



Prevalence profile of burning mouth syndrome in a sample of Egyptian population: A cross-sectional clinical based study

Dalia Ghalwash^{*} , Asmaa Abou-Bakr , Ahmed Ammar , Ahmed Hamdy , Ayman El-Gawish 

Department of Oral Medicine and Periodontology, Faculty of Dentistry, The British University in Egypt, El Sherouk City 11837, Egypt

***Correspondence:** Dalia Ghalwash, Department of Oral Medicine and Periodontology, Faculty of Dentistry, The British University in Egypt, El Sherouk City 11837, Egypt. Dalia.Ghalwash@bue.edu.eg

Academic Editor: Gaetano Isola, University of Catania, Italy

Received: July 12, 2024 **Accepted:** August 18, 2024 **Published:** October 13, 2024

Cite this article: Ghalwash D, Abou-Bakr A, Ammar A, Hamdy A, El-Gawish A. Prevalence profile of burning mouth syndrome in a sample of Egyptian population: A cross-sectional clinical based study. *Explor Med.* 2024;5:615–25. <https://doi.org/10.37349/emed.2024.00244>

Abstract

Aim: Burning mouth syndrome (BMS) is a debilitating chronic burning sensation in the oral cavity with no identifiable cause. The present research was conducted to evaluate the prevalence profile of BMS in a sample of the Egyptian population.

Methods: A cross-sectional study was performed by screening 952 subjects, all individuals with burning mouth complaints were interviewed and examined to identify the site, timing, frequency, and intensity of their burning sensations. The presence of associated xerostomia, taste disturbances, and impact on quality of life was also recorded. The extent of perceived stress was assessed using the short version of the Perceived Stress Scale.

Results: Among the total 952 cases, 75 cases suffered from BMS symptoms representing a prevalence rate of 7.9%, occurring more frequently in females and those aged 50 years and older. Additionally, 86.7% of cases suffered from systemic diseases, most commonly, diabetes mellitus and hypertension, and were on long-term medications. The intensity of BMS symptoms was relatively high (7.81 ± 1.72). It was significantly correlated with age, smoking, duration of BMS, presence of medical conditions, long-term medications, quality of life, and Perceived Stress Scale scores. The most involved locations were the tongue and buccal mucosa. Xerostomia was reported in 78.7% of cases, while disturbance of taste sensation was reported in 49.3%.

Conclusions: This is the first reported prevalence data for BMS in the Egyptian population in an attempt to improve the limited amount of relevant literature, revealing a BMS prevalence of 7.9% with a significant impact on the quality of life.

Keywords

Burning mouth syndrome, prevalence, quality of life, associated factors, stress, Egypt



Introduction

Burning mouth syndrome (BMS) is distinguished by a spontaneous chronic intraoral burning feeling while the oral mucosa is clinically healthy. This condition mostly affects mid-aged females and is of multifactorial origin involving the interaction between several local systemic and psychological factors. It is defined as idiopathic orofacial pain with a long-lasting burning sensation in the oral cavity without any organic disease directly responsible for the burning sensation [1, 2].

BMS has a chronic course usually from 6 to 7 years, BMS symptoms principally involve the tongue and may be accompanied by altered taste and xerostomia affecting daily functions such as eating and speaking [3, 4]. It is commonly associated with depression, anxiety, and psychological stress, causing a massive personal and societal impact, resulting in inadequate quality of life (QOL) [5, 6]. The unbearable mental stress associated with this chronic pain and feelings of hopelessness and despair have led to suicidal attempts in some BMS patients [2, 7].

BMS occurs more in postmenopausal women, and the prevalence increases in older age groups [6, 8]. BMS has become a frequently encountered disorder in oral medicine clinics. Even though dental specialists play a pivotal role in the diagnosis, managing BMS often benefits from the collaboration of dental and medical specialists. Hence, providing dental and medical professionals with adequate knowledge of its epidemiology is necessary, thus augmenting their awareness and ability to manage BMS symptoms, which would reduce the social burden of BMS [8].

Cross-sectional studies suggested that BMS affects a considerable number of persons with a wide prevalence range (0.7% to 15%) in different populations, ethnic groups, and settings [8–10]. In a population-based study, a BMS prevalence of 1.38% was reported in Shanghai, China [11]. A BMS prevalence of 3.7% was reported by a cross-sectional study conducted in Sweden [12]. While it raised to almost 15% in a clinical-based retrospective study from Brazil [10].

