

## The Effect of Physical Activity Level on the Low Back Pain Incidence Among Dentists in Yogyakarta City

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### ABSTRACT

Low back pain (LBP) is a complaint that dentists often encounter because of the tendency to work with static movements for a long duration of time. There are some indicated factors that may involve in the occurrence of the LBP, one of which is the level of physical activity. This study aimed to confirm and understand the association of physical activity level to the incidence of low back pain. The research method was analytical observation with a cross-sectional design. The study used questionnaires on physical activity level and low back pain which were distributed to 76 samples of dentists in the Yogyakarta City area. The data was further analyzed with a chi-square test. The results showed a value of 9.147 with degree of freedom 1 and significance of 0.002. This value is greater than the table's chi-square value of 3.841, which means that there was a significant proportion association between physical activity level and low back pain occurrence

## INTRODUCTION

Physical activity is one of the important efforts to maintain and improve health or physical fitness. Someone with habits and lifestyles sitting continuously while working or habits of low physical activity (sedentary) has a higher risk of experiencing health problems, one of which is *musculoskeletal disorder* (Santosa, 2007).

*Musculoskeletal disorders* (MSDs) are disorders of the skeletal muscles caused by muscles receiving static loads repeatedly and continuously for a long period of time and may cause complaints of damage to the joints, ligaments and tendons. *Musculoskeletal disorder* can occur in several parts of the body such as the neck, lower back, and upper arms. Dentists are one of the professions that have a high risk for *musculoskeletal disorders*. This is because, in the working time, dentists often perform static movements for a long time and require accuracy in a relatively small or even narrow area. Dentists tend to pay more attention and prioritize the comfort of the patients that being treated, without paying attention to comfort for themselves when performing treatment. The part of a dentist's body that has the highest risk of *developing musculoskeletal disorder* (MSDs) is in the neck and lower back (Gaowgzeh et al. 2015).

Low back pain (LBP) is the occurrence of pain in the back area between the lower angle of the *costae* (ribs) to the *lumbrosacral* (around the coccyx) and this pain can also radiate to other areas such as the upper back and groin (Ehrlich, 2003). Pain in spinal or paraspinal structures in the *lumbrosacral* region due to a stimulus that triggers afferent sensory nerves, causing muscle contractions and activating nerve fiber C that conducts pain impulses (Ilyas & Dharmaji, 2012).

Based on several research results, the prevalence of low back pain in some countries still shows a high percentage. Like research conducted in the United States, it is said that the prevalence of low back pain in the United States is around 60%-80% (Hills, 2014). Low back pain (LBP) is also widely complained by health workers with a large prevalence for one year in western countries of 36.2% - 57.9%, while the prevalence in Asian countries is 36.8-69.7% (Sopajareeya et al. 2009). It is estimated that approximately 40% of Central Java's population over the age of 65 has suffered from low back pain. The prevalence in males is 18.2% and in females is 13.6%. While the incidence based on patient visits to several hospitals in Indonesia ranges from 3-17% (Wagiu, 2005). According to Adiningrat & Abdul (2020), the prevalence of low back pain events among dentists in Yogyakarta city was quite high, as it affected almost half of the respondents and showed diversity among predisposing factors. The total prevalence, categorized by all the severity levels was 39 dentists (or 51%) suffered from a low back pain of musculoskeletal disorder.

There are many factors that may influence the occurrence of low back pain. From several studies that have been conducted, it is reported that risk factors for low back pain include age, sex, smoking habits, long work period of 5-10 years, work position, body mass index (BMI), family history of musculoskeletal disorder, and physical activity or exercise (Andini, 2015). Low or poor body activity is also one of the important factors that can contribute the incidence of low back pain (Maher et al. 2002).

According to Lumenta (2007), the low levels of physical activity can cause reduced flexibility in the joints and extensibility in connective tissue, so it has a higher risk of developing low back pain compared to someone who has the habit of doing physical activity. Regular physical activity can lead to two changes that can be induced in muscle fibers, namely in the capacity of ATP synthesis and changes in diameter.

According to the Ministry of Health of the Republic of Indonesia through Risesdas (2018), risk factors will increase along with lifestyle changes such as people's exercise habits that begin to decline and types of work that do not spend much energy (sedentary). Therefore, maintaining health is an obligation for every human being, one of which is by doing physical activity and exercising.

