

Original Article

Masticatory ability with depression, anxiety, and stress: Does there exist any association?

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ABSTRACT

Background: Masticatory ability as a subjective response to masticatory function indicates patients' perception of their mastication. To the best of our knowledge, there has been no study on association between masticatory ability and psychological status. This study investigated the association between self-assessed masticatory ability (SAMA) and psychological status among a large sample of Iranian adults.

Materials and Methods: In this cross-sectional study, data were extracted from 4135 adults who had been completed information in 20 counties across Isfahan province regarding masticatory ability and psychological statuses (depression, anxiety, and stress). An SAMA questionnaire, the Hospital Anxiety and Depression Scale and General Health Questionnaire were used to measure masticatory ability, depression and anxiety, and stress of study population. To analyze the data, ANOVA, χ^2 test, and multinomial regression were applied at 0.05 for the significance level.

Results: Masticatory ability was significantly correlated with depression ($P < 0.001$), anxiety ($P < 0.001$), and stress ($P < 0.001$). The participants in high masticatory ability group reported lower scores for presence of these psychological variables. Furthermore, males reported significantly higher level for masticatory ability than females ($P = 0.025$). In addition, there were significant association between low and moderate masticatory ability with anxiety (1.09, 1.08), depression (1.15, 1.13), and stress (1.11, 1.09), respectively. The association was still significant after adjusting for age, sex, educational level, and marital status.

Conclusion: Despite study limitations, the results of this study provide evidence that participants with higher score of depression, anxiety, and stress suffer lower masticatory ability.

Key Words: Anxiety, depression, masticatory, psychology, stress

Received: September 2015
Accepted: February 2016

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INTRODUCTION

The ability to decompose the foods into separate particles by chewing for preparing to swallow is

identified as masticatory function.^[1,2] Mastication as the first step for proper digestion and absorption

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How to cite this article: Roohafza H, Afshar H, Keshteli AH, Shirani MJ, Afghari P, Vali A, *et al.* Masticatory ability with depression, anxiety, and stress: Does there exist any association?. *Dent Res J* 2016;13:211-6.

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of nutrients with impact on systemic, physiologic, psychological, and neurocognitive functions is important for having a healthy life.^[2-6]

Masticatory function was evaluated using objective and subjective methods. The most common method to evaluate objective masticatory function is masticatory performance defined as standardized tests to measure the chewed foods.^[7-9] Masticatory ability as subjective responses about masticatory function was evaluated by questionnaire.^[3-5,10-12] These, along with painful swallowing, mucosal irritation, and difficulties in mastication and swallowing due to dried mouth, and some psychological status can influence mastication.^[3,11,13,14]

Uneasiness in the orofacial region in jaw movements is named masticatory pain.^[7] In some studies, the relationship between orofacial pain and depression, anxiety, stress, and fatigue has been reported.^[15-22] In a study, it was shown that masticatory muscle pain population indicates greater depression, fatigue, anxiety level, and less self-deception.^[16] Masticatory pain occurs in the females more than in males as in other clinical pain situations,^[23] while investigators in a study observed that females with chronic orofacial pain revealed more depression and not any more anxiety.^[18] Another study suggested that self-reported fatigue in orofacial pain patients can be caused by depression and somatization.^[17] In an interesting conclusion, the authors declared that chewing gum declined stress, anxiety, depression, and fatigue at work and even outside it.^[19]

Occlusal force, salivary flow rate, and remained teeth were associated with masticatory performance, and this relationship was not affected by sex.^[1,6,24,25] Medications,^[26-29] weak systemic health, female gender, and oldness cause high prevalence of xerostomia.^[30] In addition, the observed association between psychological status and xerostomia was limited to subjective oral dryness.^[28] In the previous studies,^[1,6,8,9,24] masticatory ability was deprived compared to the masticatory performance or occlusal force. Due to the subjective nature of masticatory ability measures, these studies require large samples.^[4] Furthermore, to our knowledge, there are a few studies about association or causal relationship between masticatory ability and psychological status.^[31,32] In this cross-sectional study, we investigated the association between self-assessed masticatory ability (SAMA), and depression, anxiety and distress level of the study population.