Although several studies have assessed the prevalence of BMS in different populations, the available information on the prevalence and epidemiology profile of BMS is highly variable and still insufficient, especially in African countries where there are almost no prevalence data available concerning BMS. Therefore, the present research was conducted to evaluate the prevalence profile of BMS in a sample of the Egyptian population and to determine the frequency of different accompanying factors such as xerostomia and taste disturbances, in addition to the assessment of the relation of BMS with different risk factors, perceived stress and QOL.

Materials and methods

Sample size

Based on research published in Japan regarding the incidence of BMS in the Japanese population [3], by fixing alpha at 0.05 and beta at 0.2 the incidence of BMS associated with sex was 10% in females and 9% in males. The effective size g is 0.05, and the minimal sample size to be included is 952, calculated using G*Power software (Universität Düsseldorf).

Study design

In a cross-sectional clinical-based study, screening of all the study samples was performed in the Department of Oral Medicine and Periodontology at the British University in Egypt, in the period from August 2023 to March 2024. All individuals with burning mouth complaints were examined and interviewed by two experienced dentists (AA) and (AE) to identify those with BMS according to the most recent BMS diagnostic criteria which denotes the presence of intraoral burning sensation recurring daily for more than 2 hours over more than 3 months and without clinically evident causative lesions, or any identifiable local or systemic cause [13]. Both examiners' agreement on diagnosing BMS is necessary; otherwise, the case is excluded.

The BMS cases are classified according to the intensity, size, and frequency of their burning sensations, and lastly according to the timing of the complaint. The intensity of the burning sensation was assessed using a visual analogue scale (VAS) graded from 0 to 10, where 0 indicates no burning and 10 indicates the worst burning imaginable.

The frequency of burning sensation is recorded as: intermittent and seldom, intermittent, and often, or continuous. The timing of the burning sensation is recorded as present in the morning, evening, daytime, nighttime, or day and night. Subjective oral dryness, taste disturbances, and regular smoking are also registered. Furthermore, the history of current diseases and ongoing medications is recorded. Individuals without any kind of medication or reported diseases will be defined as healthy. All the related data was obtained through a questionnaire developed by the authors using online Google Forms to simplify data collection and use in English.

Assessment of perceived stress

The Perceived Stress Scale (PSS) is one of the most widely used stress perception assessment instruments in the world [14]. The scale was originally developed in 1983 and was designed to assess the degree of stress people felt in unpredictable, out-of-control, and overloaded situations. The original version of the PSS had 14 items (PSS-14) [15], and later researchers created a shortened 10-item version (PSS-10) [14, 16].

The questions in this scale ask about the feelings and thoughts during the last month and how often the patient felt or thought a certain way. The best approach is to answer quickly. That is, do not try to count the number of times you felt a particular way; rather indicate the alternative that seems like a reasonable estimate. For each question choose from the following alternatives: 0—never, 1—almost never, 2—sometimes, 3—fairly often, 4—very often. For questions 4, 5, 7, and 8, scores are reversed like this: 0 = 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0.

Then scores for each item are added to get a total. Individual scores on the PSS can range from 0 to 40 with higher scores indicating higher perceived stress.

1. Scores ranging from 0–13 is considered low stress.
2. Scores ranging from 14–26 are considered moderate stress.
3. Scores ranging from 27–40 are considered high perceived stress.

Inclusion criteria

1. Egyptian adults more than 21 years.
2. Both males and females.
3. Patients with intraoral burning sensation recurring daily for more than 2 hours over more than 3 months without clinically evident causative lesions or any identifiable local or systemic cause.

Exclusion criteria

1. Patients with any clinically apparent causative lesions in the oral cavity or systemic cause could be responsible for the burning sensation.
2. Patients who refuse to participate in the study.

Ethical approval of the study is acquired from the Research Ethics Committee at the British University in Egypt, approval number (23-031). The procedures were fully explained to the patients, and they signed an informed consent. Participants were selected using a consecutive non-probability sampling method to minimize selection bias, non-respondent bias was minimized by describing the aim of the study to the participants and their importance and role in the study. Observer and interviewer bias were reduced by interviewing and examining new patients visiting the clinic for the first time so that the investigators have no prior knowledge of the disease status of the subject which might lead the researcher to ask questions or assess the subject differently.

Statistical analysis

In the present cross-sectional study, the mean and standard deviation values were calculated for quantitative data (VAS) while frequencies were calculated for qualitative data. Fisher exact and Chi-square tests were used to determine the relationship between frequencies of all qualitative data such as duration, site, timing of BMS, xerostomia, and taste disturbance. The significance level was set at $p < 0.05$. Statistical analysis was performed with IBM® SPSS® Statistics Version 20 for Windows. Correlations between the intensity of BMS and risk factors, QOL, and PSS scores were performed by multiple regression analysis using the Spearman correlation test.