Special Region of Yogyakarta Province has the second highest number of dentists of all regions throughout Indonesia, with an implementation ratio of 8.86 dentists in 100,000 population (Kemenkes RI, 2015). Based on data obtained from the Indonesian Dental Association (PDGI), Yogyakarta City has the highest number of dentist members when compared to other PDGI branches in the Special Region of Yogyakarta such as Sleman Regency, Bantul Regency, Kulonprogo Regency and Gunung Kidul Regency.

Therefore, this study was conducted with the aim of determining whether there is an association of physical activity level to the occurrence of low back pain among the dentists in the Yogyakarta City that could be correlated to physical activity factors.

## LITERATURE REVIEW

### Physical Activity

Physical activity belongs to any body movement that requires increasing and spending energy, and burning calories to do it (Ministry of Health, 2015). Low physical activity (lack of physical activity) is an independent risk factor for chronic disease, and overall is estimated to cause death globally (WHO, 2010). Physical activity can generally be in the form of work activities, sports activities, or leisure activities (Baecke et al. 1982). According to Kristanti (2002), the influence of physical activity can appear instantly which is referred to as an acute response or long-term influence due to regular and programmed exercise called adaptation. Acute responses include increased heart rate frequency, increased respiratory frequency, increased blood pressure and increased body temperature. While the adaptation response includes an increase in muscle mass, an increase in bone mass, an increase in the antioxidant defense system and a decrease in the frequency of resting heart rate.

### Musculoskeletal Disorders (MSDs)

*Musculoskeletal* disorder (MSDs), which is an injury and disorder that occurs in the soft tissues (muscles, tendons, ligaments, joints, and cartilage) and the nervous system. MSDs usually occur over a long period of time; weekly, monthly, even yearly. MSDs can cause a number of conditions such as pain, numbness, tingling, stiff joints, moving difficulty, muscle loss, and sometimes paralysis (Sanders, 2004). *Musculoskeletal* disorders can occur if a person sits too long in a static position so that the body position will press the *spinal disc*. This

condition affects in a lack of blood supply and nutrients that can cause damage to soft tissues.

### **Low Back Pain (LBP)**

Low back pain (LBP) is a local pain, muscle tension, or stiffness that occurs below the costal limit and above the inferior gluteal fold, with or without radiation to the leg to toe or sciatica (Koes, 2006). Low back pain is pain felt in the lumbosacral region covering the distance from the first lumbar vertebra to the first sacral vertebra. The sites that most commonly experience low back pain are in lumbar segments 4 and 5 (Kravitz & Andrews, 2012). Low back pain is also defined as pain that occurs in the lumbosacral and sacroiliac regions. The pain is often accompanied by radiating to the legs to the feet. Mobility in the lower back is very high, besides that this part supports the weight of the body, and at the same time adjacent to other tissues, namely the digestive tract and urinary tract. These two tissues or organs if they experience certain pathological changes can cause pain in the lower back area (Harsono, 2005).

Some anatomical structures and elements of the spine such as bones, ligaments, tendons, discs, and muscles play a role in the occurrence of low back pain. Many sensory innervations in the spine can conduct nociceptive signals if there is stimulation due to tissue damage. In addition to nociceptive signals, chronic low back pain can also be caused by neuropathic pain (Hills, 2014).

The onset of pain and fatigue can also be caused due to the increased lactic acid concentrations and decreased glycogen. This condition is often called muscle fatigue. Muscle fatigue is the inability of muscles to contract and metabolize the materials needed to produce the similar expenditure of work, even though nerve impulses travel normally and action potentials propagate to muscle fibers. Muscle fatigue can arise as a result of strong and prolonged muscle contractions. Initially, the occurred skeletal muscle metabolism is aerobic metabolism. When muscles do mild work, there is enough oxygen available to convert free fatty acids and glucose into energy (ATP). But when muscle work increases, then the necessary oxygen demand is insufficient. Muscles can compress blood vessels so that blood flow that carries oxygen becomes limited. When blood flow decreases, metabolites accumulate and oxygen supply in the muscles decreases. Under these conditions, additional ATP is needed which is provided through anaerobic metabolism. Anaerobic metabolism is what can cause lactic acid concentrations to increase and glycogen to decrease (Indriana, 2010).

