4.28 ± 2.56	1.83 ± 1.72	3.71 ± 1.97
Severe depression	1.16 ± 1.60	2.57 ± 4.31	0.16 ± 0.40	0.14 ± 0.37	0.16 ± 0.40	0.28 ± 0.48
Total perceived health	10.66 ± 4.45	11 ± 7.32	5.16 ± 2.56	5.28 ± 3.77	3.33 ± 3.14	5.14 ± 3.97

Discussion

Our results suggest the value of the MBP as an effective intervention for reducing health complaints and mood disturbances, in both caregivers and non-caregivers. Specifically, there were lower levels of depressive and somatic symptoms after the program, showing a progressive reduction during the intervention. With this progressive reduction, participants' self-perceived general health improved. The whole program had a positive effect on health in all participants, and each session evaluated independently reduced anxiety, negative mood, and Csal as well—although this effect was more pronounced in caregivers. Specifically, the fall in Csal levels during the post-treatment session was more marked in caregivers than in non-caregivers. In this regard, caregivers could be more sensitive to the effects of the exercises and meditation practiced during the sessions. This would then explain the greater reduction in afternoon Csal levels in this group. Previous research has demonstrated that caregivers of people with ASDs have high daily levels of negative emotions (Smith et al. 2010), and these are mainly explained by challenges associated with the care situation (Ludlow, Skelly & Rohleder, 2012; De Andrés-García et al. 2013). In this context, meditation and the types of exercises carried out during the sessions seem to significantly reduce Csal levels and mood disturbances. As noted by other authors, cortisol is a reliable and sensitive indicator of the influence of meditation on the functioning of the hypothalamic-pituitary-adrenal axis (Matousek, Dobkin & Pruessner, 2010). For this reason, our results seem to reinforce the idea that caregivers are more sensitive to the MBP sessions than the general non-chronically stressed population. Summative explanations could be related to the greater motivation and implication of caregivers in the MBP program, which probably affects the marked reduction in afternoon Csal levels observed in caregivers.

With regard to self-reported health, depressive and somatic symptoms diminished markedly over the program, especially in caregivers, who showed greater reductions in respiratory, neurosensory, and total somatic symptoms. Together with these specific reports, participants had better self-perceived general health after finishing the program. In accordance with these results, recent studies have demonstrated that mindfulness interventions are effective for reducing depressive symptomatology and health complaints in clinical and healthy populations (Keng et al. 2011; Klainin-Yobas, Cho & Creedy, 2012). The underlying mechanism for explaining these effects is unclear; nevertheless, several explanations have been suggested (Hölzel et al. 2011). Specifically, training mindfulness by an intervention program could increase the mindfulness trait in individuals through the effects of continuous meditation and exercise (Kabat-Zinn 2005; Keng et al. 2011). In relation to this, some authors have proposed that an increase in trait mindfulness is beneficial for chronic conditions, such as depression or chronic diseases (Ghasemipour, Robinson & Ghorbani, 2013; Keng et al. 2011). Although there is no consensus in the literature about the definition of trait mindfulness, Brown and Ryan (2003) defined this trait as "the general tendency of individuals to be attentive to and aware of experiences in daily life." Previous correlational studies have found this trait to be related positively to vitality and positive affect (Brown & Ryan, 2003) and negatively to depression, negative affect, and difficulties in emotional regulation (Baer, Smith, Hopkins, Krietemeyer & Toney, 2006; Cash & Whittingham 2010; Giluk, 2009). Furthermore, experimental studies have found that trait mindfulness operates as a mediator between the effectiveness of mindfulness intervention and positive outcomes (Keng et al. 2011). One of the most important factors in caregivers could be living in the present moment with non-judgmental acceptance, which is closely related to low levels of rumination and worry as it blocks the mental processes of anticipation. Some authors have suggested that this mechanism may operate in caregivers of people with dementia, taking into ac- count that they could be involved in rumination processes related to past events before the disease and events in the future related to the course of the dementia. This last issue could be especially relevant in caregivers of people with ASDs, since one of the greatest worries of this population is the future of their affected offspring (Phelps, Hodgson, McCammon & Lamson, 2009).

Training in acceptance, another component of MBP, teaches caregivers to accept the situation and the chronic character of their offspring's developmental disability. Acceptance allows the situation to be perceived anew, as well as enables positive reappraisal and non-reactivity to inner experiences (Shapiro et al. 2006). Helping individuals to discuss and find different ways of coping with the daily challenges associated with the care situation could promote alternative views of this situation and ways of dealing with it. In a care context, this would be an essential mechanism for reducing stress and improving well-being through reappraisal processes. This could be proposed as another mechanism to explain the efficacy of this type of intervention as it enables caregivers to regulate negative emotions and develop adaptive coping processes.

This preliminary study entails an advance in the comprehension of the effects of MBP interventions on general health, as it includes biological markers together with self-perceived measures. Nevertheless, some limitations must be addressed. The main limitations are the sample size and the lack of a waiting list control design, fundamentally in the case of caregivers, which limit our ability to draw conclusions about causality. Alternative explanations of the greater reduction in Csal levels and somatic symptoms in caregivers could involve a manifestation of the regression to the mean effect (Barnett, van de Pols, & Dobson, 2005). This effect is especially relevant in repeated measures analysis in samples with baseline scores extremely different from the population mean. In this case, caregivers are at risk of presenting higher initial levels of symptoms and Csal, due to their stress condition, compared to non- caregivers. In this sense, this effect would explain participants with high levels of symptoms at baseline generally improving more than those with low symptoms. Hence, the greater reductions observed in the caregivers could be explained by this phenomenon, resulting in a statistical tendency of the initial scores in caregivers to approach the mean. Future studies with larger numbers of caregivers and controls would allow other types of statistical analysis to be conducted, avoiding these confounding effects.

Moreover, no measures of trait mindfulness have been evaluated. It would also be interesting to analyze the effects of the program on this trait in future research. The fact that only the experimental group included a man, the controls all being women, could also influence the results obtained, and the possible differences between genders in the effectiveness of MBP have not been controlled for in the analysis. Another limitation is the lack of burden measures after the MBP program, even though previous research has found a mindfulness intervention to have little effect on burden (Whitebird et al. 2012).

On the other hand, the wide range of variables evaluated (including biological markers of health) and the high rate of attendance and adequate response of the participants during the program provide this study with a high level of validity to assess the effectiveness of the MBP intervention. These latter factors are notable as caregivers typically lack time and have difficulties in following an established timetable for participating in any intervention. Overall, we consider that these factors make the data that we have obtained particularly valuable.

References

Baer, R.A., Smith, G.T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment, 13* (1), 27–45.

Barnett, A.G., van de Pols, J.C., & Dobson, A.J. (2005). Regression to the mean: what it is and how to deal with it. *International Journal of Epidemiology, 34* (1), 215–220.

Baron-Cohen, S., Hoekstra, R.A., Knickmeyer, R., & Wheelwright, S. (2006). The autism spectrum quotient (AQ)-adolescent version. *Journal of Autism and Developmental Disorders, 36* (3), 343–350.

Beck, A.T., & Steer, R.A. (1993). Beck depression inventory manual. San Antonio: The Psychological Corporation.

Birnie, K., Garland, S.N., & Carlson, L.E. (2010). Psychological benefits for cancer patients and their partners participating in mindfulness-based stress reduction (MBSR). *Psychooncology, 19* (9), 1004–1009.

Bränström, R., Kvillemo, P., & Akerstedt, T. (2013). Effects of mindfulness training on levels of cortisol in cancer patients. *Psychosomatics, 54* (2), 158–164. 717

Brown, K.W., & Ryan, R.M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84* (4), 822–848. 720

Carlson, L.E., Speca, M., Faris, P., & Patel, K.D. (2007). One year pre-post intervention follow-up of psychological, immune, endocrine and blood pressure outcomes of mindfulness-based stress reduction (MBSR) in breast and prostate cancer outpatients. *Brain, Behavior, and Immunity, 21* (8), 1038–1049.

Cash, M., & Whittingham, K. (2010). What facets of mindfulness con- tribute to psychological well-being and depressive, anxious, and stress-related symptomatology? *Mindfulness, 1* (1), 177–182.

De Andrés-García, S., Moya-Albiol, L., & González-Bono, E. (2012). Salivary cortisol and immunoglobulin A: responses to stress as predictors of health complaints reported by caregivers of offspring with autistic spectrum disorder. *Hormones and Behavior, 62* (4), 464–474.

De Andrés-García, S., Sariñana-González, P., Romero-Martínez, A., Moya-Albiol, L., & González-Bono, E. (2013). Cortisol responses to stress in caregivers of offspring with autism spectrum disorder are associated with care recipient characteristics. *Stress, 16* (5), 510–519.

Dickmeis, T. (2009). Glucocorticoids and the circadian clock. *Journal of Endocrinology, 200* (1), 3–22.

Ferraioli, S.J., & Harris, S.L. (2012). Comparative effects of mindfulness and skills based parent training programs for parents of children with autism: feasibility and preliminary outcome data. *Mindfulness, 4* (2), 89–101.

Franco, C., Sola, M.M., & Justo, E. (2010). Reducción del malestar psicológico y de la sobrecarga en familiares cuidadores de enfermos de Alzheimer mediante la aplicación de un programa de entrenamiento en Mindfulness (conciencia plena). *Revista Española de Geriatría y Gerontología, 45* (5), 252–258.

Fuentes, I., Balaguer, I., Meliá, J., & García-Merita, M. (1995). Forma abreviada del Perfil de Estados de Ánimo (POMS). In E. Cantón (Ed.), Libro de Actas del V Congreso Nacional de Psicologia de la Actividad Física y el Deporte. Valencia: Universitat de Valéncia.

Ghasemipour, Y., Robinson, J.A., & Ghorbani, N. (2013). Mindfulness and integrative self-knowledge: relationships with health-related variables. *International Journal of Psychology, 48* (6), 1030-1037.

Giluk, T.L. (2009). Mindfulness, big five personality, and affect: a meta-analysis. *Personality and Individual Differences, 47* (8), 805–811.

Goldberg, D.P., & Hillier, V. (1979). A scaled version of the general health questionnaire. *Psychological Medicine, 9* (1), 139–145.

Goodman, M.J., & Schorling, J.B. (2012). A mindfulness course decreases burnout and improves well-being among healthcare providers. *International Journal of Psychiatry in Medicine, 43* (2), 119–128.

Hölzel, B.K., Lazar, S.W., Gard, T., Schuman-Olivier, Z., Vago, D. R., & Ott, U. (2011). How does mindfulness meditation work? Proposing mechanisms of action from a conceptual and neural perspective. *Perspectives on Psychological Science, 6* (6), 537–559.

Kabat-Zinn, J. (2005). Coming to our senses. London: Piatkus Books Ltd.

Keng, S.L., Smoski, M.J., & Robins, C.J. (2011). Effects of mindfulness on psychological health: a review of empirical studies. *Clinical Psychology Review, 31* (6), 1041–1056.

Kirkham, M.A. (1993). Two-year follow-up of skills training with mothers of children with disabilities. *American Journal of Mental Retardation, 97* (5), 509–520.

Klainin-Yobas, P., Cho, M.A., & Creedy, D. (2012). Efficacy of mindfulness-based interventions on depressive symptoms among people with mental disorders: a meta-analysis. *International Journal of Nursing Studies, 49* (1), 109–121.

Lengacher, C. A., Kip, K. E., Barta, M. K., Post-White, J., Jacobsen, P., Groer, M., ... & Shelton, M.M. (2012). A pilot study evaluating the effect of mindfulness-based stress reduction on psychological status, physical status, salivary cortisol, and interleukin-6 among advanced-stage cancer patients and their caregivers. *Journal of Holistic Nursing, 30* (7), 170–185.

Ludlow, A., Skelly, C., & Rohleder, P. (2012). Challenges faced by parents of children diagnosed with autism spectrum disorder. *Journal of Health Psychology, 17* (5), 702–711.

Lykins, E.L., & Baer, R.A. (2009). Psychological functioning in a sample of long-term practitioners of mindfulness meditation. *Journal of Cognitive Psychotherapy, 23* (3), 226–241.

Matousek, R., Dobkin, P. L., & Pruessner, J. (2010). Cortisol as a marker for improvement in mindfulness-based stress reduction. *Complementary Therapies in Clinical Practice, 16* (1), 13–19.

Merkes, M. (2010). Mindfulness-based stress reduction for people with chronic diseases. *Australian Journal of Primary Health, 16* (3), 200– 210.

Miguel-Tobal, J.J., Casado, M.I., Cano-Vindel, A., & Spielberger, C.D. (2001). Inventario de Expresion de Ira Estado-Rasgo: STAXI-2.Madrid: TEA Ediciones.

Minor, H.G., Carlson, L.E., Mackenzie, M.J., Zernicke, K., & Jones, L. (2006). Evaluation of a mindfulness-based stress reduction (MBSR) program for caregivers of children with chronic conditions. *Social Work in Health Care, 43* (1), 91–109.

Nixon, C.D., & Singer, G.H. (1993). Group cognitive behavioral treatment for excessive parental self-blame and guilt. *American Journal of Mental Retardation, 97* (6), 665–672.

Oken, B.S., Fonareva, I., Haas, M., Wahbeh, H., Lane, J. B., Zajdel, D., & Amen, A. (2010). Pilot controlled trial of mindfulness meditation and education for dementia caregivers. *Journal of Alternative and Complementary Medicine, 16* (10), 1031–1038.

Pérez-Blasco, J., Viguer, P., & Rodriguez, M. F. (2013). Effects of a mindfulness-based intervention on psychological distress, well-being and maternal self-efficacy in breastfeeding mothers: results of a pilot study. *Archives of Women's Mental Health, 16* (3), 227–236.

Phelps, K.W., Hodgson, J.L., McCammon, S.L., & Lamson, A.L. (2009). Caring for an individual with autism disorder: a qualitative analysis. *Journal of Intellectual and Developmental Disability, 34* (1), 27–35.

Pruessner, J.C., Kirschbaum, C., Meinlschmid, G., & Hellhammer, D.H. (2003). Two formulas for the computation of the area under the curve represent measures of total hormone concentration versus time-dependent change. *Psychoneuroendocrinology, 28* (7), 916– 931.

Ruiz-Robledillo, N., & Moya-Albiol, L. (2013). Self-reported health and cortisol awakening response in parents of people with Asperger syndrome: the role of trait anger and anxiety, coping and burden. *Psychology and Health, 28* (11), 1246–1264.

Ruiz-Robledillo, N., González-Bono, E., & Moya-Albiol, L. (2014). Lack of institutional support entails disruptions in cortisol awakening response in caregivers of people with high-functioning autism. *Journal of Health Psychology, 19* (12), 1586-1596.

Sandín, B., & Chorot, P. (1995). Escala de Síntomas Somáticos-Revisada (ESS-R). Madrid: Universidad Nacional de Educación a Distancia (UNED).

Seisdedos, N. (1982). STAI: Inventario de Ansiedad Estado-Rasgo [State-Trait Anxiety Inventory]. Madrid: TEA Ediciones.

Shapiro, S.L., Carlson, L.E., & Astin, J.A. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology, 62* (3), 373–386.

Singer, G., Ethridge, B., & Aldana, S. (2007). Primary and secondary effects of parenting and stress management interventions for parents of children with developmental disabilities: a meta-analysis. *Mental Retardation and Developmental Disabilities Research Reviews, 13* (4), 357–369.

Singh, N.N., Lancioni, E., Winton, A.S.W., Fisher, B.C., Wahler, R.G., McAleavey, K., ... & Sabaawi, M. (2006). Mindful parenting decreases aggression, noncompliance, and self-injury in children with autism. *Journal of Emotional and Behavioral Disorders, 14* (3), 169–177.

Singh, N.N., Lancioni, E., Winton, A.S.W., Singh, J., Curtis, W.J., Wahler, R.G., & McAleavey, K.M. (2007). Mindful parenting decreases aggression and increases social behavior in children with developmental disabilities. *Behavior Modification, 31* (6), 749–771.

Smith, L.E., Hong, J., Seltzer, M.M., Greenberg, J.S., Almeida, D.M., & Bishop, S.L. (2010). Daily experiences among mothers of adolescents and adults with autism spectrum disorder. *Journal of Autism and Developmental Disabilities, 40* (2), 167–178.

Spielberger, C.D., Gorusch, R.L., Lushene, R., Vagg, P.R., & Jacobs, G.A. (1983). Manual for the State-Trait Anxiety Inventory. Consulting Psychologists Press.

Whitebird, R., Kreitzer, M., Crain, A.L., Lewis, B.A., Hanson, L.H., & Enstad, C.J. (2012). Mindfulness-based stress reduction for family caregivers: a randomized controlled trial. *The Gerontologist, 53* (4), 676–686.

Zarit, S.H., Reever, K.E., & Bach-Peterson, J. (1980). Relatives of the impaired elderly: correlates of feelings of burden. *Gerontologist, 20,* 649–654.

Chapter 8

Study 7: Effects of a cognitive-behavioral intervention program on the health of caregivers of people with autism spectrum disorder.

