

# Prevalence of Temporomandibular Disorder in Children and Adolescents from Public Schools in Southern Portugal

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## Abstract

**Background:** The prevalence of temporomandibular disorder (TMD) in children and adolescents is in the range of 6-68% and can be triggered or aggravated by emotional stress. **Aim:** The study was to investigate the prevalence of TMD in Portuguese children and adolescents and its association with emotional stress. **Materials and Methods:** The sample comprised 3,260 students aged 5-19 years. The questionnaire was used to assess the presence of TMD, and was applied in a single moment. **Results:** TMD was observed in 821 (25.2%) students. The most common symptoms of TMD were: if considered tense or nervous (52%), have headaches (36.8%), and habit of clenching or grinding teeth (27.3%). The girls had a 1.36 higher probability of developing TMD than boys (95% CI: 1.14-1.63;  $p < 0.001$ ); moreover, students from the older age group had a 2.31 higher probability of developing the disorder (95% CI: 1.85-2.89;  $p < 0.001$ ). Students who considered themselves tense or nervous presented 8.74 higher probability (95% CI: 7.03-10.86;  $p < 0.001$ ) of developing TMD. **Conclusion:** This study showed a high prevalence of TMD in children and adolescents in southern Portugal, and revealed a significant association between this dysfunction and the levels of emotional stress. Female students, older students, and those considered tense or nervous have a higher probability of developing TMD.

**Keywords:** Adolescent, children, emotional stress, prevalence, temporomandibular disorder

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## Introduction

Temporomandibular disorder (TMD) is a dysfunction that affects the tempomandibular joints (TMJ) and masticatory muscles of the stomatognathic system and associated structures.<sup>[1-3]</sup> The disease can affect individuals of any age group, with a higher prevalence among women in the age group of 20-45 years;<sup>[1-3]</sup> however, many studies have reported a high incidence of signs and symptoms of the disorder in children

similar to those seen in adults.<sup>[4-6]</sup> Several studies indicate that approximately 60-70% of the population has at least one sign of TMD at some point in their life.<sup>[3,7]</sup> In children and adolescents, the prevalence of TMD ranges between 6% and 68%.<sup>[1,6,8,9]</sup>

The etiology of TMD is multifactorial and its signs and symptoms involve pain in the TMJ, pre-auricular region, cervical spine, head and face, muscle fatigue in the cervical and craniofacial region and the muscles of mastication, range limitation of jaw motion and joint noises and headaches.<sup>[2,10-12]</sup> The spasm of the muscles of mastication is the main cause of painful symptoms in TMD; this can be caused by distention, malocclusion, or the contraction muscle fatigue due to the presence of parafunctional habits, including bruxism and nail biting.<sup>[2,3,13]</sup> Several studies conducted in different populations have shown that these habits can be developed or aggravated by emotional stress.<sup>[2,3,13-15]</sup>

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Thus, psychosocial factors such as anxiety, stress, and depression play an important role in the pathogenesis of TMD.<sup>[16]</sup>

High levels of stress may lead to the development of constant dental clamping, affecting the circulation in local muscles and altering the ionic balance in cell membranes; this, in turn, leads to the accumulation of lactic and pyruvic acids, resulting in the stimulation of pain receptors.<sup>[16]</sup> There are various instruments for the assessment of TMD, including indices, questionnaires, protocols, rating scales, and diagnostic criteria. Of these, questionnaires have the advantage of low cost, ease of use, and fast for epidemiological survey; in addition, these can be easily applied to a large number of individuals.<sup>[17]</sup> National studies on the prevalence of TMD in children and adolescents are unavailable; therefore, studies are crucial to identify the prevalence of this disorder as it affects many individuals who are in the growth phase and are unaware of their diagnosis, which help prevent the appearance of craniofacial growth abnormalities, pain in the TMJ, or mandibular dysfunction in adulthood.<sup>[18]</sup>

Thus, the objectives of this study were to assess the prevalence of TMD in children and adolescents from public schools in southern Portugal and its association with emotional stress.

## Material and methods

The design of this study was epidemiological, observational, analytical, and cross-sectional. The study was approved by the Ethics Committee of the Regional Health Administration of the Algarve, the Regional Directorate of Education of the Algarve, the Directorate General for Innovation and Curriculum Development, the Ministry of Education and Science, and the Directors of the schools that participated in the project. Written informed consent was obtained from all subjects.

### Population and sample:

The population involved students (of both sexes) enrolled in public schools from all counties of Algarve. The region of Algarve, South of Portugal, has 16 counties: Albufeira, Alcoutim, Aljezur, Castro Marim, Faro, Lagoa, Lagos, Loulé, Monchique, Olhão, Portimão, São Brás, Silves, Tavira, Vila do Bispo, and Vila Real de Santo António.