Low back pain is classified into viscerogenic (due to pathological processes in the kidneys), neurogenic (due to pathological conditions in neoplasms, arachnoiditis, or spinal canal stenosis), vasculogenic (due to aneurysms or peripheral vascular disease), psychogenic (due to anxious or depressive states), and spondyogenic (due to pathological processes that occur in the vertebral column) (Harsono, 2005).

According to Deardorff (2003) low back pain in terms of clinical course is divided into two types, namely *Acute Low Back Pain* (*acute low back pain that attacks suddenly and in a short span of time*), *Chronic Low Back Pain* (*chronic low back pain that can attack for a long time*). Meanwhile, when viewed from the causative factors, low back pain can also be divided into another two types, namely

Degenerative Low Back Pain (*degenerative low back pain due to age factors but can also be caused by other causes such as genetic, environmental, autoimmune, inflammatory, infectious, toxin-induced, or other factors*) and Non Degenerative Low Back Pain (Non-degenerative low back pain, which has many risk factors or causes, and generally associated with an acute traumatic event or cumulative trauma).

Harsono (2005) states that there are several risk factors for low back pain such as gender, which is known that in female this complaint is more common, especially during the menstrual cycle. In addition, the process of menopause can also cause reduced bone density due to a decrease in estrogen hormones, allowing low back pain. Age factor, which is one factor that can aggravate the occurrence of low back pain, where complaints of low back pain are often suffered by elderly people. This happens because of a decrease in body functions, especially in the bones, so that the bones are no longer elastic as they were when they were young. Postural or body position is said to affect the incidence of low back pain because the sitting position can press the spine and increase the activity of the lower back muscles, causing pain in the area compared to the standing position. Obese, someone who has excess in weight, has a higher risk of low back pain due to the load on the joints of increased weight. Work activity, this kind of activity could be a risk factor from a workplace that cause many skeletal muscle disorders, especially the appearance of low back pain, are heavy physical work, handling and lifting the wrong items, repetitive movements, position, posture, and static vibration. Psychosocial, various psychological and social factors can increase the risk of low back pain. Anxiety, depression, stress, responsibility, job dissatisfaction, mental, stress at work can make a person more at risk of low back pain. History of injury or trauma, a person who has experienced previous injury or trauma is at risk for low back pain due to recurrence factors or because the injury is chronic. Physical Activity, wrong posture is a cause of low back pain that is often not realized by sufferers, especially postures that become habits. A person's habits such as sitting, standing, sleeping, lifting weights in the wrong position can cause low back pain. And smoke, an active smoker is more at risk of developing low back pain than a nonsmoker. It is thought that this is due to a decrease in oxygen supply to the discs and reduced oxygen in the blood due to nicotine to the narrowing of arteries.

## **METHODOLOGY**

This study is an analytical observational study with a cross-sectional research design. The study was carried out for around 4 months duration and took all the registered dentists within the Indonesian Dental Association (PDGI) Yogyakarta City Area, Yogyakarta Special Region Province (DIY) as the population.

Samples were taken using simple random sampling techniques by determining the minimum sample that must be included in the study with the calculation of the sample size formula as follows:

$$n = \frac{Z_{1-\frac{\alpha}{2}}^2 P (1-P)}{d^2} \quad (\text{Adiningrat \& Abdul, 2020})$$

- n = Minimum sample size
- $Z_{(1-\alpha/2)}$  = Standard normal distribution values (Z table) at a given  $\alpha$
- P = Price of proportion in population
- D = Tolerable errors (absolute)

If:

- $\alpha$  = 5% (confidence level 95%)
- $Z_{(1-\alpha/2)}$  = 1,96 (Z value)
- P = The proportion of the population is expected when unknown, then set to 50% (0.5) according to Notoadmojo (2010)
- D = The desired degree of deviation, 6% (0.6) has been considered

The minimum sample calculation in this study is as follows:

$$n = \frac{1,96^2 0,5(1-0,5)}{0,06^2} = 266,7 \approx 267$$

The formula for calculating the sample size in the limit population:

$$\text{Sample size} = \frac{\text{Sampel minimum}}{1 + \frac{\text{Sampel minimum} - 1}{\text{Populasi}}} \quad (\text{Adiningrat \& Abdul, 2020})$$

