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DETERMINANTS OF TEMPOROMANDIBULAR DYSFUNCTION AND BRUXISM IN ACADEMICIANS

ORIGINAL ARTICLE

ABSTRACT

Purpose: Temporomandibular dysfunction and bruxism are common problems. Academicians have physical and emotional risk factors that may be associated with temporomandibular dysfunction due to excessive workload and psychological stress. The aim of this study was to reveal the emotional and physical determinants of temporomandibular dysfunction and bruxism in academicians

Methods: Two hundred and ninety-six (217 female and 79 male) academicians working in higher education institutions with a mean age of 35.31 ± 9.20 years, were included in the study. Daily computer time of the participants was questioned. International Physical Activity Questionnaire Short Form (IPAQ), Beck Depression Inventory (BDI), Neck Disability Index (NDI), and Fonseca Anamnestic Index (FAI) were applied via online surveys.

Results: It was demonstrated that 92.9% of the participants were physically inactive or minimal active, 36% showed depressive symptoms, 69.2% had neck disability, 24 % had and moderate-severe temporomandibular dysfunction symptoms, and 44% had bruxism. Bruxers were found to have higher BDI ($p<0.05$) and FAI ($p<0.001$) levels compared to non-bruxers. Significant positive correlations between FAI and BDI ($r=0.316$, $p<0.001$), FAI and NDI ($r=0.526$, $p<0.001$), BDI, and NDI ($r=0.527$, $p<0.001$) was found. Presence of bruxism ($\beta=0.361$, $p<0.001$) and a greater NDI ($\beta=0.442$, $p<0.001$) were each uniquely associated with greater FAI score. Daily computer time, IPAQ, and BDI were not significantly associated with FAI score ($p>0.05$).

Conclusion: Key factors of temporomandibular joint dysfunction appear to be physical parameters such as neck disability and bruxism in academics. However, psychological symptoms and physical activity level do not seem to be independent determinants of temporomandibular dysfunction.

Keywords: Bruxism, emotional stress, neck pain, temporomandibular joint

AKADEMİSYENLERDE TEMPOROMANDİBULAR DİSFOKSİYON VE BRUKSİZMİN BELİRLEYİCİLERİ

ARAŞTIRMA MAKALESİ

ÖZ

Amaç: Temporomandibular disfonksiyon ve bruksizm yaygın problemlerdir. Akdemisyenler aşırı iş yükü ve psikolojik stres nedeniyle temoporomandibular difonksiyonla ilişkili olabilcek fiziksel ve emosyonel risk faktörlerine sahiptir. Bu çalışmanın amacı, akademisyenlerde temporomandibular disfonksiyon ve bruksizmin emosyonel ve fiziksel belirleyicilerini ortaya koymaktır.

Yöntem: Yükseköğretim kurumlarında görev yapan, yaş ortalaması 35,31 ± 9,20 yıl olan 296 (217 kadın ve 79 erkek) akademisyen çalışmaya dahil edildi. Katılımcıların günlük bilgisayar kullanım süreleri sorgulandı. Uluslararası Fiziksel Aktivite Anketi Kısa Formu (UFAA), Beck Depresyon Envanteri (BDE), Boyun Özür İndeksi (BÖİ) ve Fonseca Anamnestik İndeksi (FAİ) çevrimiçi anketler yoluyla uygulandı.

Sonuçlar: Katılımcıların %92,9'unun fiziksel olarak hareketsiz veya minimal düzeyde aktif olduğu, %36'sının depresif belirtiler gösterdiği, %69,2'sinin boyun özürü, %24'ünün orta- şiddetli temporomandibular disfonksiyon semptomları ve %44'ünün bruksizmi olduğu gösterildi. Bruksizmi olanların, olmayanlara göre daha yüksek BÖİ ($p<0,05$) ve FAİ ($p<0,05$) seyilerine sahip oldukları bulundu. FAİ ve BDE ($r=0,316$, $p<0,001$), FAİ ve BÖİ ($r=0,526$, $p<0,001$), BDE ve BÖİ ($r=0,527$, $p<0,001$) arasında pozitif korelasyon bulundu. Bruksizm varlığı ($\beta=0,361$, $p<0,001$) ve daha yüksek BÖİ skoru ($\beta=0,442$, $p<0,001$) bağımsız olarak daha yüksek FAI skoru ile ilişkiliydi. Günlük bilgisayar kullanım süresi, UFAA ve BDE, FAİ skoru ile anlamlı olarak ilişkili değildi ($p>0,05$).

