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Work-Related Factors, Exercise Habits, and Individual Characteristics on Musculoskeletal Disorders among Indonesian Young Dentists

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Abstract

MSDs disorders among dentists are one of the most common complaints. A high prevalence of MSDs among dentists is evident, with 63.5% of young Indonesian dentists experiencing musculoskeletal symptoms. This study aims to explore risk factors that can increase the incidence of MSDs among young dentists. Methods: This study employed a cross-sectional design with a population of 162, which served as the entire sample. The questionnaire instrument contains questions about gender, age, weight, height, smoking habits, daily sleep duration, exercise habits, length of work, and length of service. There is also a standard questionnaire, namely the Nordic Body Map, to evaluate musculoskeletal disorders in individuals. Data analysis used the chi-square test and the multiple logistic regression test. Results: The highest MSDs were reported to occur in the upper back (69.8 %), followed by the lower back (67.3%) and neck (63.6%), while the lowest prevalence was reported in the ankle (8.6%). Gender, length of service, and exercise habits are associated with the occurrence of MSDs. Conclusion: The prevalence of MSDs among young dentists is still high. Length of service is the most influential risk factor.

Introduction

Musculoskeletal disorders are defined as any form of pain or injury caused by the musculoskeletal system (MS) (i.e., muscles, joints, ligaments, tendons, or nerves) (Edrees *et al*., 2024) . Musculoskeletal Disorders (MSDs) are a major health burden for the dental profession. The causes of MSDs are a direct result of repetitive work or non-ergonomic practices in the workplace (Rajvanshi *et al*., 2015) and the use of work tools that cause vibration hazards. Broadly, several studies have investigated that the prevalence of MSDs is high among dentists (Batham and Yasobant, 2016; Lietz, Ulusoy and Nienhaus, 2020; Ohlendorf *et al*., 2020) . Another study on the prevalence of MSDs in dentists worldwide is described to vary between 10.8% - 97.9% (Ohlendorf *et al*., 2020) . Data from a review article explains that in the Health sector, the estimated prevalence of degenerative lumbar spine disease is 21% and osteoporosis of the hands is 37% which occurs in dentists as a result of their work (Greggi *et al*., 2024). A high prevalence of MSDs among dentists is evident, with 63.5% of young Indonesian dentists experiencing musculoskeletal symptoms (Lietz *et al*., 2020).

MSDs occur when someone works in a work position that can expose the human body to certain loads with certain positions that occur repeatedly (Punnett and Wegman, 2004). This causes the joints, muscles, and tendons to experience excessive force in uncomfortable work positions. Intense work activities require large muscle exertion that causes fatigue and has the potential for MSDs. (Fernandez, 1995) . Previous studies have shown that 72.6% of Dental Personnel experience MSDs (Davoudi-

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Kiakalayeh *et al*., 2017). In a study conducted on dental students, musculoskeletal symptoms were found (Zafar and Almosa, 2019). Several factors contribute to the emergence of this disorder, which are very multifactorial, including genetic factors, environmental factors, and work factors in the form of body posture and length of work (Chan *et al*., 2018; Soo *et al*., 2023). As a dentist, the work activities carried out every day during practice pose a risk of MSDs. Work that sits for a long time in an uncomfortable position, uses great strength in carrying out dental service practices, and is exacerbated by movements that (Meisha *et al*., 2019; Greggi *et al*., 2024). These activities are not balanced with sufficient rest and recovery time, so the risk of MSDs becomes greater. MSDs can disrupt daily activities, such as lost school time(Lestari *et al*., 2020).

Research on MSDs in dental students is still limited, while most of the existing studies are cross-sectional and do not provide a long-term picture. Variability in measurement methods in MSDs research causes data inconsistency and makes it difficult to compare results between studies. In addition to well-known factors such as non-ergonomic posture and long working hours, sleep quality is thought to play a significant role in the prevalence of MSDs among dental students. Students who experience sleep disturbances or poor sleep quality may be more susceptible to MSDs because the body does not get enough time for recovery and regeneration. Analysis of these factors is important to obtain a more comprehensive picture of the causes of MSDs and to develop more effective preventive measures.

Methods

This study used a cross-sectional design, and the study was conducted in September 2024. The population of this study was 162 young dentists at the Dental and Oral Hospital of Muhammadiyah University of Semarang. This study used the total population as a sample, so that all young dentists would be included in the study. This. The independent variables in this study are gender, age, BMI, smoking habits, sleep quality, exercise habits, and length of service. The dependent variable is musculoskeletal disorders.