Accepted for publication in: Ruiz-Robledillo, N[1]., & Moya-Albiol, L[1]. (in press). Effects of a cognitive-behavioral intervention program on the health of caregivers of people with autism spectrum disorder. *Psychosocial Intervention.*

[1] Department of Psychobiology, University of Valencia

Introduction

The prevalence of autism spectrum disorder (ASD), characterized by difficulties in socialization, communication and repetitive and restricted interests and behavior (American Psychiatric Association, 2013), has increased dramatically in recent years (Elsabbagh et al., 2012). Given the nature of the disorder and its chronic nature, individuals with ASD need long-term caregivers. Due to the early symptoms manifestation in ASD, caregivers are usually close family members, more specifically, their parents (Karst & Van Hecke, 2012; Lovell, Moss & Wetherell, 2012a; Ruiz-Robledillo, Antón-Torres, González-Bono & Moya-Albiol, 2012; Ruiz-Robledillo & Moya-Albiol, 2012; Seguí, Ortiz-Tallo & De Diego, 2008). This is an important social issue, as family caregivers often face a range of psychosocial problems including legal hurdles, and financial and work-related complications, as well as challenges associated with the care process itself (Lavelle et al., 2014; Ruiz-Robledillo & Moya-Albiol, 2012; Ruiz-Robledillo et al., 2012; Seguí et al., 2008). All of these problems may arise in the case of informal caregivers of people with ASD. While coping with these problems, caregivers are under high levels of chronic stress, with negative consequences not only for their quality of life but also for their health. In line with this, they have been found to have more somatic symptoms, higher levels of anxiety and depression, and poorer perceived general health than the general population (De Andrés-García et al., 2012; Johnson, Frenn, Feetham & Simpson, 2011; Khanna et al., 2011; Lovell et al., 2012a; Ruiz-Robledillo & Moya-Albiol, 2013; Ruiz-Robledillo & Moya-Albiol, 2014a; Ruiz-Robledillo, González-Bono & Moya-Albiol, 2014). On the other hand, several psychosocial and psychological factors have been demonstrated to ameliorate these negative health consequences (Ruiz-Robledillo & Moya-Albiol, 2014a). Indeed, caregivers with high levels of social support, adaptive coping skills, a high emotional regulation capacity and resilience have fewer health complaints (Bekhet, Johnson, & Zauszniewski, 2012; Boyd, 2002; Lai & Oei, 2014; Lovell, Moss & Wetherell, 2012b; Ruiz-Robledillo, De Andrés-García, Pérez-Blasco, González-Bono & Moya-Albiol, 2014; Ruiz-Robledillo & Moya-Albiol, 2014b; Ruiz-Robledillo & Moya-Albiol, 2013).

Although the negative consequences of caring for people with a diagnosis of ASD have been widely analyzed, few studies have evaluated the effectiveness of psychotherapeutic interventions for reducing health complaints and stress levels in this population. The high effectiveness of several intervention approaches in reducing health complaints and stress perception in different samples of informal caregivers has been shown (López & Crespo, 2007; Sorrell, 2014; Van Mierlo, Meiland, Van der Roest & Dröes, 2012). Indeed, problem-solving therapy, psychoeducation, counseling, peer support interventions, and respite programs have been effective reducing stress perception and its negative effects, as well as significantly improving quality of life and well-being (Cheon, Chang, Kong & Song, 2011; Martín-Carrasco et al., 2009; Rivera, Elliott, Berry & Grant, 2008; Shilling et al., 2013; Sorensen, Waldorff & Waldemar, 2008). However, the majority of studies analyzed samples of caregivers taking care of dementia or cancer patients, or stroke survivors, whereas the effectiveness in samples of ASD patients' caregivers has been little studied. In this sense, most studies conducted in these informal caregivers analyzed the effects on the caregiver status of interventions focused on the management of behavioral problems and autistic symptoms in the care recipient, with positive outcomes. (Drew et al., 2002; Salt et al., 2002; Smith et al., 2000; Tonge et al., 2006). Other studies have evaluated the effectiveness of multi-component treatments, namely, interventions oriented to the treatment of symptoms of both care recipients and caregivers. This type of intervention has shown high effectiveness lessening perceived stress and improving health status in caregivers of people with developmental disabilities compared to interventions focusing only on care recipients (Singer, Ethridge & Aldana, 2007). Other treatment strategies, such as mutual help groups (Huws, Jones & Ingledew, 2001), and more recent interventions, such as mindfulness-based approaches, have also reported to be effective improving the quality of life in informal ASD patients caregivers (Dykens, Fisher, Taylor, Lambert & Miodrag, 2014; Ruiz-Robledillo, Sariñana-González, Pérez-Blasco, González-Bono & Moya-Albiol, in press). However, little research has been carried out for specific psychotherapeutic interventions aiming to teach cognitive and behavioral stress management strategies to ASD patient caregivers. In this regard, the effectiveness of cognitive-behavioral therapy (CBT) in this population is poorly studied. Recent revisions of several meta-analyses pointed out the high efficacy of this type of intervention in different problems (Butler, Chapman, Forman & Beck, 2006; Hoffman, Asnaani, Vonk, Sawyer & Fang, 2012). CBT is effective for the treatment of depression, anxiety disorders, insomnia, and several stress related disorders (Butler et al., 2006; Hoffman et al., 2012). Furthermore, this type of treatment has shown a higher efficacy than other intervention strategies, demonstrating its higher effectiveness when compared with other therapeutic approaches (Butler et al., 2006; Hoffman et al., 2012).

As indicated, most studies were conducted in dementia patient caregivers, with significant positive results (Akkerman & Ostwald, 2004; Arango-Lasprilla et al., 2014; Selwood, Johnston, Katona, Lyketsos & Livingston, 2007). Regarding ASD patient caregivers, few studies demonstrated the effectiveness of CBT in the reduction of health complaints and perceived stress (Bristol et al., 1993; Hastings & Beck, 2008). To date, however, no specific CBT program focusing on stress management has been developed for and evaluated in family caregivers of people with ASD.

Recent research has identified several risk and protective factors for health outcomes in informal caregivers of people with ASD (Ruiz-Robledillo & Moya-Albiol, 2014a). These findings suggest that it would be worthwhile to develop and implement psychotherapeutic strategies based on these factors. The present study aimed to analyze the effectiveness of a CBT intervention program in reducing burden, somatic symptoms and depression, and improving mood state in family caregivers of people with ASD. We hypothesized that caregivers would have fewer somatic and depressive symptoms after the intervention and at one-month follow-up and lower burden immediately after the intervention than at baseline (Bristol et al., 1993; Hastings and Beck, 2008; Ruiz-Robledillo et al., in press; Salt et al., 2002). Furthermore, we expected to find a significant reduction in negative mood states over the course of the whole intervention program, as has been previously described (Ruiz-Robledillo et al., in press).

Participants and Procedure

The sample comprised 17 parents of ASD diagnosed people (10 women and 7 men) who had cared for their offspring for approximately 14 years. Participants mean age was 52 years, most of them were married (76%) and with a high educational level (64.7%). With regard to the care recipients, 13 were males and 4 females with a mean percentage of disability of 75%. Caregivers were recruited from members of an association of relatives of people with ASD (*Asociación Valenciana de Padres de Personas con Autismo, APNAV*) in the region of Valencia (Spain). Firstly, a meeting was conducted with caregivers to explain the aim of the research and the criteria for participation, namely, being the mother or father of an individual with a clinical diagnosis of an ASD; living at home with the care recipient; and having been the primary caregiver (that is, the person with the greatest responsibility for the daily care and rearing of the child) for at least two years before the study. In this meeting, parents were told about the content and procedure of the intervention program. After indicating that they wished to participate in the study, selected parents were interviewed to collect demographic data and information about their caregiving status. They all took part in the study voluntarily and completed an informed consent form in accordance with the ethical principles for research involving human subjects (Declaration of Helsinki).

The intervention program consisted of eight 2-hour sessions once a fortnight. The program is fundamentally based on a cognitive-behavioral approach, employing therapeutic strategies that have demonstrated efficacy in stress reduction. Further, the therapy was adapted to the ASD care context, taking into account factors that have been shown to be modulators of health status in family caregivers of people with ASD, in order to increase its effectiveness in this population. The development of the content and the implementation of the program were undertaken by the first author, with the supervision of the second author. The content of the intervention is summarized in Table 1.

Table 1. Content of the CBT program.

	Contents	**Homework**
Session 1	-Introduction to the program norms -Psychoeducation: ASD, stress, healthcare -Introduction to the CBT techniques	-Thought Record (ABC model)
	ONE WEEK	
Session 2	-Cognitive Restructuring -Introduction to Leisure Activities -Introduction to Diaphragmatic Breathing	-Practice Leisure Activities -Cognitive Restructuring -Practice of Diaphragmatic Breathing
	ONE WEEK	
Session 3	-Importance of Self-esteem -Importance of Leisure Activities I -Progressive Muscle Relaxation I	-Practice Leisure Activities -Practice of Progressive Muscle Relaxation
	ONE WEEK	
Session 4	-Importance of Leisure Activities II -Discussion: Acceptation VS Resignation -Progressive Muscle relaxation II	-Increasing Leisure Activities -Practice of Progressive Muscle Relaxation
	ONE WEEK	
Session 5	-Communication Styles: aggressive, passive and assertive -Active listening	-Increasing Leisure Activities -Global relaxation -Practice of active listening
	ONE WEEK	

Session 6	-Problem solving technique -Introduction of the concept of Locus of control	-Practice of Problem Solving Technique -Practice Leisure Activities -Global relaxation
	ONE WEEK	
Session 7	-Review of the contents of the program -Elaboration of an integral self-care plan	-Develop and implement a self-care plan
	ONE MONTH	
Session 8	-Review of the self-care plan implementation -Identification of barriers in the program implementation -Benefits of the program	

Instruments

Mood State

Mood was evaluated using the abbreviated version of the *Profile of Mood States* (POMS), developed by Fuentes Balaguer, Meliá, and García-Merita, (1995).This version is composed of 29 items configured by adjectives that respond to the question 'How are you feeling right now?' Items are grouped in five subscales: tension (e.g. tense, nervous), depression (e.g. sad; unhappy), anger (e.g. angry; bad-tempered), vigor (e.g. lively; energetic), and fatigue (e.g. fatigued; exhausted). A total score was also calculated by summing scores on all subscales, subtracting the vigor scale score and adding a constant of 100. The higher the total score, the worse the mood. Cronbach's alpha of this instrument is higher than 0.80.

Somatic Symptoms

Somatic symptoms were assessed with the revised Spanish version of the *Somatic Symptoms Scale* (ESS-R) created by Sandín and Chorot (1995). This instrument is composed of 80 items focused on the frequency of immunological (e.g. influenza; general state of low energy), cardiovascular (e.g. tachycardia; elevated blood pressure), respiratory (e.g. repetitive sneezing; difficult breathing), gastrointestinal (e.g. nausea; constipation), neurosensory (e.g. gait instability; dizziness), muscular (e.g. backache; joint pain), dermatological (e.g. eczema; pimples on the skin), and genito-urinary (e.g. discomfort when urinating; difficulty urinating) complaints. Each scale is composed of ten items ranked on a five-point Likert scale from 0 (never) to 4 (more than five times in the last 2 years), with reliability coefficients ranging from 0.79 to 0.84. The total number of symptoms is also calculated.

Depressive Symptoms

Depressive symptomatology was evaluated by the *Beck Depression Inventory* (Beck & Steer 1993). This questionnaire assesses the intensity and severity of emotional, cognitive, and somatic aspects of depressive symptomatology through 21 self-report items ranked on a four-point Likert scale (e.g. Crying: I don´t cry anymore than I used to/I cry more than I used to/I cry over every little things/I feel like crying, but I can´t; Sadness: I do not feel sad/I feel sad much of the time/I am sad all the time/I am so sad or unhappy that I can´t stand it). It has a reliability coefficient of 0.83.

Burden

Burden on the caregivers was evaluated using the *Burden Interview* created by Zarit et al. (1980). This instrument is composed of 22 items ranked on a five-point Likert scale from 0 (never) to 4 (nearly always) with a maximum score of 88. The reliability coefficient is 0.92. The items are related to health, social, and personal lifestyle, and interpersonal relations with the care recipient who has functional and behavioral disabilities (e.g. `Do you feel that your relative currently affects our relationships with other family members or friends in a negative way?´; `Do you feel your health has suffered because of your involvement with your relative?´; `Do you feel that your social life has suffered because you are caring for your relative?´). For each of these domains, caregivers express their feelings of burden with the higher scores representing a greater burden.

Evaluation Procedure

Burden was evaluated before and after the intervention. Somatic symptoms and depression were evaluated before the implementation of the intervention, immediately after the intervention and at 1 month of follow-up. Mood state was evaluated in session 1 (pre-treatment), session 4 (mid-treatment), and session 8 (post-treatment), and again 1 month later during the follow-up session. In the case of mood state, each participant completed the mood questionnaire before and after each of the aforementioned sessions.

Statistical analyses

ANOVA for repeated measures was performed to explore changes over time, in somatic and depressive symptoms (comparing pre-treatment, post-treatment and follow-up scores) and in mood state (comparing pre-treatment, mid-treatment, post-treatment and follow-up scores). Greenhouse-Geisser adjustments to degrees of freedom and Bonferroni adjustments for multiple contrasts were applied as appropriate. For burden, a paired-sample t-test was employed (assessing differences between pre- and post-treatment scores).

All statistical analyses were performed using IBM SPSS Statistics (version 21.0), considering $p<.05$ to be significant. The descriptive values are expressed as mean and standard deviation (M and SD, respectively).

Results

Was the intervention program effective in caregivers?

a) Somatic symptoms

There were significant changes over time in respiratory ($F[1.845,29.525]=6.602$, $p=.005$, $\eta^2_{\text{partial}}=.292$); neurosensory ($F[1.824,29.188]=9.787$, $p=.001$, $\eta^2_{\text{partial}}=.380$); and genito-urinary ($F[1.777,28.431]=5.234$, $p=.014$, $\eta^2_{\text{partial}}=.246$) symptoms, as well as the total number of symptoms ($F[1.435,22.968]=6.361$, $p=.011$, $\eta^2_{\text{partial}}=.284$). For respiratory, neurosensory and total number of symptoms, post-hoc analyses revealed differences between pre-treatment scores and both post-treatment ($p=.029$; $p=.004$; $p=.050$, respectively) and follow-up ($p=.013$; $p=.050$; $p=.006$, respectively) scores. In all cases, caregivers had fewer symptoms post-treatment and at follow-up than pre-treatment. With regard to genito-urinary symptoms, caregivers had significantly fewer symptoms at follow-up than pre-treatment ($p=.033$) (Table 2).

b) Burden, depression, and negative mood state

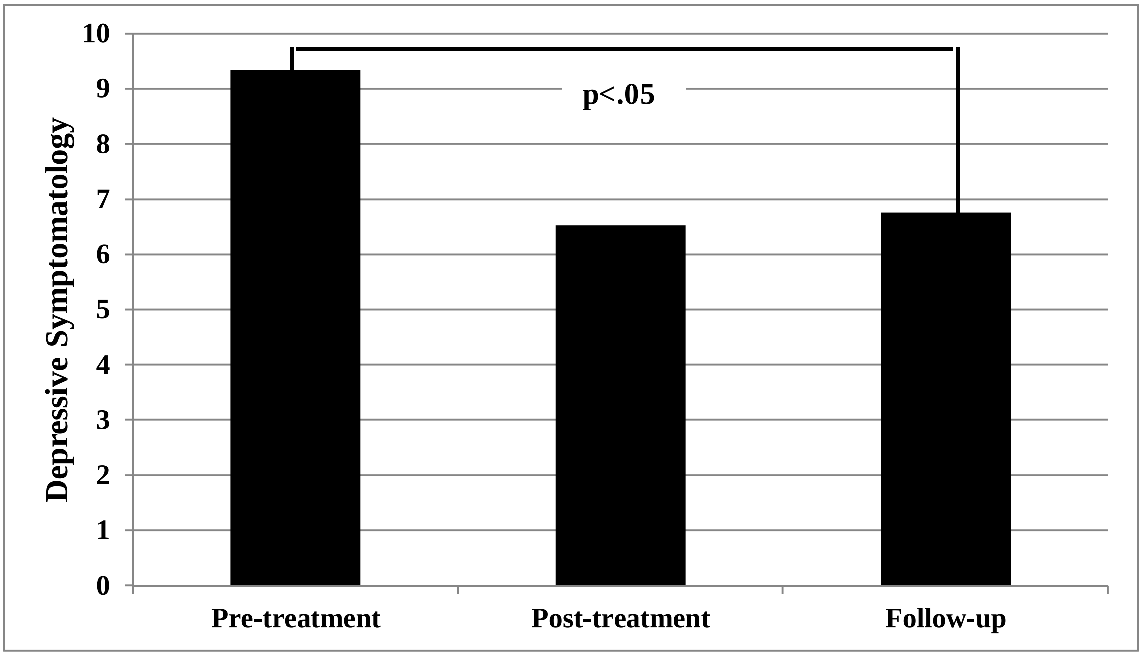
In the case of burden, a significant reduction was found after the intervention ($t[16]=2.775$, $p=.014$, $d=.47$).