Considering an estimate of the population dimension, among the number of students between the elementary school (1<sup>st</sup>-4<sup>th</sup> and 5<sup>th</sup>-9<sup>th</sup>) and high school (10<sup>th</sup>-12<sup>th</sup>) (52,480 students), the minimum sample size was taken as 2,527 students, taking into account an estimate of the annual prevalence of TMD of 20% reported in international

studies<sup>[7,19-21]</sup> and assuming an error margin of 2% with a confidence level of 99%.

A stratified random sample was used, where the target population was divided into subgroups considered homogeneous, and then a sample from each stratum was randomly selected. Therefore, within each county, schools were randomly selected (if there was more than one school in the county). The sample dimension in counties considered the number of students enrolled in each county. Taking into account non-adherence by students and/or parents, the questionnaires were distributed to all students in selected schools.

Inclusion criteria involved the students who had brought the parental or guardian consent and who wanted to participate.

Students were divided into three age groups: group 1 composed of students aged 5-9 years, group 2 included students aged 10-14 years, and group 3 had students aged above 15 years. This division considered the grade school level divided by schools, including the elementary school and high school.

## Measures

The instrument of measurement consisted of a questionnaire that was applied only once during October 2012 to January 2013. The questionnaire consisted of two parts: Socio-demographic characterization of population and Fonseca Anamnestic Questionnaire.

### *Socio-demographic characterization of population questionnaire*

The questions about socio-demographic characteristics of the population included the school name, age, grade school, and gender. We also included questions about prior knowledge of TMD diagnosis and whether the individual has made or makes any treatment for TMD. The choices of answers for these last questions were YES and NO.

### *Fonseca Anamnestic Questionnaire*

The Fonseca Anamnestic Questionnaire is a modified version of the Index Anamnestic Helkimo and is one of the few instruments available in Portuguese and features that assess the severity of the TMD symptoms. The Helkimo index was one of the first to be referred to in the literature as having the reliability to identify signs and symptoms of TMD.<sup>[17,21,22]</sup>

The Fonseca Anamnestic Questionnaire obtained a 95% correlation with the clinical Helkimo index ( $r = 0.6169$ ,  $p < 0.05$ ), and 95% reliability in application and allows

one to collect a large number of information in a short period of time, and is a low-cost application, easy for perception-based evaluation, and does not influence the appraiser in obtaining answers.<sup>[17,21,22]</sup>

This instrument consists of 10 questions, whose answer options are NO, SOMETIMES, and YES. The questionnaire included questions on the presence of TMJ pain, head and neck pain, pain while chewing, questions on parafunctional habits, limitation of joint movement, perception of malocclusion, and emotional stress.<sup>[17]</sup>

Each answer has a value; answer NO has 0 value, SOMETIMES has 5 values, and YES has 10 values. The sum of the values obtained provides an index that classifies individuals in the absence of TMD (0-15 values), mild TMD (20-45 values), moderate TMD (50-65 values), and severe TMD (70-100 values).<sup>[17]</sup>

### Statistical study

In the first approach, descriptive statistics were made to all variables in the study. After that, Chi-squared Test of Independence was applied in order to evaluate associations between the occurrence of TMD and gender, age group, and emotional stress.

In order to satisfy the requirements of applicability of Chi-squared Test for Independence, the variable TMD was grouped into absence and presence (included mild, moderate, and severe TMD).

The influence of the variables use in this study with the presence of TMD was assessed using binary logistic regressions. The models Enter e Forward LR and the Omnibus, Hosmer, Lemeshow, and Nagelkerke tests were used. The models' results were presented as Odds Ratios (OR) crude and adjusted and respective confidence intervals.

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 3,260 children and adolescents aged 5-19 years ( $11.83 \pm 3.8$  years), of which 1,504 (46.1%) were male and 1,756 (53.9%) were female.

From the 16 counties of the Algarve region, six did not participate because of logistics issues or refused to participate in the study. Of the students evaluated, 684 (21%) were from the counties of Portimão, 651 (20%) from Faro, 642 (19.7%) from Loulé, 427 (13.1%) from Silves, 244 (7.5%) from Vila Real Santo António, 202 (6.2%) from São Brás do Alportel, 155 (4.8%) from Albufeira, 142 (4.4%) from Olhão, 75 (2.3%) from Vila do Bispo, and 38 (1.2%) from Aljezur.

Only 56 (1.7%) students reported that they had been diagnosed with TMD, and 26 (0.8%) were undergoing treatment.

