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ORIGINAL ARTICLE

A Study of the Relationship Between Job Related Stress and Temporomandibular Disorders in Accountants Working in Jakarta

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ABSTRACT

Stress is a known risk factor for Temporomandibular Disorders (TMD), however there are few studies of TMD in people who work in high stress jobs. Accounting is a profession known for its high levels of stress and expectation. **Objective:** The aim of this study is to investigate the relationship between the intensity and frequency of job related stress and the occurrence of TMD in accountants in Jakarta. **Methods:** A cross-sectional study, with ethics approval from the Ethical Committee of the Faculty of Dentistry, University Indonesia, was performed on 116 accountants aged 21 to 50, living in Jakarta. Subjects were asked to complete two questionnaires; the first was the Job Stress Survey questionnaire that examined the intensity and frequency of job related stress, and the second was the TMD Diagnostic Index, which assessed TMD prevalence. **Results:** Fisher's exact test showed a significant relationship between the intensity of job related stress and the occurrence of TMD in accountants ($p = 0.003$). Chi-square tests showed a significant relationship between the frequency of job related stress and the occurrence of TMD in accountants ($p = 0.032$). **Conclusion:** There is a relationship between the intensity and frequency of job related stress, and the occurrence of TMD in accountants.

Keywords: accountant, job related stress, job stress survey questionnaire, temporomandibular disorders, TMD Diagnostic Index

INTRODUCTION

Psychological stress is an intrinsic part of the human existence.¹ Job stress can be described as an excessive strain, leading to harmful physical or emotional responses that occur when the capabilities of the worker cannot match the resources or requirements of the job.² Work related stress is one of the biggest health and safety challenges the world faces and is common amongst Jakartans.² A United Nations report labeled job related stress as 'The 20th Century Disease', and the WHO reported that job related stress has become a world wide epidemic.² Stress responses are triggered at physiological, psychological, and behavioural levels. Physiological reactions include changes in the cardiovascular system, the respiratory system, the immunological system, the musculoskeletal system, and other chronic disorders.²

Temporomandibular disorders have been cited as an oral health problem because the prevalence is quite high; with one in two people experiencing TMD worldwide.¹ TMD is a collective term, encompassing a broad spectrum of clinical joint and muscle problems in the orofacial area. These disorders are characterised by jaw pain, joint sounds, limited jaw function, headaches, neck and shoulder pain, and tinnitus etc.³

The aetiology of TMD is diverse and multifactorial, ranging from malocclusion, trauma, parafunctional activities, to emotional stress.¹ It is known that stress affects the body by activating the limbic system, reticular system, the HPA axis, and sympathetic nerve fibres. Activation of these structures can cause increased muscle tonicity leading to additional muscle conditions such as TMD.^{1,4,5}

Several studies have explored the relationship between job related stress and chronic diseases, and TMD and stress, however studies of the relationship between job related stress and TMD are lacking. The aim of this study is to investigate the relationship between the intensity and frequency of job related stress, and the occurrence of TMD in the productive population. This study focused on those aged between 20 and 50 years, and was based on Carlsson and Gonçalves conclusion that TMD symptoms were predominately found in this age group.^{6,7} Accountants were chosen as the target population, as the profession is known for its high levels of stress. Factors that increase stress on accountants are the need for punctuality, intolerance for mistakes, heavy workloads, continuous changes in the regulations, and the need for intense levels of concentration.⁸

OBJECTIVE

The aim of this study is to investigate the relationship between the intensity and frequency of job related stress, and the occurrence of TMD in the productive population.

METHODS

This 2013 study was a cross-sectional, descriptive and analytical study with ethics approval from the Ethical Committee of the Faculty of Dentistry, Universitas Indonesia. The required sample size of 116 was calculated with 95% confidence interval and 80% power.⁹

Consecutive technique sampling (non-probability sampling) was performed in this study, meaning every subject that met the inclusion criteria was involved in the sample group, until the number of required subjects were fulfilled. Inclusion criteria included subjects either male or female, aged between 20 and 50 years. They were required to work full time as an accountant in Jakarta, in either the public or private sector, and to have held the same position for at least 6 months. Individuals with dentofacial deformities were excluded from the sample.