Tartışma: Akademisyenlerde temporomandibular eklem disfonksiyonunun anahtar faktörleri boyun özürü ve bruksizm gibi fiziksel parametreler olarak karşımıza çıkmaktadır. Bununla birlikte psikolojik semptomlar ve fiziksel aktivite düzeyi, temporomandibular disfonksiyonun bağımsız belirleyicileri gibi görünmemektedir.

Anahtar Kelimeler: Boyun Ağrısı, Bruksizm, emosyonel stres, temporomandibular eklem

INTRODUCTION

Temporomandibular dysfunction (TMD) is a complex problem which associated with temporomandibular joint, masticatory muscles, and other related structures. The prevalence of TMD has been reported to 3-15% in the general population (1). Temporomandibular dysfunction is classified according to research diagnostic criteria for TMD (RDC/TMD). The first axis is divided into the following three groups: Group 1, muscle disorders including myofascial pain (Ia) and myofascial pain with a limited mandibular opening (Ib); Group 2, disc displacement with reduction (IIa), no reduction, limited mandibular opening (IIb) and limited mandibular opening (IIc); and Group 3, arthralgia, arthritis and arthrosis of temporomandibular joint (TMJ) (III) (2).

Depression is defined as one of the most common health problems in worldwide. It is estimated that there are approximately 264 million people struggling with depression worldwide. The prevalence of depression in the world has been reported as 4.4% (3). Although this rate is between 5.5%-29.5% among academic staff, 5.5% of academic staff working at private universities have been reported to have burnout syndrome (4, 5). Factors such as workload, excessive job demands, and pressure to advance the academic career have been reported to be associated with psychological stress (6, 7). In addition, gender, low job satisfaction, and conflict with colleagues are known to increase depressive symptoms in academics (8).

Bruxism is defined as grinding and clenching teeth during sleep or wakefulness, and its prevalence was reported as 20% in the adult population. The main causes of bruxism were indicated as emotional stress, smoking, alcohol, and anxiety (9). It is also emphasized that bruxism is more common in women than men and is closely related to familial responsibilities and occupational stress (10).

Neck pain is a very common musculoskeletal problem, and its prevalence varies between 40.4% and 80.1% in academic staff (11). Research indicated that neck pain increases symptoms of TMD. Pathomechanics of the neck region adversely affects temporomandibular joint biomechanics since the temporomandibular joint and the neck region are very close to each other. The neuroanatomical partnership of neck region and mandibular region pain sensory also leads this situation (12).

Workload and physical activity level were found to be associated with musculoskeletal problems in academicians (13). Furthermore, the relationship between insufficient physical activity and psychological stress has been revealed in the literature (14). Due to the COVID- 19 pandemic, the time spent by academics on the computer has been prolonged due to the online continuation of lectures, meetings, and seminars. When quarantine condition was added to this situation, it can be predicted that the physical activity level of academicians decreased during this period. Insufficient physical activity and prolonged computer use may lead to TMD due to its musculoskeletal and psychological effects.

There are studies investigating musculoskeletal conditions and related physical and psychological parameters in academic staff. However, a number of studies investigating TMD in a cause-effect relationship, especially in this population are quite limited. Therefore, the primary aim of this study was to reveal the effects of bruxism, daily computer time, physical activity level, depressive symptoms, and neck pain on TMD in academicians as well as the associations among these physical and psychological parameters. The secondary aim was to investigate the daily computer time, physical activity level, depression level, neck pain, and TMD severity differences between the bruxers and non-bruxers.