If:

- Minimum sample = 266,7
- Adjusted population = 153

Then the calculation of the applicable sample size in this study is as follows:

$$\text{Sample size} = \frac{266,7}{1 + \frac{266,7-1}{153}} = 76,2 \approx 76 \text{ participants}$$

The incidence of low back pain was determined through the *Modified Oswestry Low Back Pain Disability Questionnaire* that has been conducted during the preliminary study. Measurement of physical activity intensity using the questionnaire media *The Questionnaire of Baecke et al Measurement of a Person's Habitual Physical Activity* which contains 16 questions. Each question point has a minimum score of 1 and a maximum value of 5. Interpretation of questionnaire results is based on *The Questionnaire of Baecke et al Measurement of a Person's Habitual Physical Activity*:

Indeks Baecke Score	Description
≤7,5	Mild activity
>7,5	Moderate activity

The analysis was applied to determine the association between physical activity and low back pain using the *chi-square test* using the SPSS software.

## RESULT

Table 2. Distribution of Respondents by Gender

<b>Gender</b>	<b>Sum (n)</b>	<b>Percentage (%)</b>
Male	24	32
Female	52	62
Sum	76	100

Table 2 showed that female respondents dominate compared to male group with a proportion of 2: 1.

Table 3. Distribution of Respondents by Age Group

<b>Age group(s)</b>	<b>Sum (n)</b>	<b>Percentage (%)</b>
17-25 Year	2	3
26-35 Year	34	44
36-45 Year	20	27
46-55 Year	8	10
56-65 Year	6	8
> 65 Year	6	8
Sum	76	100

Table 3 showed the distribution of respondents by age group. The largest distribution of respondents was in the age group of 26-35 years with a percentage of 44%. While the smallest distribution of respondents is in the age group of 17-25 years with a percentage of 3%.

Table 4. Distribution of Respondents Based on the Incidence of Low Back Pain

<b>LBP incidence</b>	<b>Sum(n)</b>	<b>Percentage (%)</b>
LBP (+)	39	51
LBP (-)	37	49
Sum	76	100

Table 4 showed the distribution of the incidence of low back pain among the respondents. There were 39 respondents suffering from low back pain and 37 respondents did not suffer from low back pain.

Table 5. Distribution of Respondents by Level of Physical Activity

<b>Physical activity</b>	<b>Sum (n)</b>	<b>Percentage (%)</b>
Mild	34	45
Moderate	42	55
Sum	76	100

Table 5 showed the distribution of the respondent's level of physical activity. There were 34 (45%) respondents had a mild level of physical activity and 42 (55%) respondents had a moderate level of physical activity.

Table 6. Frequency Distribution of Physical Activity and Low Back Pain

LBP	Physical activity	
	Mild	Moderate
Positive (+)	24 (31,6%)	15 (19,7%)
Negative (-)	10 (13,2%)	27 (35,5%)

Based on table 6 it could be seen that there were 24 (31.6%) respondents suffering from low back pain with mild physical activity level, and there were around 15 (19.7%) respondents suffering from low back pain with moderate physical activity level. While respondents who did not suffer from low back pain with mild physical activity levels were up to 10 (13.2%) respondents, and up to 27 (35.5%) respondents did not suffer from low back pain with moderate physical activity level.

Table 7. Analysis of the Association of Physical Activity Level and Low Back Pain

Chi-Square Test	N	Value	df	Significance p
Physical activity & LBP	76	9.147 <sup>a</sup>	1	0.002

Based on chi-square analysis, a value of 9.147 was obtained with the degree of freedom 1 and a significance of 0.002. This value was greater than the table's chi-square value of 3.841. Therefore, it could be concluded that null hypothesis should be rejected, which means that there was a significant proportional association between physical activity and the occurrence of low back pain.

## DISCUSSION

The results in our study showed that the distribution of the frequency of low back pain to the dentist profession in the Yogyakarta City area was more suffered by female more than male with a percentage of 35%. This is supported by the theory put forward by Chou et al. (2013) that female and elderly people are more susceptible to complaints of low back pain. One of the possible causes is the menstrual phase experienced by female subjects. In post-menopausal women the calcification of the bones, especially in the spine, may also aggravate the occurrence of low back pain.