Each subject was asked to read a brief explanation page, they were then asked to sign an informed consent form and to provide some personal information. Subjects were asked to complete a Job Stress Survey (JSS) designed by Spielberger, to examine the intensity and frequency of job related stress.¹⁰ They also completed the TMD Diagnostic Index (TMD-DI), developed by Himawan et al. in 2006, to assess for possible TMD.³

The modified JSS questionnaire was adapted for the Indonesian population from the original 1991 JSS

Table 1. Classification of Job Related Stress Levels Based on the Job Stress Survey¹¹

Description	Low	Moderate	High
Job Stress Intensity	1-39	40-60	60-90
Job Stress Frequency	0-34	35-40	41-90

questionnaire by Spielberger. Sunarwinto measured the accuracy of the translation in a previous study in 1996 using the corrected item-total correlation technique. The job related stress intensity scale assigned correlation ranged from 0.3538 to 0.7176 and the job related stress frequency scale assigned correlation ranged from 0.5082 to 0.8366. The reliability of the translation was tested using Cronbach's alpha (the job related stress intensity scale assigned Cronbach's alpha equaled 0.94 and the job related stress frequency scale assigned Cronbach's alpha equaled 0.96), thus ensuring validity and reliability of the questionnaire.¹³

There are 2 subscales within the JSS that estimate job related stress intensity and frequency. The job related stress intensity scale evaluates the perceived severity of each given stressor on a scale of 1 to 9. Whereas the job related stress frequency scale evaluates how often each stressor was encountered in the past 6 month on a scale of 0 to 9.^{10, 11, 13}

Scores for the intensity subscale were measured and collated, with the scores from each item added together. The final score was then divided by the total number of items (30) in the intensity subscale. The divided values were then multiplied by 10, to avoid a fractionated number. The same calculation was performed on the frequency subscale. Job related stress intensity and frequency level groupings were based on the JSS measurements and are outlined in Table 1.¹¹

The TMD-DI consisted of 8 questions, where respondents were asked to rate their experiences using a frequency scale. If the respondent never experienced symptoms the frequency score scored 0, seldom was scored 1, often was scored 2, and always was scored 3.³

To For the final assessment of the TMD-DI, scores were summed and subjects with a TMD-DI index score ≤ 3 were categorized as non-TMD sufferers, and subjects with a TMD-DI index scores >3 were diagnosed with TMD.¹²

RESULTS

Categorical data was obtained using two measurement tools, the TMD-DI and JSS questionnaire. The results of this study are presented in two major parts; one using the univariate analysis technique and the other is the bivariate analysis technique.

Table 2. Frequency of TMD Symptoms in the Group of Subjects who Experienced TMD

Items	Never	Seldom	Often	Always
Do you experience symptoms of joint trismus upon waking in the morning?	32 (47.8%)	31 (46.3%)	4 (6.0%)	0
Do you experience symptoms such as headaches?	3 (4.5%)	39 (58.2%)	23 (34.3%)	2 (3.0%)
Do you experience pain on opening and closing of the mouth?	44 (65.7%)	19 (28.4%)	4 (6.0%)	0
Do you experience pain in the neck region?	9 (13.4%)	29 (43.3%)	28 (41.8%)	1 (1.5%)
Do you experience tinnitus?	20 (29.9%)	41 (61.2%)	6 (9.0%)	0
Do you clench your teeth when you're worried?	33 (49.3%)	27 (40.3%)	6 (9.0%)	1 (1.5%)
Do you clench your teeth when you're angry?	21 (31.3%)	25 (37.3%)	20 (29.9%)	1 (1.5%)
Do you clench your teeth when you're concentrating?	25 (37.3%)	29 (43.3%)	10 (14.9%)	3 (4.5%)

Univariate analysis

Among 116 subjects (48 males and 68 females), 67 subjects were diagnosed with TMD (26 males and 41 females), and 49 subjects were not diagnosed with TMD (22 males and 27 females). These results indicate that the prevalence of TMD in the study population was 57.8%; with 60% of females and 54% of males in the sample group experiencing TMD.

In the group of subjects who experienced TMD, the most frequent symptoms found were headaches (95.5%), pain in the neck region (86.6%), tinnitus (70.1%), and clenching when angry (68.7%). Results are outlined in Table 2.