Results

Among the total 952 cases, 75 cases (7.9%) suffered from BMS symptoms while 877 (92.1%) did not, with a significant difference of ($p < 0.001$). Data concerning the age ranges and sex distribution showed that females constituted 60% of BMS cases, history of smoking habit, and systemic conditions affecting 86.7% of cases the most common of which were diabetes mellitus and hypertension, long-term medications, and the mean value of BMS intensity assessed via VAS scores among the 75 BMS cases which were 7.81 are presented in Table 1.

Table 1. The numbers and frequencies of BMS demographic data, medical condition, medication, and intensity of BMS

	Variables	BMS		
		n	%	p-value
Age	< 50	10	13.3%	< 0.001*
	50–59	21	28%	
	60–69	33	44%	
	70–79	11	14.7%	
Sex	Female	45	60%	0.083ns
	Male	30	40%	
Smoking	Yes	16	21.3%	< 0.001*
	No	59	78.7%	
Systemic condition	None	10	13.3%	< 0.001*
	Hypertension disease	46	61.3%	
	Diabetes mellitus disease	37	49.3%	
	Cardiovascular disease	13	17.3%	
	Kidney disease	32	42.7%	
Any long-term medications	None	10	13.3%	< 0.001*
	Antidiabetic drugs	37	49.3%	
	Antihypertensive drugs	46	61.3%	
	Others	38	50.7%	
Intensity of BMS (VAS)	Score 3	1	1.3%	< 0.001*
	Score 4	3	4%	
	Score 5	4	5.3%	
	Score 6	7	9.3%	
	Score 7	14	18.7%	
	Score 8	17	22.7%	
	Score 9	15	20%	
Score 10	14	18.7%		

*: significant ($p < 0.05$); ns: non-significant ($p \geq 0.05$); BMS: burning mouth syndrome; VAS: visual analogue scale

Among a total of 75 BMS cases, 33.3% had BMS for 2 years and 33.3% had BMS for 3 years. The most involved locations were the tongue and the whole mouth, 45.3% of cases reported intermittent and frequent frequency followed by continuous then intermittent and seldom frequency of BMS as shown in Table 2. While in 44% of cases, the reported timing of BMS was day and night followed by morning (30.7%), subjective oral dryness was reported in 78.7% of cases, while disturbance of taste sensation was reported in 49.3%. The impact of BMS on QOL was moderate as reported in 32% of cases, followed by extreme in 26.7% of cases, then very much (22.7%), and only 18.7% of cases reported it was affected a little. When the PSS scores were considered, no cases displayed low stress, while 53.3% of cases displayed moderate PSS scores and 46.7% of cases displayed high PSS scores as presented in Table 3.

Table 2. Duration site and frequencies of BMS

	Variables	BMS		
		n	%	p-value
Duration of BMS	3 months	2	2.7%	< 0.001*
	6 months	5	6.7%	
	1 year	18	24%	
	2 years	25	33.3%	
	3 years	25	33.3%	
Site of BMS	Tongue	24	32%	< 0.001*
	Cheeks	5	6.7%	
	Tongue and cheek	10	13.3%	
	The whole mouth	32	42.7%	
	Tongue and lips	1	1.3%	
	Tongue, cheeks, and lips	2	2.7%	
	Tongue, cheek, and gingiva	1	1.3%	
	Frequency of BMS	Intermittent and seldom	19	
	Intermittent and often	34	45.3%	
	Continuous	22	29.3%	

*: significant ($p < 0.05$); ns: non-significant ($p \geq 0.05$); BMS: burning mouth syndrome

Table 3. The frequencies of BMS data

	Variables	BMS		
		n	%	p-value
Time of the day of BMS	Morning	23	30.7%	< 0.001*
	Night	4	5.3%	
	Day and night	33	44%	
	Daytime	13	17.3%	
	Evening	2	2.7%	
Oral dryness	Yes	59	78.7%	< 0.001*
	No	16	21.3%	
Taste disturbance	Yes	37	49.3%	0.908ns
	No	38	50.7%	
Quality of life	A little	14	18.7%	0.404ns
	Moderately	24	32%	
	Very much	17	22.7%	
	Extremely	20	26.7%	
PSS scores	Low stress	0	0%	< 0.001*
	Moderate stress	40	53.3%	
	High perceived stress	35	46.7%	

*: significant ($p < 0.05$); ns: non-significant ($p \geq 0.05$); BMS: burning mouth syndrome; PSS: Perceived Stress Scale

Table 4 demonstrates the correlation between the intensity of BMS and risk factors such as age, sex, smoking, medical condition, and long-term medications, as well as QOL and PSS scores, where a statistically positive correlation was encountered between the intensity of BMS and age, smoking, duration of BMS, medical conditions, and long-term medications. Also, a significantly positive strong correlation was found between the intensity of BMS and QOL and PSS scores. There was not any missing data from participants.