METHODS

Study design and participants

This was a cross-sectional study conducted among academicians from Turkey. A google form link was sent to the e-mail addresses of the academicians on the web pages of thirteen different universities. Among the participants who filled out the questionnaires, those who met the inclusion criteria were included in the study. The study population was composed of 296 (217 women and 79 men, mean age of 35.30 ± 9.20 years) academicians, between the ages of 20 and 65 years. Volunteer individuals working as academic staff in a higher education institution were included in the study. Exclusion criteria were having rheumatic, orthopedic, or neurological diseases, temporomandibular or cervical region

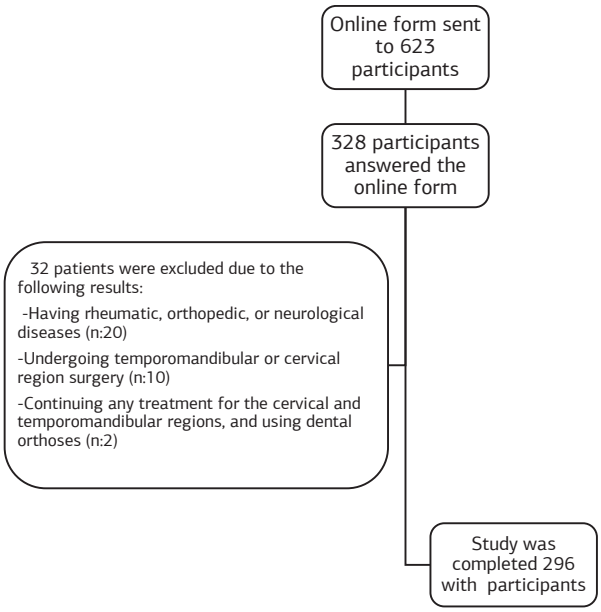

Figure 1. Sample Selection Flowchart

surgery, continuing any treatment for the cervical and temporomandibular regions, and using dental orthoses. The study was carried out via online surveys which were conducted using Google Forms. The online survey link was shared using WhatsApp and email to potential participants. The sample selection flowchart was presented in Figure1.

The study protocol was approved by the non-interventional clinical research ethics committee of Lokman Hekim University (reference number: G.O:2021003). All participants were informed about the study protocol based on the Helsinki Declaration and their consents were obtained before the study.

Data collection

We collected data on demographic characteristics age, sex, body weight, height, and medical history of the participants.

Self-reported outcomes

To determine the time spent with the computer, the participants were asked "How many hours per day do you use your computer during your work at the workplace and at home?". A dichotomous variable was generated as "less than 6 hours" and "above 6 hours" according to the responses.

Physical activity level was evaluated with International Physical Activity Questionnaire (IPAQ) Short Form. The International Physical Activity Questionnaire is a standardized self report measure of habitual physical activity. The short form provides information about the frequency and duration of walking, moderate and vigorous activities over the last 7 days, as well as a single-item question about weekday sitting. The calculation of the total score on the IPAQ short form includes the total of the duration (minutes per day) and frequency (days per week) of walking, moderate and vigorous activities (15).

Beck Depression Inventory (BDI) was used to evaluate depressive symptom levels. The total score of the scale ranges from 0 to 63. Higher scores indicate higher level of depressive symptoms. Scores from 0 through 9 indicate minimal depression; scores from 10 through 18 indicate mild depression; scores from 19 through 29 indicate moderate depression; and scores from 30 through 63 indicate severe depression (16).

Neck pain intensity, related functional disability, and associated emotional factors evaluated using Neck Disability Index (NDI). The scale has 10 sections: pain intensity, personal care, lifting, reading, headaches, concentration, work, driving, sleeping, and recreation consisting of 6 questions in each section. Item scores range from 0 to 5 with a to-

tal score ranging from 0 (no pain and disability) to 50 (maximum pain and disability). Scores from 0 through 4 indicate no disability; scores from 5 through 14 indicate mild disability; scores from 15 through 24 indicate moderate disability; scores from 25 through 34 indicate severe disability; and from scores 34 to 50 indicate complete disability (17).

Temporomandibular joint dysfunction was evaluated using the Fonseca Anamnestic Index (FAI). FAI is a simple, quick, easy, and low-cost patient-reported assessment instrument for TMDs. The FAI is a 10-item multidimensional instrument that allows assessment of jaw function limitation, pain frequency, psychological distress, and parafunctional behaviors related to TMDs. The FAI consist of ten questions with a three-point scale (0 = no, 5 = sometimes and 10 = yes). The total score of the FAI determines the following classifications: absence of signs and symptoms of TMD (0–15 points), mild TMD (20–45 points), moderate TMD (50–65 points), and severe TMD (70–100 points). FAI is a reliable (ICC values each index question ranges from 0.739 to 0.897) and valid (Cronbach's alpha coefficient value is 0.805) questionnaire (18).

