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Effect of Sitting Positions on Lower Back Pain among Office Workers: A Case Study at the Directorate General of New, Renewable Energy and Energy Conservation (EBTKE) in 2022

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A condition known as lower back pain occurs when the back hurts so much that it makes routine tasks difficult. Employees who use computers for work and spend much time sitting during the day can pose ergonomic risks. This research aims to determine whether the incidence of low back pain in employees of the Office of the Directorate General of New, Renewable Energy and Energy Conservation (EBTKE) in 2022 is related to sitting posture while working. An analytical survey with

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a cross-sectional approach is the research method used. The research tool used is a questionnaire that collects primary data. After the data was calculated using the Slovin method, 53 respondents were selected randomly and used as samples. The results showed that there was no relationship between the division of departments (p=0.68) and the incidence of low back pain, but there was a relationship between sitting posture (p=0.605) and this condition, there was no relationship between slouched posture (p0.001) and conditions, and there was no relationship between the amount of time spent sitting at work (p=0.105).

Keywords: Incidence of lower back pain; ergonomics; sitting position while working; hunched posture; sitting duration.

1. INTRODUCTION

Every human needs work to earn income, which is used to fulfill their daily needs. Body position when working, which is carried out incorrectly/not ergonomically and repeatedly, will result in a lot of exposure/potential danger received by a worker. When a worker receives a long period of exposure/potential danger, the total exposure received will be large, and this can cause health problems, which are classified as occupational diseases [1].

Disorders that develop due to connections at work or are caused by work and work attitudes are known as occupational diseases [2]. One example of a disease that is often found to be related to a person's workplace is spinal problems or lower back pain. Back pain is a symptom not categorized as a disease, and the location of the discomfort, specifically located in the area between rib XII (lower rib edge) and the gluteal fold, determines its etiology. Local and radicular pain and discomfort in one or both legs often occur along with neurological symptoms in the lower extremities. This condition can affect all age groups and is generally associated with sedentary work, smoking, obesity, and low socio-economic status [3].

Low back pain is now the number one cause of disability globally. The prevalence of low back pain that limits activity in 2015 was 7.3%, indicating that there were 540 million people affected at any one time. In 2015 In recent decades, disability due to back pain has increased most in low-income communities and the middle, such as in Asia, Africa, and the Middle East, where health and social care systems are not optimal in dealing with this growing burden in addition to other priorities such as infectious diseases [4]. Meanwhile, in Indonesia, based on a national socio-economic survey by the Indonesian Central Statistics Agency in 2016, as many as 26.74% of the working population in Indonesia had health complaints. Based on this background, the research problem that will be answered in this study was formulated, namely: "Is there a correlation between the incidence of lower back pain in workers of the Directorate General of New, Renewable Energy and Energy Conservation (EBTKE) in 2022 and the way they sit while working?" The research aims to understand whether there is a correlation between sitting position during activities and the incidence of lower back pain in employees of the Office of the Directorate General of New, Renewable Energy and Energy Conservation (EBTKE) in 2022.

2. LITERATURE REVIEW

The human back is formed by the spine, or in Latin, it is called the vertebral column. The vertebral column consists of small bones (os. vertebrae) that stack on each other to make the spine. Between each vertebra, there are soft pads called intervertebral discs, which help to absorb pressure and keep the bones from rubbing against each other, and ligaments attach each vertebra. This collection of vertebrae forms the vertebral canal which contains the spinal cord and branches into roots and peripheral nerves [5].

The vertebral column has a complex structure consisting of anterior and posterior planes. In the anterior part, intervertebral discs (as articulations) are supported by the anterior and posterior longitudinal ligaments. Meanwhile, the posterior part consists of the pedicle, lamina of the spinal canal, and the transverse and spinous processes, which function as support and protective muscles for the spine. Apophyseal joints connect the posterior parts of the spine. The facet and sacroiliac joints are covered by synovial, intervertebral discs and elastic ligaments, which play a role in flexion, extension, and rotation of the spine and lateral movement of

the spine. The vertebral column in adults has a length of 57-67 cm and consists of 33 bones, of which 24 are separated into seven cervical bones, 12 thoracic bones, five lumbar bones, and the remaining nine vertebrae are fused into five sacrum bones, and 4 coccygeus bones (tailbone) [6].