Table 4. Correlations showing ICC and *p*-values between intensity of BMS and risk factors, QOL, and PSS scores

	Correlations (Spearman)	Intensity of BMS
Age	Correlation coefficient	0.259
	Sig. (2-tailed)	0.025
Gender	Correlation coefficient	-0.226
	Sig. (2-tailed)	0.052
Smoking	Correlation coefficient	0.288
	Sig. (2-tailed)	0.012
Duration	Correlation coefficient	0.323
	Sig. (2-tailed)	0.005
Medical condition	Correlation coefficient	0.475
	Sig. (2-tailed)	< 0.001
Long term medications	Correlation coefficient	0.327
	Sig. (2-tailed)	0.004
QOL	Correlation coefficient	0.863**
	Sig. (2-tailed)	< 0.001
PSS	Correlation coefficient	0.492**
	Sig. (2-tailed)	0.001

**· Correlation is significant at the ($p < 0.05$) level. BMS: burning mouth syndrome; PSS: Perceived Stress Scale; QOL: quality of life

Discussion

Dental professionals play a vital role in the diagnosis of BMS. Hence, providing sufficient information about its prevalence, clinical presentation, and associated factors to dental and medical specialties is essential to improve their knowledge and understanding of BMS, thus enhancing the efficacy and rate of diagnosis of this condition to help improve the QOL and reduce the societal burden caused by BMS [6]. A recent meta-analysis concerning the worldwide prevalence of BMS revealed a variation between the BMS prevalence rate acquired from the population-based and clinical-based studies, which was 1.73% and 7.72% respectively [8]. The present cross-sectional clinical-based study took place in the Department of Oral Medicine and Periodontology clinics which has been reported as the ideal specialty to achieve optimum contact with patients [10, 17].

To the authors' knowledge, the present research is the first study to assess the prevalence of BMS in Egypt. The only published study involving Egyptians was focused on particular disease complications as it assessed the presence of BMS only in type 2 diabetic patients with peripheral neuropathy [18], hence it does not reflect the actual prevalence rate of BMS beyond this specific patient group. Other than that, all published literature including a recent systematic review and meta-analysis of the worldwide prevalence estimate of BMS [8], as well as the latest systematic review assessing the clinical and epidemiologic profile of BMS patients, did not include a single study stemming from Egypt or any other African country [19].

In the current study, the prevalence of BMS was found to be 7.9% of the present sample of the Egyptian population, and this prevalence rate coincides with results of a meta-analysis reporting a pooled worldwide prevalence of BMS of 7.72% in clinical dental practice [8]. It is also in close range to the occurrence rate of BMS of 7.03% which was reported in the Saudi Arabian population [20]. Additionally, clinical-based studies reported an almost similar BMS prevalence of 6.96%, 8.96%, and 7.50% in Asia [11, 21, 22]. While a higher prevalence of BMS was reported in Brazil (14.91%) and in China (15.71%) due to the increase in medication use, depression, and percentage of menopausal females [10, 23].

Among BMS patients in the present study, 60% were females while 40% were males. This agrees with a previous meta-analysis reporting that persistent pain was more frequently encountered in females [24]. Other studies also confirmed the general higher trend of BMS in females than males [8, 25]. However, another study reported higher rates of chronic pain in males [26]. The sex differences might be related to dissimilar pain thresholds due to different hormone levels and the increased tendency of females to report health-related symptoms including pain [27, 28]. Only 21.3% of BMS cases were smokers, however, smoking was positively correlated to the intensity of BMS in the current study. On the contrary, it was inversely correlated to the intensity and quality of pain in BMS in recent research [29].

