

Relationship of Psycho-physiological Stress on Oral Halitosis among Adult Female Patients Attending a Dental Institution in Mysore City, India – A Cross-Sectional Study

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ABSTRACT

One of the priorities of dentistry is to lower the incidence of oral halitosis. Malodor is a social concern for an individual and an alarm to unhealthy lifestyle. It is caused by various oral and extra oral etiologies. Psycho-physiological stress like menstruation, is one of the common phenomena among human race, leading to many changes in the body, has also been suggested in the literatures to be a predisposing factor for the production of volatile sulfur compounds. A three months cross-sectional study among patients attending the out-patient Department of Dental Institution in Mysuru was performed. Among 31 participants having menstrual cycle at the time of clinical evaluation, 67.7% had low organoleptic scores while 32.3% had high organoleptic scores.

Conclusion: There was a statistical significant difference seen in between mean salivary flow and tongue coating with severity of oral malodor. But there was no significant association between Psychophysiological Stress and oral halitosis. This could be because of lesser sample of participants having menstruation involved in the study.

It is recommended to further conduct various longitudinal and experimental studies for assessing the causal and scientific relationship, respectively.

Keywords: Oral malodor, Psychophysiological stress, Salivary flow rate, Menstrual cycle

INTRODUCTION

One of the major concerns of the human population is oral halitosis, making it the third most frequent reason for seeking dental aid [1]. Halitosis is a term originated from the combination of Latin word “halitus” (breathe) with a Greek suffix “osis” (result of a pathologic process) [2]. Although, every individual experiences bad breathe occasionally, persistent oral malodor affects at least 50% of the population [3]. Unfortunately, it is to be taken in notice that there are no elaborated literatures in India regarding prevalence of normative oral malodor.

Stress has been also suggested to be a contributory factor in the development of bad breath [4]. There are evidences which explain psychophysiological differences (like heart rate patterns) in stress reactivity across the menstrual cycle [5]. Studies have shown that the level of volatile sulfur compounds (VSC) was higher in menstruation in comparison with other phases like follicular and pre-menstruation [6-8]. There are sex hormones like β -estradiol whose effects were seen on oral mucosa in women [9] and is associated with halitosis [10]. It can also disturb conditions in the oral cavity through changes in salivary flow (i.e., may induce hyposalivation). Hyposalivation can alter levels of

antibacterial salivary secretory immunoglobulin A (sIgA) and lactoferrin, which could promote the accumulation of microorganisms and thereby facilitate the production of VSC. Past Literature reveals the assumptions that fluctuation in hormonal variations during different phases of menstrual cycles can influence anxiety and stress, which in turn affect psychiatric symptoms such as oral dryness feeling and eventually can increase the VSC [10]. Anxiety and stress could have effect on sympathetic system activation and then the composition of saliva [11]. Although, these effects could

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be involved in stress-induced VSC production, the mechanism on how stress influence the production of VSC is not clear [4]. Given well established relationships between psychophysiological stress and oral-health as well as other health problems (e.g. coronary artery disease) problems in women [12], these findings may have important implications for detection, prevention and treatment of various diseases.

Owing to the scarcity of the literature in the Indian context, the present study was undertaken to assess the relationship between psycho-physiological stress and oral halitosis using organoleptic method among adult patients attending a dental institution in Mysore city, India.

MATERIALS AND METHODOLOGY

The present descriptive cross-sectional study was undertaken over a period of three months (May and July 2015) on adult patients attending a dental institution in Mysore city, India

Prior to the study, **ethical clearance** was obtained from the Institutional Ethical Committee, JSS Dental College and Hospital, Mysuru in accordance with the World Medical Association Declaration of Helsinki 2008, written **informed consent** was obtained from each of the study participants.

A specially designed structured proforma was used for recording all relevant information that included demographic details, psycho-physiological stress – tongue coating, salivary flow rate and oral halitosis. There were other factors like oral hygiene habits, deleterious habits and oral health status included too in order to nullify the effects of confounding factors.

A clinical evaluation sheet included the recording of following parameters: Tongue coating using Winkel Tongue Coating Index (WTCI) [13]. Unstimulated salivary flow rate [14]. Halitosis using organoleptic method [15].

Training and calibration of the examiner: The clinical examination and measurement of oral halitosis score was carried out by a single investigator. Prior to the commencement of the study, training and calibration of the investigator was carried out using Carranza method [16]. The inter-examiner reliability was found to be good with a Cohen's Kappa coefficient value of 0.8.