Data collection was conducted by the interview method using a questionnaire instrument containing questions about gender, age, weight, height, smoking habits, how long to sleep in a day, exercise habits, length of work, and length of service. And there is a standard questionnaire, namely the Nordic Body Map, which is a measuring tool used to evaluate musculoskeletal disorders in individuals. This questionnaire is designed to systematically map the location of pain or discomfort in the body. This tool involves five main anatomical areas: neck, upper back (thoracic), lower back (lumbar), shoulders, and arms and hands. This study was approved by young dentists who filled out and signed the informed consent form, after which interviews and BMI measurements were conducted.

The data analysis conducted was an univariate analysis by presenting data in the form of a table containing frequencies and percentages between factors. Bivariate analysis was conducted by testing the relationship between factors and MSDs using the chi-square test and Fisher's exact test. Multivariate analysis was used to determine the factors most related to MSDs with multiple logistic regression tests. The software used for data analysis in this study was IBM SPSS Statistics 21. This research has received an ethical certificate from the ethics committee, and the number of the ethics certificate is 001/RSGM/KEPK/PE/2024.

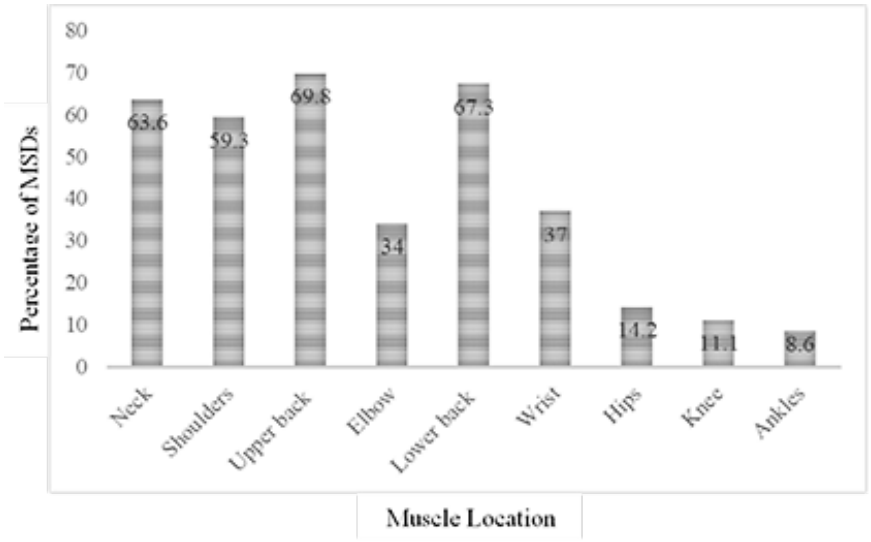
Results and Discussion

This study was dominated by women as respondents (72.8%), while the average age was 24 years. The BMI category most experienced by respondents was obesity 1 (40.7 %). Many had good sleep quality (78.4 %), and more respondents did sports than those who did not (56.2%). Only 13.6 % of respondents worked more than 8 hours, and most of the respondents worked less than 10 years (38.3%). Among the 162 respondents, at least 87% felt pain on one side of their body. Figure 1 shows that the highest prevalence of MSDS pain was reported in the upper back (69.8%), followed by the lower back (67.3%) and neck (63.6%), while the lowest prevalence was reported in the ankle (8.6%).

TABLE 1. Information on Respondent Characteristics

Variable	f (%)	Mean±SD
Gender		
Man	44 (27.2)	
Woman	118 (72.8)	
Age		
21-24	95 (58.6)	24.20±2.067
25-28	67 (41.4)	
IMT		
BB Less	7 (4.3)	24,560±2,7943
BB Normal	27 (16.7)	
Advantages of BB	61 (37.7)	
Obesity 1	66 (40.7)	
Obesity 2	1 (0.6)	
Smoking habit		
Non-Smoker	143 (88.3)	
Smoker	19 (11.7)	
Sleep quality		
Good	127 (78.4)	7.01±1.520
Bad	35 (21.6)	
Exercise Habits		
Yes	91 (56.2)	
No	71 (43.8)	
Length of working		
<8 hours	22 (13.6)	8.45±0.819
>=8 hours	140 (86.4)	
Years of service		
<5 years	62 (38.3)	12.73±9.790
>=5 years	100 (61.7)	
MSDs Complaints		
No	21 (13)	3.64±2.411
MSDs	141(87)	

