

Original

# Association of temporomandibular disorder symptoms with anxiety and depression in Portuguese college students

Beatriz Minghelli<sup>1,2</sup>), Marcos Morgado<sup>3</sup>), and Tatiana Caro<sup>1</sup>)

<sup>1</sup>School of Health Jean Piaget Algarve, Piaget Institute, Silves, Portugal

<sup>2</sup>National School of Public Health, Nova University of Lisbon, Lisbon, Portugal

<sup>3</sup>Faculty of Sport and Physical Education, University of Coimbra, Coimbra, Portugal

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**Abstract:** We investigated the prevalence of temporomandibular disorder (TMD) and its association with anxiety and depression among 1,493 Portuguese college students (age 17-69 years) at Piaget Institute. The assessment instruments were the Fonseca Anamnestic Questionnaire and the Hospital Anxiety and Depression Scale. TMD was present in 633 (42.4%) students, and anxiety or depression was present in 456 (30.5%) students. Regarding the association of TMD with anxiety and depression, 280 of the 633 students (61.4%) with TMD symptoms also had signs of anxiety or depression ( $P < 0.001$ ). As compared with men, women had an odds ratio of 1.9 (95% confidence interval: 1.53-2.46;  $P < 0.001$ ) for TMD. As compared with students without signs of anxiety or depression, students with such signs had an odds ratio of 3.1 (95% confidence interval: 2.42-3.84;  $P < 0.001$ ) for TMD. College students from various fields of study and regions of Portugal had a high prevalence of TMD, which was significantly associated with anxiety and depression. (J Oral Sci 56, 127-133, 2014)

Keywords: temporomandibular disorder; anxiety; depression; prevalence.

## Introduction

Temporomandibular disorder (TMD) is a condition that affects the temporomandibular joints (TMJ) and

masticatory muscles of the stomatognathic system and associated structures. It can affect individuals of any age, although prevalence is higher among women and people aged 20-45 years (1-3). Several studies indicate that approximately 60-70% of the population has at least one sign of TMD at some point in life, yet only 5% need treatment for TMD (3,4).

The causes of TMD are multifactorial, and its signs and symptoms include pain in the TMJ and pre-auricular region, cervical spine, head, and face; cranial cervicofacial and masticatory muscle fatigue; limited mandibular range of motion; and presence of joint noises (2). Spasm of the masticatory muscles is a painful symptom in TMD and is caused by muscle distension, contraction, or fatigue due to the presence of parafunctional habits such as bruxism and onychophagia (2,3,5). Several studies, in different populations, have shown that these habits are triggered or aggravated by emotional stress (2,3-10). Evidence indicates that myofascial pain and functional somatic syndromes such as fibromyalgia and chronic fatigue syndrome are comorbidities of the muscular pain that may be due to psychosocial factors. The manifestations of myofascial pain and discomfort coincide with moments of tension and stress, which causes muscular hyperactivity, and this tension can lead to parafunctional habits. Thus, psychosocial factors such as anxiety, stress, and depression might be important in the pathogenesis of TMD (11).

TMD prevalence and its association with anxiety and depression have not been studied at the national level. Such studies are needed in order to determine the prevalence of TMD, as the disorder affects many individuals who are unaware of their diagnosis.

The objectives of this study were to estimate the prevalence of TMD in Portuguese college students from

Correspondence to Dr. Beatriz Minghelli, Escola Superior de Saúde Jean Piaget, Algarve, Enxerim 8300-025, Silves, Portugal  
E-mail: beatriz.minghelli@silves.ipiaget.pt

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Piaget Institute and evaluate its association with anxiety and depression.

### Materials and Methods

This observational, analytical, and cross-sectional epidemiological study enrolled students who signed a consent form agreeing to participate in the study. In the informed consent document, all participants were informed of the objectives of the study and that they could withdraw from the study at any time. They were also assured of the confidentiality of the results obtained and their right to self-determination and privacy, thus respecting the ethical principles of research.

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and was approved by the Ethics Committee of the Regional Health Administration of the Algarve and the schools that participated in the project (278/12 D.S.P.P, 11-26-2012).

### Population

The study population was students enrolled in all courses of the following institutions of higher education: the Higher Institute for Intercultural Studies and Transdisciplinary Studies in Almada, Santo André, and Viseu; the School of Health Jean Piaget in Macedo de Cavaleiros, Silves, Vila Nova de Gaia, and Viseu; and the School of Education Jean Piaget in Vila Nova de Gaia. All students who agreed to participate were eligible for inclusion, regardless of age or sex.