Table 2. Scores (mean and standard deviation) in somatic symptoms and burden in pre and post-treatment and one month follow-up for caregivers (*p<.05; **p<.01; ***p<.001).

	Pre-treatment	Post-treatment	Follow-up
Somatic Symptoms			
Immunological	8.76 ± 6.18	8.29 ± 4.95	7.41 ± 5.30
Respiratory**	9.53 ± 7.70	6.29 ± 4.59	6.65 ± 6.72
Cardiovascular	10 ± 7.55	6.35 ± 5.55	7.65 ± 6.50
Gastrointestinal	9.59 ± 7.87	8.76 ± 7.02	8.71 ± 7.43
Neurosensory***	8.12 ± 8.44	5.24 ± 7.07	6.47 ± 8.14
Genital-urinary*	7.35 ± 7.21	5.35 ± 4.60	4.71 ± 5.34
Muscular	13.53 ± 10.01	11.24 ± 8.91	12 ± 9.63
Dermatological	11.18 ± 8.13	10.06 ± 6.91	10.65 ± 8.89
Total Symptoms*	78.05 ± 53.16	61.58 ± 39.78	64.23 ± 45.91
Burden*	67.52 ± 12.50	61.58 ± 12.73	

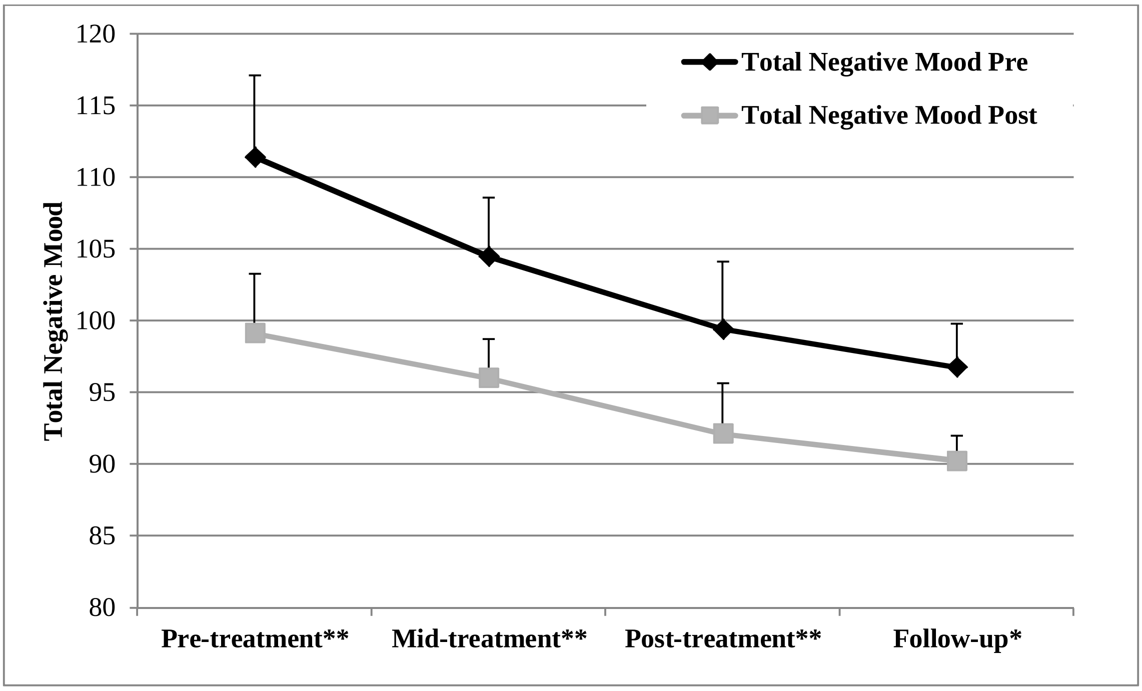
For depressive symptoms, changes over time were also significant (F([1.349,21.581]=5.329, p=.022, η^2_{partial}=.250), caregivers having fewer depressive symptoms at follow-up than pre-treatment (p=.014) (Figure 1).

Figure 1. Scores (mean and standard deviation) in depressive symptomatology in pre and post-treatment and one month follow-up.



With regard to mood state, there were significant changes over time in scores for total negative mood (F[2.347,37.559]=9.913, p=.001, η^2_{partial}=.383) and all the subscales, namely, for depression (F[2.224,35.583]=7.568, p=.001, η^2_{partial}=.321; vigor F[2.484,39.736]=4.728, p=.010, η^2_{partial}=.228); anger (F[2.147,34.347]=4.833, p=.013, η^2_{partial}=.232); fatigue (F[2.528,40.447]=3.762, p=.023, η^2_{partial}=.190); and tension (F[2.099,33.590]=5.845, p=.006, η^2_{partial}=.268). In the case of depression, vigor and total negative mood, significant differences were observed from pre-treatment to mid-treatment (p=.010; p=.027 and p=.010 for each subscale respectively) and to follow-up (p=.004, p=.050 and p=.007 respectively). For fatigue and tension, differences were significant comparing pre-treatment and follow-up scores (p=.050 and p=.020, respectively). We only observed significant differences between post-treatment and follow-up in the case of total negative mood (p=.011). Post-hoc analyses did not identify any significant differences in anger. On all subscales except for vigor, scores fell progressively over the course of the whole intervention program. No significant interaction was observed between the time of measurement with respect to the session (pre- or post-session) and time of measurement with respect to the treatment (pre-/ mid-/post-treatment or follow-up) for any of the mood scores evaluated. (Figure 2)

Figure 2. Effect of each evaluated CBT session on mood state (*p<.05; **p<.01).



Discussion

The results of the present study demonstrate the effectiveness of the CBT program applied for reducing burden, somatic symptoms, depression and mood disturbances in caregivers of people with ASD. The types of psychotherapeutic strategies employed in this study have also been found to be effective in previous studies conducted with informal caregivers (Martínez et al., 2014; Losada-Baltar et al., 2004). However, these earlier studies implemented interventions focusing on single techniques. In caregivers of people with dementia, two types of intervention, one oriented to the management of dysfunctional thoughts about informal caring and the other to problem-solving strategies, showed significant effectiveness for reducing stress levels, the program focusing on dysfunctional thoughts being more effective than those on problem-solving (Losada-Baltar et al., 2004). Problem-solving therapy was also found to be effective at reducing burden in caregivers of people with cerebral palsy (Martínez et al., 2014). In the present study, both skills were trained in the same integrated program. Probably the combination of these two types of skills, together with the other skills worked on during the program, increases the efficacy of the intervention. To our knowledge, this is the first study focused on the evaluation of a program integrating several cognitive-behavioral techniques adapted to the care context in caregivers of people with ASD.

The intervention applied focuses on strengthening skills that have been shown to be protective for health and reducing factors related to health deterioration in this population, following the model proposed by Ruiz-Robledillo and Moya-Albiol (2014a). There is evidence that depending on caregivers' perception of the level of control they have over stressors, different coping strategies could be effective (Ruiz-Robledillo and Moya-Albiol, 2013). In the program, the following were discussed: the concept of locus of control, characteristics of the stressors, differences between acceptance and resignation, and effective coping depending on the perceived control of each stressor. In the case of high perceived control of the stressor, caregivers were encouraged to apply problem-solving strategies and active coping. On the other hand, leisure activities were encouraged and emotion regulation strategies, such as relaxation and cognitive restructuration, were worked on to help caregivers to manage stressors over which they had less control. This approach enables caregivers to pay less attention to negative feelings and acquire higher emotion regulation skills, which have been demonstrated to be directly related to better health status in this population (Ruiz-Robledillo & Moya-Albiol, 2014b). Increasing leisure activities and being present during these activities could help caregivers to reduce negative feelings, capitalizing on positive situations promoted by leisure activities. Furthermore, leisure activities could serve as a respite and an escape from the stress focus, something that has been shown to be related to positive health outcomes in this population (Ruiz-Robledillo & Moya-Albiol, 2013).

To our knowledge, no previous interventions conducted with caregivers of people with ASD have integrated training in effective communication styles and assertiveness. These skills are especially relevant in caregivers of people with ASD, taking into account that they are constantly in contact with educational, health and other public services due to their caring role. Specifically, training in effective communication styles could reduce social anxiety potentially associated with these interactions. In turn, this could also reduce stress and negative health outcomes. In dementia patient caregivers, communication difficulties predicted significantly the burden (Savundranayagam, Hummert & Montgomery, 2005). Hence, in a recent study, effective communication styles and assertiveness were included as a one of the main components of a CBT program, with positive results (Arango-Lasprilla et al., 2014). In addition, the effects of communication training have been effective in family caregivers of dementia patients, reducing distress and improving significantly the interaction with the care recipient and the medical staff (Done & Thomas, 2001; Ripich, Ziol, Fritsch & Durand, 2000). However, this fact had not been proven in ASD patients informal caregivers, although they also have to interact constantly with several clinicians.

On the other hand, the fact that to participate in the program caregivers join a group of individuals with the same caring role in itself increases their level of social support, through the interaction with peers, offering opportunities to learn about strategies employed by other caregivers and identified in relation to the problems discussed during the sessions (Boyd, 2002). In this sense, previous research demonstrated the effectiveness of peer support interventions in family caregivers of chronic disabling children (Shilling et al., 2013). In ASD patients' caregivers, peer support based on email interaction showed positive results (Huws et al., 2001). Hence, the contents of the interactions were based generally in giving a sense to autism, trough the discussion of searching for meaning, adjusting to changes, providing peer support and sharing individual experiences. In the present study, the inherent performance of the program encouraged participants to share experiences, creating a sense of group integrated by individuals with a similar problem. This fact, as previously studied, is one of the main mechanisms underlying the effectiveness of group treatment. Sharing the same social identity, being able to help others and being also helped could enormously benefit caregivers (Shilling et al., 2013).

Overall, the program provides participants with a range of effective coping strategies and skills for dealing with everyday challenges associated with the care situation. The observed improvements in health are probably directly related to increases in resilience and coping, previous research indicating the positive effects of these skills on health status and mood (Ruiz-Robledillo et al., 2014). This fact has important and significant clinical implications for informal caregivers and clinicians. Firstly, caregivers' health status and quality of life are closely related to the quality of the care provided to care recipients. Improving health in caregivers results in an increase in the quality of the provided care and in turn, in a better functioning and quality of life of care recipients. Furthermore, the improvement of caregivers´ health could reduce their medical visits and medication consumption, lowering the economical costs of their medical healthcare. Moreover, the potential burden of medical institutions could be reduced, especially if this type of interventions could be applied early after the diagnosis of the care recipient. This would prevent the health deterioration of informal caregivers, and therefore, the costs derived from the medical attention of this population

Although the present study represents an advance in our understanding of which psychotherapeutic approaches may be effective for reducing health complaints and negative mood states in informal caregivers of people with ASD, several limitations have to be taken into account. The relatively small sample size and the pre-post design limit the conclusions that can be drawn about causality and the generalization of the findings. On the other hand, informal caregivers usually have extreme difficulties in attending to therapeutic programs due to a lack of time and commitments related to their caring role. In line with this, relatively few data are available concerning the effectiveness of interventions in this population. We believe that the results obtained in this study contribute to filling this gap in the literature and encourage efforts to develop and implement comprehensive interventions for caregivers.

Future studies should attempt to replicate the results with a larger sample size. Furthermore, it could be interesting to explore differences in the effectiveness of different intervention modalities and whether the effectiveness can be increased by combining additional therapeutic approaches for reducing health complaints in caregivers. New psychotherapeutic strategies such as mindfulness and yoga are also producing good results in informal caregivers (Ruiz-Robledillo et al., in press; Waelde, Thompson & Gallaguer-Thompson, 2004). It is reasonable to suppose that individual caregivers benefit more or less from specific interventions depending on their personality traits and other psychosocial and contextual variables. Future studies should evaluate which types of variables could be significant predictors of the success of particular interventions in caregivers of people with ASD.

References

Akkerman, R.L., & Ostwald, S.K. (2004). Reducing anxiety in Alzheimer's disease family caregivers: the effectiveness of a nine-week cognitive-behavioral intervention. *American journal of Alzheimer's disease and other dementias, 19* (2), 117-123.

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Washington, DC.

Arango-Lasprilla, J.C., Panyavin, I., Merchán, E.J.H., Perrin, P.B., Arroyo-Anlló, E. M., Snipes, D.J., & Arabia, J. (2014). Evaluation of a Group Cognitive–Behavioral Dementia Caregiver Intervention in Latin America. *American journal of Alzheimer's disease and other dementias, 29* (6), 548-555.

Beck, A.T., & Steer, R.A. (1993), Beck Depression Inventory Manual. San Antonio, TX: The Psychological Corporation.

Bekhet, A.K., Johnson, N.L., & Zauszniewski, J.A. (2012). Resilience in family members of persons with autism spectrum disorder: A review of the literature. *Issues in mental health nursing, 33* (10), 650-656.

Boyd, B. (2002). Examining the relationship between stress and lack of social support in mothers of children with autism. *Focus on Autism and Other Developmental Disabilities, 17* (4), 208-215.

Bristol, M.M., Gallagher, J.J. & Holt, K.D. (1993). Maternal depressive symptoms in autism: Response to psychoeducational intervention. *Rehabilitation Psychology, 38* (1), 3–10.

Butler, A.C., Chapman, J.E., Forman, E.M., & Beck, A.T. (2006). The empirical status of cognitive-behavioral therapy: a review of meta-analyses. *Clinical psychology review, 26* (1), 17-31.

Cheon, S.H., Chang, S.O., Kong, G.S., & Song, M.R. (2011). Development and Evaluation of Community-based Respite Program for Family Caregivers of Elders with Dementia. *Journal of Korean Academy of Fundamentals of Nursing, 18* (3), 337-347.

De Andrés-García, S., Moya-Albiol, L., & González-Bono, E. (2012). Salivary cortisol and immunoglobulin A: Responses to stress as predictors of health complaints reported by caregivers of offspring with autistic spectrum disorder. *Hormones and behavior, 62* (4), 464-474.

Done, D.J., & Thomas, J.A. (2001). Training in communication skills for informal carers of people suffering from dementia: a cluster randomized clinical trial comparing a therapist led workshop and a booklet. *International Journal of Geriatric Psychiatry, 16* (8), 816-821.

Drew, A., Baird, G., Baron-Cohen, S., Cox, A., Slonims, V., Wheelwright, S., ... & Charman, T. (2002) A pilot randomised control trial of a parent training intervention for pre-school children with autism: Preliminary findings and methodological challenges. *European Child & Adolescent Psychiatry, 11* (6), 266–272.

Dykens, E.M., Fisher, M.H., Taylor, J.L., Lambert, W., & Miodrag, N. (2014). Reducing distress in mothers of children with autism and other disabilities: a randomized trial. *Pediatrics, 134* (2), 454-463.

Elsabbagh, M., Divan, G., Koh, Y. J., Kim, Y. S., Kauchali, S., Marcín, C., ... & Fombonne, E. (2012). Global prevalence of autism and other pervasive developmental disorders. *Autism Research, 5* (3), 160-179.

Fuentes, I., Balaguer, I., Meliá, J. & García-Merita, M. (1995). Forma abreviada del Perfil de Estados de Ánimo (POMS). In E. Cantón (Ed.), Libro de Actas del V Congreso Nacional de Psicología de la Actividad Física y el Deporte. Valencia, Spain: Universitat de Valencia.

Hastings, R., & Beck, A. (2008). Practitioner Review: Stress intervention for parents of children with intellectual disabilities. *Journal of Child Psychology and Psychiatry, 45* (8), 1338-1349.

Hofmann, S.G., Asnaani, A., Vonk, I.J., Sawyer, A.T., & Fang, A. (2012). The efficacy of cognitive behavioral therapy: a review of meta-analyses. *Cognitive therapy and research, 36* (5), 427-440.

Huws, J.C., Jones, R.S.P. & Ingledew, D.K. (2001). Parents of children with autism using an e-mail group: A grounded theory study. *Journal of Health Psychology, 6* (5), 569–584.

Johnson, N., Frenn, M., Feetham, S., & Simpson, P. (2011). Autism spectrum disorder: parenting stress, family functioning and health-related quality of life. *Families, Systems, & Health, 29* (3), 232.

Karst, J.S., & Van Hecke, A.V (2012). Parent and family impact of autism spectrum disorders: a review and proposed model for intervention evaluation. *Clinical Child and Family Psychology Review, 15* (3), 247-277.

Khanna, R., Madhavan, S.S., Smith, M.J., Patrick, J.H., Tworek, C., & Becker-Cottrill, B. (2011). Assessment of health-related quality of life among primary caregivers of children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 41* (9), 1214-1227.

Lai, W.W., & Oei, T.P.S. (2014). Coping in Parents and Caregivers of Children with Autism Spectrum Disorders (ASD): a Review. *Review Journal of Autism and Developmental Disorders,* 1-18.