Bruxism was determined with the question "Do you have any habits such as clenching or grinding your teeth?" in Fonseca Anamnestic Questionnaire (19). Participants who answered "yes" or "sometimes" to this question were assigned as bruxer (n=131), and those who answered "no" as non-bruxer (n=165).

Statistical Analysis

Statistical analysis was performed using the Statistical Package for Social Science (SPSS), version 22 (SPSS Inc., Chicago, IL, USA). The significance level was set at $p<0.05$. Normality tests (visual and analytical) were performed to determine whether the numerical data were normally distributed. The categorical data of the bruxers and non-bruxers based on daily computer time, IPAQ, BDI, and NDI and FAI classification were compared using Chi-square test. Pearson correlation coefficients were calculated to determine the associations among age, BMI, BDI, NDI, and FAI results. A regression model was used to determine the independent variables that contributed significantly to the variance in FAI results. Hierarchical multiple regression analyses were performed so that the influence of age, sex, and BMI could be controlled for, prior to assessing the effects of bruxism, daily computer time, IPAQ, BDI, and NDI. Age, sex, and BMI were entered in step one and the bruxism, daily computer time, IPAQ BDI, and NDI results were then entered in step two. Categorical data were entered into the regression analysis by means of dummy coding.

Table 1. Demographic Characteristics

Variable	%(n)	Mean (SD)
Age		35.31 (9.20)
BMI		23.55 (4.21)
Sex		
Female	73.3 (217)	
Male	26.7 (79)	
Daily computer time		
Less than 6 hours	41.6 (123)	
Above 6 hours	58.4 (173)	
IPAQ		
Inactive	49.3 (146)	
Minimally active	43.6 (129)	
Active	7.1 (21)	
BDI		
Minimal Depression	63.9 (189)	
Mild Depression	24 (71)	
Moderate Depression	9.5 (28)	
Severe Depression	2.7 (8)	
NDI		
No Disability	30.7 (91)	
Mild Disability	60.1 (178)	
Moderate Disability	8.1 (24)	
Severe Disability	1 (3)	
Complete Disability	-	
FAI		
No Signs TMD	39.2 (116)	
Mild TMD	36.8 (109)	
Moderate TMD	19.9 (59)	
Severe TMD	4.1 (12)	

Abbreviations: BMI: Body Mass Index, IPAQ: International Physical Activity Questionnaire, BDI: Beck Depression Inventory, NDI: Neck Disability Index, FAI: Fonseca Anamnestic Index

RESULTS

This study was completed with 296 participants. Demographic characteristics along with daily computer time, IPAQ, BDI, NDI and FAI classifications of the participants were presented in Table 1.

Table 2 presents the comparison of the daily computer time, IPAQ, BDI, and NDI and FAI classification data between bruxers and non-bruxers. Bruxers were found to have higher BDI ($p<0.05$) and

Table 2. Differences of Daily Computer Time, IPAQ, BDI, NDI And FONSECA Scores in Individuals With and Without Bruxism

Variable	Individuals with bruxism (n=131/%44)	Individuals without bruxism (n=165/%56)	p
Daily computer time less than/ above 6 hours	51/80	72/93	0.415
IPAQ inactive/minimally active/active	71/52/8	75/77/13	0.321
BDI minimal/mild/moderate/severe	77/30/18/6	112/41/10/2	0.034*
NDI no/mild/moderate/severe/complete	60/91/13/1/0	31/87/11/2/0	0.111
FAI minimal/mild/moderate/severe	19/62/41/9	97/47/18/3	<0.001*

*p<0.05, Abbreviations: IPAQ: International Physical Activity Questionnaire, BDI: Beck Depression Inventory, NDI: Neck Disability Index, FAI: Fonseca Anamnestic Index

FAI (p< .001) levels compared to non-bruxers. Daily computer time, IPAQ and NDI classification results were similar in bruxer and non-bruxer individuals (p>0.05).