MATERIALS AND METHODS

This study was conducted as part of the Study on the Epidemiology of Psychological Alimentary Health and Nutrition Project. This project was a community-based study designed to evaluate the epidemiological aspects of functional gastrointestinal disorders and their association with lifestyle and psychological determinants in Iran in 2011. Detailed information about the methodology of the study has recently been published.^[33]

The study population of this cross-sectional study was selected among 4 million people in 20 counties across Isfahan Province. Convenience sampling was performed according to geographical region to determine the number of participants needed in each region. The participants were selected from healthy people who live in Isfahan Province. The questionnaires were given to the participants in their home and workplace, and they answered the questionnaires during their leisure time. All the participants were asked to complete a self-administered questionnaire to collect information regarding demographic, oral and dental health, lifestyle factors including nutritional habits and dietary intakes, gastrointestinal function, and psychological status. The completed questionnaires were received in sealed envelopes. All collected data were anonymous and confidential. Participation in this study was completely optional. The response rate was 86.16%. From the selected sample, we used data from 4135 adults who had completed information on both SAMA and psychological status (depression, anxiety, and distress). The Regional Bioethics Committee of Isfahan University of Medical Sciences scientifically and ethically approved the study protocol. The protocol was explained for the participants, and a written consent form was obtained from all the participants.

Measurements

Demographic factors

All participants completed a self-administered questionnaire to determine demographic characteristics of age, gender, educational status including undergraduate and graduate, and marital status including married and single (unmarried, divorced, or widow).

Masticatory ability

For assessing SAMA, a validated questionnaire comprising seven questions, based on previous

investigations, was used to assess the masticatory function.^[34] The content and face validity of the main questionnaire in its different sections was established by the opinion of a relevant panel of experts. Furthermore, a pilot study was conducted on 100 samples to evaluate the internal consistency using Cronbach's alpha. The minimum acceptable Cronbach's alpha level of 0.7 was exceeded by all sections of the main questionnaire. The face and content validity of the final questionnaire was found to be satisfactory. To evaluate masticatory function based on a series of measurable mastication indicators, latent class analysis (LCA) was used. Masticatory function was considered as a latent variable that could not be evaluated directly. LCA examines the pattern of relations among a set of observed categorical or continuous variables and identifies and classifies similar individuals' into latent classes (i.e. unmeasured groups). This leads subjects within each latent class to be highly similar to each other and uniquely different from other classes across the set of studied variable. Accordingly, comparisons can be made across constructed latent classes with regard to the participants' response to the measured variables.^[34]

Hospital Anxiety and Depression Scale

The validated version of Hospital Anxiety and Depression Scale was used to study depression and anxiety among individuals.^[35,36] The questionnaire consisted of 14 items that could be divided into two. Both scales consisted of seven items with a score ranging from 0 to 21. Higher scores reflect more anxiety and more depression. Threshold points for clinical levels of anxiety and depression were set at a score of ≥ 11 . Cronbach's alpha coefficient has been found to be 0.78 for the anxiety subscale and 0.86 for depression sub-scale.^[36]

12-item General Health Questionnaire

The stress level was measured by the validated version of 12-item General Health Questionnaire (GHQ-12) item.^[37,38] GHQ-12 is a consistent and reliable instrument for use in general population studies. Each item was rated on a 4-point scale (less than usual, no more than usual, fairly more than usual, and much more than usual). The system used to score the GHQ-12 questionnaires was the 0-0-1-1 method. Using this method, a participant could have been scored between 0 and 12 points; a score of 4 or more was used to identify a participant with high-stress level. Cronbach's alpha coefficient has been found to be 0.87.^[38]

Statistical analysis

Continuous variables were expressed as mean \pm standard deviation and ANOVA was used to compare the means between groups. Qualitative variables were expressed as frequency and χ^2 tests were used to compare frequencies. Multinomial regression was applied to find the association between SAMA with depression, anxiety, and stress while demographic variables were adjusted. Odds ratio were reported with the corresponding 95% confidence intervals. Independent variables included scores of depression, anxiety, and stress. Dependent variable was SAMA, and adjusting variables were age, sex, educational level, and marital status. SPSS, version 15 (SPSS Inc., Chicago, Illinois, USA) was used for analysis. $P \leq 0.05$ was considered statistically significant for all analyses.