Lavelle, T.A., Weinstein, M.C., Newhouse, J.P., Munir, K., Kuhlthau, K.A., & Prosser, L.A. (2014). Economic burden of childhood autism spectrum disorders. *Pediatrics, 133* (3), 520-529.

López, J., & Crespo, M. (2007). Interventions for caregivers of older and dependent adults: a review. *Psicothema, 19* (1), 72-80.

Losada-Baltar, A., Izal-Fernández, M., Montorio-Cerrato, I., Cobaleda, S., & Pérez-Rojo, G. (2004). Eficacia diferencial de dos intervenciones psicoeducativas para cuidadores de familiares con demencia. *Revista de Neurología, 38* (8), 701-708.

Lovell, B., Moss, M., & Wetherell, M. (2012a). The psychosocial, endocrine and immune consequences of caring for a child with autism or ADHD. *Psychoneuroendocrinology, 37* (4), 534-542.

Lovell, B., Moss, M., & Wetherell, M. (2012b). With a little help from my friends: Psychological, endocrine and health corollaries of social support in parental caregivers of children with autism or ADHD. *Research in Developmental Disabilities, 33* (2), 682-687.

Martín-Carrasco, M., Martín, M. F., Valero, C. P., Millán, P. R., García, C. I., Montalbán, S. R., ... & Vilanova, M. B. (2009). Effectiveness of a psychoeducational intervention program in the reduction of caregiver burden in Alzheimer's disease patients' caregivers. *International Journal of Geriatric Psychiatry, 24* (5), 489-499.

Martínez, F., Avilés, M., Ramírez, J.M., Riquelme, H., Garza, T., & Barrón, F. (2014). Impacto de una intervención psicosocial en la carga del cuidador de niños con parálisis cerebral. *Atención Primaria, 46* (8), 401-407.

Ripich, D.N., Ziol, E., Fritsch, T., & Durand, E.J. (2000). Training Alzheimer's disease caregivers for successful communication. *Clinical Gerontologist, 21* (1), 37-56.

Rivera, P.A., Elliott, T.R., Berry, J.W., & Grant, J.S. (2008). Problem-solving training for family caregivers of persons with traumatic brain injuries: a randomized controlled trial. *Archives of Physical Medicine and Rehabilitation, 89* (5), 931-941.

Ruiz-Robledillo, N., Antón-Torres, P., González-Bono, E. & Moya-Albiol, L. (2012) Consecuencias del cuidado de personas con Trastorno del Espectro Autista sobre la salud de sus cuidadores: estado actual de la cuestión. *Revista Electrónica de Psicología Iztacala, 15* (4), 1571-1590.

Ruiz-Robledillo N, De Andrés-García S, Pérez-Blasco J, González-Bono E, Moya-Albiol L. (2014) Highly resilient coping entails better perceived health, high social support and low morning cortisol levels in parents of children with autism spectrum disorder. *Research in Developmental Disabilities, 35* (3), 686–95.

Ruiz-Robledillo N, González-Bono E, & Moya-Albiol L. (2014). Lack of institutional support entails disruption in cortisol awakening response in caregivers of people with high-functioning autism. *Journal of Health Psychology, 19 (12), 1586-1596.*

Ruiz-Robledillo, N. & Moya-Albiol, L. (2012). El cuidado informal: una visión actual. *Revista de Motivación y Emoción, 1,* 22-30.

Ruiz-Robledillo, N., & Moya-Albiol, L. (2013). Self-reported health and Cortisol Awakening Response in parents of people with Asperger syndrome: the role of trait anger and anxiety, coping and burden. *Psychology and Health, 28* (11), 1246-1264.

Ruiz-Robledillo, N., & Moya-Albiol, L. (2014a). Protective and risk factors of health in caregivers of people with autism spectrum disorders. *OA Autism, 2* (1), 1-5.

Ruiz-Robledillo, N., & Moya-Albiol, L. (2014b). Emotional intelligence modulates cortisol awakening response and self-reported health in caregivers of people with autism spectrum disorders. *Research in Autism Spectrum Disorders, 8* (11), 1535-1543.

Ruiz-Robledillo, N., Sariñana-González, P., Pérez-Blasco, J., González-Bono, E., & Moya-Albiol, L. (in press). A Mindfulness-Based Program Improves Health in Caregivers of People with Autism Spectrum Disorder: a Pilot Study. *Mindfulness.*

Salt, J., Shemit, J., Sellars, V., Boyd, S., Coulson, T. & Mc Cool, S. (2002) The Scottish Centre for Autism preschool treatment programme. II: The results of a controlled treatment outcome study. *Autism, 6* (1), 33–46.

Sandín, B. & Chorot, P. (1995). Escala de Síntomas Somáticos-Revisada (ESS-R). Madrid: Universidad Nacional de Educación a Distancia (UNED).

Savundranayagam, M.Y., Hummert, M.L., & Montgomery, R.J.V. (2005). Investigating the effects of communication problems on caregiver burden. *Journal of Gerontology: Social Sciences, 60* (1), 48–55.

Seguí, J.D., Ortiz-Tallo, M., & De Diego, Y. (2008). Factores asociados al estrés del cuidador primario de niños con autismo: sobrecarga, psicopatología y estado de salud. *Anales de Psicología, 24* (1), 100-105.

Selwood, A., Johnston, K., Katona, C., Lyketsos, C., & Livingston, G. (2007). Systematic review of the effect of psychological interventions on family caregivers of people with dementia. *Journal of affective disorders, 101* (1), 75-89.

Shilling, V., Morris, C., Thompson-Coon, J., Ukoumunne, O., Rogers, M., & Logan, S. (2013). Peer support for parents of children with chronic disabling conditions: a systematic review of quantitative and qualitative studies. *Developmental Medicine & Child Neurology, 55* (7), 602-609.

Singer, G., Ethridge, B. & Aldana, S. (2007). Primary and secondary effects of parenting and stress management interventions for parents of children with developmental disabilities: A meta-analysis. *Mental Retardation and Developmental Disabilities Research Reviews, 13* (4), 357–369.

Smith, R., Groen, A.D. & Wynn, J.W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. *American Journal on Mental Retardation, 105* (4), 269–285.

Sørensen, L.V., Waldorff, F.B., & Waldemar, G. (2008). Early counselling and support for patients with mild Alzheimer's disease and their caregivers: A qualitative study on outcome. *Aging and Mental Health, 12* (4), 444-450.

Sorrell, J.M. (2014). Moving beyond caregiver burden: identifying helpful interventions for family caregivers. *Journal of psychosocial nursing and mental health services, 52* (3), 15-18.

Tonge, B., Brereton, A., Kiomall, M., Mackinnon, A., King, N. & Rinehart, N. (2006). Effects on parental mental health of an education and skills training program for parents of young children with autism: A randomized controlled trial. *Journal of the American Academy of Child and Adolescent Psychiatry, 45* (5), 561–569.

Van Mierlo, L.D., Meiland, F.J., Van der Roest, H.G., & Dröes, R.M. (2012). Personalised caregiver support: effectiveness of psychosocial interventions in subgroups of caregivers of people with dementia. *International journal of geriatric psychiatry, 27* (1), 1-14.

Waelde, L.C., Thompson, L., & Gallagher-Thompson, D. (2004). A pilot study of a yoga and meditation intervention for dementia caregiver stress. *Journal of Clinical Psychology, 60* (6), 677-687.

Zarit, S.H., Reever, K.E. & Bach-Peterson, J. (1980). Relatives of the impaired elderly: Correlates of feelings of burden. *Gerontologist, 20,* 649–654.

Chapter 9

Discussion

The findings of this research underline how severely the health status of informal caregivers of people with ASD is affected by their caregiving role, this being reflected in both self-reported and biological markers of health. As hypothesized, informal caregivers were found to have more somatic symptoms and poorer perceived general health than non-caregivers. Furthermore, they had high levels of negative affect and medication use. These results have been reinforced by the evaluation of CAR, a reliable biological marker of health status (Fries, Dettenborn and Kirschbaum, 2009).

In contrast to previous studies (Lovell, Moss and Wetherell, 2012; Seltzer et al., 2010), in the present research, informal caregivers of people with ASD were found to have a higher CAR than non-caregivers. As has been proposed, these differences could be due to the anticipation of care demands by caregivers. The anticipation hypothesis was put forward in the work of Schulz, Kirschbaum, Prüßner, and Hellhammer (1998) in relation to individuals chronically stressed by work overload. In that research, the CAR was higher in chronically stressed than non-stressed individuals. Further research evaluating CAR on weekdays and at weekends in similar populations replicated these results, and the authors associated a higher CAR with the anticipation of upcoming demands (Schlotz, Hellhammer, Schulz and Stone, 2004). Recent research conducted in the general population has also demonstrated the effects of anticipated challenge on CAR (Wetherell, Lovell and Smith, 2014). Specifically, the CAR of individuals was evaluated on a normal day and on a day on which they were to be subjected to a laboratory stressor, and CAR was found to be higher on the day of the anticipated laboratory stressor than the normal day. Taking into account that caregivers should cope every day with several demands associated with care context, such anticipation could be a common and chronic condition in this population. This may explain, in part, the higher CAR that has been obtained in two consecutive days in this population. In this sense, it has been proposed that CAR is closely related to awakening processes, fundamentally to the activation of memory representation, about self and orientation in time and space (Fries et al., 2009). In this regard, structures related to memory processes, such as the hippocampus, directly influence the HPA axis, activating or inhibiting its activity (Fries et al., 2009). The anticipation of upcoming demands could be linked to memory processes and the association between hippocampus and the HPA axis could be the biological mechanism underlying the anticipation hypothesis. In the care context, the higher CAR in caregivers of people with ASD could be a consequence of their representation of the care demands after awakening. As has been found previously, caregivers need to cope every day with a range of challenges associated with the care context, and clearly, they also have to deal with other challenges associated with their daily life. In line with this, higher CAR could be an adaptive change in order to increase physiological resources to face these daily challenges. However, high cortisol levels maintained over time could trigger hypercortisolism, severely affecting the health status of the caregiver (Schulz et al., 1998; Lindfors and Lundberg, 2002). On the other hand, as has been observed, perceived stress and demands may be modulated by various psychological trait variables. In particular, both resilience and EI have shown to be associated with health outcomes.

As in previous research (Bekhet, Johnson and Zauszniewski et al., 2012), resilient coping was found to be a protective factor against negative health outcomes in caregivers. Highly resilient caregivers presented better perceived general health and lower morning cortisol levels than caregivers with lower resilience levels. In relation to this, previous research has demonstrated that highly resilient individuals have a greater ability to cope with stressful situations, minimizing alterations in the functioning of the HPA axis (Ozbay et al., 2007). It seems likely that, compared to caregivers with a low level of resilience, highly resilient caregivers perceive care demands to be less burdensome, as a consequence of their more adaptive coping resources. This fact could be closely related to their lower levels of morning cortisol levels, a possible biological mechanism underlying their better health status. Furthermore, resilience was closely related to social support, demonstrating that the two variables could interact in providing protection against health deterioration in this population (Boyd, 2002).

As with resilience, EI showed a significant association with CAR and self-reported health in caregivers. However, depending on the component of EI considered, different relationships were found. Attention to feelings was associated with more symptoms and poorer self-perceived general health. Greater attention to feelings could enhance rumination processes and this might be characteristic of neurotic personalities, both constructs classically related to negative health consequences (Sansone and Sansone, 2012). Due to the higher prevalence of negative affect in the informal care context, constantly paying attention to one’s own emotions could reinforce and magnify this negative emotionality in caregivers. In contrast, high clarity and repair could allow caregivers to identify and adequately manage negative emotional states, with an adaptive continuum from the perception of feelings, to their identification and regulation. Such abilities could decrease the negative affect in caregivers. In line with this, clarity and repair were associated with lower morning cortisol levels in the present research. Taking into account that negative affect has been related to higher CAR (Polk, Cohen, Doyle, Skoner and Kirschbaum, 2005), it is probable that caregivers with higher clarity and repair abilities had lower negative affect and, in line with this, lower morning cortisol levels. Such a pattern could also explain the better self-reported health in caregivers with high clarity and repair and lower attention to feelings. Furthermore, as proposed in the case of resilience, caregivers with lower attention and higher clarity and repair could have better emotional regulation abilities, coping in an adaptive manner with the stress associated with the care situation and perceiving the level of care demands to be less burdensome. This could also explain the lower CAR in caregivers with the aforementioned pattern of EI. Given that both resilience and EI are protective variables that promote adaptive coping stress abilities, and based on the obtained results, it is probably that those caregivers with higher resilience and greater clarity and emotional repair perceive the care demands as less stressful. Therefore, this perception could be related to an adaptive anticipation of care demands, regulating the HPA axis activity, maintaining it in an optimal functioning.

When other contextual factors were studied, institutional support was also found to be a significant protective factor of health in this population, as observed previously in caregivers of people with schizophrenia (González-Bono, De Andrés-García, Romero-Martínez and Moya-Albiol, 2013; González-Bono, De Andrés-García and Moya-Albiol, 2012). Caregivers with institutional support exhibited better health status and lower burden than caregivers without support. Furthermore, the former showed a normal CAR, unlike caregivers without support, who presented a blunted CAR. In this regard, the multidimensional treatment approach applied with caregivers in this research, demonstrated efficacy in both caregivers and care recipients. It has previously been found that this type of intervention is more effective than single types of treatment applied alone (Singer, Ethridge and Aldana, 2007). However, no studies had evaluated new treatment approaches, such as mindfulness interventions, which have shown to be effective reducing perceived stress and negative mood in caregivers of children with chronic conditions (Minor, Carlson, Mackenzie, Zernicke and Jones, 2008).

In the present work, the mindfulness-based program developed showed a significant efficacy in reducing somatic symptoms and depression while improving perceived general health in caregivers. Furthermore, as had been hypothesized, caregivers who participated in the intervention presented lower negative mood after the intervention than at the baseline. These results were reinforced by the findings concerning their cortisol response to the sessions. Specifically, caregivers experienced a significant reduction in cortisol levels over the course of the sessions, demonstrating the positive effect on the HPA axis of the meditation and exercises conducted during the intervention program. Furthermore, caregivers showed greater reductions in cortisol levels, negative mood and health complaints than non-caregivers. This result is especially important in terms of demonstrating the potential value of this intervention for chronically stressed populations. In relation to this, training caregivers in the principles of mindfulness, such as living in the present moment with non-judgmental acceptance, could be directly associated with the improvement of health status (Oken et al., 2010). Taking into account that worries about the future of the care recipient, rumination processes and negative affect could be precursors of stress and health deterioration in this population, teaching caregivers new coping skills for dealing with these factors could be particularly effective.

Like the mindfulness intervention, a CBT program adapted to the care context was found to be effective for reducing health problems and negative mood in caregivers of people with ASD. In this intervention, sessions were oriented to teach caregivers specific coping skills to deal with the stress derived from the care situation. Accordingly, caregivers could be expected to strengthen their resilience and emotional regulation abilities, both variables that have demonstrated to be protective against health deterioration in this population. Although the efficacy of the mindfulness and CBT-based approaches could be due to different mechanisms, both were oriented to provide caregivers with effective coping skills to deal with the stress in an adaptive manner. This focus seems to be successful for reducing health complaints, increasing perceived quality of life in caregivers.

Regarding the functioning of the ANS, experiments were conducted to evaluate the electrodermal response to acute cognitive stressors in the laboratory setting. Caregivers had a lower electrodermal response to acute stress than non-caregivers. As has been found in other chronically stressed populations, a habituation mechanism could explain these results (Gump and Mathews, 1999). In samples of abused children or individuals with a background of severe poverty, the response of the ANS to acute stress was observed to be blunted (Evans and Kim, 2007; Murali and Chen, 2005). Being under high levels of chronic stress could affect the functioning of the ANS, making this system hypo-responsive due to habituation mechanisms (Carroll, Phillips, Ring, Der and Hunt, 2005; Evans and Kim, 2007; Murali and Chen, 2005). In this regard, when the acute stress response has been studied in this population with other biological markers, the results were the same (De Andrés-García, Moya-Albiol and González-Bono, 2012). Caregivers also exhibited lower cortisol response to acute stress than non-caregivers when the same stress protocol was applied, demonstrating that there may also be a habituation to stress in the case of the HPA axis (De Andrés-García et al., 2012). Taken together, these findings imply that the adaptive stress response may be weakened in caregivers, and this could have severe consequences for their health when dealing with several daily stressors. Alternative explanations are based on the effects of chronic stress enhancing adaptive coping and resilience for dealing with the stressor in caregivers (Gump and Mathews, 1999). It is plausible that caregivers develop stronger adaptive coping strategies, and this could reduce their need for greater physiological resources to cope with the stress, protecting their health status. This hypothesis would be consistent with the association observed between self-reported health and EDA, a lower electrodermal response being protective of health.

The main limitation of this research is that the design of the study is cross-sectional and correlational, something characteristic of field studies in general and those carried out in this populations in particular, which means that causality could not be addressed. Furthermore, the relatively small sample sizes in some of the studies may limit the generalization of the results in some cases. However, the situation of caregivers makes it extremely difficult to establish studies with larger samples, due to the lack of time and commitments of this population. Along with this, employing biological samples, the number of participants is appropriate, given the complexity in the obtention and determination of the samples.