The function of the vertebral column is to support the human body so that humans can stand, walk, sit, and when in an upright position, where mechanically the position of the human body opposes the force of gravity, but with the presence of the vertebral column the human body can still stand and balance. Another important function of the vertebral column is to protect the spinal cord, which receives nerve supply from the brain and supplies the entire body [7].

The human vertebral column is strengthened by ligaments and trunk muscles, which support body weight and regulate the balance of movement. Around the vertebral column is a group of strong muscles in pairs called the back muscles, which are located in the posterior part of the body. The function of these muscles is to provide spinal movement, trunk stability, and coordination between limb and trunk movements. Back muscles are categorized into three groups. First are intrinsic muscles, which are muscles that are attached to the spine. The second group is superficial muscles, which help with shoulder and neck movement. The final group is the intermedius muscles, which assist in thoracic movement. Only the intrinsic muscles are considered true back muscles of the three groups [8].

The two muscles in the superficial layer are the splenius capitis and the splenius cervicis. These two muscles help with shoulder and neck movement. Splenius capitis originates from the spinous process/origo splenius cervicis of the spinous processes of the C7 and T1-T3 (or T4) vertebrae and the supraspinous ligament. The splenius capitis functions in ipsilateral head rotation and head extension. The splenius cervicis also forms part of the base of the posterior triangle of the neck. The splenius cervicis originates from the spinous processes of T3-T6 and functions in rotation of the upper cervical vertebrae and extension of the upper cervical vertebrae.

Furthermore, the intermediate muscles, which consist of the erector spinae, are divided into three muscles that reach the entire back, divided into three regional groups consisting of the spinalis, longissimus dorsi, and iliocostalis muscles. These intermediate muscles play a role in thoracic movement, the upper spinal column, and head flexion. Firstly, the spinal muscles, consisting of the spinalis thoracis, the most medial erector spinae muscle in the thoracic region, originate from the T11-L2 spinous process and merge with the longissimus thoracis muscle laterally. The spinalis cervicis originates from the nuchae ligament and spinal processes of C7 and spinalis capitis; some semispinalis capitis fibers insert into the spinous processes of C7 and T1. Next, the longissimus muscle, consisting of the longissimus capitis, which originates from the transverse processes C4-T4; the longissimus cervicis, which originates from T1-T4; the longissimus thoracis, which is the largest group of erector spinae, which consists of the lumbar and thoracic sections which originate from the transverse processes of the inferior vertebral section. Lastly, the erector spinae is the iliocostalis muscle, which is the most lateral part of the erector spinae that attaches to the ribs, namely the iliocostalis cervicis, iliocostalis thoracis, and iliocostalis lumborum [9].

Intrinsic muscles / deep muscles that extend from the base of the skull to the sacrum. These deep muscles are covered by fascia and lie behind the erector spinae. These are short muscles associated with the spinous and transverse processes of the vertebrae. The three deep back muscles consist of the semispinalis, multifidus, and rotator muscles. These muscles stabilize the spine and play a role in proprioception and balance. Apart from that, these muscles also play a role in the movement of the spinal column and maintaining body posture [10].

Low back pain is a symptom, not a disease, that can be caused by various factors, known and unknown, and is determined by its location, namely between rib XII (lower rib border) and the gluteal fold. This pain is local, radicular, or both and is often accompanied by pain in one or both legs and is associated with neurological symptoms in the lower extremities [11].

According to The International Classification of Diseases, the prevalence of low back pain is defined as acute or chronic pain in the lumbar and/or sacral region of the spine, which can be caused by a sprain, strain, displacement of the intervertebral disc, or any part of

the spinal anatomy surrounding the spine [12].