Table 1 shows the absolute and relative frequencies of answers to the Fonseca Anamnestic Questionnaire. The most common symptoms of TMD (summing the answers YES and SOMETIMES) were the following: if considered tense or nervous (52%), have headaches (36.8%), habit of clenching or grinding teeth (27.3%), and pain in the neck (17.7%).

A total of 2,439 (74.8%) students did not have TMD and 821 (25.2%) had TMD; moreover, 729 (22.4%) students presented with mild TMD, 83 (2.5%) had moderate, and 9 (0.3%) had severe TMD.

Of the 821 (100%) students with TMD, most were female (61.5%) and belonged to the age group of 15-19 years (43.4%), followed by the age group of 10-14 years

**Table 1: Fonseca Anamnestic Questionnaire**

Questions	Answers		
	Yes (%)	Sometimes (%)	No (%)
Do you have difficulty in opening your mouth?	31 (1)	131 (4)	3,098 (95)
Do you have difficulty in moving the jaw from side to side?	32 (1)	131 (4)	3,097 (95)
Do you have fatigue/muscle pain when you chew?	36 (1.1)	430 (13.2)	2,794 (85.7)
Do you feel headaches often?	201 (6.2)	996 (30.6)	2,063 (63.3)
Do you feel neck pain or stiff neck?	70 (2.1)	509 (15.6)	2,681 (82.2)
Do you have ear pain or in the region of TMJs?	47 (1.4)	417 (12.8)	2,796 (85.8)
Did you observed if you have TMJ noises when chewing or when you open your mouth?	124 (3.8)	329 (10.1)	2,807 (86.1)
Did you observed if you have any habits such as clenching or grinding your teeth?	338 (10.4)	550 (16.9)	2,372 (72.8)
Do you feel that your teeth are not well articulated?	194 (6)	177 (5.4)	2,889 (88.6)
Do you consider yourself a person tense or nervous?	401 (12.3)	1,294 (39.7)	1,565 (48)

(34.2%). With regard to emotional stress, 709 (86.3%) of the students with TMD considered themselves tense or nervous (considering the answers YES and SOMETIMES) [Table 2].

In the adjusted model, the values obtained in the Omnibus, Hosmer, Lemeshow, and Nagelkerke tests were respectively  $p = 0.000$ ,  $p = 0.673$ ,  $R^2 = 0.266$  being considered mathematically valid models to perform the analysis (applied to the characteristics of the sub-sample absence and presence of TMD adjusted for the age group, gender, and tension).

Table 3 shows the values obtained with the binary logistic regression analysis for the presence of TMD. The data revealed that girls have 1.36 higher probability of developing TMD than boys (95% CI: 1.14-1.63;  $p < 0.001$ ); moreover, students in the older age group have 2.31 higher probability (95% CI: 1.85-2.89;  $p < 0.001$ ). With regard to emotional stress, the data revealed that students who considered themselves tense or nervous had 8.74 higher probability (95% CI: 7.03-10.86;  $p < 0.001$ ) of developing TMD. The values of the adjusted OR showed values similar to the crude OR demonstrating independence between the variables analyzed.

## Discussion

The results of this study revealed a high prevalence of TMD in a stratified representative sample of adolescents in southern Portugal (25.2%), verifying that a minimum percentage of these had prior knowledge of TMD diagnosis (1.7%). These data are similar to those

obtained in the studies of Bernal and Tsamtsouris<sup>[19]</sup> who found a prevalence of 21.2% in children aged 3-5 years; however, the age of the sample analyzed in this study differs. The study of Feteih<sup>[8]</sup> revealed a TMD prevalence of 21.3% in 385 adolescents in the age group of 12-16 years. Some studies<sup>[6,23]</sup> have shown a higher prevalence rate than that in the present study, such as Gazit *et al.*,<sup>[23]</sup> which evaluated 369 Israeli students in the age group of 10-18 years (56.4%).

Regarding severity, most students exhibited mild TMD (22.4%). The same was observed in a longitudinal study of Magnusson *et al.*,<sup>[6]</sup> which evaluated 119 children at intervals of 4 years and found that, in most cases, the signs were mild; however, moderate TMD was noted in 11% of the 11-year-old children and 17% of the 15-year-old children. The most common symptoms of TMD observed in this study included emotional stress (52%), headache (36.8%), habit of clenching or grinding teeth (27.3%), pain in the neck (17.7%), fatigue/muscle pain while chewing (14.3%), and ear pain or in the region of TMJ (14.2%).