RESULTS

Table 1 presents the demographic characteristics and the scores of depression, anxiety, and stress among 4135 persons who returned completed questionnaires. According to the masticatory ability classification, participants were divided into three groups as high, moderate, and low SAMA. SAMA was significantly correlated with depression ($P < 0.001$), anxiety ($P < 0.001$), and stress ($P < 0.001$). The

Table 1: Demographic characteristics and psychological variables according to masticatory ability

Variable	Masticatory ability			P
	High (n=2997)	Moderate (n=1082)	Low (n=56)	
Demographic characteristics				
Age group, n (%) (years)				
≥ 40	1816 (70.0)	639 (68.1)	31 (59.6)	0.174
< 40	780 (30.0)	300 (31.9)	21 (40.4)	
Sex, n (%)				
Male	1378 (46.0)	446 (41.2)	24 (42.9)	0.025
Female	1619 (54.0)	636 (58.8)	32 (57.1)	
Educational level, n (%)				
Under graduate	1213 (41.5)	468 (44.7)	27 (50.0)	0.100
Graduate	1713 (58.5)	579 (55.3)	27 (50.0)	
Marital status, n (%)				
Unmarried	552 (18.8)	197 (18.7)	12 (21.8)	0.850
Married	2381 (81.2)	854 (81.3)	43 (78.2)	
Psychological variables				
Depression score	5.57 \pm 0.05	7.04 \pm 0.10	7.27 \pm 0.57	<0.001
Anxiety score	3.11 \pm 0.06	4.18 \pm 0.12	4.47 \pm 0.73	<0.001
Stress score	1.80 \pm 0.04	2.49 \pm 0.09	2.69 \pm 0.47	<0.001

participants in high SAMA group reported lower scores for presence of these psychological variables. Furthermore, males reported significantly higher level for SAMA than females ($P = 0.025$).

Multivariate regression analysis in Table 2 shows a significant association between low and moderate SAMA level with anxiety (1.09, 1.08), depression (1.15, 1.13), and stress (1.11, 1.09), respectively. The association was still significant after adjusting based on age and sex and based on age, sex, marital status, and educational level.

DISCUSSION

The results of this cross-sectional community-based study showed that males reported the significantly higher level of SAMA than females. Masticatory function is closely associated with the number of retained teeth and dental status. Similar to the findings of previous studies, increased number of lost teeth was significantly associated with poor masticatory function.^[34,39]

In addition, we found that participants with higher depression, anxiety, and distress level reported lower SAMA. In one study, depressive symptoms were related to joint pain while anxiety symptoms were more particular for muscle pain relative to joint pain.^[21] In a prospective large sample study, 1329 participants during the 2-year follow-up were assessed for the presence of chronic orofacial pain, anxiety, depression, life stressors, and mechanical dysfunction. The researchers concluded that anxiety and chronic widespread pain indicated probably the onset of this pain.^[15] In a study, at University Hospital of Heidelberg, 222 patients suffering from temporomandibular disorders were examined. The results showed that females with chronic orofacial

pain revealed more depression.^[18] The results of another study provided evidence that reduction of masticatory function was associated with reduced remaining natural teeth and salivary flow rate.^[6]

According to our knowledge, there has not been a study on the association between masticatory function and depression, anxiety, and distress among Iranian adults. However, the obtained results confirmed previous findings regarding the association between masticatory ability's components and psychological status.^[2,18,21] Some factors can influence mastication such as the efficacy of tooth surfaces' contacts,^[1,3,12,25] the ache in muscles, dentition, jaw, and mucous on chewing,^[10,22] and painful swallowing.^[13,40]