Correlation analysis exhibited significant positive correlations between FAI and BDI (r=0.316, p< .001), FAI and NDI (r=0.526, p< .001), age and BMI (r= 0.268, p< .001), and BDI and NDI (r=0.527, p< .001). Age and BMI were not correlated with FAI, BDI, and NDI (p>0.05) (Table 3).

Table 4 presents the results of hierarchical multiple regression analyses. In Step 1 of the analysis, demographic characteristics were significantly related to FONSECA (p<0.05), and the overall model explained 4.4 percent of the variance. In Step 2, after accounting the effects of age, sex, and BMI; bruxism, daily computer time, IPAQ, BDI, and NDI explained an additional 36.7% (p< .001) of the variance in FONSECA. Examination of the beta values for the final model revealed that the presence of bruxism (β=0.361, p< .001) and greater NDI (β=0.442, p< .001) were each uniquely associated with greater FAI score. Daily computer time, IPAQ, and BDI were not associated with FAI score (p>0.05).

DISCUSSION

The present study investigated the effects of bruxism, daily computer time, physical activity level, depressive symptoms, and neck pain on TMD in academicians as well as the daily computer time, physical activity level, depression level, neck pain, and TMD severity differences between the bruxers and non-bruxers. TMD was associated with neck disability and depression. However, when demographic characteristics such as age, gender and BMI were eliminated, it was shown that only bruxism and neck disability affect temporomandibular joint dysfunction independently. There was no difference between bruxers and non-bruxers in terms of physical activity level and daily computer use. It was found that physical activity level and duration of computer use did not affect TMD. Besides, the current study revealed that academicians have a high incidence of physical inactivity, depressive symptoms, neck pain, bruxism, and TMD.

It is not surprising that individuals with bruxers have higher beck depression scores. Pingitore et al. (20) suggested that the most important predictor of bruxism is type A personality associated with stress, which is an important risk factor

Table 3. Pearson Correlational Coefficients For Associations Among The FONSECA, BDI, NDI, BMI, and Age

	FAI	Age	BMI	BDI	NDI
FAI		-0.058	0.095	0.316**	0.526**
Age			0.268**	-0.045	-0.021
BMI				0.066	0.069
BDI					0.527**

**p<0.001 , Abbreviations: BMI: Body Mass Index, BDI: Beck Depression Inventory, NDI: Neck Disability Index, FAI: Fonseca Anamnestic Index

Table 4. Regression Analysis With FONSECA As The Dependent Variable

Variables	R^2	R^2 Change	F Change	Standardized β	t
Step 1					
Age	0.044	0.044	4.445*	-0.080	-1.680
Sex				0.034	0.711
BMI				0.071	1.433
Step 2					
Bruxism	0.411	0.367	35.821**	0.361	7.706**
Daily computer time				0.002	0.044
IPAQ				-0.024	-0.533
BDI				0.003	0.063
NDI				0.442	8.034**

*p<0.05, **p<0.01, Abbreviations: BMI: Body Mass Index, IPAQ: International Physical Activity Questionnaire, BDI: Beck Depression Inventory, NDI: Neck Disability Index

for depression. Przystanska (21) also emphasized that anxiety, psychological stress, and depression are important determinants of bruxism. Parallel to this evidence, our study revealed that depressive symptoms are of the factors leading to bruxism in academic staff.

There are many studies indicated that bruxism increases TMD (22, 23). It has been reported that the risk of TMD of bruxers is 4.8 times higher than non-bruxers (24). Activation of the masticatory muscles during bruxism can reach 110% of the maximum voluntary muscle contraction (25). Bruxism often causes masseter muscle spasms, narrows the joint space, and is indirectly responsible for excessive anterior disc displacement of the articular disc during movement (26, 27). These impacts of the bruxism may explain the result of the current study that bruxism is one of the independent determinants of temporomandibular joint dysfunction in academic staff.