Results from the JSS questionnaire show that job related stress intensity levels were mostly low to moderate, and job related stress frequency levels were also mostly low.

Results laid out in Table 4 show that there were fewer subjects diagnosed with TMD in the group who experienced lower levels of job related stress intensity (43.9%). There were a higher percentage of patients diagnosed with TMD (67.9%) in the group who experienced moderate levels of job related stress intensity. This trend continued into the group who experienced high levels of job related stress intensity, as all subjects were diagnosed with TMD.

Furthermore, results revealed that there were fewer subjects diagnosed with TMD in the group who experienced low levels of job related stress frequency (49.2%). Whilst in the groups with moderate and high levels of job related stress frequency there were more subjects diagnosed with TMD, 54.5% and 57.8% respectively.

Bivariate analysis

A cross tabulation was completed between intensity levels of job related stress, frequency levels of job related stress, and the occurrence of TMD. The results of each test are outlined in Table 5.

The relationship between job related stress intensity and TMD occurrence in those of a productive age was analysed using Fisher's exact test. Results from these tests were assigned a p-value equal to 0.003 (smaller than 0.005).

The relationship between job related stress frequency and TMD occurrence in those of a productive age was analysed using the Chi-square test. Results from the Chi-square test were assigned a p-value equal to 0.032 (smaller than 0.005).

DISCUSSION

Univariate analysis reveals that the prevalence of TMD in the study sample was 57.8%. This finding is consistent with a previous epidemiological study by Gonçalves, which concluded TMD prevalence could vary between 16 and 59%.

There was a higher prevalence of TMD in female subjects within the sample population, a finding that is consistent with LeResche, Bonjardim et al, and Okeson's earlier studies.^{1,14,15} Conversely, the ratio of TMD in males compared with females in the subject group was 1:1.1. This finding is inconsistent with Okeson and LeResche's findings, which concluded that females were 1.5-2 times more prone to TMD than males.^{1, 14}

The most frequently reported symptoms of TMD in the subject population were headaches (95.5%), pain in the neck region (86.6%), tinnitus (70.1%), and clenching of the teeth when angry (68.7%). Results are shown in Table 2

Results outlined in table 4 show that there were a higher percentage of TMD sufferers as levels of job related stress intensity and frequency increased. This indicates that the higher the level of job related stress intensity and frequency, the more likely the person is to develop TMD.

Table 3. Distribution of Subjects Based on Job Related Stress Intensity and Frequency Levels

Variable	Frequency	Percentage (%)
Job Related Stress Intensity		
Low	57	49.1
Moderate	53	45.7
High	6	5.2
Job Related Stress Frequency		
Low	63	54.3
Moderate	22	19.0
High	31	26.7

Table 4. Distribution of Subjects Based on Job Related Stress Intensity Levels, Job Related Stress Frequency Levels, and the Occurrence of TMD.

Variable	Non-TMD	TMD	Total
Job Related Stress Intensity			
Low	32 (56.1%)	25 (43.9%)	57 (100%)
Moderate	17 (32.1%)	36 (67.9%)	53 (100%)
High	0 (0%)	6 (100%)	6 (100%)
Job Related Stress Frequency			
Low	32 (50.8%)	31 (49.2%)	63 (100%)
Moderate	10 (45.5%)	12 (54.5%)	22 (100%)
High	7 (42.2%)	24 (57.8%)	31 (100%)

The relationship between the intensity and frequency of job related stress and the occurrence of TMD in subjects of a productive age were studied using a comparative hypothesis test between the 2 unpaired categorical variables. Fisher’s exact test showed that there was a significant relationship between the intensity level of job related stress and the occurrence of TMD in subjects of a productive age ($p = 0.003$). Chi-square tests also showed that there was a significant relationship between the frequency of job related stress and the occurrence of TMD in subjects of a productive age ($p = 0.032$). This finding is consistent with other research projects, which found that emotional stress could affect TMD prevalence.^{1,4,5}

A common factor that influences masticatory function is increased levels of emotional stress. The emotional centres of the brain influence muscle function, including the masticatory muscles.^{1,4,5} In a stable emotional condition, rhythmic muscle activity is usually predictable and mastication runs efficiently. If an individual is experiencing a higher emotional state,