Intra-examiner calibration: This was performed by a single investigator on 10 participants in the afternoon session in the month of April 2015. The participants were examined by the investigator for plaque, gingival status, tongue coating and oral halitosis using plaque index, gingival index, tongue coating index and organoleptic scoring respectively using sterile instruments under adequate illumination. The second examination of the same 10 participants was carried out in another afternoon session two days after the baseline examination. The consistency with regard to organoleptic scoring was satisfactory with the Kappa value of 0.78. And also was the same for, plaque index as kappa value of 0.69, gingival index kappa value of

0.72 and winkel's tongue coating index kappa value of 0.67, showing a substantial agreement of consistency.

PILOT STUDY

In April 2015, a pilot study was undertaken on 10 participants to test the feasibility of the protocol, identify any organizational and technical problems, to eliminate difficulties or ambiguities in wording of the questionnaire and to test the validity and reliability of the questionnaire.

Eligibility criteria

Participants who fulfilled the following eligibility criteria were recruited through a convenience sampling technique and were not a part of the final study.

Inclusion criteria:

- Patients attending out-patient department of college
- More than 18 years
- Willing to participate in the study
- Permanent dentition
- Minimum of 20 natural teeth present

Exclusion criteria:

- Minor and medically compromised patients (debilitating conditions)
- Who cannot read and understand either of Kannada or English languages
- Undergone already any treatment like oral prophylaxis 1 month back or undergoing any orthodontic corrections, acute pain therapies

Sample size estimation

Considering 50% prevalence of halitosis in patients, 95% confidence interval and 5% of precision (d), the sample size was calculated to be 500 among which 246 female patients were considered to analyse the relationship between the physiological stress and oral halitosis.

Sampling design and methodology

The study participants were selected using convenience sampling technique to enable ease of data collection. Any participant willing to enroll in the study attending the outpatient department of the dental institution was involved.

Administration of the questionnaire

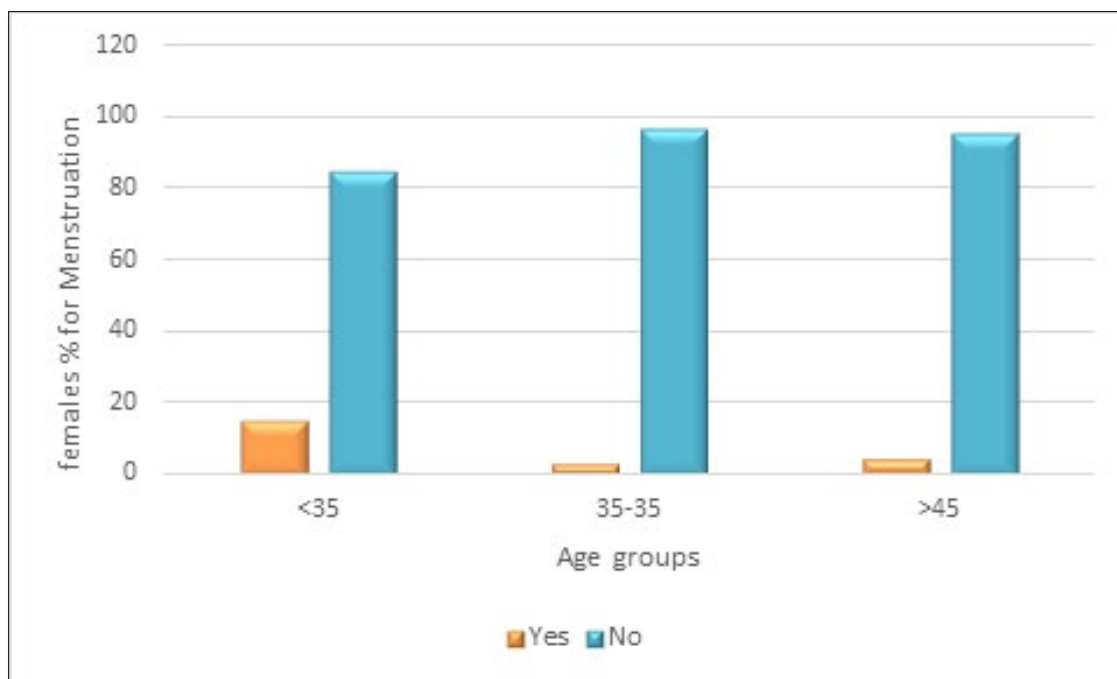
The study proforma was self-administered to those subjects who were found eligible for inclusion. However, the investigator provided brief instruction to the participants before they started filling the proforma. The subjects took 10-15 min to fill up the questionnaire following which they were subjected to clinical examination.