The study showed highest incidence of low back pain (LBP) occurs in the age range of 26-35 and 35-45 years with a percentage of 21%. This is supported by the theory of Widjaya et al. (2012) which states that increasing one's age will affect the decline in physical functional abilities. In the age range of 30-40 years, there will be an aging process characterized by bone degeneration that triggers tissue damage, tissue turnover to scar tissue and fluid reduction in bones. This bone degeneration may involve in causing complaints of low back pain.

The results of the chi-square test analysis showed that there was a significant association between physical activity and the incidence of low back pain among the dental practitioners in the Yogyakarta City. Our study of 76 respondents suggested that there was a difference (95% CI,  $p < 0.05$ ) between the incidence of low back pain in respondents with mild (31,6%) and moderate (19,7%) physical activity levels of 11.9%. This is in line with the theory put forward by WHO (2010) that lack of physical activity level is an independent risk factor for musculoskeletal diseases such as low back pain. These results were also in accordance with previous research conducted by Gaowgzeh (2015) which reported that there is a difference in the incidence of low back pain by 40% in dentists with mild and moderate physical activity levels. This was also supported by Andini's research (2015) that adequate and regular physical activity can help prevent and improve complaints of low back pain. The lack of physical activity can reduce oxygen supply to the muscles so that it can lead to LBP complaints. Generally, complaints of low back pain are less common in people who in their daily lives have adequate resting time and moderate levels of physical activity.

The incidence of positive low back pain (LBP) was more dominated in the group of respondents with a mild physical activity level of 31.6%. This could be related to the lack of activity, sports, and leisure activities. Lumenta (2007) states that lack of physical activity levels can cause reduced flexibility in joints and extensibility in connective tissue, so it may come with a higher risk of low back pain compared to someone who has a habit of doing physical activity. The results of this study were also in line with research conducted by Massuda et al. (2017) which indicates that the level of physical activity is directly related to the incidence of low back pain, pain intensity and functional disability index. Research conducted on medical workers at the hospital shows that the incidence of low back pain is higher in the group that has a mild physical activity level of 88.9% compared to the group that has a moderate level of physical activity.

A moderate level of physical activity in a person will help in doing his job, because by doing moderate physical activity will help the body adapt to muscle fatigue that will be experienced while working (Hutson & Ellis, 2006). Work activities tend to muscle contraction activities, while leisure activities tend to relax stage in sports activities, the tendency in both phases of activity above can be facilitated simultaneously. This tendency to muscle contraction activity is thought to affect the metabolism of muscle tissue which will then affect the occurrence of low back pain. When ATP (Adenosine triphosphate) as an energy source runs out due to continuous use, the muscles will not be able to contract and will experience fatigue. Muscle contraction is based on two filaments actin and myosin. The myosin filaments hydrolyze ATP to ADP and lactic acid binds actin for contraction. Build lactic acid will inhibit ATP forming enzymes, muscle fatigue causes muscle imbalance and ischemia that will trigger the onset of pain (Valachi, 2003).

In this study, respondents who had a moderate level of physical activity also had the same risk of lower back pain. This condition can occur due to low levels of sports activity and high work activity or vice versa. It is at this high level of work that dentists are at risk associated with the incidence of low back pain. An increase

in the number of patients, types of cases and performed procedures will increase the frequency and intensity of dentist work. This may increase the potential incidence of low back pain if done with a bad postural body. Gupta et al. (2008) suggests that the duration of time needed by dentists to work, can increase the potential for muscle fatigue in the arms, neck, and lower back which can cause pain. With regular physical activity, the body gets used to the muscle fatigue experienced. This muscle laxity adaptation reduces the risk of lower back pain. Stretching before treating patients and resting between one patient and the next can also prevent and reduce these complaints.

## CONCLUSION AND RECOMMENDATION

Based on our study, it can be concluded that there is a significant proportion association between mild physical activity and the occurrence of low back pain.

## FURTHER STUDY

Further research can be done on a larger scale and research on other predisposing factors that may influence the incidence of low back pain.

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