The findings presented in this Doctoral Thesis represent a significant advance in our understanding of the consequences for health of caring for offspring with ASD. The multidimensional approach in analysis of the health of caregivers, employing both biological and self-reported measures, makes it possible to assess their status in a comprehensive way. This approach enhances the reliability of the results obtained and provides relevant information about the biological mechanisms that could underlie the impact on health of caring for an individual with ASD. Furthermore, the identification of protective as well as risk factors is important to guide the development of assessment protocols including related variables. Such assessments could provide essential information to clinicians about caregivers at risk of severe health impairment. Identifying groups of caregivers at a high risk could make it possible to prevent future health problems, by offering psychotherapeutic interventions. Further, the results obtained could also be useful to inform the development of such interventions for reducing health problems and stress perception in this population. As demonstrated, two types of intervention focused on stress management are useful for reducing health complaints, including techniques and exercises oriented to enhancing factors found to be protective of health and reducing the risk factors.

Future studies should consider other biological markers of health, and other psychological traits of caregivers that could be involved in the impact of caring on their health. In addition, as a lack of time is characteristic of informal caregivers, the efficacy of other modalities of intervention based on new technologies should be analyzed, for instance, telehealth approaches. Such innovative approaches could avoid one of the main barriers to treatment adherence in this population, taking into account that this type of imntervention could be performed in their own homes with the help and guidance of professionals via Internet. Furthermore, future research should analyze the differential efficacy of diverse types of treatments or their combination, in order to establish effective intervention protocols for this population. Finally, analysis of the functioning of HPA axis and ANS before and after psychotherapeutic interventions could provide evidence to reinforce the present results and shed light on the efficacy of the treatments in reestablishing the correct functioning of these physiological systems.

References

Bekhet, A. K., Johnson, N. L., & Zauszniewski, J. A. (2012). Resilience in family members of persons with autism spectrum disorder: A review of the literature. Issues in mental health nursing, 33 (10), 650-656.

Boyd, B. A. (2002). Examining the relationship between stress and lack of social support in mothers of children with autism. *Focus on Autism and Other Developmental Disabilities, 17* (4), 208-215.

Carroll, D., Phillips, A.C., Ring, C., Der, G., & Hunt, K. (2005). Life events and hemodynamic stress reactivity in the middle-aged and elderly. *Psychophysiology, 42* (3), 269-276

De Andrés-García, S., Moya-Albiol, L., & González-Bono, E. (2012). Salivary cortisol and immunoglobulin A: responses to stress as predictors of health complaints reported by caregivers of offspring with autistic spectrum disorder. *Hormones and Behavior, 62* (4), 464-474.

Evans, G.W., & Kim, P. (2007). Childhood poverty and health: cumulative risk exposure and stress dysregulation. *Psychological Science, 18* (11), 953-957.

Fries, E., Dettenborn, L., & Kirschbaum, C. (2009). The cortisol awakening response (CAR): facts and future directions. *International Journal of Psychophysiology, 72* (1), 67-73.

Gonzalez-Bono, E., De Andres-Garcia, S., & Moya-Albiol, L. (2011). The cortisol awakening response in caregivers of schizophrenic offspring shows sensitivity to patient status. *Anxiety, Stress, & Coping, 24* (1), 107-120.

González-Bono, E., de Andrés-García, S., Romero-Martínez, Á., & Moya-Albiol, L. (2013). Cardiovascular Response to Psychosocial Repeated Stress in Caregivers of Offspring with Schizophrenia. *The Spanish journal of Psychology, 16.*

Gump, B.B., & Matthews, K.A. (1999). Do background stressors influence reactivity to and recovery from acute stressors? *Journal of Applied Social Psychology, 29* (3), 469–494.

Lindfors, P., & Lundberg, U. (2002). Is low cortisol release an indicator of positive health? *Stress and Health, 18* (4), 153-160.

Lovell, B., Moss, M., & Wetherell, M. (2012). The psychosocial, endocrine and immune consequences of caring for a child with autism or ADHD. *Psychoneuroendocrinology, 37* (4), 534-542.

Minor, H. G., Carlson, L. E., Mackenzie, M. J., Zernicke, K., & Jones, L. (2006). Evaluation of a mindfulness-based stress reduction (MBSR) program for caregivers of children with chronic conditions. *Social Work in Health Care, 43* (1), 91-109.

Murali, R., & Chen, E. (2005). Exposure to violence and cardiovascular and neuroendocrine measures in adolescents. *Annals of Behavioral Medicine, 30*(2), 155–163.

Oken, B. S., Fonareva, I., Haas, M., Wahbeh, H., Lane, J. B., Zajdel, D., & Amen, A. (2010). Pilot controlled trial of mindfulness meditation and education for dementia caregivers. *The Journal of Alternative and Complementary Medicine, 16* (10), 1031-1038.

Ozbay, F., Johnson, D. C., Dimoulas, E., Morgan III, C. A., Charney, D., & Southwick, S. (2007). Social support and resilience to stress: from neurobiology to clinical practice. *Psychiatry (Edgmont), 4* (5), 35.

Polk, D. E., Cohen, S., Doyle, W. J., Skoner, D. P., & Kirschbaum, C. (2005). State and trait affect as predictors of salivary cortisol in healthy adults. *Psychoneuroendocrinology, 30* (3), 261-272.

Sansone, R. A., & Sansone, L. A. (2012). Rumination: relationships with physical health. *Innovations in Clinical Neuroscience, 9* (2), 29.

Schlotz, W., Hellhammer, J., Schulz, P., & Stone, A. A. (2004). Perceived work overload and chronic worrying predict weekend–weekday differences in the cortisol awakening response. *Psychosomatic Medicine, 66* (2), 207-214.

Schulz, P., Kirschbaum, C., Prüßner, J., & Hellhammer, D. (1998). Increased free cortisol secretion after awakening in chronically stressed individuals due to work overload. *Stress and Health, 14* (2), 91-97.

Seltzer, M. M., Greenberg, J. S., Hong, J., Smith, L. E., Almeida, D. M., Coe, C., & Stawski, R. S. (2010). Maternal cortisol levels and behavior problems in adolescents and adults with ASD. *Journal of Autism and Developmental Disorders, 40* (4), 457-469.

Singer, G. H., Ethridge, B. L., & Aldana, S. I. (2007). Primary and secondary effects of parenting and stress management interventions for parents of children with developmental disabilities: A meta-analysis. *Mental Retardation and Developmental Disabilities Research Reviews, 13* (4), 357-369.

Wetherell, M. A., Lovell, B., & Smith, M. A. (2014). The effects of an anticipated challenge on diurnal cortisol secretion. *Stress*, 1-25.

Funding Source

This work was supported by the the University of Valencia (Programa ‘‘Atracció de Talents’’ VLCCAMPUS 2011 para investigadores en formación), the Spanish Ministry of Science and Innovation (PSI2008-0448/PSIC), and the Committee for Business, Research, and Science of the Regional Government of Valencia, research groups and networks of excellence (ACOMP/2010/250; PROMETEO/2011/048; ISIC/2013/001).

Capítulo 1

Introducción

En las últimas décadas se ha producido un incremento alarmante de la prevalencia del Trastorno del Espectro Autista (TEA) (Elsabbagh et al., 2012), caracterizado por dificultades en la socialización, la comunicación y un patrón de intereses y conductas restringidos y repetitivos (American Psychiatric Association, 2013). La especificidad de la sintomatología característica del TEA y los problemas de conducta que conllevan se asocian generalmente a diversos grados de discapacidad. Ello hace imprescindible que las personas con TEA dispongan de cuidadores y/o cuidadoras que puedan atender sus demandas y necesidades (Ruiz-Robledillo y Moya-Albiol, 2012). Debido a la manifestación temprana de los síntomas del TEA, el papel de los/las cuidadores/as es generalmente asumido por miembros de la familia nuclear, en la mayoría de los casos, por las madres y los padres (Davis y Carter, 2008; Hastings, 2003; Rivard, Terroux, Parent-Boursier y Mercier, 2014; Ruiz-Robledillo, Antón-Torres, González-Bono y Moya-Albiol, 2012; Schieve, Blumberg, Rice, Visser y Boyle, 2007). Cuidar de una persona diagnosticada de TEA implica hacer frente a una serie de desafíos relacionados, directa o indirectamente, con el rol de cuidador/a (Ruiz-Robledillo et al., 2012). Este hecho supone estar sometido a un estrés de tipo crónico, lo que puede conllevar graves consecuencias para la salud del/a cuidador/a (De Andrés-García, Moya-Albiol y González-Bono, 2012; Lovell, Moss y Wetherell, 2012; Ruiz-Robledillo et al, 2012). De hecho, en comparación con la población general, los/las cuidadores/as informales de personas con TEA muestran más síntomas somáticos, depresión y ansiedad y una peor calidad de vida (Allik, Larsson y Smedje, 2006; De Andrés-García et al., 2012.; Ruiz-Robledillo et al., 2012; Singer y Floyd, 2006).

La exposición a estrés crónico ha estado clásicamente asociada a graves consecuencias negativas para la salud en diversas poblaciones, entre las que se encuentran personas con síndrome de burnout, diagnosticadas de estrés post-traumático, que han sido víctimas de violencia de género y cuidadores/as informales (Blasco-Ros, Sánchez-Lorente y Martínez, M., 2010; De Andrés García et al., 2012; Mingote, Moreno y Gálvez, 2004; Sánchez-Lorente, Blasco-Ros y Martínez, 2012; Schnurr y Jankowski, 1999). Este deterioro de la salud puede deberse a la alteración en el funcionamiento de diversos sistemas fisiológicos relacionados con la respuesta de estrés, siendo el eje Hipotálamo-Hipofiso-Adrenal (HHA) y el Sistema Nervioso Autónomo (SNA) dos de los sistemas más importantes (Juster, McEwen y Lupien, 2010).

El funcionamiento del eje HHA se ha estudiado fundamentalmente mediante la medición de los niveles de cortisol, una hormona estrechamente relacionada con la respuesta al estrés y responsable de diversos cambios biológicos característicos de ésta (Dedovic, Duchesne, Andrews, Engert y Pruessner, 2009; Hellhammer, Wüst y Kudielka, 2009). El cortisol es un glucocorticoide secretado por las glándulas suprarrenales con un ritmo circadiano de secreción específico, alcanzando los niveles máximos a los 30 minutos después de despertar (Clow, Hucklebridge, Stalder, Evans y Thorn, 2010). Este rápido aumento, llamado Respuesta Matutina de Cortisol (CAR, en sus siglas en inglés), ha demostrado ser uno de los marcadores más fiables del funcionamiento del eje HHA (Chida y Steptoe, 2009). El propósito de esta respuesta adaptativa se fundamenta en la producción de cambios fisiológicos con el objetivo de preparar al individuo para hacer frente a los desafíos del día, manteniendo la homeostasis del organismo (Fries, Dettenborn y Kirschbaum, 2009).

Los estudios que han analizado la CAR han hallado que esta respuesta se ve modulada por diversos factores demográficos, fisiológicos y del estilo de vida, tales como la edad, el género, la fase del ciclo menstrual, y el tabaquismo, así como también diversos factores psicológicos y psicosociales (Chida y Steptoe, 2009; Fries et al., 2009). Además, la CAR se ha utilizado en estudios previos como un marcador fiable del estado de salud en varias poblaciones, incluyendo muestras de personas sometidas a altos niveles de estrés crónico (Chida y Steptoe, 2009; Fries et al., 2009). En cuidadores/as informales, los resultados relativos a la CAR han sido heterogéneos. Al comparar con personas que no imparten cuidados, algunos estudios han encontrado mayor CAR (Wahbeh, Kishiyama, Zajdel y Oken, 2008), otros menor (Bella, García y Spadari-Bratfisch, 2011; Seltzer et al., 2010) y, finalmente, otras investigaciones no han hallado diferencias (Lovell, Moss y Wetherell, 2012a). Estas discrepancias podrían deberse a diversos factores que no han sido analizados, incluyendo diferencias en el diagnóstico de los receptores de los cuidados, otros factores contextuales o diversos rasgos psicológicos de los/las cuidadores/as. En el caso específico de los/las cuidadores/as de personas con TEA, un estudio encontró una CAR reducida (Seltzer et al., 2010), mientras que en otro no se hallaron diferencias significativas respecto al grupo control (Lovell et al., 2012a). Sin embargo, estas investigaciones consideraron el espectro del autismo completo, sin tener en cuenta la gravedad de la sintomatología autista del receptor de los cuidados.

El otro sistema fisiológico que desempeña un rol fundamental en la respuesta al estrés es el SNA. Los marcadores utilizados en mayor medida en este contexto han sido fundamentalmente las actividades electrodérmica (AED) y cardiovascular. Su evaluación ha demostrado ser útil para entender la alteración del funcionamiento del SNA en poblaciones crónicamente estresadas (Boucsein, 2012; Thayer, Ahs, Fredrikson, Sollers, y Wager, 2012). En cuidadores/as informales, escasos estudios han evaluado el funcionamiento del SNA en laboratorio o en situaciones naturales (Gallagher y Whiteley, 2012; Gonçalves y Graça, 2011; González-Bono, De Andrés-García, Romero-Martínez y Moya-Albiol, 2013; Soares, 2009). En este sentido, se ha descrito una mayor respuesta electrodérmica al estrés agudo en cuidadores/as de personas con cáncer que en personas que no imparten cuidados (Gonçalves y Graça, 2011). En otro estudio, no se hallaron diferencias entre cuidadores/as de personas con adicción a las drogas y no cuidadores/as (Soares, 2009). Es plausible argumentar que, tal y como ocurre en otros marcadores biológicos de salud, la inconsistencia en los resultados podría deberse a los diferentes diagnósticos de la persona que recibe los cuidados, así como al tiempo transcurrido desde la recepción del diagnóstico y la gravedad del mismo. En cualquier caso, no se han realizado investigaciones que analicen la respuesta electrodérmica al estrés agudo en laboratorio en muestras de cuidadores/as de personas con TEA.

Factores protectores y de riesgo para la salud

Gran parte de las investigaciones llevadas a cabo en este ámbito han identificado diversos factores de riesgo que pueden contribuir al deterioro de la salud que se produce en cuidadores/as informales de personas con TEA. Entre ellos, los factores psicosociales y aquellos relacionados con la persona que recibe los cuidados son los que han recibido mayor atención (Boyd, 2002; Davis y Carter, 2008; Lai y Oei, 2014; Lecavalier, Leone y Wiltz, 2006). Un afrontamiento desadaptativo y un menor apoyo social conllevan efectos negativos para la salud en esta población (Boyd, 2002; Lai y Oei, 2014; Lovell, Moss y Wetherell, 2012b), al igual que una mayor severidad de la sintomatología autista y una alta frecuencia de problemas de conducta de la persona con TEA (Huang et al., 2014; Lecavalier et al., 2006; Lovell, Moss y Wetherell, 2015; Ruiz-Robledillo et al., 2012). Sin embargo, escasos estudios se han focalizado en analizar los factores de protección para la salud y, hasta el momento, ninguno de ellos se ha centrado en el contexto de cuidado de personas con TEA. Junto a ello, hacer constar que en ningún caso se han empleado marcadores biológicos en la evaluación de los factores protectores para la salud en este colectivo.

Recientemente se ha resaltado la resiliencia como factor protector de la salud en poblaciones crónicamente estresadas (Rutten et al., 2013). A pesar de la falta de consenso sobre su definición, la resiliencia se relaciona con un afrontamiento efectivo del estrés que permite evitar sus consecuencias perniciosas, es más, permite obtener resultados positivos de las situaciones estresantes (Bayat, 2007). Es por ello que ha sido asociada a una visión positiva de las situaciones estresantes, a una adaptación exitosa a tales situaciones y a efectos protectores contra el deterioro de la salud de los/las cuidadores/as informales (Bayat, 2007; Fernández-Lansac y Crespo, 2011). De este modo, un estudio reciente describió una asociación positiva entre la resiliencia y un funcionamiento psicológico adaptativo en cuidadores/as informales de personas con demencia (Fernández-Lansac, Crespo, Cáceres y Rodríguez-Poyo, 2012). En el caso de los TEA, se ha demostrado que altos niveles de resiliencia proporcionan a los/las cuidadores/as habilidades de afrontamiento eficaces para la gestión de las situaciones estresantes, sufriendo por tanto, menos consecuencias negativas para la salud (Bekhet, Johnson, y Zauszniewski, 2012). Sin embargo, no hay estudios previos que hayan evaluado los efectos de la resiliencia sobre el estado de salud en este colectivo empleando tanto marcadores auto-informados como biológicos de salud.