RESULTS

The present study was conducted among 500 participants, who fulfilled the eligibility criteria and consented to participate in the study constituted the study sample. We are considering here the female adult population (n=245) among which only 31 patients had presence of menstruation.

Distribution of age among females in relation to presence of menstrual cycle

The 245 female participants were asked for the presence of menstrual cycle at that point of time and 12.7% (n=31) of females reported yes. The majority of the females (15.6%) were below 35 years (n=28). Rest were 3.7% (n=1) in the age group of 35-45 years and 5.1% (n=2) above 45 years reported for the presence of menstrual cycle. There was a statistical significance ($p=0.001$) between the menstrual cycle and age groups of the study participants (**Graph 1**).



Graph 1. Distribution of age among females in relation to presence of menstrual cycle.

Clinical oral health parameters in relation to various menstrual cycles

Gender: Independent samples t-test was applied for comparing various mean scores of clinical parameters in relation to gender.

Mean salivary flow of study participants in relation to gender was 2.0 ± 0.9 among which males had salivary flow of 2.05 ± 0.9 and females had 1.95 ± 0.9 , showing no statistical significance ($p=0.214$).

The mean tongue coating index score in relation to gender was 8.16 ± 2.6 . Males had mean tongue coating index score as 8.21 ± 2.6 and females had 8.11 ± 2.7 . No statistical significance ($p=0.687$) present between gender and mean tongue coating index (**Table 1**).

Menstrual cycle: Independent samples t-test was applied for comparing various mean scores of clinical parameters in relation to menstrual cycle (present/absent).

The mean individual scores salivary flow and tongue coating indices among the participants who had menstrual periods at that time were 1.59 ± 0.9 , 8.58 ± 2.7 , respectively. Whereas, the participants who claimed absence of menstruation at that point of time had mean individual scores of salivary flow and tongue coating indices as 1.99 ± 0.9 and 8.03 ± 2.7 , respectively, showing a decrease in all the parameters. There were no statistical significant difference seen between menstrual cycle and mean salivary flow ($p=0.567$) whereas mean tongue coating showed a statistical significance present between the groups ($p=0.021$) (**Table 1**).

Table 1. Clinical oral health parameters in relation to gender and menstrual cycle.

Factors	Mean salivary flow Mean (SD)	Mean tongue coating Mean (SD)
Gender[#]		
Males	2.05 (0.9)	8.21 (2.6)
Females	1.95 (0.9)	8.11 (2.7)
Statistical inference	t=1.243 df=498 p=0.214	t=0.403 df=498 p=0.687
Menstrual Cycle[#]		
Present	1.59 (0.9)	8.59 (2.7)
Absent	1.99 (0.9)	8.03 (2.7)
Statistical Inference	t=-2.332 df=243 p=0.567	t=1.064 df=243 p=0.021

[#]Independent T test applied

Organoleptic scores in relation to gender and menstrual cycle: The organoleptic scores were dichotomized as (low and high oral malodor) having low comprised of absent, slight and moderate organoleptic scores of Rosenberg et al. [15] and high comprising strong and severe scores.

Chi square test is applied for finding the prevalence of oral malodor.

Gender: Males (50.8%) were seen with slightly greater percentage of malodor than females (49.2%). Among males

65.4% (n=166) had low oral malodor and 34.6% had high oral malodor. Whereas, in females 72 % (n=177) had low oral malodor and 28% (n=69) had high oral malodor. There was no statistical significance (p=0.112) seen between the groups (**Table2**).

Menstrual cycle: Among 6.2% (n=31) participants having menstruation, 67.7% (n=21) had low organoleptic scores and 32.3% (n=10) having high malodor, showing no statistical significance (p=0.271) between the groups (**Table2**).

Table 2. Organoleptic scores in relation to gender and menstrual cycle.

Factors	Organoleptic scores n (%)		Total N (%)	Statistical Inference
	Low	High		
Gender				
Male	166 (65.4)	88 (34.6)	254 (50.8)	χ^2 value: 2.525* df: 1 p value: 0.112
Female	177 (72)	69 (28)	246 (49.2)	
Menstrual cycle	21 (67.7)	10 (32.3)	31 (6.2)	χ^2 value: 2.613* df: 2 p value: 0.271

Correlation analysis: Oral halitosis (organoleptic hedonic scores) was found to increase in relation to decrease in salivary flow rate and presence of menstrual cycle. Whereas, oral halitosis is directly proportional to tongue coating score (**Table 3**).

Table 3. Correlation between the independent variables and organoleptic scores among study participants.