### Measurements

The measuring instruments were administered only once. The participants answered a questionnaire consisting of three parts: sociodemographic characteristics, the Fonseca Anamnestic Questionnaire, and the Hospital Anxiety and Depression (HAD) scale.

### Sociodemographic characteristics of the participants

The sociodemographic information collected included age, sex, school name, and course of study. We also included items on prior knowledge of TMD diagnosis and whether the individual had ever been or was currently being treated for TMD. The answer choices for these last questions were “yes” and “no”.

### Fonseca Anamnestic Questionnaire

The Fonseca Anamnestic Questionnaire is a modified version of the Helkimo Anamnestic Index and is one of a few such instruments available in Portuguese to assesses the severity of TMD symptoms. The Helkimo Anamnestic Index was one of the first instruments to

be confirmed as reliable in identifying TMD signs and symptoms (12,13).

The Fonseca Anamnestic Questionnaire has a 95% correlation with the Helkimo Anamnestic Index ( $r = 0.6169$ ,  $P < 0.05$ ) and 95% reliability in application and allows rapid, inexpensive collection of a great deal of information. It is easy to complete and does not bias the answers of respondents (13). It consists of ten questions, with answers options of no, sometimes, and yes. The items include questions on the presence of TMJ pain, head and neck pain, pain while chewing, parafunctional habits, limitation of joint movement, perception of malocclusion, and emotional stress (13).

An answer of “no” was scored as 0, “sometimes” as 5, and “yes” as 10. The sum of the item scores provides an index that classifies individuals as having no TMD (score, 0-15), mild TMD (20-45), moderate TMD (50-65), and severe TMD (70-100) (13).

### HAD scale

The HAD was developed by Zigmond and Snaith in 1983, and the Portuguese version was validated by Botega et al. We selected this scale because it is used to identify and measure the intensity of anxiety and depression in nonpsychiatric environments, as in the present population, and has been applied to this type of population in several previous studies (14). The scale consists of 14 items divided into two scales. Seven items measure anxiety (HADS-A), and seven measure depression (HADS-D). Thus, the concepts of anxiety and depression are separated (15).

To complete the questionnaire, the participant selects the answer choice that is closest to what he/she felt during the previous week. Each item is scored from 0 to 3, depending on the response, and the maximum score is 21 points for each scale. In both scales a score of 0-7 indicates absence of anxiety or depression, a score of 8-10 indicates possible anxiety or depression, and a score of 11 or higher indicates presence of anxiety or depression (14,15). Thus, an individual could have no, either, or both anxiety and depression. Several studies, in a wide variety of clinical populations, found that HAD had good sensitivity, specificity, and internal consistency in assessing anxiety and depression symptoms (15).

### Data analysis

In the initial analysis, descriptive statistics were used to characterize all covariates. Then, the chi-square test of independence was used to evaluate associations of TMD with sex, age group, course of study, school location, and anxiety and depression. To ensure the applicability of

**Table 1** Associations of TMD with study covariates

Variables (n, %)		No TMD (860, 57.6%)	TMD (633, 42.4%)	P value
Sex	Male (471, 31.5%)	323 (68.6%)	148 (31.4%)	<0.001
	Female (1,022, 68.5%)	537 (52.5%)	485 (47.5%)	
Age group, years	17-19 (164, 11.0%)	100 (61.0%)	64 (39.0%)	0.617
	20-29 (1,110, 74.3%)	638 (57.5%)	472 (42.5%)	
	30-39 (154, 10.3%)	83 (53.9%)	71 (46.1%)	
	40-69 65 (4.4%)	39 (60.0%)	26 (40.0%)	
Course of study	Health (1,084, 72.6%)	633 (58.4%)	451 (41.6%)	0.540
	Education (317, 21.2%)	174 (54.9%)	143 (45.1%)	
	Management and Engineering (92, 6.2%)	53 (57.6%)	39 (42.4%)	
Locality	North (845, 56.6%)	472 (55.9%)	373 (44.1%)	0.439
	Center (135, 9.0%)	79 (58.5%)	56 (41.5%)	
	Alentejo (64, 4.3%)	40 (62.5%)	24 (37.5%)	
	South (449, 30.1%)	269 (59.9%)	180 (40.1%)	