The association between psychological status and pain on biting, chewing or mouth opening in the orofacial region is possibly caused by muscular hyperactivity and subsequently altered muscle mechanics,^[22] facial trauma, grinding, health anxiety,^[15] nonneuropathic pain conditions,^[20] and hypersensitivity to painful stimuli.^[16]

These psychological status especially for stress may cause xerostomia, not only by sympathetic nervous system activation but also, through psychotropic drugs as the most common side-effect.^[26-28] Antidepressants cause xerostomia by reduction of both nonstimulated^[28] and stimulated salivary flow rate without biochemical alteration.^[27]

Not only psychological disorders can cause inappropriate oral health and related behaviors such as smoking, noncompliance with oral hygiene and dental visiting but also, through associated xerostomia result in tooth loss and reduced SAMA.^[1,6]

These pain, tooth loss, and xerostomia can restrict chewing the foods because muscular system pain reduces ability and efficiency of jaw movements,^[22]

Table 2: Multivariate analysis of psychological variables and masticatory ability

Variable	Masticatory ability	Crude			Model 1			Model 2		
		OR	95% CI	P	OR	95% CI	P	OR	95% CI	P
Anxiety	High	1			1			1		
	Moderate	1.08	1.06-1.10	0.000	1.07	1.05-1.09	0.000	1.07	1.04-1.09	<0.001
	Low	1.09	1.02-1.17	0.005	1.08	1.01-1.16	0.017	1.10	1.02-1.18	0.008
Depression	High	1			1			1		
	Moderate	1.13	1.11-1.16	0.000	1.13	1.10-1.16	0.000	1.13	1.10-1.16	<0.001
	Low	1.15	1.07-1.24	0.000	1.15	1.06-1.24	0.000	1.16	1.07-1.25	<0.001
Stress	High	1			1			1		
	Moderate	1.09	1.06-1.12	0.000	1.08	1.05-1.11	0.000	1.08	1.05-1.11	<0.001
	Low	1.11	1.02-1.22	0.012	1.12	1.02-1.22	0.013	1.11	1.01-1.22	0.022

Model 1: Age and sex adjusted; Model 2: Age, sex, marital status, and educational level adjusted; CI: Confidence interval; OR: Odds ratio

jaw occluding, and chewing.^[10] Furthermore, dried mouth provides inconvenience and pain not just for mucosal irritation and oral mucosal pathologic alterations but even with pain and difficulties in mastication and swallowing. Mastication and swallowing troubles are the most common adverse xerostomia-related effect.^[13]

Normal mastication improves general health. In this regard, Smith *et al.*^[19] reported that chewing gum lowered stress, anxiety, depression and fatigue both at work and outside. Also, this act led to greater well-being and perceptions of better performance. Chewing may be similar to types of meditation where repetitive activity as intonation, plays an important role for these deductions. Then, it can be suggested to patients suffering from masticatory problems to chew gum.

The limitations of this study included lack of any objective assessment method for masticatory function, the omission of some psychological variables, and absence of clinical examinations. In addition, this study conducted in Isfahan province that it may affect the generalizability of the results.

CONCLUSION

The results of the current study showed that participants with a higher score of depression, anxiety, and distress reported lower SAMA. Therefore in the diagnosis, evaluation, and treatment of patients who complain from poor mastication, psychological status should be considered. Because the psychological problems may affect both physical and mental health. It is proposed for future investigation to measure masticatory performance in patients suffering from psychological disorders as depression, anxiety, stress, and other psychological variables.

ACKNOWLEDGMENTS

We wish to thank all people who participated in this study.

Financial support and sponsorship

This study was financially supported by Vice Chancellery for Research and Technology, Isfahan University of Medical Sciences (IUMS).

Conflicts of interest

The authors of this manuscript declare that they have no conflicts of interest, real or perceived, financial or non-financial in this article.

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