Independent variables	Organoleptic score (τ_b)	p-value
Gender	-0.090	0.029
Salivary flow rate	-0.465	0.001
Tongue coating score	0.174	0.001
Menstrual cycle	0.089	0.027

Ordinal logistic regression analysis: There was an increase seen in unstimulated salivary flow rate, it was associated with an increase in organoleptic score having an odds ratio of 0.314 (95% CI, 0.246 to 0.401). This effect was statistically significant (Wald $\chi^2=86.117$, $p<0.001$).

Also, the increase in the tongue coating score was associated with an increase in organoleptic scoring having an odds ratio

of 0.989 (95% CI, 1.077 to 1.239). It was statistically significant (Wald $\chi^2=16.248$, $p<0.001$) too.

The presence of menstrual cycle was associated with an increase in organoleptic scoring having an odds ratio of 1.414 (95% CI, 0.696 to 2.881) times when compared to female participants not having menstruation at that point of time of our study. However, the effect was not statistically insignificant (Wald $\chi^2=0.919$, $p=0.338$) (**Table 4**).

Table 4. Ordinal logistic regression analysis indicating the factors predicting oral halitosis among study participants.

Predictor	Odds ratio	95% CI		Wald's statistic	p value
		Lower bound	Upper bound		
Salivary flow rate	0.314	0.246	0.401	86.117	<0.001
Tongue coating	1.155	1.077	1.239	16.248	<0.001
Menstrual Cycle (Present)	1.416	0.696	2.881	0.919	0.338
Menstrual Cycle (Absent)=Ref					

DISCUSSION

Two forms of stress psychophysiological (Menstrual cycle) and psychological (self-perceived stress) were considered in the present study. Among 31 participants having menstrual cycle at the time of clinical evaluation, 67.7% had low organoleptic scores while 32.3% had high organoleptic scores. There was a weak positive, statistically insignificant ($p=0.027$) correlation ($\tau_b=0.089$) between menstrual cycle and oral halitosis in the present study. The presence of menstrual cycle was associated with an insignificant ($p=0.338$) increase in organoleptic scoring having an odds ratio of 1.414. The precise evaluation of the different phases of menstruation would have resulted in accurate assessment of this association.

However, the decrease in salivary flow rate, dryness of mouth, stress and anxiety associated with menstruation along with hormonal changes have all been documented to be predisposing factors for oral malodor during menstruation [16-18].

There was a study involving 20 female students to evaluate the association between menstrual cycle and salivary β -estradiol as well as with the production of volatile sulfur compounds (VSC) found mouth odor to be significantly influenced by different phases of menstruation. The oral

malodor although associated with other covariates such as stresses and dryness of mouth, showing no significant difference in the salivary flow rate at different phases of menstrual cycle. They concluded that the exact mechanism on how oral dryness could influence the production of VSC was not well understood [16]. Also few studies found oral dryness to be associated with psychological aspects related to pain and anxiety during menstruation. Anxiety and stress could be influenced by fluctuation of hormonal changes during different phases of menstrual cycle and affect psychiatric symptoms such as oral dryness and eventually can increase the VSC. Anxiety and stress could have effect on sympathetic system activation and composition of saliva. However, its mechanism was not fully understood [17,18].

One of the observational studies assessed the changes in VSC levels, clinical parameters and bacterial levels during menstrual cycle among 10 female subjects with periodontitis and 12 periodontally healthy female subjects. They found that Bleeding on probing (BOP) significantly increased in the ovulation phase among participants with periodontitis but not among healthy subjects. The VSC levels in subjects with periodontitis increased 2.2-fold in the ovulation phase compared with the follicular phase. In the ovulation phase, VSC levels and BOP were significantly higher in subjects with periodontitis than in healthy subjects. The number and salivary levels of *Prevotella intermedia* in subjects with

periodontitis were significantly higher in the ovulation phase than in the follicular phase [19].

CONCLUSION

There was a statistical significant difference seen in between mean salivary flow and tongue coating with severity of oral malodor. But there was no significant association between Psychophysiological Stress and oral halitosis.

The strength of the study is it is single calibrated trained examiner was present in the study, ruling out the inter examiner bias. Whereas the limitations of the study are it had only 31 participants having psychophysiological stress and hence cannot generalize the result. Also, because of the cross-sectional design of the study, temporal relationships might have been indicated between stress factors and oral malodor.

It is recommended for a longitudinal approach assessing stress and oral malodor that could authentically establish causal relationship. Studies using biochemistry markers, psychological assessment and other possible explanatory variables should be considered to elucidate the role of psychological factors in causing odiferous compounds.

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