

## Burning mouth syndrome (BMS): evaluation of thyroid and taste

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### ABSTRACT

#### *Background*

Burning mouth syndrome (BMS) is a chronic, intraoral burning sensation seen mainly in middle-aged and post-menopausal females, without identifiable oral lesions or abnormal laboratory findings, but often associated with psychogenic disorders such as depression. The latter can have a range of causes, including hormonal.

#### *Objective*

Since there may be connections between BMS, psychogenic changes, hormonal changes and taste abnormalities, we have examined aspects of taste and thyroid function.

#### *Patients and methods*

We selected 50 patients with BMS (study group) and 50 healthy subjects (control group) and analysed their ability to taste bitter, acid and spicy substances and analysed their thyroid function and undertook thyroid echography.

#### *Results*

Taste sensation was normal in all controls. However, 30 of the patients with BMS reported ageusia for bitter taste and 2 had ageusia for acid. The use of pepper sauce (Tabasco®) (spicy substance) produced a strong burning to the tongue in 28 patients of the BMS group but only in 10 controls.

No control patients showed abnormality of thyroid function or echographic abnormality.

Five patients in the BMS group had biochemical evidence of hypothyroidism, 4 patients had raised levels of thyroid auto-antibodies and, of the 41 remaining BMS patients, most (34) had thyroid echographic changes indicative of nodularity.

#### *Conclusions*

Hypothyroidism may be responsible for a negative influence on taste and consequent increase in trigeminal sensorial sensation (tactile, thermal and painful sensation).

**Key words:** Oral burning, pain phantom, taste, thyroid.

## INTRODUCTION

Burning mouth syndrome (BMS) is a burning sensation affecting the tongue or other oral sites, usually in the absence of either clinical or laboratory abnormalities (1,2). Accompanying symptoms may include complaints of a dry mouth and taste disturbances.

BMS predominantly affects women in their fourth and fifth decades of life, with an overall female-to-male ratio of 7:1. In the majority of cases there is no detectable cause, though there are frequently psychogenic changes (3-6). This is an important problem since the prevalence in the United States has been reported as 0.7% of the population, with numbers in Europe reaching 7% (range 2.5%- 5.1 %) (7,8). BMS most commonly involves the anterior two-thirds of the tongue, the hard palate, the lips and, to a lesser extent, gingival tissue. On rare occasions, symptoms involve the floor of the mouth or soft palate (9,10).

Studies in BMS have shown that the cause is elusive (3-6), and psychological factors may be the result rather than the cause of the oral sensation of pain-burning (4,5).

The cause of BMS therefore remains poorly understood. Interestingly, many patients with BMS report that the oral burning is attenuated or disappears during meals, or when they have confectionery or chewing gum in the mouth (3). Patients with BMS often also report dysgeusia and phantom tastes (11) and sensory testing has revealed taste deficits and heat/pain tolerance among BMS patients (12).

In the central nervous system there are neuronal connections between taste and oral pain: taste normally inhibiting oral pain. The taste receptors for bitter taste are the smallest and more vulnerable to injury than others (13-19). Damage to the chorda tympani or any alteration in the gustative papillae releases that inhibition, and may lead to an intensification of normal trigeminal sensations, as well as to phantom trigeminal sensations (tactile, thermal and painful) (12). BMS might thus be considered to be a phantom pain (12,16,19).

It has been suggested that in some subjects who sustained a damage of facial nerve (the so-called 'supertasters'), the balance of taste sensation is disturbed and that phantom tastes and a burning sensation can ensue due to the release from the normal inhibitory function of the facial nerve (7). Interestingly, thyroid hormones are involved in the maturation and specialization of taste buds (20-23).

The aim of this study was to examine the integrity of taste in BMS patients and examine any possible association with thyroid pathology.

## PATIENTS AND METHODS

We selected 50 BMS patients (35 women; mean age 48 years) with no evidence of factors known to cause oral burning - oral candidosis, diabetes, contact allergy or vitamin B12 deficiency (Study Group). A further 50 healthy patients (28 women, mean age 45 years), seen for conservative dental care, constituted the Control Group. None of subjects were taking any drugs or medicines and did not report some evident illness.

All patients were resident in Naples (Italy). All patients gave

informed consent.

All subjects gave a blood sample to evaluate thyroid function [ FT3, FT4, TSH (thyroid-stimulating hormone), TBG (thyroid binding globulin), anti-thyroperoxidase antibodies, anti-thyroglobulin antibodies, anti-microsomal antibodies ], and thyroid ecography. We evaluated taste sensibility in every subject, testing the bitter, acid and spicy sensations. For the bitter taste we utilized tannin, for the acid taste citric acid and for the spicy one we used pepper sauce (tabasco®), while distilled water was considered neutral (as a taste control).

The patients were requested first to rinse the mouth with 10ml distilled water and were then tested with the various substances, repeating the identical sequence: water, bitter, and acid. For bitter, acid and saccharose we used a solution obtained from dissolving 5 g of pure substance in 100 ml distilled water. For each patient it is drawn by 1 ml of solution was placed by dropper on the anterior tongue.

The test was completed with the administration of pepper sauce (tabasco®) by cotton-bud and placed on anterior part of tongue, and then, in order to neutralize the burning, saccharose was then applied to the tongue.

All patients reported their taste perceptions in relationship to a visual analogue scale (VAS). Results were analyzed using the Students t test.

## RESULTS

The results are summarised in Table 1.