**Table 2** Associations of the presence of anxiety or depression with study covariates

Variables (n, %)		No anxiety or depression (1,037, 69.5%)	Anxiety or depression (456, 30.5%)	P value
Sex	Male (471, 31.5%)	344 (73.0%)	127 (27.0%)	0.042
	Female (1,022, 68.5%)	693 (67.8%)	329 (32.2%)	
Age group, years	17-19 (164, 11.0%)	119 (72.6%)	45 (27.4%)	<0.001
	20-29 (1,110, 74.3%)	786 (70.8%)	324 (29.2%)	
	30-39 (154, 10.3%)	103 (66.9%)	51 (33.1%)	
	40-69 (65, 4.4%)	29 (44.6%)	36 (55.4%)	
Course of study	Health (1,084, 72.6%)	791 (73.0%)	293 (27.0%)	<0.001
	Education (317, 21.2%)	219 (69.1%)	98 (30.9%)	
	Management and Engineering (92, 6.2%)	27 (29.3%)	65 (70.7%)	
Locality	North (845, 56.6%)	567 (67.1%)	278 (32.9%)	<0.001
	Center (135, 9.0%)	101 (74.8%)	34 (25.2%)	
	Alentejo (64, 4.3%)	8 (12.5%)	56 (87.5%)	
	South (499, 30.1%)	361 (80.4%)	88 (19.6%)	

the chi-square test of independence, TMD was classified as absent and present (which included mild, moderate, and severe TMD). For presence of anxiety or depression, only two groups were considered: absence of anxiety and depression versus presence of anxiety or depression (which included individuals classified as having anxiety or depression and those with possible anxiety or depression).

The effects of covariates on the presence of TMD were assessed by binary logistic regression. The Enter and Forward LR models and omnibus, Hosmer-Lemeshow, and Nagelkerke tests were used. The model results are presented as crude and adjusted odds ratios (ORs) and confidence intervals (CIs).

The statistical analysis was performed with the Statistical Package for Social Sciences (SPSS) version 19.0. Statistical significance was set at 0.05.

## Results

The sample consisted of 1,493 students aged 17-69 years (mean: 24.37; SD: 6.37; median: 22.00; mode: 20.00). There were 471 (31.5%) males and 1,022 (68.5%) females.

Regarding campus enrollment, 767 (51.4%) students attended Vila Nova de Gaia, 449 (30%) Silves, 135 (9.1%) Almada, 64 (4.3%) Santo André, 44 (2.9%) Viseu, and 34 (2.3%) Macedo de Cavaleiros. Their courses of study were health (72.6%), education (21.2%), and management and engineering (6.2%).

Analysis of sociodemographic characteristics revealed that 46 (3.1%) students had received a previous TMD diagnosis, among whom only 14 (0.9%) had received some type of treatment. In total, 633 students (42.4%) had TMD, which was classified as mild in 520 (34.8%) students, moderate in 93 (6.2%), and severe in 20 (1.3%).

The most prevalent symptoms reported by students

**Table 3** Association between TMD and anxiety/depression

Anxiety/depression ( <i>n</i> , %)	No TMD (860, 57.6%)	TMD (633, 42.4%)	<i>P</i> value
No anxiety or depression (1,037, 69.5%)	684 (66.0%)	353 (34.0%)	<0.001
Anxiety or depression (456, 30.5%)	176 (38.6%)	280 (61.4%)	

**Table 4** Results of binary logistic regression analysis of TMD risk

Variables	Odds Ratio <sub>crude</sub> (95% CI); <i>P</i>	Odds Ratio <sub>adjusted**</sub> (95% CI); <i>P</i>
Sex (male*)		
Female	1.94 (1.53-2.46); <i>P</i> < 0.001	1.94 (1.53-2.46); <i>P</i> < 0.001
Anxiety or depression (none*)		
Presence	3.05 (2.42-3.84); <i>P</i> < 0.001	3.08 (2.45-3.87); <i>P</i> < 0.001

\* class reference; \*\* adjusted for sex and absence/presence of anxiety or depression

**Table 5** Results of binary logistic regression analysis of anxiety/depression risk

Variables	Odds Ratio <sub>crude</sub> (95% CI); <i>P</i>	Odds Ratio <sub>adjusted**</sub> (95% CI); <i>P</i>
Sex (male*)		
Female	1.26 (0.95-1.66); <i>P</i> = 0.108	–
Age group (17-39 years*)		
40-69 years	0.85 (0.56-1.28); <i>P</i> = 0.43	–
Course of study (Health or Education*)		
Management and Engineering	1.29 (0.56-2.95); <i>P</i> = 0.54	–
Locality (North, Center, or South*)		
Alentejo	12.29 (4.09-36.98); <i>P</i> < 0.001	15.64 (7.37-33.18); <i>P</i> < 0.001