In the present study, 86.7% of BMS cases suffered from one or more systemic conditions, most commonly hypertension, and diabetes mellitus, and were on long-term medications, which is mostly attributed to the older ages of the affected patients in the current study. This is in accordance with a retrospective study that reported that 97% of BMS patients have at least one comorbidity and other studies stating that two-thirds of BMS cases have systemic conditions [30–32]. Additionally, using multiple medications was proposed to have an important association with BMS, especially in older females [33, 34]. This agrees with the present results revealing a statistically positive correlation between intensity of BMS and age, medical conditions, and long-term medications.

In the present study, the intensity of BMS symptoms was assessed by VAS scores recording a mean value of 7.81 ± 1.72 representing high intensity which is in line with prior research describing BMS pain as being of moderate to severe intensity [35]. However, it was higher than the mean VAS score of 4.3 which was reported in a prior study in Saudi Arabia [20]. Moreover, the intensity of BMS symptoms was found to positively correlate with age, smoking, duration of BMS, presence of medical conditions, and long-term medications.

BMS frequency was intermittent in most of the study sample. The timing of BMS symptoms was reported to classically occur throughout the day in the majority of BMS cases [36], which agrees with the results of the present study. While according to other studies BMS symptoms reach the maximum intensity by late evening without interfering with sleep [37]. In most cases, symptoms of a burning mouth had persisted for more than one year, and in almost one-third of cases it persisted for 3 years in the current results, indicating the chronic course of BMS which is in line with previous research [2, 5, 6]. The most involved locations were the whole mouth, the tongue, and the buccal mucosa. This is in line with prior research revealing that the tongue, alone or in conjunction with other areas, was the main site of BMS in 81.9% of cases [20, 34, 36, 38].

Subjective oral dryness was reported by 78.7% of BMS patients in the current results, and this is in accordance with other research reporting that 46% to 67% of BMS patients complain of subjective dryness of the mouth that affects their QOL [20, 38–40]. Subjective oral dryness in those patients may be a consequence of other systemic diseases or due to the use of medications that could interfere with normal salivary gland function, it is also associated with psychological factors such as depression [41, 42]. The aging process may participate in and enhance xerostomia, as most BMS patients are above 50 [2]. BMS patients may have the feeling of oral dryness due to the reduction of saliva which plays a fundamental role in moistening and protecting the oral mucosa. The high salivary viscosity and lack of mucous secretion may also contribute to the uncomfortable oral sensation [39].

Taste disturbance was reported in 49.3% of cases in the present study, which is in accordance with a recent case-control study reporting incidence of dysgeusia in 45.6% of BMS patients [38], also in line with a preceding case-control study which revealed that BMS patients had reduced taste sensitivity associated with the onset of a burning sensation [2, 43, 44]. While other studies reported taste alteration in only 10.7% and 15.9% of BMS cases [20, 36].

The high intensity of BMS and associated symptoms revealed in the present study, along with the prolonged course of the condition can affect the QOL of BMS patients where 81.4% of BMS cases reported moderate to extreme impact of BMS symptoms on the QOL which agrees well with several studies [4, 5, 29, 45]. In the current study, 53.3% of cases displayed moderate PSS scores and 46.7% of cases displayed high

PSS scores reflecting the high amount of stress BMS patients are burdened with. This complies with a recent psychological assessment that reported a significantly higher psychological stress score in the BMS group in comparison to the control group [2]. Moreover, earlier research reported that 80% of BMS patients had anxiety disorders and depression before the onset of BMS [30, 34, 46], which agrees well with our results revealing a significantly positive strong correlation between the intensity of BMS and QOL as well as PSS scores.

Different diagnostic criteria for BMS have been used over the years mainly directed at reaching the diagnosis of BMS after ruling out other causes of burning sensation [8]. The most recent diagnostic criteria for BMS were used in the present study which entails the presence of recurrent intraoral burning sensation for more than 2 hours per day for more than 3 months without clinically apparent cause [13].

To our knowledge, this is the first report of prevalence data for BMS in the Egyptian population in an attempt by the authors to improve the limited amount of relevant literature available. Another strength is the large sample size used in the current study to be more representative, increasing the generalizability of results. Also, a combination of patient interviews and clinical examination was carried out to increase the reliability and validity of our results in addition to examination by two experienced dentists to confirm the diagnosis of BMS otherwise patients are excluded from the study. Another strong point is the large sample size used in the current study to be more representative, increasing the generalizability of results.