Turk et al. (28) indicated that emotional stress and depressive symptoms make it difficult to manage pain, which is one of the main symptoms of temporomandibular dysfunction. Besides, Schwartz et al. (29) suggested that emotional stress is a key factor for spasm and myofascial pain, especially in the masticatory muscles, and is a more important cause for TMD than the occlusal disorder. Similarly, Laskin (30) emphasized that mandibular muscle spasm induced by stress and depressive symptoms may lead to occlusal disorder, joint and disc degeneration, which are the basic parameters of TMD. Although there was a correlation between BDI and TMD, BDI was not an independent determinant of TMD in the current study. According to this result, we think that depressive symptoms may have an indirect effect.

Olivo et al. (31) a high correlation was found between TMD and neck pain. Various studies have shown that patients with TMD have more painful and hyperactive cervical muscles and more active trigger points in the neck region than patients without TMD (32, 33). The most common hypothesis explaining this strong relationship between neck pain and temporomandibular dysfunction is that the spinal nerves carrying nociceptive inputs of the neck region and trigeminal nerve carrying nociceptive inputs of the temporomandibular region, enter the same center (Trigeminal Subnucleus Caudatus) before reaching the cortex. Therefore, pain in the neck region can be felt in the temporomandibular area (33, 34). One of the other common hypotheses regarding this situation is that the postural impairment in the neck region cause head malposition and disrupt the biomechanics in the temporomandibular region. These hypotheses explain our result indicating neck pain is one of the independent determinants of TMD.

The current study was revealed that the level of physical activity in academics did not affect TMD and physical activity level was similar between bruxers and non-bruxers. Previous studies exhibited that regular physical activity is as effective as NSAIs on pain (35). Joint and muscle pain are

among the sub-parameters of TMD. Although there is no clear evidence about the association between physical activity level and TMD or bruxism, it can be suggested that regular physical activity may lead to a reduction in the pain symptoms of this dysfunction. However, the effect on pain alone may not be sufficient for the level of physical activity to be a determinant of TMD. Besides, regular physical activity has positive effects on depression and anxiety, which are the most important causes of bruxism. Positive effects of regular aerobic exercise and strength training on depression and anxiety were reported (36). Our study indicated that physical activity level did not affect TMD and bruxism. This result may be related to the insufficient physical activity levels of the majority of the participants. It has been emphasized in many studies that the level of physical activity decreased significantly during the pandemic period, and the main reason for this situation is social isolation (37, 38). The closure of schools and the distance education process and online meetings may have seriously reduced the physical activity level of academics during this period.

Prolonged daily computer use increases the susceptibility to physical inactivity and can lead to various musculoskeletal problems such as waist, back, neck, and wrist pain (39). However, contrary to our expectations, the duration of daily computer use was not a factor for bruxism and TMD. We did not evaluate whether the participants abided by ergonomic rules or required rest periods during computer use. Nevertheless, the current study exhibited that daily computer time is not an independent predictor of TMD.

The current study has some limitations. Advanced clinical assessment methods were not used to evaluate the temporomandibular joint and bruxism. Psychological status was evaluated by only depressive symptoms. Moreover, as the participants were included via online questionnaires, only self-reported scales were used in this study.

Neck disability and bruxism were found to be independent determinants of TMD in academic staff. Musculoskeletal problems are common as well as emotional problems in this population who are working with the excessive workload and occupational stress. Psychological symptoms and physical inactivity can be indirect factors for TMD due to their effects on physical parameters such as neck disability and bruxism. However, they do not seem to be independent determinants of TMD. The prevalence of TMD in academic staff is the result of the combination of many different parameters. Therefore, a psychosocial perspective is required in addition to a biomechanical perspective in approaching such problems.

Sources of Support: None

Conflict of Interest: The authors report no conflicts of interest.

Ethical Approval: This study was approved by the non-interventional clinical research ethics committee of Lokman Hekim University (Approval Date: 19.01.2021 and Approval Number: 2021003). The study was conducted following the Declaration of Helsinki.

Informed Consent: All participants were informed about the study protocol and their consents were obtained.

Peer-Review: Externally peer reviewed.

Author Contribution: H.E.K.: study design, collection, analysis and interpretation of data, drafted manuscript; B.U.: analysis and collection of data and critical revision of manuscript; M.S.: collection of data and critical revision of manuscript; A.R.T.: collection of data and critical revision of manuscript; N.B.: collection, analysis and interpretation of data and critical revision of manuscript.

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