\* class reference; \*\* adjusted for sex, age group, course of study, and locality

with TMD (combining participants answering yes and sometimes) were nervous tension ( $n = 541$ ; 85.5%), headache (477; 75.4%), neck pain or stiffness (421; 66.5%), TMJ noises while chewing or opening the mouth (341; 53.9%), habitual clenching or grinding of teeth (300; 47.4%), and fatigue/muscle pain while chewing (275; 43.5%). Less common symptoms were pain in the ear or TMJ (236; 37.3%), a feeling that the teeth do not fit together well (192; 30.3%), difficulty opening the mouth (168; 26.5%), and difficulty moving the jaw laterally (111; 17.6%).

Table 1 shows the associations of sex, age group, course of study, and school location with TMD ( $P < 0.001$ ,  $P = 0.617$ ,  $P = 0.540$ ,  $P = 0.439$ , respectively). Only the association between sex and TMD was significant.

The results of the HAD scale showed that 456 (30.5%) students had some level of anxiety or depression, 306 (20.5%) had possible anxiety or depression, and 150 (10%) had probable anxiety or depression. Table 2 shows the associations of sex, age group, course of study, and school location with levels of anxiety and depression, as determined by the HAD scale ( $P = 0.042$ ,  $P < 0.001$ ,  $P < 0.001$ ,  $P < 0.001$ , respectively). All covariates were significantly associated with anxiety and depression. Among the 633 students with TMD symptoms, 280

(44.2%) had signs of anxiety or depression; this association was statistically significant ( $P < 0.001$ ; Table 3).

Table 4 shows the results of binary logistic regression analysis of the presence of TMD. As compared with men, women had an OR of 1.9 (95% CI: 1.53-2.46;  $P < 0.001$ ) for TMD. Students with anxiety or depression had an OR of 3.1 (95% CI: 2.42-3.84;  $P < 0.001$ ) for TMD, as compared with students without these symptoms.

In the adjusted model, the values obtained in the omnibus, Hosmer-Lemeshow, and Nagelkerke tests, as applied to the characteristics of the subsample absence and presence of TMD (adjusted for sex and absence and presence of anxiety or depression), were  $P < 0.001$ ,  $P = 0.96$ ,  $R^2 = 1.10$ , respectively. This model was confirmed to be mathematically valid for the analysis.

The chi-square test of independence showed higher prevalences of anxiety and depression among students aged 40 years or older, those enrolled in Management and Engineering, and those from the Alentejo campus. Logistic regression analysis of these covariates was stratified so that these options had the highest proportions of students with anxiety and depression.

Table 5 shows the results of binary logistic regression analysis of the presence of anxiety or depression. Students at the Alentejo campus had a crude OR of 12.3

(95% CI: 4.09-36.98;  $P < 0.001$ ) and an adjusted OR of 15.64 (95% CI: 7.37-33.18;  $P < 0.001$ ) for anxiety or depression, as compared with students enrolled at other campuses.

In the adjusted model, the results of the omnibus, Hosmer-Lemeshow, and Nagelkerke tests, as applied to the characteristics of the subsample absence and presence of anxiety or depression (adjusted for sex, age group, course of study, locality, and presence of TMD), were  $P < 0.001$ ,  $P = 0.460$ ,  $R^2 = 0.102$ , respectively. This model was confirmed to be mathematically valid for the analysis.

## Discussion

The results of this study revealed a high prevalence of TMD (42.4%) among college students from various regions of Portugal and showed that few of these students had prior knowledge of TMD.

Otuyemi et al. (16) found a TMD prevalence similar to that in the present study among 308 students studying medicine and dentistry at the University of Nigeria. However, other studies, which used the same instrument to measure TMD prevalence in college students, reported even higher values (13,14). Nomura et al. (13) assessed TMD prevalence in 218 dental students at the University of São Paulo, Brazil and found that 53.2% had some degree of TMD. Among all relevant studies, the largest sample was in a study by de Oliveira et al. (17): 2,396 students (age  $22.1 \pm 4.9$  years) were evaluated in 15 Brazilian cities, and the prevalence of TMD was 68.6%. These differences in reported TMD prevalences may be due to the characteristics of the course of study, the time when the questionnaire was administered, and the characteristics of the populations.