Otro posible factor protector de la salud es la inteligencia emocional (IE), cuyo análisis resulta fundamental debido al marcado afecto negativo que caracteriza a la población objeto de estudio, que además conlleva consecuencias negativas para la salud (De Andrés-García et al., 2012; Singer y Floyd, 2006). La IE es generalmente definida como la capacidad de identificar y gestionar los estados emocionales negativos, además de incrementar los positivos (Salovey, Mayer, Goldman, Turvey, y Palfai, 1995). Se puede describir en términos de tres factores: atención o tendencia a prestar atención y pensar en las emociones y sentimientos; claridad o capacidad de entender los propios estados emocionales; y reparación o capacidad de regular las emociones, reduciendo las negativas y/o prolongando las positivas (Fernández-Berrocal, Extremera y Ramos, 2004). Aunque la IE ha demostrado tener un efecto protector contra el deterioro de la salud en varias muestras (Schutte, Malouff, Thorsteinsson, Bhullar, y Rooke, 2007), no todos los componentes de la IE parecen tener la misma relación con los resultados de salud. En particular, la atención se ha asociado con una peor salud, en contraste con la claridad y la reparación, que se han relacionado con resultados positivos (Ciarrochi, Deane y Anderson, 2002; Extremera y Fernández-Berrocal, 2006; Extremera y Fernández-Berrocal, 2002). Pese a ello, hasta la actualidad no se han llevado a cabo estudios con el objetivo de evaluar la influencia de la IE en el contexto del cuidado, a pesar de ser una variable que está estrechamente relacionada con la regulación emocional.

En cuanto a las variables contextuales, el apoyo institucional orientado tanto a los/las cuidadores/as como a las personas dependientes ha demostrado ser un factor de protección de la salud en cuidadores/as de personas con esquizofrenia (González-Bono et al, 2013; González-Bono, De Andrés García y Moya-Albiol, 2011). En estos estudios, aquellos/as cuidadores/as sin apoyo institucional mostraron una menor frecuencia cardíaca en respuesta al estrés inducido en laboratorio y una CAR amortiguada en comparación con los/las que recibieron apoyo institucional. Por otra parte, los receptores de los cuidados tenían mayores niveles de autonomía y menor gravedad de la sintomatología en el grupo con apoyo institucional (González-Bono et al, 2013; González-Bono et al, 2011). Sin embargo, el efecto de esta variable no ha sido contemplado hasta el momento en el contexto de cuidado de personas con TEA.

Intervenciones psicoterapéuticas con cuidadores/as informales

A pesar de que el deterioro de la salud ha sido ampliamente demostrado en cuidadores/as de personas con TEA, escasas investigaciones han analizado los efectos de diversas intervenciones psicoterapéuticas enfocadas a mejorar el estado de salud en esta población. Algunos estudios han evaluado los efectos indirectos de las intervenciones dirigidas a la reducción de los problemas de conducta y la sintomatología autista de los receptores de los cuidados sobre el estado de salud de sus cuidadores/as. Se ha concluido que este tipo de intervenciones tiene efectos positivos en la mayoría de los casos, fundamentalmente en la reducción de los niveles de estrés (Drew et al., 2002; Salt et al., 2002; Smith, Groen y Wynn, 2000; Tonge et al., 2006). Sin embargo, existe relativamente poca investigación sobre los efectos de las intervenciones centradas en la enseñanza de técnicas de manejo del estrés dirigidas a la mejora del estado de salud en cuidadores/as. En un meta-análisis sobre intervenciones grupales en cuidadores/as informales de personas con trastornos del desarrollo se indica que las intervenciones basadas en una orientación cognitivo-conductual son eficaces para reducir la percepción de estrés y la disfunción psicológica (Singer, Ethridge y Aldana, 2007). Sin embargo, estos estudios no tuvieron en cuenta la eficacia de programas de intervención desarrollados o adaptados para un contexto de cuidado específico, además de que no evaluaron más de una variable de salud.

En cuanto a nuevos enfoques terapéuticos, como la terapia basada en Mindfulness, diversas investigaciones han descrito resultados positivos para la salud en cuidadores/as familiares de personas con TEA (Ferraioli y Harris, 2013; Singh et al., 2007; Singh et al, 2006). En concreto, un estudio demostró un efecto positivo en los niveles de estrés después de una intervención de Mindfulness orientada a la enseñanza de diversas habilidades para interactuar con sus hijos a cuatro padres de personas con TEA (Singh et al., 2007). Otro estudio más reciente también ha mostrado resultados positivos en la implementación de un programa de reducción de estrés basado en Mindfulness en esta población, reduciendo los niveles de estrés, depresión y ansiedad (Dykens, Fisher, Taylor, Lambert y Miodrag, 2014). Sin embargo, no se emplearon marcadores biológicos de salud en ninguno de estos estudios.

Considerando todo lo expuesto hasta el momento, los principales objetivos e hipótesis de la presente Tesis Doctoral son los siguientes:

1. *Caracterizar el estado de salud de una muestra de cuidadores/as familiares de personas con síndrome de Asperger (SA)*[3] *a través de medidas de salud auto-informadas y la CAR en comparación con un grupo de no cuidadores/as. Además, se pretende identificar las variables relacionadas con la persona receptora de los cuidados y las variables psicosociales y psicológicas rasgo de los/las cuidadores/as que sean predictores del estado de salud de éstos.* Se ha hipotetizado que los/as cuidadores/as que están al cuidado de una persona con SA consumirán más fármacos y tendrán una peor percepción de salud que el grupo control de no cuidadores/as (Allik et

---

[3] Tener en cuenta que esta investigación fue diseñada, y los receptores de los cuidados involucrados fueron diagnosticados antes de la publicación de la quinta edición del Manual Diagnóstico y Estadístico de los Trastornos Mentales [DSM-5], pero la mayoría, si no todos, probablemente se le asignaría un diagnóstico de TEA bajo los nuevos criterios del DSM.

al., 2006). Además, también se espera que muestren una menor CAR que el grupo control (Bella et al., 2011; González-Bono et al., 2011), aunque, como se ha indicado anteriormente, los resultados a este respecto no son concluyentes (Lovell et al., 2012a; Wahbeh et al., 2008). Junto a ello, se espera encontrar que un menor apoyo social, un mayor uso de un afrontamiento desadaptativo, un marcado afecto negativo junto a una gran percepción de sobrecarga estarán asociados con una peor salud (Hastings et al., 2005; Khanna et al., 2011). Por último, se ha planteado la hipótesis de que los/las cuidadores/as con mayores niveles de resiliencia e IE mostrarán menos síntomas.

2. *Investigar la asociación entre la resiliencia y diversos marcadores de salud (tanto auto-informados como la CAR) en cuidadores/as familiares de personas con TEA. El objetivo secundario fue identificar posibles asociaciones entre la resiliencia, la salud y el apoyo social en esta población.* Se ha hipotetizado que aquellos/as cuidadores/as altamente resilientes mostrarán una mejor percepción de salud general y niveles de cortisol matutino inferiores (Cicchetti y Rogosch, 2007; Fernández-Lansac et al., 2012). Aunque no hay estudios anteriores que hayan analizado el papel mediador del apoyo social en la asociación entre la resiliencia y la salud, se espera que éste pueda mediar dicha asociación.

3. *Investigar la relación entre los componentes de la IE (atención, claridad y reparación) y diversos marcadores de salud (tanto salud auto-informada como CAR) en cuidadores/as familiares de personas con TEA. El objetivo secundario fue evaluar si la CAR es un mediador entre la IE y la percepción de salud.* En general, se espera que la percepción de salud se asocie negativamente con la atención y positivamente con la claridad y la reparación (Ciarrochi et al., 2002; Extremera y Fernández-Berrocal, 2006). Aunque no existen resultados concluyentes a este respecto en cuidadores/as, se ha planteado la hipótesis de que una respuesta alterada del eje HHA mediará la relación entre la IE y la salud, como se sugiere en un estudio previo llevado a cabo con estudiantes (Mikolajczak, Roy, Luminet, Fillée y Timary, 2007).

4. *Contrastar los problemas de salud en cuidadores/as de personas con autismo de alto funcionamiento (AAF)*[4] *que estaban y no estaban recibiendo apoyo institucional, y un grupo de no cuidadores/as, a través de la evaluación de la salud auto-informada y la*

---

[4] Como se ha señalado en relación al objetivo 1, esta investigación fue diseñada y los beneficiarios de los cuidados involucrados fueron diagnosticados antes de la publicación del DSM-5, pero la mayoría, si no todos, probablemente se le asignaría un diagnóstico de TEA bajo los nuevos criterios.

CAR. El objetivo secundario fue explorar variables que podrían modular la eficacia del apoyo institucional en la protección de la salud de los/las cuidadores/as, como la sobrecarga y el estado funcional de la persona receptora de los cuidados (nivel de autonomía y severidad de la sintomatología autista). Se ha hipotetizado que los/las cuidadores/as sin apoyo institucional presentarán más síntomas somáticos y una CAR alterada en comparación con aquellos/as con apoyo y con los/las no cuidadores/as (Allik et al., 2006; Tonge et al., 2006). Además, se espera que el grupo sin apoyo muestre mayores niveles de sobrecarga que los que reciben apoyo institucional (Salt et al., 2002). Asimismo, es probable que los receptores de los cuidados de los/las cuidadores/as sin apoyo muestren sintomatología autista más severa y mayores niveles de dependencia que los receptores de los cuidados de aquellos/as con apoyo. Por último, se ha planteado la hipótesis de que una mayor autonomía y síntomas menos severos en los receptores de los cuidados junto a menores niveles de sobrecarga de los/las cuidadores/as se asociarán a una mayor CAR (Seltzer et al., 2010).

5. *Comparar la respuesta de estrés a un estresor cognitivo de laboratorio en cuidadores/as informales de personas con TEA y no cuidadores/as a través del análisis de la AED. Los objetivos secundarios fueron comparar la salud auto-informada y el afecto negativo entre ambos grupos, y analizar la asociación entre la respuesta electrodérmica, y la salud auto-informada y las respuestas psicológicas al estrés.* A pesar de la falta de pruebas concluyentes de los estudios previos, se ha hipotetizado que los/las cuidadores/as mostrarán una menor respuesta electrodérmica y mayores respuestas psicológicas que los no cuidadores/as, debido a los altos niveles de afecto negativo en los/las primeros/as (Miquel, Fuentes, García-Merita y Rojo, 1999; Naveteur, Buisine y Gruzelier, 2005; Patrick 2008). En función de las investigaciones previas, se ha planteado la hipótesis de que las puntuaciones más altas en ansiedad, ira y estado de ánimo negativo se relacionarán con una menor AED en ambos grupos (Carrillo et al. 2001). Además, se espera que la frecuencia de síntomas somáticos sea mayor en los participantes con mayor respuesta electrodérmica (Papousek, Schulter y Premsberger, 2002).

6. *Analizar los efectos de un programa basado en Mindfulness en el estado de ánimo y el estado de salud a través de la utilización de medidas de auto-informe y marcadores biológicos de estrés y salud (niveles de cortisol vespertino y la CAR), en un muestra de padres y madres de personas con TEA (cuidadores/as) y padres y madres de personas*

con un desarrollo típico (no cuidadores/as). El objetivo secundario fue analizar la eficacia del programa para mejorar la salud y el estado de ánimo negativo en cada grupo, comparando su impacto entre ambos. Se ha hipotetizado que habrá una mejora del estado de ánimo en toda la muestra (menor ansiedad, estado de ánimo negativo, y sentimientos de ira) (Lykins y Baer 2009), así como niveles de cortisol vespertino más bajos (Lengacher et al. 2012), después de cada una de las sesiones evaluadas. Además, se espera una mejora en el estado de salud después del programa de intervención, además de una normalización de los niveles de cortisol matutinos (Branstrom, Kvillemo y Åkerstedt, 2013). Por último, se ha planteado la hipótesis de que estas mejoras en la salud y el estado de ánimo serán más pronunciadas en los/las cuidadores/as que en los no cuidadores/as después del programa, debido a los altos niveles de estrés a los que están sometidos de forma crónica los primeros. Esta hipótesis está en línea con los resultados de investigaciones previas en las que este tipo de programa se ha utilizado también en cuidadores/as (Lengacher et al 2012; Minor, Carlson, Mackenzie, Zernicke y Jones, 2006).

7. *Evaluar la eficacia de un programa cognitivo-conductual en la reducción de la sobrecarga, los síntomas somáticos y la depresión, y en la mejora del estado de ánimo de cuidadores/as informales de personas con TEA.* Se ha hipotetizado que los/las cuidadores/as mostrarán un menor nivel de sobrecarga inmediatamente después de la intervención y menor sintomatología somática y depresiva después de la intervención y al mes de seguimiento (Bristol, Gallagher y Holt, 1993; Hastings y Beck, 2008; Salt et al, 2002). Además, se espera una reducción significativa en el estado de ánimo negativo a lo largo de todo el programa de intervención.

Referencias

Allik, H., Larsson, J.O., & Smedje, H. (2006). Health-related quality of life in parents of school-age children with Asperger syndrome or high-functioning autism. *Health and quality of life outcomes, 4* (1), 1-8.

American Psychiatric Association. (2013). Diagnostic and statistical manual of mental disorders (5th ed.). Washington, DC.

Bayat, M. (2007). Evidence of resilience in families of children with autism. *Journal of Intellectual Disability Research, 51* (9), 702-714.

Bekhet, A.K., Johnson, N.L., & Zauszniewski, J.A. (2012). Resilience in family members of persons with autism spectrum disorder: A review of the literature. *Issues in Mental Health Nursing, 33* (10), 650-656.

Bella, G.P., García, M.C., & Spadari-Bratfisch, R.C. (2011). Salivary cortisol, stress, and health in primary caregivers (mothers) of children with cerebral palsy. *Psychoneuroendocrinology, 36* (6), 834-842.

Blasco-Ros, C., Sánchez-Lorente, S., & Martínez, M. (2010). Recovery from depressive symptoms, state anxiety and post-traumatic stress disorder in women exposed to physical and psychological, but not to psychological intimate partner violence alone: a longitudinal study. *BMC Psychiatry, 10* (1), 98.

Boucsein, W. (2012). Electrodermal activity. Springer.

Boyd, B.A. (2002). Examining the relationship between stress and lack of social support in mothers of children with autism. *Focus on Autism and Other Developmental Disabilities, 17* (4), 208-215.

Bränström, R., Kvillemo, P., & Akerstedt, T. (2013). Effects of mindfulness training on levels of cortisol in cancer patients. *Psychosomatics, 54* (2), 158–164.

Bristol, M.M., Gallagher, J.J. & Holt, K.D. (1993). Maternal depressive symptoms in autism: Response to psychoeducational intervention. *Rehabilitation Psychology, 38* (1), 3–10.

Carrillo, E., Moya-Albiol, L., González-Bono, E., Salvador, A., Ricarte, J., & Gómez-Amor, J. (2001). Gender differences in cardiovascular and electrodermal responses to public speaking task: the role of anxiety and mood states. *International Journal of Psychophysiology, 42* (3), 253–264.

Chida, Y., & Steptoe, A. (2009). Cortisol awakening response and psychosocial factors: a systematic review and meta-analysis. *Biological Psychology, 80* (3), 265-278.

Ciarrochi, J., Deane, F.P., & Anderson, S. (2002). Emotional intelligence moderates the relationship between stress and mental health. *Personality and Individual Differences, 32* (2), 197-209.

Cicchetti, D., & Rogosch, F.A. (2007). Personality, adrenal steroid hormones, and resilience in maltreated children: A multilevel perspective. *Development and Psychopathology, 19* (3), 787–809.

Clow, A., Hucklebridge, F., Stalder, T., Evans, P., & Thorn, L. (2010). The cortisol awakening response: more than a measure of HPA axis function. *Neuroscience & Biobehavioral Reviews, 35* (1), 97-103.

Davis, N.O., & Carter, A.S. (2008). Parenting stress in mothers and fathers of toddlers with autism spectrum disorders: Associations with child characteristics. *Journal of Autism and Developmental Disorders, 38* (7), 1278-1291.

De Andrés-García, S., Moya-Albiol, L., & González-Bono, E. (2012). Salivary cortisol and immunoglobulin A: responses to stress as predictors of health complaints reported by caregivers of offspring with autistic spectrum disorder. *Hormones and Behavior, 62* (4), 464-474.

Dedovic, K., Duchesne, A., Andrews, J., Engert, V., & Pruessner, J.C. (2009). The brain and the stress axis: the neural correlates of cortisol regulation in response to stress. *Neuroimage, 47* (3), 864-871.

Drew, A., Baird, G., Baron-Cohen, S., Cox, A., Slonims, V., Wheelwright, S., ... & Charman, T. (2002). A pilot randomised control trial of a parent training intervention for pre-school children with autism. *European Child & Adolescent Psychiatry, 11* (6), 266-272.

Dykens, E.M., Fisher, M.H., Taylor, J.L., Lambert, W., & Miodrag, N. (2014). Reducing distress in mothers of children with autism and other disabilities: a randomized trial. *Pediatrics, 134* (2), 454-463.

Elsabbagh, M., Divan, G., Koh, Y.J., Kim, Y.S., Kauchali, S., Marcín, C., ... & Fombonne, E. (2012). Global prevalence of autism and other pervasive developmental disorders. *Autism Research, 5* (3), 160-179.