Source: Primary Data, 2024



Source: Primary Data, 2024

TABLE 2. Risk factors for MSDs

Variables	Category	MSDs						PR	95%CI	P value
		No Pain		Pain		Total				
		f	%	f	%	f	%			
Gender	Man	10	22.7	34	77.3	44	100.0	2.4	1,118-7,319	0.046
	Woman	11	9.3	107	90.7	118	100.0			
BMI	Normal	3	11.1	24	88.9	27	100.0	0.8	0.222-2.978	1,000
	Abnormal	18	13.3	117	86.7	135	100.0			
Age	21-24	12	12.6	83	87.4	95	100.0	0.9	0.369-2.355	1,000
	25-28	9	13.4	58	86.6	67	100.0			
Smoke	Non-smoker	16	11.2	127	88.8	143	100.0	0.4	0.112-1.109	0.077
	Smoker	5	26.3	14	73.7	19	100.0			
Sleep quality	Good	16	12.6	111	87.4	127	100.0	0.9	0.293-2.552	0.780
	Bad	5	14.3	30	85.7	35	100.0			
Sports Habit	Yes	17	18.7	74	81.3	91	100.0	3.3	1,233-12,011	0.027
	No	4	5.6	67	94.4	71	100.0			
Length of working	<8 hours	9	40.9	13	59.1	22	100.0	4.8	2,622-20,801	0,000
	>=8 hours	12	8.6	128	91.4	140	100.0			
Years of service	<5 years	3	4.8	59	95.2	62	100.0	0.3	0.065-0.823	0.029
	>=5 years	18	18	82	82	100	100.0			

Source: Primary Data, 2024

TABLE 3. Results of Multivariate

Variables	β	p	Exp β
Gender	1,141	0.036	3,130
Length of working	2,350	0,000	10,489
Exercise Habits	1,602	0.012	4,963

Source: Primary Data, 2024

The results of the chi-square test explain that there is a relationship between gender, exercise habits, length of service, and MSDs (Table 2). The results of the multivariate test explain that the most influential variable is length of service (Table 3).

Most studies report that neck pain is the most common complaint experienced by dentists. (Ohlendorf *et al*., 2020; Gandolfi *et al*., 2021; Hussein, Mando and Radisauskas, 2022; Singh *et al*., 2022; AlSahiem *et al*., 2023). When dentists work in a bent and twisted neck position, as well as a static position without rest, these are the most frequently reported causes of neck pain. (Presoto, Petromilli and Sasso, 2016; José *et al*., 2017). Other studies reported this was related to a decrease in the use of dental magnifying glasses of less than a quarter, even though their use has been proven to be efficient in reducing MSDs because it prevents improper bending of the neck, and the work posture is considered better when using dental magnifying glasses. (Plessas, 2018; Carpentier *et al*., 2019; Lietz, Ulusoy and Nienhaus, 2020) Another factor that may contribute to neck pain is the prolonged use of electronic devices every day. A study reported that the use of portable electronic devices (laptops, tablets, and phones) resulted in greater neck flexion, which can increase chronic neck pain. (Lee *et al*., 2021)

This study found that pain in the upper back was the most common. When practicing, young dentists sit for a long time, and the upper back tends to bend often, so that the curvature of the spine is shaped like the letter C. In addition, several young dentists' practices require working in alternating standing and sitting positions, which further increases the risk. Studies report that upper and lower back pain will be more severe than in those who only stand or sit. (Grado *et al*., 2019) Previous studies also reported that most (72.6%) dentists felt pain and discomfort in the upper and lower back areas, which were quite high compared to other specialist doctors. (Younis *et al*., 2022)

Previous studies have reported that women are at higher risk of MSDs than men (Plessas, 2018; Gandolfi *et al*., 2021). This may be attributed to differences in muscle mass, joint structure, and hormonal influences. Estrogen, for instance, affects ligament laxity and pain perception, potentially increasing susceptibility to musculoskeletal strain and injury. Additionally, women generally have lower upper-body strength, which can lead to greater physical strain during certain tasks, thereby contributing to the development of musculoskeletal disorders (Bouhet *et al*., 2024). Likewise, this study reports that women are at greater risk of MSDs. Married women have additional tasks at home compared to those who are single. Likewise, women during menopause will be at greater risk compared to younger women due to osteoporosis, osteoarthritis, and sarcopenia. (Khadilkar, 2019).