The responses from the Fonseca Anamnestic Questionnaire revealed that most of the subjects (86.3%) were tense or nervous at some point (information obtained from the student's perspective). The study by Martins *et al.*<sup>[16]</sup> revealed that 72.4% of the subjects who required treatment for TMD reported to be under emotional stress. The same was observed by Bertoli *et al.*,<sup>[24]</sup> who found a significant difference in the signs and symptoms of TMD according to emotional status (higher in those with tense status compared to calm status).

**Table 2: Associations between the presence of TMD with gender, age group, and emotional stress**

Variables (n, %)		Temporomandibular disorders				p-value
		Absence (%)	Mild (%)	Moderate (%)	Severe (%)	
Gender	Male (1,504, 46.1%)	1,188 (79)	285 (18.9)	26 (1.7)	5 (0.3)	<0.001*
	Female (1,756, 53.9%)	1,251 (71.2)	444 (25.3)	57 (3.2)	4 (0.2)	
Age group	5-9 years (1,090, 33.4%)	906 (83.1)	168 (15.4)	14 (1.3)	2 (0.2)	<0.001*
	10-14 years (1,216, 37.3%)	935 (76.9)	259 (21.3)	21 (1.7)	1 (0.1)	
	15-19 years (954, 29.3%)	598 (62.7)	302 (31.7)	48 (5)	6 (0.6)	
Emotional stress	Yes (401, 12.3%)	107 (26.7)	241 (60.1)	46 (11.5)	7 (1.7)	<0.001*
	Sometimes (1,295, 39.7%)	879 (67.9)	384 (29.7)	29 (2.2)	2 (0.2)	
	No (1,565, 48%)	1,453 (92.8)	104 (6.6)	8 (0.5)	0	

\*Chi-squared Independence Tests

**Table 3: Results of binary logistic regression for the presence of TMD**

Variables	Odds ratio crude (CI 95%); P-value	Odds ratio adjusted** (CI 95%); P-value
Gender (male*) Female	1.36 (1.14-1.63); 0.001	1.36 (1.14-1.63); 0.001
Age group (5-9 years*) 10-14 years	1.28 (0.99-1.56); 0.05	1.25 (0.99-1.56); 0.05
Age group (10-14 years*) 15-19 years	2.31 (1.85-2.89); <0.001	2.31 (1.85-2.89); <0.001
Emotional stress (presence*) Absence	8.74 (7.03-10.86); <0.001	8.74 (7.03-10.86); <0.001

\*Class reference, \*\*adjusted for variables gender, age group, and emotional stress



Several studies have found that a child's emotional status may influence the risk of developing signals of TMD.<sup>[25,26]</sup> High tension level can lead to the development of a constant dental clamping, which affects the local circulation in muscles, altering the cell membranes that perform ion exchange; this leads to an accumulation of lactic and pyruvic acids which results in the stimulation of pain receptors.<sup>[15]</sup>

The study by Muhtarodullary *et al.*<sup>[27]</sup> evaluated 40 children with primary dentition and 40 children with mixed dentition (age group 4-13 years) and found that the most frequent sign was headache (15% and 27.5%, respectively). Bonjardim *et al.*<sup>[28]</sup> evaluated 217 adolescents aged 12-18 years and found that the most prevalent symptoms were joint sounds (26.72%) and headache (21.65%); furthermore, the study by Feteih<sup>[8]</sup> revealed a prevalence of headache in 22% of the adolescents.

Bertoli *et al.*<sup>[24]</sup> evaluated the signs and symptoms of TMD in 50 children in the age group of 4-18 years who had headaches; they found a higher prevalence of signs and symptoms of TMD in patients having headaches compared to the control group. Franco *et al.*<sup>[20]</sup> evaluated 1,307 students in the age group of 12-14 years, and found that 45.5% of the students presented a headache, and this symptom was associated with the presence of TMD.

The headaches are very common among children and adolescents mainly in the premenstrual period, migraine, stress, tension-type headaches, and headache due to high blood pressure.<sup>[29]</sup> Thus, the presence of headache could also have causes other than the overhead of the muscles of the temporomandibular region. Liljeström *et al.*<sup>[30]</sup> observed the association of TMD and headache in a group of adolescents with primary headache and concluded that TMD should always be considered when headaches are associated with ear pain, difficulty in opening the mouth, and fatigue or stiffness of the jaw.