Extremera, N., & Fernandez-Berrocal, P. (2002). Relation of perceived emotional intelligence and health-related quality of life of middle-aged women. *Psychological Reports, 91* (1), 47-59.

Extremera, N., & Fernández-Berrocal, P. (2006). Emotional intelligence as predictor of mental, social, and physical health in university students. *The Spanish Journal of Psychology, 9* (1), 45-51.

Fernández-Berrocal, P., Extremera, N., & Ramos, N. (2004). Validity and reliability of the Spanish modified version of the Trait Meta-Mood Scale. *Psychological Reports, 94* (3), 751-755.

Fernández-Lansac, V., & Crespo, M. (2011). Resiliencia, Personalidad Resistente y Crecimiento en Cuidadores de Personas con Demencia en el Entorno Familiar: Una Revisión. *Clínica y Salud, 22* (1), 21-40.

Fernández-Lansac, V., Crespo López, M., Cáceres, R., & Rodríguez-Poyo, M. (2012). Resiliencia en cuidadores de personas con demencia: estudio preliminar. *Revista Española de Geriatría y Gerontología, 47* (3), 102-109.

Ferraioli, S.J., & Harris, S.L. (2013). Comparative effects of mindfulness and skills-based parent training programs for parents of children with autism: Feasibility and preliminary outcome data. *Mindfulness, 4* (2), 89-101.

Fries, E., Dettenborn, L., & Kirschbaum, C. (2009). The cortisol awakening response (CAR): facts and future directions. *International Journal of Psychophysiology, 72* (1), 67-73.

Gallagher, S., & Whiteley, J. (2012). Social support is associated with blood pressure responses in parents caring for children with developmental disabilities. *Research in Developmental Disabilities, 33* (6), 2099-2105.

Gonçalves, T., & Graça, M. (2011). Variables fisiológicas y sobrecarga familiar en hijos de enfermos oncológicos. *Revista Argentina de Clínica Psicológica, 20* (3), 255–263.

González-Bono, E., De Andrés-García, S., & Moya-Albiol, L. (2011). The cortisol awakening response in caregivers of schizophrenic offspring shows sensitivity to patient status. *Anxiety, Stress, & Coping, 24* (1), 107-120.

González-Bono, E., de Andrés-García, S., Romero-Martínez, Á., & Moya-Albiol, L. (2013). Cardiovascular Response to Psychosocial Repeated Stress in Caregivers of Offspring with Schizophrenia. *The Spanish journal of Psychology, 16*.

Hastings, R.P. (2003). Child behaviour problems and partner mental health as correlates of stress in mothers and fathers of children with autism. *Journal of Intellectual Disability Research, 47* (4-5), 231-237.

Hastings, R.P., Kovshoff, H., Brown, T., Ward, N.J., Degli Espinosa, F., & Remington, B. (2005). Coping strategies in mothers and fathers of preschool and school-age children with autism. *Autism, 9* (4), 377-391.

Hastings, R., & Beck, A. (2008). Practitioner Review: Stress intervention for parents of children with intellectual disabilities. *Journal of Child Psychology and Psychiatry, 45* (8), 1338-1349.

Hellhammer, D.H., Wüst, S., & Kudielka, B.M. (2009). Salivary cortisol as a biomarker in stress research. *Psychoneuroendocrinology, 34* (2), 163-171.

Huang, C.Y., Yen, H.C., Tseng, M.H., Tung, L.C., Chen, Y.D., & Chen, K.L. (2014). Impacts of Autistic Behaviors, Emotional and Behavioral Problems on Parenting Stress in Caregivers of Children with Autism. *Journal of Autism and Developmental Disorders, 44* (6), 1383-1390.

Juster, R.P., McEwen, B.S., & Lupien, S.J. (2010). Allostatic load biomarkers of chronic stress and impact on health and cognition. *Neuroscience & Biobehavioral Reviews, 35* (1), 2-16.

Khanna, R., Madhavan, S.S., Smith, M.J., Patrick, J.H., Tworek, C., & Becker-Cottrill, B. (2011). Assessment of health-related quality of life among primary caregivers of children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 41* (9), 1214-1227.

Lai, W.W., & Oei, T.P.S. (2014). Coping in Parents and Caregivers of Children with Autism Spectrum Disorders (ASD): a Review. *Review Journal of Autism and Developmental Disorders,* 1-18.

Lecavalier, L., Leone, S., & Wiltz, J. (2006). The impact of behaviour problems on caregiver stress in young people with autism spectrum disorders. *Journal of Intellectual Disability Research, 50* (3), 172-183.

Lengacher, C.A., Kip, K.E., Barta, M., Post-White, J., Jacobsen, P.B., Groer, M., ... & Shelton, M.M. (2012). A pilot study evaluating the effect of mindfulness-based stress reduction on psychological status, physical status, salivary cortisol, and interleukin-6 among advanced-stage cancer patients and their caregivers. *Journal of Holistic Nursing, 30* (3), 170-185.

Lovell, B., Moss, M., & Wetherell, M. (2012a). The psychosocial, endocrine and immune consequences of caring for a child with autism or ADHD. *Psychoneuroendocrinology, 37* (4), 534-542.

Lovell, B., Moss, M., & Wetherell, M. A. (2012b). With a little help from my friends: Psychological, endocrine and health corollaries of social support in parental caregivers of children with autism or ADHD. *Research in Developmental Disabilities, 33* (2), 682-687.

Lovell, B., Moss, M., & Wetherell, M. (2015). The psychophysiological and health corollaries of child problem behaviours in caregivers of children with autism and ADHD. *Journal of Intellectual Disability Research, 59* (2), 150-157.

Lykins, E. L. B., & Baer, R. A. (2009). Psychological functioning in a sample of long-term practitioners of mindfulness meditation. *Journal of Cognitive Psychotherapy, 23* (3), 226–241.

Mikolajczak, M., Roy, E., Luminet, O., Fillée, C., & de Timary, P. (2007). The moderating impact of emotional intelligence on free cortisol responses to stress. *Psychoneuroendocrinology, 32* (8), 1000-1012.

Mingote, J., Moreno, B., & Gálvez, M. (2004). Desgaste profesional y salud de los profesionales médicos: revisión y propuestas de prevención. *Medicina clínica, 123* (7), 265-270.

Minor, H.G., Carlson, L.E., Mackenzie, M.J., Zernicke, K., & Jones, L. (2006). Evaluation of a mindfulness-based stress reduction (MBSR) program for caregivers of children with chronic conditions. *Social Work in Health Care, 43* (1), 91-109.

Miquel, M., Fuentes, I., García-Merita, M., & Rojo, L. (1999). Habituation and sensitization processes in depressive disorders. *Psychopathology, 32* (1), 35–42.

Naveteur, J., Buisine, S., & Gruzelier, J. H. (2005). The influence of anxiety on electrodermal responses to distractors. *International Journal of Psychophysiology, 56* (3), 261–269.

Papousek, I., Schulter, G., & Premsberger, E. (2002). Dissociated autonomic regulation during stress and physical complaints. *Journal of Psychosomatic Research, 52* (4), 257–266.

Patrick, C.J. (2008). Psychophysiological correlates of aggression and violence: An integrative review. *Transactions of the Royal Society B, 363* (1503), 2543–2555.

Rivard, M., Terroux, A., Parent-Boursier, C., & Mercier, C. (2014). Determinants of Stress in parents of children with autism spectrum disorders. *Journal of Autism and Developmental Disorders, 44* (7), 1609-1620.

Ruiz-Robledillo, N., & Moya-Albiol, L. (2012). El cuidado informal: una visión actual. *Revista de Motivación y Emoción, 1,* 22-30.

Ruiz-Robledillo, N., Antón-Torres, P., González-Bono, E. & Moya-Albiol, L. (2012). Consecuencias del cuidado de personas con Trastorno del Espectro Autista sobre la salud de los cuidadores: estado actual de la cuestión. *Revista Electrónica de Psicología Iztacala, 15* (4), 1571-1590.

Rutten, B.P.F., Hammels, C., Geschwind, N., Menne-Lothmann, C., Pishva, E., Schruers, K., ... & Wichers, M. (2013). Resilience in mental health: linking psychological and neurobiological perspectives. *Acta Psychiatrica Scandinavica, 128* (1), 3-20.

Salovey, P., Mayer, J.D., Goldman, S.L., Turvey, C., & Palfai, T.P. (1995). Emotional attention, clarity, and repair: Exploring emotional intelligence using the Trait Meta-Mood Scale. In J. W. Pennebaker (Ed.), Emotion, Disclosure, & Health. Washington: American Psychological Association. Pp. 125-151.

Salt, J., Shemilt, J., Sellars, V., Boyd, S., Coulson, T., & Mc Cool, S. (2002). The Scottish Centre for autism preschool treatment programme II: the results of a controlled treatment outcome study. *Autism, 6* (1), 33-46.

Sánchez-Lorente, S., Blasco-Ros, C., & Martínez, M. (2012). Factors that contribute or impede the physical health recovery of women exposed to intimate partner violence: a longitudinal study. *Women's Health Issues, 22* (5), e491-e500.

Schieve, L.A., Blumberg, S.J., Rice, C., Visser, S.N., & Boyle, C. (2007). The relationship between autism and parenting stress. *Pediatrics, 119* (Supplement 1), S114-S121.

Schnurr, P.P., & Jankowski, M.K. (1999). Physical health and post-traumatic stress disorder: review and synthesis. *Seminars in Clinical Neuropsychiatry, 4* (4), 295-304.

Schutte, N.S., Malouff, J.M., Thorsteinsson, E.B., Bhullar, N., & Rooke, S.E. (2007). A meta-analytic investigation of the relationship between emotional intelligence and health. *Personality and Individual Differences, 42* (6), 921-933.

Seltzer, M.M., Greenberg, J.S., Hong, J., Smith, L.E., Almeida, D.M., Coe, C., & Stawski, R.S. (2010). Maternal cortisol levels and behavior problems in adolescents and adults with ASD. *Journal of Autism and Developmental Disorders, 40* (4), 457-469.

Singer, G.H., & Floyd, F. (2006). Meta-analysis of comparative studies of depression in mothers of children with and without developmental disabilities. *American Journal on Mental Retardation, 111* (3), 155-169.

Singer, G.H., Ethridge, B.L., & Aldana, S.I. (2007). Primary and secondary effects of parenting and stress management interventions for parents of children with developmental disabilities: A meta-analysis. *Mental Retardation and Developmental Disabilities Research Reviews, 13* (4), 357-369.

Singh, N.N., Lancioni, G.E., Winton, A.S., Fisher, B.C., Wahler, R.G., Mcaleavey, K., ... & Sabaawi, M. (2006). Mindful parenting decreases aggression, noncompliance, and self-injury in children with autism. *Journal of Emotional and Behavioral Disorders, 14* (3), 169-177.

Singh, N.N., Lancioni, G.E., Winton, A.S., Singh, J., Curtis, W.J., Wahler, R.G., & McAleavey, K.M. (2007). Mindful parenting decreases aggression and increases social behavior in children with developmental disabilities. *Behavior Modification, 31* (6), 749-771.

Smith, T., Groen, A.D., & Wynn, J.W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. *American Journal on Mental Retardation, 105* (4), 269-285.

Soares, A.J. (2009). Variáveis Psicossociais e Reactividade Emocional em Cuidadores de Dependentes de Substâncias. Unpublished doctoral dissertation. University of Minho, Minho, Portugal.

Thayer, J.F., Åhs, F., Fredrikson, M., Sollers III, J.J., & Wager, T.D. (2012). A meta-analysis of heart rate variability and neuroimaging studies: implications for heart rate variability as a marker of stress and health. *Neuroscience and Biobehavioral Reviews, 36* (2), 747-756.

Tonge, B., Brereton, A., Kiomall, M., Mackinnon, A., King, N., & Rinehart, N. (2006). Effects on parental mental health of an education and skills training program for parents of young children with autism: A randomized controlled trial. *Journal of the American Academy of Child and Adolescent Psychiatry, 45* (5), 561-569.

Wahbeh, H., Kishiyama, S.S., Zajdel, D., & Oken, B.S. (2008). Salivary cortisol awakening response in mild Alzheimer disease, caregivers, and noncaregivers. *Alzheimer Disease & Associated Disorders, 22* (2), 181-183.

Capítulo 9

Discusión

Los resultados de esta Tesis Doctoral ponen de manifiesto la afectación del estado de salud de los/las cuidadores/as informales de personas con TEA como consecuencia de su rol de cuidador/a, lo que se refleja tanto en los registros autoinformados como en los marcadores biológicos empleados. Tal y como se ha hipotetizado, los/as cuidadores/as presentan mayor número de síntomas somáticos y peor salud general percibida que los/as no cuidadores/as. También tienen un marcado afecto negativo y un mayor consumo de fármacos. Estos resultados se han visto reforzados por la evaluación de la CAR, un marcador biológico fiable, validado y habitualmente utilizado, del estado de salud (Fries, Dettenborn y Kirschbaum, 2009).

En contraste con estudios previos (Lovell, Moss y Wetherell, 2012; Seltzer et al, 2010), los/as cuidadores/as informales de personas con TEA han mostrado una CAR más elevada que los/as no cuidadores/as. Tal y como se ha propuesto, estas diferencias podrían deberse a la anticipación de las demandas de cuidado por parte de los/as cuidadores/as. La hipótesis de la anticipación fue propuesta en una investigación de Schulz, Kirschbaum, Prüßner, y Hellhammer (1998) en relación con personas crónicamente estresadas debido a la sobrecarga de trabajo. En dicha investigación, la CAR fue mayor en aquellos participantes crónicamente estresados en comparación con los no estresados. Una investigación adicional evaluó la CAR de lunes a viernes y los fines de semana en poblaciones similares, replicando estos resultados. En este caso, los autores asociaron una mayor CAR con la anticipación de las demandas diarias (Schlotz, Hellhammer, Schulz y Stone, 2004). Estudios recientes realizados en población general también han demostrado los efectos de la anticipación de los desafíos diarios en la CAR (Wetherell, Lovell y Smith, 2014). Concretamente, se evaluó la CAR en un día normal y en un día en el que los participantes iban a ser sometidos a un estresor de laboratorio, encontrándose que la CAR era más elevada en el día en el que los participantes iban a ser sometidos al estresor en comparación con el día normal. Teniendo en cuenta que los/as cuidadores/as se enfrentan diariamente a las demandas asociadas al cuidado, dicha anticipación puede ser un estado habitual y de carácter crónico. Ello podría explicar, en parte, la elevada CAR de esta población que ha sido obtenida en dos días consecutivos. En este sentido, se ha propuesto que la CAR está estrechamente relacionada con diversos procesos que se producen al despertar, fundamentalmente con la activación de la representación de aspectos concretos de la memoria, como la percepción sobre uno mismo y la orientación en el tiempo y el espacio. De este modo, las estructuras relacionadas con los procesos de memoria, como el hipocampo, influyen directamente en el eje HHA, activando o inhibiendo su actividad (Fries et al., 2009). La anticipación de las próximas demandas diarias estaría vinculada a los procesos de memoria y la asociación entre el hipocampo y el eje HHA podría ser el mecanismo biológico que subyace a la hipótesis de la anticipación. En el contexto del cuidado, la mayor CAR en los/as cuidadores/as de personas con TEA podría ser una consecuencia de su representación de las demandas de cuidado tras el despertar. Como se ha visto anteriormente, estas personas tienen que afrontar diariamente una variedad de retos asociados con el contexto de cuidado, y obviamente, también tienen que hacer frente a otros desafíos relacionados con su vida diaria. En línea con esto, una mayor CAR podría ser un cambio adaptativo a fin de aumentar los recursos fisiológicos para enfrentar estos desafíos diarios. Sin embargo, niveles elevados de cortisol mantenidos en el tiempo de forma crónica podrían desencadenar hipercortisolemia, afectando gravemente el estado de salud (Lindfors y Lundberg, 2002; Schulz et al., 1998). Sin embargo, tal y como se ha constatado, el estrés y las demandas percibidas pueden ser moduladas por diversas variables psicológicas rasgo. En concreto, tanto la resiliencia como la IE han demostrado estar asociadas a la CAR y a las consecuencias del proceso del cuidado sobre la salud.

Al igual que en una investigación previa (Bekhet, Johnson y Zauszniewski, 2012), un afrontamiento resiliente ha resultado ser un factor protector frente a los resultados de salud negativos en este colectivo. Los/as cuidadores/as más resilientes presentaron mejor percepción de salud general y unos niveles de cortisol matutinos más bajos que aquellos menos resilientes. En relación a ello, estudios previos han demostrado que los individuos altamente resilientes tienen una mayor capacidad para hacer frente a situaciones de estrés, reduciendo al mínimo las alteraciones en el funcionamiento del eje HHA (Ozbay et al., 2007). Parece probable que, en comparación con los/as cuidadores/as con menor resiliencia, los altamente resilientes perciban las demandas de cuidado menos estresantes, como consecuencia de sus recursos de afrontamiento más adaptativos. Este hecho podría estar estrechamente relacionado con sus niveles más bajos de cortisol matutino, un mecanismo biológico que puede subyacer al mejor estado de salud de este grupo. Por otra parte, la resiliencia está estrechamente relacionada con el apoyo social, lo que demuestra que las dos variables podrían interactuar para proporcionar protección contra el deterioro de la salud en esta población (Boyd, 2002).