Control subjects all detected no flavour after tasting distilled water but all perceived the bitter and the acidic flavours. Oral burning provoked by pepper sauce (tabasco®) is reduced after the administration of saccharose to the back of the tongue in 32 (65%) and abolition in 3 (5%) of the 50 controls.

The study group had different reactions. In 19 (38%) the use of distilled water evoked a phantom-taste (bitter and/ or metal taste). When tested with the bitter substance, 30 patients (60%) reported ageusia, 12 of these (24%) declared hypogeusia and only 8 patients (16%) identified the correct bitter taste.

When tested with the sour taste, 45 BMS patients (90%) reported the correct taste, 2 (4%) ageusia and 3 (6%) had hypogeusia.

When pepper sauce (tabasco®) was applied to the tongue, all BMS patients, relived their experiences of oral burning; and the subsequent application of saccharose neutralized, only for some patients, the oral burning.

Pepper sauce (tabasco®) induced a strongly burning sensation, to be compared to a strong burn, from 28 patients (56%) of the Study Group in comparison to 10 of the control subjects (20%).

After use of pepper sauce (tabasco®), saccharose reduced oral burning in 8 BMS patients (16%) and abolished oral burning in 2 patients (4%) in comparison to controls, where there was a reduction of burning in 32 persons (65%) and abolition of oral burning in 3 person (5%).

This confirm a prevalence of trigeminal sensations in comparison to taste receptors in the patients of the Study Group. No controls showed abnormalities of thyroid function or

**Table 1.** Results of taste test

Intensity values	Distilled water		Bitter		Acid		pepper sauce ( tabasco®)		Neutralization with saccharose	
	Study group n (%)	Control group n (%)	Study group n (%)	Control group n (%)	Study group n (%)	Control group n (%)	Study group n (%)	Control group n (%)	Study group n (%)	Control group n (%)
0	31 (62)	50 (100)	30 (60)	0	2 (4)	0	0	0	28 (56)	5 (10)
1	19 (38)	0	12 (24)	0	3 (6)	0	0	0	12 (24)	10 (20)
2			8 (16)	50 (100)	45 (90)	50 (100)	22 (44)	40 (80)	8 (16)	32 (65)
3			0	0	0	0	28 (56)	10 (20)	2 (4)	3 (5)

  

Mann-Whitney test	P> 0,9999	P=0,4857	P=0,4857	P> 0,9999	P> 0,9999
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Legend of scores

Values VAS scale	Distilled water	Bitter-acid	pepper sauce ( tabasco®)	Neutralization with saccharose
0	absence of taste	absence of taste	absence of burning	some change
1	taste phantom	light taste	light burning	light reduction
2		correct taste	medium burning	discrete reduction
3		strong taste	strong burning	absence of burning

Score for VAS scale 10 cm : 1up to 3 cm; 2 up to 6 cm; 3 up to 10 cm

**Table 2.** Results of thyroid function

Thyroid	Study group n (%)	Control group n (%)
<b>FT3↓ FT4↓ TSH↑</b>	5 of 50 (10) <sup>a</sup>	0 <sup>a</sup>
<b>Ab-antimicrosomal Ab-antiperoxidase Ab-antithyroglobulin</b>	4 of 50 (8) <sup>b</sup>	0 <sup>b</sup>
<b>Echographic alterations</b>	34 of 41 (83) <sup>c</sup>	0 <sup>c</sup>

<sup>a</sup> P= 0,0580  
<sup>b</sup> P= 0,1189  
<sup>c</sup> P= 0,0001

echographic abnormality.

Five BMS patients ( Study Group) had low levels of FT3 and FT4 and high levels of TSH (true hypothyroidism), and 4 patients had thyroid autoantibodies but normal hormone levels (incipient hypothyroidism). Though thyroid function studies were normal in the remaining 41 patients with BMS, 34 of them showed thyroid echographic alterations with dyshomogeneity and a tendency to nodule formation. ( Table 2). These data were analysed by Fisher’s exact test .

**DISCUSSION**

The present study of burning mouth syndrome showed abnormal taste perception and thyroid dysfunction in a substantial proportion of patients. This relationship has not hitherto been explored, and the findings are intriguing. Interestingly, thyroid hormones are involved in the maturation and specialization of taste buds (20-23).

Some patients with a hormonal profile of euthyroidism can have incipient hypothyroidism having because these subjects are at the lower limits of range for T3 and T4 levels with TSH at the top (borderline hypothyroidism) (24).

Oxidative stress (excess free radicals) can affect the thyroid. Oxidative stress can degrade ordinary T3 to form reverse T3 (rT3) that has quite the opposite hormonal effect of T3 (25). rT3 has no action on the cell, except to bind to receptor sites, and blocks the action of T3 (26).

During constant stress, the adrenal glands respond by synthesizing a large amount of cortisol, which inhibits the conversion of T4 to T3 and favours the conversion of T4 to rT3. If stress is prolonged, a condition called “reverse T3 dominance” occurs and persists even after the stress has passed and cortisol levels fallen. rT3 itself can act like cortisol and block the conversion of T4 to T3 (27).

Our aetiopathogenetic hypothesis for BMS is that the patients are supertasters with a low resistance to stress and a tendency to hypothyroidism. The thyroid hypofunction may be responsible for hypogeusia, for bitter taste, and for the release of inhibitions for sensitive trigeminal sensation (oral pain and burning) (12,21,22).

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