The possible relation between TMD and headache can be explained by the fact that headache is related to muscle activity; thus, activities involving the head and neck likely play an important role in the etiology of many headaches.<sup>[31]</sup>

Pain in the temporomandibular region appears to be relatively common with prevalence rates ranging from 0 to 18%, with an average of 3%; however, it is a condition usually seen in young and middle-aged adults, rather than in children or the elderly.<sup>[1]</sup> Pain in the ears may be present in individuals with TMD due to the proximity between that area and the TMJ and masticatory muscles because these structures have a common trigeminal nerve innervation, thus producing reflex pain.<sup>[31]</sup> Some

studies show only 3% and 4% prevalence of pain in the TMJ in children in the age groups of 7-14 years and 15-18 years, respectively.<sup>[32,33]</sup> A study by Muhtarodullary *et al.*<sup>[27]</sup> revealed 22.5% prevalence of pain in the TMJ in children aged 13 years and a study by Bonjardim *et al.*<sup>[28]</sup> showed 12.9% prevalence of pain in the face or jaw. The present study found a higher prevalence rate of pain, but was considered low compared to the other symptoms analyzed. It is believed that the low prevalence of pain in children may be due to a delayed action of risk factors, or the risk factors may be present but a certain duration of exposure to these risk factors is required for the pain to develop. Another explanation may be that in children, muscle tissue have a greater potential for cure and adjustment; hence, continuous pain does not develop.<sup>[1]</sup>

With regard to gender, girls showed a higher prevalence of TMD (61.5%), and these findings are in accordance with the results of other studies conducted in different populations.<sup>[8,34,35]</sup> Hirsch *et al.*<sup>[35]</sup> evaluated 1,011 German children and adolescents aged 10-17 years and found a higher probability of developing TMD in girls compared to boys (OR for girls versus boys: 1.42-1.53;  $p \leq 0.05$ ). The high prevalence of TMD in girls could be explained on the basis of physiological characteristics, particularly hormonal variations and structures in the connective tissue and muscle. The greater laxity of these tissues, related to estrogen levels, explains that these tissues have a lower capacity to support the functional pressure, thus leading to TMD.<sup>[3,36]</sup> The study by Leresche *et al.*<sup>[37]</sup> found variations in clinical pain intensity in women with TMD during the menstrual cycle, where the highest values of pain coincided with the period of higher concentrations of estrogen.

The highest prevalence of TMD was also observed in the older individuals, who were not analysed based on gender, this increase in prevalence with advancing age may be related to the hormonal impact. Future research is needed to find out the association of TMD with hormonal action.

The age of onset of TMD in children and adolescents is still unknown.<sup>[1]</sup> Data from this study revealed the highest prevalence of TMD in older students. The same was observed in the studies of Bertoli *et al.*<sup>[24]</sup> and Gazit *et al.*<sup>[23]</sup> Some studies reveal that the frequency of signs and symptoms of TMD increases during childhood and, in adolescence, reaches a level similar to that found in adults.<sup>[34,37,38]</sup>

The data from this study revealed a significant association between TMD and levels of anxiety or depression, which are in agreement with the results obtained in several studies.<sup>[10,13,39]</sup>

As previously reported, individuals subjected to some kind of stress can develop parafunctional habits and muscle tension, which leads to the development of TMD.<sup>[16]</sup> Thus, the parafunctional components, especially those that increase muscle tension and cause changes in the emotional status are good indicators of the jaw pain in patients with TMD, which indicates that anxiety or depression can be considered as etiological factors for TMD.

This study presented a limitation to the use of questionnaires as a method of collecting data in order to classify the individual as having TMD, requiring more detailed clinical examination of the signs and symptoms of TMD as well as imaging tests to confirm the diagnosis.

A limitation of the use of Fonseca Anamnestic Questionnaire is that it does not offer diagnostic classification of TMD. Thus, the data obtained with this index are restricted to the classification of the severity of signs and symptoms of TMD. Another limitation is the scoring system, since three affirmative answers are given to questions about headache, cervical pain, and perception of emotional tension, the individual will be classified as having mild TMD. However, these same symptoms can occur in isolation, with no association with TMD. Nevertheless, questionnaires are most widely used in prevalence studies since it is easier to get a large sample and apply these in children and adolescents, in terms of logistics. Hence, the simplicity of the Fonseca Anamnestic Questionnaire favors its use in epidemiological population studies. These limitations may be related to the high prevalence observed in this study.

The present study is a pioneering study, conducted on a sample of only one region of the country; however, it indicates that the prevalence of this condition may be higher. Disclosing the subject of the study with the population is of great importance for the participants as they become more aware of the signs and symptoms of TMD and are able to ask for help in solving it. Future studies are needed including a sample from other regions of the country in order to be aware of this disorder on the national level.

## Conclusion

The results of this study revealed a high prevalence of TMD in a sample of children and adolescents in southern Portugal, and described a relationship between this dysfunction with the levels of emotional stress. Female students, older students, and those considered tense or nervous are more likely to develop TMD.

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