Women had a higher prevalence of TMD, which is consistent with the findings of earlier studies of various populations (9,13,14,17). As compared with men, women had an OR of 1.9 (95% CI: 1.53-2.46;  $P < 0.001$ ) for TMD. This high prevalence of TMD in women might be due to physiological characteristics, particularly hormonal variations and structures in connective tissue and muscle. The greater laxity of these tissues, which is related to estrogen level, may explain why these tissues are less able to support functional pressure, thereby leading to TMD (3,13,18). LeResche et al. (19) found that pain intensity varied during the menstrual cycle among women with TMD: pain intensity was greater when estrogen concentration was higher.

The most common self-reported TMD symptoms on the Fonseca Anamnestic Questionnaire were nervous tension (85.5%), headache (75.4%), neck pain or stiff-

ness (66.5%), and TMJ noise while chewing or opening the mouth (53.9%). These findings are similar to those of Nomura et al. (13), who found that 76.7% of students considered themselves tense people, 65.5% had TMJ clicking, 64.7% had frequent headache, and 61.2% had neck pain.

Excessive tension can lead to constant dental clamping, which alters local circulation in muscles and ion exchange in cell membranes. These lead to accumulation of lactic and pyruvic acids, which contributes to stimulation of pain receptors (1,3). A possible explanation for the association between TMD and headache is that headaches are related to muscle activity, so activity involving the head and neck is probably important in the etiology of many headaches. The presence of noise in TMJ may be due to incorrect positioning of the articular cartilage, which displaces the mandibular condyle superiorly when the mouth is opened, resulting in a click (3).

The HAD showed that 30.5% of the present students had anxiety or depression. Inam et al. (20) found a higher prevalence of anxiety and depression (60%) among 252 students at Ziauddin Medical University, and Jadoon et al. (21) found a prevalence of anxiety and depression of 43.9% among medical students in Multan, Pakistan.

Most of the present participants with anxiety and depression were women, as was the case in other studies (21,22). As compared with men, women are more likely to report depressive symptoms and have a higher rate of psychosomatic illnesses (23).

Students in the Alentejo region had higher levels of anxiety and depression. Several studies have noted a higher number of suicides in this region than in other parts of Portugal, probably due to low population density, the lower degree of integration, and both family and social isolation (24,25). Almeida and Quintão (25) found that a group of elderly adults living in Alentejo had high rates of depression and suicidal ideation.

We found that TMD was significantly associated with anxiety and depression levels, which accords with the results of several studies (5,14,20,26-29). Kindler et al. (30) found that individuals with depression symptoms have an OR of 2.1 (95% CI: 1.5-3.0;  $P < 0.001$ ) for pain on palpation of the TMJ and that depressive symptoms may be specific to the development of joint pain, while symptoms of anxiety are specific to muscular pain.

Slade et al. (31) followed 171 participants for up to 3 years: 8.8% were diagnosed with first-onset TMD. Furthermore, depression, perceived stress, and mood were associated with pain sensitivity and increased the risk of TMD by a factor of two to three. Liao et al. (9) found that TMD incidence in individuals with depression

was 2.65 times that of those without depression.

Individuals subject to stress may develop parafunctional habits and muscle tension, which lead to development of TMD (1,3). Thus, parafunctional components, especially those that increase muscle tension, and changes in emotional states are good indicators of jaw pain in people with TMD, which suggests that anxiety and depression are etiological factors in TMD.

There are other questionnaires for assessing the presence of TMD. The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) was drafted by Dworkin and Leresche in 1992 and is used to diagnose specific TMD subtypes, thereby allowing standardization and replication of research on the most common forms of muscle- and joint-related TMD (32,33). Thus, it is more elaborate than the instrument used in this study and includes more questions for classifying TMD, which could have increased the frequency of nonresponse by the present participants. We opted to use the Fonseca Anamnestic Questionnaire because this study was a cross-sectional epidemiological study of a large sample. The use of a straightforward, inexpensive questionnaire allowed for the rapid collection of a great deal of information.

The present study has some limitations. A questionnaire was used to classify TMD. More-detailed clinical examination of TMD signs and symptoms and imaging tests to confirm the diagnosis would have been useful. Furthermore, we did not evaluate the effects of student work load (classes, evaluation or traineeship period) and the area of traineeship (for example: oncology or palliative care area) that could contribute to increased levels of anxiety and depression.

The results revealed a high prevalence of TMD among college students in various academic faculties (namely, Health, Education, and Management and Engineering) and regions of Portugal. In addition, TMD was associated with levels of anxiety and depression.

This was a pioneer study; thus, actual TMD prevalence might be higher. Greater understanding of this condition among populations exposed to high levels of emotional stress, such as college students, is of considerable importance in increasing awareness of TMD signs and symptoms and encouraging affected individuals to seek treatment.

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