Como en el caso de la resiliencia, la IE también ha mostrado una asociación significativa con la CAR y la percepción de salud en los/as cuidadores/as, diferente en función del componente de la IE considerado. La atención a las emociones se asoció con más síntomas y peor percepción de salud general. Una mayor atención a las emociones podría incrementar procesos de rumiación, algo característico de personalidades con altos niveles de neuroticismo. Ambos constructos han sido clásicamente asociados a consecuencias negativas para la salud (Lahey, 2009; Sansone y Sansone, 2012). Debido a la alta prevalencia de afecto negativo en el contexto del cuidado informal, estar prestando constantemente atención a las propias emociones podría reforzar y magnificar esta emocionalidad negativa. Por el contrario, una alta claridad y reparación emocional podrían permitir a los/as cuidadores/as identificar y gestionar adecuadamente los estados emocionales negativos, con un continuo de adaptación que va desde la adecuada percepción de las emociones, hasta su identificación y posterior regulación. Estas habilidades disminuirían el afecto negativo. En línea con ello, la claridad y la reparación se asociaron con menores niveles de cortisol matutinos en la presente investigación. Teniendo en cuenta que el afecto negativo se ha relacionado con una mayor CAR (Polk, Cohen, Doyle, Skoner y Kirschbaum, 2005), es probable que los/las cuidadores/as con mayores capacidades de claridad y reparación emocional sufran un menor afecto negativo y, por tanto, menores niveles de cortisol matutino. Este patrón también podría explicar la mejor percepción de salud en aquellos con alta claridad y reparación y menor atención a las emociones. Por otra parte, tal y como se propone en el caso de la resiliencia, los/as cuidadores/as con una baja atención y mayor claridad y reparación emocional podrían tener mejores habilidades de regulación emocional para hacer frente de manera adaptativa al estrés asociado a la situación de cuidado, reduciéndose la percepción estresante de las demandas del cuidado. Este hecho también podría explicar la menor CAR en aquellos participantes que presentaron el patrón de EI anteriormente mencionado. Teniendo en cuenta que tanto la resiliencia como la IE son variables protectoras que fomentan un afrontamiento al estrés adaptativo, y en función de los resultados obtenidos, es plausible pensar que aquellos/as cuidadores/as más resilientes y con mayores capacidades de claridad y reparación emocional perciban las demandas del cuidado como menos estresantes. Por tanto, esta percepción puede estar relacionada con una anticipación de las demandas del cuidado más adaptativa, regulando la actividad el eje HHA, manteniendo un funcionamiento óptimo de éste.

Al analizar otros factores contextuales, el apoyo institucional ha mostrado ser un factor protector para la salud en esta población, al igual que se ha descrito en cuidadores/as de personas con esquizofrenia (González-Bono, De Andrés-García, Romero-Martínez y Moya-Albiol, 2013; González-Bono, De Andrés-García y Moya-Albiol, 2012). Los/as cuidadores/as con apoyo institucional exhibieron un mejor estado de salud y una menor sobrecarga que aquellos/as sin apoyo. Por otra parte, los/las que disponían de apoyo institucional mostraron una CAR con valores dentro de la normalidad, a diferencia de los/las que no recibían dicho apoyo, que presentaron una CAR amortiguada. En este sentido, el enfoque de tratamiento multidimensional aplicado demostró una eficacia significativa, tanto en los/as cuidadores/as como en las personas dependientes. Estudios previos han hallado que este tipo de intervención es más eficaz que los tipos individuales de tratamiento aplicados de forma aislada (Singer, Ethridge y Aldana, 2007). Sin embargo, ningún estudio había evaluado nuevos enfoques de tratamiento, como las intervenciones de Mindfulness, que han demostrado ser eficaces para reducir el estrés percibido y el estado de ánimo negativo en cuidadores/as de niños con patologías crónicas, empleando para ello marcadores biológicos (Minor, Carlson, Mackenzie, Zernike y Jones, 2008).

En el presente trabajo, el programa basado en Mindfulness desarrollado ha mostrado una eficacia significativa en la reducción de los síntomas somáticos y la depresión, mejorando al mismo tiempo la percepción de salud general de los/as cuidadores/as. Por otra parte, tal y como se había hipotetizado, presentaron una mejoría en el estado de ánimo tras la intervención en comparación con la línea base. Estos resultados se vieron reforzados por los obtenidos en relación a la respuesta de cortisol durante las sesiones. En concreto, los/as cuidadores/as experimentaron una reducción significativa en los niveles de cortisol en el transcurso de las sesiones, lo que demuestra el efecto positivo sobre el eje HHA de la meditación y los ejercicios realizados durante el programa de intervención. Además, mostraron reducciones más marcadas en los niveles de cortisol, el estado de ánimo negativo y en los problemas de salud que los/as no cuidadores/as. Este hallazgo es especialmente importante ya que afianza la validez de la intervención aplicada para diversas poblaciones crónicamente estresadas. En este sentido, la formación de este colectivo en los principios del Mindfulness, como vivir en el momento presente a través de una aceptación sin prejuicios, podría estar asociado directamente con la mejora del estado de salud (Oken et al., 2010). Teniendo en cuenta que la preocupación por el futuro del receptor de los cuidados, los procesos rumiativos y el afecto negativo podrían ser precursores del estrés y el deterioro de la salud, la enseñanza de nuevas habilidades de afrontamiento para hacer frente a estos factores sería particularmente eficaz en esta población.

Al igual que la intervención de Mindfulness, el programa de intervención cognitivo-conductual adaptado al contexto del cuidado aplicado ha demostrado ser eficaz para reducir los problemas de salud y el estado de ánimo negativo en cuidadores/as de personas con TEA. En esta intervención, las sesiones se orientaron a enseñar habilidades específicas de afrontamiento para hacer frente al estrés derivado de la situación de cuidado. En consecuencia, podría esperarse que fortalecieran su capacidad de resiliencia y regulación emocional, ya que ambas variables han demostrado tener un efecto protector contra el deterioro de la salud en esta población. Aunque la eficacia de la intervención basada en Mindfulness y la basada en una orientación cognitivo-conductual podría ser debida a diferentes mecanismos, ambos programas estaban orientados a proporcionar diversas habilidades de afrontamiento efectivas para hacer frente al estrés de una manera adaptativa. Este enfoque ha resultado ser de gran utilidad para reducir los problemas de salud, aumentando la calidad de vida percibida de los/as cuidadores/as.

En cuanto al funcionamiento del SNA, se llevó a cabo un estudio experimental con la finalidad de evaluar la respuesta electrodérmica a estresores cognitivos agudos en el contexto de laboratorio. Los/as cuidadores/as mostraron una menor respuesta electrodérmica al estrés agudo que los/as no cuidadores/as. Como se ha señalado en otros grupos de individuos crónicamente estresados, un mecanismo de habituación podría explicar estos resultados (Gump y Mathews, 1999). En muestras de niños que han sufrido maltrato o individuos con un historial de pobreza severa, se observó que la respuesta del SNA al estrés agudo estaba amortiguada (Evans y Kim, 2007; Murali y Chen, 2005). El hecho de estar sometido a altos niveles de estrés crónico podría afectar al funcionamiento del SNA, haciendo este sistema hipo-responsivo debido a un mecanismo de habituación (Carroll, Phillips, anillo, Der y Hunt, 2005; Evans y Kim, 2007; Murali y Chen, 2005). En este sentido, los resultados fueron similares cuando se utilizaron marcadores cardiovasculares para analizar la respuesta al estrés agudo en esta población (De Andrés García, Moya-Albiol y González-Bono, 2012). En este estudio, los/as cuidadores/as también mostraron menor respuesta de cortisol al estrés agudo que el grupo control cuando se aplicó el mismo protocolo de estrés, lo que demuestra que también puede existir un mecanismo de habituación en el caso del eje HHA (De Andrés-García et al., 2012). Tomado en conjunto, estos resultados indican que la respuesta adaptativa al estrés puede estar debilitada en los/as cuidadores/as, lo cual podría tener graves consecuencias para su salud a la hora de afrontar diversos factores estresantes diariamente. Explicaciones alternativas se basan en los efectos del estrés crónico en la mejora del afrontamiento adaptativo y la resiliencia para hacer frente al estrés (Gump y Mathews, 1999). Es plausible que los/as cuidadores/as desarrollen estrategias de afrontamiento más adaptativas fruto del afrontamiento constante de estresores diarios, lo cual podría reducir su necesidad de altos recursos fisiológicos para hacer frente al estrés, protegiendo su estado de salud. Esta hipótesis sería coherente con la asociación observada entre la percepción de salud y la respuesta electrodérmica, siendo una respuesta electrodérmica menor protectora del estado de salud.

La principal limitación de esta Tesis Doctoral es que el diseño del estudio es transversal y correlacional, algo característico de los estudios de campo en general y de los llevados a cabo en este tipo de poblaciones en particular, lo que significa que no se puede establecer causalidad en los resultados obtenidos. Por otra parte, el tamaño relativamente pequeño de la muestra en algunos de los estudios pueden limitar la generalización de los resultados. Sin embargo, la situación de los/as cuidadores/as hace que sea extremadamente difícil establecer estudios con muestras más grandes, debido a la falta de tiempo y las obligaciones de esta población. Junto a ello, indicar que al contar con muestras biológicas, el número de participantes es adecuado, debido a la complejidad de la obtención de las mismas y al alto coste económico de su determinación.

Los resultados presentados en esta Tesis Doctoral suponen un avance significativo en el estudio de las consecuencias del cuidado de personas diagnosticadas de TEA para la salud de sus cuidadores/as principales. El enfoque multidimensional en el análisis de la salud de esta población, empleando tanto medidas biológicas como auto-informadas, hace que haya sido posible evaluar su estado de salud de forma integral. Este enfoque incrementa la fiabilidad de los resultados obtenidos y proporciona información relevante acerca de los mecanismos biológicos que podrían subyacer al impacto sobre la salud de cuidar a una persona con TEA. Por otra parte, la identificación de los factores de protección, así como de riesgo, es esencial para guiar el desarrollo de protocolos de evaluación que incluyan dichas variables. Estas evaluaciones podrían proporcionar información esencial para el personal clínico sobre aquellos/as cuidadores/as en mayor riesgo de deterioro grave de la salud. La identificación de grupos de alto riesgo puede hacer posible evitar futuros problemas de salud, aplicando intervenciones psicoterapéuticas. Además, los resultados obtenidos podrían ser de utilidad para informar sobre el desarrollo de este tipo de intervenciones orientadas a reducir los problemas de salud y la percepción de estrés en esta población. Como se ha demostrado, dos tipos de intervención centradas en el manejo del estrés han sido útiles para reducir los problemas de salud, incluyendo técnicas y ejercicios orientados a la mejora de los factores que se han mostrado protectores de la salud y la reducción de los factores de riesgo.

Estudios futuros deben considerar otros marcadores biológicos de salud, y otros rasgos psicológicos de esta población que podrían estar involucrados en el impacto del cuidado sobre la salud. Además, como la falta de tiempo es una característica de los/as cuidadores/as informales, la eficacia de otras modalidades de intervención debe ser analizada, por ejemplo, las orientaciones basadas en las nuevas tecnologías, conocidas como “Telesalud”. Estos enfoques innovadores podrían evitar uno de los principales obstáculos para la adherencia al tratamiento en esta población, ya que se pueden llevar a cabo desde el propio domicilio con la ayuda y guía del profesional a través de Internet. Por otra parte, investigaciones futuras deberían analizar la eficacia diferencial de diversos tipos de tratamientos o su combinación, con el fin de establecer protocolos de intervención eficaces. Finalmente, el análisis del funcionamiento del eje HHA y SNA antes y después de la implementación de las intervenciones psicoterapéuticas podría proporcionar evidencia para reforzar los resultados actuales y arrojar luz sobre la eficacia de los tratamientos en el restablecimiento del funcionamiento correcto de estos sistemas fisiológicos.

Referencias

Bekhet, A.K., Johnson, N.L., & Zauszniewski, J.A. (2012). Resilience in family members of persons with autism spectrum disorder: A review of the literature. *Issues in mental health nursing, 33* (10), 650-656.

Boyd, B.A. (2002). Examining the relationship between stress and lack of social support in mothers of children with autism. *Focus on Autism and Other Developmental Disabilities, 17* (4), 208-215.

Carroll, D., Phillips, A.C., Ring, C., Der, G., & Hunt, K. (2005). Life events and hemodynamic stress reactivity in the middle-aged and elderly. *Psychophysiology, 42* (3), 269-276

De Andrés-García, S., Moya-Albiol, L., & González-Bono, E. (2012). Salivary cortisol and immunoglobulin A: responses to stress as predictors of health complaints reported by caregivers of offspring with autistic spectrum disorder. *Hormones and Behavior, 62* (4), 464-474.

Evans, G.W., & Kim, P. (2007). Childhood poverty and health: cumulative risk exposure and stress dysregulation. *Psychological Science, 18* (11), 953-957.

Fries, E., Dettenborn, L., & Kirschbaum, C. (2009). The cortisol awakening response (CAR): facts and future directions. *International Journal of Psychophysiology, 72* (1), 67-73.

González-Bono, E., De Andrés-García, S., & Moya-Albiol, L. (2011). The cortisol awakening response in caregivers of schizophrenic offspring shows sensitivity to patient status. *Anxiety, Stress, & Coping, 24* (1), 107-120.

González-Bono, E., de Andrés-García, S., Romero-Martínez, Á., & Moya-Albiol, L. (2013). Cardiovascular Response to Psychosocial Repeated Stress in Caregivers of Offspring with Schizophrenia. *The Spanish journal of Psychology, 16.*

Gump, B.B., & Matthews, K.A. (1999). Do background stressors influence reactivity to and recovery from acute stressors? *Journal of Applied Social Psychology, 29* (3), 469–494.

Lahey, B.B. (2009). Public health significance of neuroticism. *American Psychologist, 64* (4), 241-256.

Lindfors, P., & Lundberg, U. (2002). Is low cortisol release an indicator of positive health? *Stress and Health, 18* (4), 153-160.

Lovell, B., Moss, M., & Wetherell, M. (2012). The psychosocial, endocrine and immune consequences of caring for a child with autism or ADHD. *Psychoneuroendocrinology, 37* (4), 534-542.

Minor, H.G., Carlson, L.E., Mackenzie, M.J., Zernicke, K., & Jones, L. (2006). Evaluation of a mindfulness-based stress reduction (MBSR) program for caregivers of children with chronic conditions. *Social Work in Health Care, 43* (1), 91-109.

Murali, R., & Chen, E. (2005). Exposure to violence and cardiovascular and neuroendocrine measures in adolescents. *Annals of Behavioral Medicine, 30* (2), 155–163.

Oken, B.S., Fonareva, I., Haas, M., Wahbeh, H., Lane, J. B., Zajdel, D., & Amen, A. (2010). Pilot controlled trial of mindfulness meditation and education for dementia caregivers. *The Journal of Alternative and Complementary Medicine, 16* (10), 1031-1038.

Ozbay, F., Johnson, D.C., Dimoulas, E., Morgan III, C.A., Charney, D., & Southwick, S. (2007). Social support and resilience to stress: from neurobiology to clinical practice. *Psychiatry (Edgmont), 4* (5), 35.

Polk, D.E., Cohen, S., Doyle, W.J., Skoner, D.P., & Kirschbaum, C. (2005). State and trait affect as predictors of salivary cortisol in healthy adults. *Psychoneuroendocrinology, 30* (3), 261-272.

Sansone, R.A., & Sansone, L.A. (2012). Rumination: relationships with physical health. *Innovations in Clinical Neuroscience, 9* (2), 29.

Schlotz, W., Hellhammer, J., Schulz, P., & Stone, A.A. (2004). Perceived work overload and chronic worrying predict weekend–weekday differences in the cortisol awakening response. *Psychosomatic Medicine, 66* (2), 207-214.

Schulz, P., Kirschbaum, C., Prüßner, J., & Hellhammer, D. (1998). Increased free cortisol secretion after awakening in chronically stressed individuals due to work overload. *Stress and Health, 14* (2), 91-97.

Seltzer, M.M., Greenberg, J.S., Hong, J., Smith, L.E., Almeida, D.M., Coe, C., & Stawski, R.S. (2010). Maternal cortisol levels and behavior problems in adolescents and adults with ASD. *Journal of Autism and Developmental Disorders, 40* (4), 457-469.

Singer, G.H., Ethridge, B.L., & Aldana, S.I. (2007). Primary and secondary effects of parenting and stress management interventions for parents of children with developmental disabilities: A meta-analysis. *Mental Retardation and Developmental Disabilities Research Reviews, 13* (4), 357-369.

Wetherell, M.A., Lovell, B., & Smith, M.A. (2014). The effects of an anticipated challenge on diurnal cortisol secretion. *Stress*, 1-25.