Among the limitations of the present cross-sectional study is the probability of information bias that might happen during the gathering of information concerning risk factors and health conditions, for instance, social embarrassment may prevent some patients, especially females from revealing behaviors such as smoking. To minimize that bias, the anonymous nature of the questionnaire was conveyed to patients. Also, in this type of study, it is not feasible or practical to perform random sampling thus consecutive sampling method was used to reduce selection bias. Another limitation of this cross-sectional study can only identify correlations but not causal relationships, as for the correlation found between the intensity of BMS and high-stress scores, it cannot be confirmed if stress causes BMS or vice versa. More high-quality cross-sectional surveys using standard sampling methods among different populations are required to further elucidate the epidemiology profile of BMS and to improve the knowledge and attitude about BMS to ensure an early diagnosis, improving the prognosis with development of new management protocols of BMS to reduce its burden on QOL.

Conclusions

A prevalence of BMS of 7.9% was discovered in the present sample of the Egyptian population, occurring more frequently in females and older age groups. The majority of BMS cases suffered from one or more systemic conditions, most commonly hypertension and diabetes mellitus, and were on long-term medications. The intensity of BMS symptoms was high and was significantly correlated with age, smoking, duration of BMS, presence of medical conditions, long-term medications, QOL, and PSS scores. Subjective oral dryness was reported by 78.7% and taste disturbance was reported by 49.3% of BMS cases, further contributing to the adverse impact on the QOL in those patients.

Abbreviations

BMS: burning mouth syndrome

PSS: Perceived Stress Scale

QOL: quality of life

VAS: visual analogue scale

Declarations

Author contributions

DG: Conceptualization, Supervision and editing, Writing review, results, and discussion & conclusion. AAB: Resources, data collection, and writing the original draft. AA, AH and AEG: Clinical examination and data collection and writing the original draft.

Conflicts of interest

The authors declare that they have no competing interests.

Ethical approval

Approval was obtained from the Research Ethics Committee, Faculty of Dentistry, the British University in Egypt with approval No. 23-031.

Consent to participate

The procedures were fully explained to the patients, and they signed an informed consent.

Consent to publication

Not applicable.

Availability of data and materials

The datasets that support the findings of this study are available from the corresponding author upon reasonable request.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Copyright

© The Author(s) 2024.

References

1. Treede R, Rief W, Barke A, Aziz Q, Bennett MI, Benoliel R, et al. Chronic pain as a symptom or a disease: the IASP Classification of Chronic Pain for the International Classification of Diseases (ICD-11). *Pain*. 2019;160:19–27. [DOI] [PubMed]
2. Tan HL, Renton T. Burning mouth syndrome: An update. *Cephalalgia Rep*. 2020;3. [DOI]
3. Suzuki N, Mashu S, Toyoda M, Nishibori M. Oral burning sensation: prevalence and gender differences in a Japanese population. *Pain Pract*. 2010;10:306–11. [DOI] [PubMed]
4. Ariyawardana A, Chmieliauskaite M, Farag AM, Albuquerque R, Forssell H, Nasri-Heir C, et al. World Workshop on Oral Medicine VII: Burning mouth syndrome: A systematic review of disease definitions and diagnostic criteria utilized in randomized clinical trials. *Oral Dis*. 2019;25:141–56. [DOI] [PubMed]
5. Ducasse D, Courtet P, Olie E. Burning mouth syndrome: current clinical, physiopathologic, and therapeutic data. *Reg Anesth Pain Med*. 2013;38:380–90. [DOI] [PubMed]
6. Pereira JV, Normando AGC, Rodrigues-Fernandes CI, Rivera C, Santos-Silva AR, Lopes MA. The impact on quality of life in patients with burning mouth syndrome: A systematic review and meta-analysis. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2021;131:186–94. [DOI] [PubMed]
7. Fukushima Y, Kitamura T, Ikami E, Yumoto M, Sano Y, Sato T, et al. A case of burning mouth syndrome leading to suicide 10 days after self-cutting of tongue. *Psychogeriatrics*. 2020;20:126–8. [DOI] [PubMed] [PMC]