The results of the study prove that there is a relationship between the length of work and MSDs. Long working hours increase the risk of MSDs, as prolonged duration of work leads to extended exposure to repetitive movements, static postures, and biomechanical stress. These factors can cause microtrauma to muscles, tendons, and ligaments, triggering an inflammatory response that contributes to the development of musculoskeletal disorders(Eyvazlou *et al*., 2021). Young dentists who practice for extended periods with poor posture are particularly at high risk, as continuous strain without adequate recovery time can result in cumulative tissue damage. This is in line with previous studies, which reported that longer working hours per day and per week are associated with a higher prevalence of MSDs—especially among operators working more than 8 hours per day and more than 40 hours per week, where up to 90% report experiencing one or more MSDs. (Gandolfi *et al*., 2021)

Several studies have shown that the prevalence of chronic pain is significantly related to years of experience (Grado *et al*., 2019; Gandolfi *et al*., 2021; Younis *et al*., 2022) . Similarly, this study found that the prevalence of MSDs is higher in young dentists with longer working periods. The longer the working period, the greater the cumulative exposure to ergonomic risk factors such as awkward postures, repetitive movements, and static muscle loading. These continuous mechanical stresses can lead to microtrauma in musculoskeletal tissues, which, over time, trigger an inflammatory response, tissue degeneration, and chronic pain (Alzayani *et al*., 2021). Young dentists who fail to maintain proper working posture from the beginning of their careers are more likely to develop poor ergonomic habits, which accelerate musculoskeletal strain. Previous studies have also reported that back pain can appear shortly after entering the profession, with prevalence increasing from 72% in those with less than 3 years of experience to 84% in those with 3 to 6 years of experience (Grado *et al*., 2019).

More than half of the young dentists in this study did sports (56.2 %). This finding is supported by several previous studies stating that most participants did some physical exercise (AlSahiem *et al*., 2023) . However, it can be seen that young dentists who experience MSDs are more common among dentists who do not exercise (94.4 %). The prevalence ratio results also show that young dentists who do not exercise are 3.3 times more likely to be at risk than those who do exercise. Regular exercise can help prevent and reduce the intensity of MSDs (Hashim and Al-ali, 2013; Feng *et al*., 2014) , and can provide mental relaxation from the high stress experienced by young dentists during work and training (Tezel *et al*., 2005) which leads to a healthier lifestyle and reduces the risk of MSDs (Hildebrandt *et al*., 2000) . Regardless of the type of work, regular exercise, training, and yoga are important preventive measures against many chronic diseases (Booth *et al*., 2012). A cross-sectional design only allows the establishment of possible relationships between MSDs and the research variables investigated. In addition, there is a possibility of prevalence bias because MSDs felt during a certain period may not have occurred at the time of the study.

More than half of the young dentists in this study reported engaging in physical exercise (56.2%). This finding aligns with several previous studies indicating that a majority of participants performed some form of physical activity (AlSahiem *et al*., 2023). However, MSDs were found to be more prevalent among young dentists who did not exercise (94.4%). The prevalence ratio also indicates that young dentists who do not engage in regular physical activity are 3.3 times more likely to develop MSDs compared to those who do exercise. From a pathophysiological perspective, regular physical activity plays a critical role in maintaining musculoskeletal health by improving muscle strength, flexibility, and joint stability, which can reduce biomechanical strain and prevent tissue damage. Exercise also promotes better blood flow to muscles and tendons, facilitating nutrient delivery and waste removal, thereby reducing inflammation and supporting tissue repair (Rhim *et al*., 2022). Moreover, regular physical activity contributes to stress reduction by modulating cortisol levels and enhancing endorphin release, which not only supports psychological well-being but also decreases muscle tension commonly associated with stress-induced MSDs (Tezel *et al*., 2005; Hildebrandt *et al*., 2000). Therefore, incorporating exercise routines, including strength training, stretching, or yoga, serves as a preventive strategy against the development of chronic musculoskeletal conditions (Booth *et al*., 2012). Nevertheless, due to the cross-sectional nature of this study, only associations—not causal relationships—can be inferred, and there is a possibility of prevalence bias, as reported MSDs may not reflect current or persistent conditions

Conclusion

This study shows a high prevalence of MSDs among young dentists, even though only 1 body part is complained of. Gender, length of work, and exercise habits are the most influential factors in increasing the risk of MSDs. Dental schools should encourage the application of ergonomic principles and stretching in between practices. Adding sports

classes outside the curriculum and preparing easily accessible sports facilities on campus are arrangements that can minimize the negative impact of MSDs among young dentists. Future research needs to conduct studies with a cohort design so that the process of MSDs occurring over time can be seen, and what factors can increase the risk.

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