Table 5. The Relationship Between The Intensity and Frequency of Job Related Stress and the Occurrence of TMD

Independent Variables	Occurrence of TMD (n = 116)		p
	Non-TMD (100%)	TMD (100%)	
Job Stress Intensity			
Low	32 (65.3%)	25 (37.3%)	0.003*
Moderate	17 (34.7%)	36 (53.7%)	
High	0 (0%)	6 (9%)	
Job Stress Frequency			
Low	32 (65.3%)	31 (46.3%)	0.032**
Moderate	10 (20.4%)	12 (17.9%)	
High	7 (14.3%)	24 (35.8%)	

* Fisher’s Exact Test; $p < 0.005$

** Chi-square Test; $p < 0.05$

e.g. frightened, frustrated, or angry modifications can occur in the muscle activities.

Afferent and efferent nerve fibres innervate our muscles. Efferent nerves consist of alpha and gamma motor neurons, and each neuron has different roles. The hypothalamus, the reticular system, and particularly the limbic system are primarily responsible for the emotional state of an individual. These centres influence muscle activity in many ways, one of which is through gamma efferent pathways. Increased emotional stress will excite the limbic structure and hypothalamus-pituitary-adrenal (HPA) axis, leading to an activation of the gamma efferent system. The gamma efferent fibres are an active component of muscle contraction and an increase in its activity will cause an intrafusal fibre contraction. This sensitises the spindle and as a result any stretching of the muscle will cause a reflex contraction. This process affects the myotatic (stretch) reflex and increases muscle sensitivity to external stimuli, which later causes higher head and neck muscle tonicity. Just as increased gamma efferent activity increases the sensitivity of the myotatic reflex, decreased gamma efferent activity decreases the sensitivity of this reflex. An increase in its tonicity will increase the risk of muscle fatigue and will also cause increased intra-articular TMJ pressure.^{1,5}

Increased gamma efferent activities can increase irrelevant muscle activities, which can lead to dramatic effects for masticatory function.^{1,5} The reticular formation, with influence from the limbic system and HPA Axis, can create additional muscle activity that is unrelated to the accomplishment of a specific task. Often these activities assume the role of nervous habits such as biting fingernails or pencils, clenching the teeth together, or bruxism.¹

Autonomic nerve fibres, both sympathetic and parasympathetic, innervate our muscles. Emotional stress can affect an individual’s sympathetic response.

The autonomic nervous system constantly monitors and regulates numerous subconscious systems that maintain homeostasis. One of the functions of the autonomic system is to regulate blood flow within the body. The sympathetic nervous system is closely related to the fight-or-flight reflex that is activated by stressors. In the presence of stress, the capillary blood flow of the outer tissues is constricted, permitting increased blood flow to the more vital musculoskeletal structures and internal organs. Dilation of blood vessels in the musculoskeletal structures allows a larger supply of oxygen and ATP to the musculoskeletal tissues. Prolonged activity of the sympathetic nervous system can affect certain tissues, such as muscles and cause increased muscle tone, thereby producing painful muscle conditions.¹

The sample group in this study was mostly exposed to conditions of chronic psychological stress (job related stress) at a fairly high level. Approximately 50% of the population experienced both moderate and high level of job related stress intensity and frequency. This considerable and continued levels of stress may result in the negative changes mentioned above.

The Authors believe it is important to note the possible biases in this study. The first is recall bias, which is a systematic error caused by differences in the accuracy or completeness of the recollections retrieved, by study participants, regarding events or experiences from the past. It especially occurred during the job related stress frequency assessment and during the clenching habits assessment, which can often occur unconsciously. Other limitations were the factors of limited time, a lack of understanding of the questions asked, and fatigue experienced by the subjects during the assessment of 8 items of TMD-DI and 30 items of JSS, that was completed after their busy work schedule. Additionally, the study didn't differentiate between the lengths of time that each subject had worked in their profession; therefore job related stress levels between newer and older employees couldn't be differentiated.

CONCLUSION

Based on the results of this study, it can be concluded that there is a relationship between the intensity and frequency level of job related stress and the occurrence of TMD in those of a productive age.

CONFLICT OF INTEREST

There are no potential conflicts of interest, or any financial or personal relationships with people or organizations that could inappropriately bias the conduct and findings of this study.

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