8. Wu S, Zhang W, Yan J, Noma N, Young A, Yan Z. Worldwide prevalence estimates of burning mouth syndrome: A systematic review and meta-analysis. *Oral Dis.* 2022;28:1431–40. [DOI] [PubMed]
9. Coculescu EC, Tovar S, Coculescu BI. Epidemiological and etiological aspects of burning mouth syndrome. *J Med Life.* 2014;7:305–9. [PubMed] [PMC]
10. Fattori E, Teixeira DS, de Figueiredo MA, Cherubini K, Salum FG. Stomatological disorders in older people: An epidemiological study in the Brazil southern. *Med Oral Patol Oral Cir Bucal.* 2019;24:e577–82. [DOI] [PubMed] [PMC]
11. Ge S, Liu L, Zhou Q, Lou B, Zhou Z, Lou J, et al. Prevalence of and related risk factors in oral mucosa diseases among residents in the Baoshan District of Shanghai, China. *PeerJ.* 2020;8:e8644. [DOI] [PubMed] [PMC]
12. Bergdahl M, Bergdahl J. Burning mouth syndrome: prevalence and associated factors. *J Oral Pathol Med.* 1999;28:350–4. [DOI] [PubMed]
13. The Orofacial Pain Classification Committee. International Classification of Orofacial Pain, 1st edition (ICOP). *Cephalalgia.* 2020;40:129–221. [DOI] [PubMed]
14. Lee E. Review of the psychometric evidence of the perceived stress scale. *Asian Nurs Res (Korean Soc Nurs Sci).* 2012;6:121–7. [DOI] [PubMed]
15. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav.* 1983;24:385–96. [PubMed]
16. Cohen S, Williamson GM. Perceived stress in a probability sample of the United States. In: Spacapan S, Oskamp S, editors. *The Social Psychology of Health.* Cham: Sage; 1988. pp. 31–67.
17. Li L, Gao YL, Cao YP, Liu QY, Qi JJ, Yuan CQ. Epidemiological investigation on the prevalence of oral mucosal diseases in the elderly. *General J Stomatol.* 2015;2:123–4. Chinese.
18. Nada A, Abdel Moneim W, Fakhr M, El-Sawy S. Prevalence of Burning Mouth Syndrome in A sample of Egyptian Patients with Diabetic Neuropathy: A Cross Sectional Hospital-Based Study. *Adv Dental J.* 2020;2:34–42. [DOI]
19. de Lima-Souza RA, Pérez-de-Oliveira ME, Normando AGC, Louredo BVR, Mariano FV, Farag AM, et al. Clinical and epidemiological profile of burning mouth syndrome patients following the International Headache Society classification: a systematic review and meta-analysis. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2024;137:119–35. [DOI] [PubMed]
20. Assiri KI, Dawasaz AA, Alshehri AA, Mohammad F, Alyami YD. Burning mouth syndrome in Southwestern Saudi Arabian population – Part I: Prevalence. *Saudi J Oral Sci.* 2019;6:65–71. [DOI]
21. Chai L, Zhan YB, Zhang HC, Yan Y, Mu S, Zhang MX, et al. Analysis on the constitution of periodontal diseases and oral mucosal diseases. *J Harbin Med University.* 2014;48:234–7. Chinese.
22. Liu QQ, Yang C, Zhang YY. A clinical analysis of 1,500 cases of oral mucosa diseases in Henan Province. *Henan Med Res.* 2017;26:1170–2. Chinese.
23. Wang H, He F, Xu C, Fang C, Peng J. Clinical analysis for oral mucosal disease in 21 972 cases. *Zhong Nan Da Xue Xue Bao Yi Xue Ban.* 2018;43:779–83. Chinese. [DOI] [PubMed]
24. Fayaz A, Croft P, Langford RM, Donaldson LJ, Jones GT. Prevalence of chronic pain in the UK: a systematic review and meta-analysis of population studies. *BMJ Open.* 2016;6:e010364. [DOI] [PubMed] [PMC]
25. Nasri-Heir C, Zagury JG, Thomas D, Ananthan S. Burning mouth syndrome: Current concepts. *J Indian Prosthodont Soc.* 2015;15:300–7. [DOI] [PubMed] [PMC]
26. Zhang J, Li D, Li MY, Sha JJ, Jiang XJ. Prevalence of oral mucosal diseases and related risk factors in the middle-aged and elderly people of Hui and Han population in Zhongwei City, Ningxia Province. *Chinese J Conservative Dent.* 2016;26:736–40. Chinese.
27. Maurer AJ, Lissounov A, Knezevic I, Candido KD, Knezevic NN. Pain and sex hormones: a review of current understanding. *Pain Manag.* 2016;6:285–96. [DOI] [PubMed]

28. Asher M, Asnaani A, Aderka IM. Gender differences in social anxiety disorder: A review. *Clin Psychol Rev.* 2017;56:1–12. [DOI] [PubMed]
29. Calabria E, Canfora F, Leuci S, Coppola N, Pecoraro G, Giudice A, et al. Gender differences in pain perception among burning mouth syndrome patients: a cross-sectional study of 242 men and 242 women. *Sci Rep.* 2024;14:3340. [DOI] [PubMed] [PMC]
30. Freilich JE, Kuten-Shorrer M, Treister NS, Woo S, Villa A. Burning mouth syndrome: a diagnostic challenge. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2020;129:120–4. [DOI] [PubMed]
31. Wu Y, Chiang C. Association of medications with burning mouth syndrome in Taiwanese aged patients. *J Dent Sci.* 2023;18:833–9. [DOI] [PubMed] [PMC]
32. Ghalwash D, Abou-Bakr A, Hussein RR, et al. Comorbidities and final outcome of post COVID-19 associated oral mucormycosis patients: a cross-sectional study. *Egypt J Otolaryngol.* 2024; 40:51. [DOI]
33. Pereira SR, Velasquez JT, Duggan S, Ivanisevic B, McKenna JP, McCreary C, et al. Recent advances in the understanding of the aetiology and therapeutic strategies in burning mouth syndrome: Focus on the actions of cannabinoids. *Eur J Neurosci.* 2022;55:1032–50. [DOI] [PubMed]
34. Adamo D, Spagnuolo G. Burning Mouth Syndrome: An Overview and Future Perspectives. *Int J Environ Res Public Health.* 2022;20:682. [DOI] [PubMed] [PMC]
35. Aravindhan R, Vidyalakshmi S, Kumar MS, Satheesh C, Balasubramaniam AM, Prasad VS. Burning mouth syndrome: A review on its diagnostic and therapeutic approach. *J Pharm Bioallied Sci.* 2014;6: S21–5. [DOI] [PubMed] [PMC]
36. Kohorst JJ, Bruce AJ, Torgerson RR, Schenck LA, Davis MDP. The prevalence of burning mouth syndrome: a population-based study. *Br J Dermatol.* 2015;172:1654–6. [DOI] [PubMed] [PMC]
37. Lopez-Jornet P, Pagan DM, Mateos PA, Agudo CR, Pons-Fuster A. Circadian rhythms variation of pain in burning mouth syndrome. *Geriatr Gerontol Int.* 2015;15:490–5. [DOI] [PubMed]
38. Adamo D, Canfora F, Calabria E, Coppola N, Sansone M, Spagnuolo G, et al. Burning Mouth Syndrome and Hypertension: Prevalence, Gender Differences and Association with Pain and Psycho-Social Characteristics-A Case Control Study. *Int J Environ Res Public Health.* 2023;20:2040. [DOI] [PubMed] [PMC]
39. de Pedro M, López-Pintor RM, Casañas E, Hernández G. General health status of a sample of patients with burning mouth syndrome: A case-control study. *Oral Dis.* 2020;26:1020–31. [DOI] [PubMed]
40. Ghalwash DM. Diagnostic and prognostic value of salivary biomarkers in oral cancer and precancer: Review article. *J Oral Maxillofac Surgery Med Pathol.* 2020;32:538–43. [DOI]
41. Acharya S, Hägglin C, Jontell M, Wenneberg B, Ekström J, Carlén A. Saliva on the oral mucosa and whole saliva in women diagnosed with burning mouth syndrome. *Oral Dis.* 2018;24:1468–76. [DOI] [PubMed]
42. Ibrahim SS, Abou-Bakr A, Ghalwash DM, Hussein RR. Effectiveness of thyme honey in the management of xerostomia in geriatric patients with end-stage renal disease: a randomized controlled clinical trial with a biochemical assessment. *Eur J Med Res.* 2023;28:406. [DOI] [PubMed] [PMC]
43. Braud A, Descroix V, Ungeheuer M, Rougeot C, Boucher Y. Taste function assessed by electrogustometry in burning mouth syndrome: a case-control study. *Oral Dis.* 2017;23:395–402. [DOI] [PubMed]
44. Ghalwash D, Abou-Bakr A, Abd El Wahed S. Comorbidity of hypertension and chronic renal failure and their impact on oral complications: A cross-sectional study. *IJCBS.* 2023;24:240–7.
45. Alhendi F, Ko E, Graham L, Corby P. The association of sleep disturbances with burning mouth syndrome: An overlooked relationship-A qualitative systematic review. *Oral Dis.* 2023;29:6–20. [DOI] [PubMed]
46. Taiminen T, Kuusalo L, Lehtinen L, Forssell H, Hagelberg N, Tenovuori O, et al. Psychiatric (axis I) and personality (axis II) disorders in patients with burning mouth syndrome or atypical facial pain. *Scand J Pain.* 2011;2:155–60. [DOI] [PubMed]