There are five main categories of etiology of low back pain. Firstly, from a mechanical perspective, such as injuries to the spine or intervertebral discs. Intervertebral disc herniation is also a common factor. Pregnancy can also be a mechanical cause of back pain. Second is the degenerative process. The presence of degenerative conditions such as spinal osteoarthritis and degenerative disc disease. Third, inflammation is mainly caused by inflammatory (seronegative) spondyloarthropathies such as ankylosing spondylitis. Fourth, oncological or malignant, this can be caused by lytic lesions in the spine, bone marrow cancer, or compressive nerve phenomena from lesions that occupy adjacent spaces. Often appears as a pathological fracture. And fifth, by infection. It can occur from spinal infections, discs, epidural abscesses, and muscle/soft tissue abscesses [13].

Based on the findings of basic health research in 2018, the prevalence of musculoskeletal diseases in Indonesia, identified by medical personnel, was 11.9%, and based on diagnoses or symptoms, it was 24.7%. Although the number of low back pain patients in Indonesia is unknown, estimates range from 7.6% to 37%. According to statistics from the Central Statistics Agency (2018), 26.74% of the working population aged over 15 years reported complaints or health problems. The incidence of low back pain is widespread in the adult population. Some studies show that up to 23% of adults worldwide suffer from chronic low back pain. This population also shows a 24% to 80% one-year recurrence rate [14].

Based on its onset, low back pain can be divided into a) Acute pain, which is sudden, deep, and severe. A person cannot sleep well, and the pain in his back increases with every movement. Discomfort lasts less than eight weeks; and b) Chronic pain, which is ongoing and usually does not go away. Although it sometimes lasts a week or several weeks, discomfort often appears after a few days. Sometimes, the pain is recurring, and simple exercise can also cause a recurrence [15].

The clinical manifestations or symptoms and signs of low back pain in each person can differ, ranging from pain and weakness in the feet and legs to the hips, and vary according to the underlying cause. Low back pain can cause neuropathic or nociceptive pain. There are neurological symptoms such as radicular pain and radiculopathy, where pain can occur if the root is involved, which many call sciatica. Clinical findings of sciatica usually include a history of dermatomal leg pain, leg pain worse than back pain, and leg pain that worsens when the patient coughs, strains, or sneezes. At the same time, radiculopathy is characterized by weakness, decreased sensory sensitivity, or motor disorders associated with the radix or their combination and occurs with radicular pain [16].

There are several symptoms and signs that people with lower back pain should be aware of, which are known as red flags. If someone has the symptoms or signs mentioned, that person should immediately get a referral for therapy. The components of red flags are divided into symptoms and signs. Several components of the symptoms are age under 18 years, age over 50 years, immunocompromise, and components of the signs are lower extremity muscle weakness, saddle anesthesia, decreased anal sphincter tone, hyperreflexia, hyporeflexia, and areflexia [17].

Various factors play a role in the occurrence of lower back pain. The first factor is individual factors such as gender, age, body mass index, personal habits such as smoking, physical activity, and history of musculoskeletal disease or trauma. Then there are work factors such as workload, position while working, and duration of work, as well as physical environmental factors such as vibration and noise.

Low back pain generally occurs due to acute traumatic events and also results from cumulative traumatic events. The severity can vary, from being twisted to being involved in a vehicle accident. Usually, in the workplace, cumulative trauma is more likely to cause lower back pain. The course and development of low back pain can be said to be complex and varied. Several anatomical structures and components of the lumbar spine (such as bones, ligaments, tendons, discs, and muscles) play a role in low back pain. Most lumbar spine components have sensory innervation, which can produce nociceptive signals and function in response to stimuli that damage tissue. Neuropathic (such as sciatica) is also a cause, and most cases of chronic low back pain have a mixed etiology of nociceptive and neuropathic [18].

Another factor underlying the pathophysiology of low back pain is changes in the structure of the intervertebral discs due to the aging and degeneration process. As the aging process occurs, the volume and shape of the discs change. Changes in the biomechanical properties of the disc structure, sensitization of nerve endings by the release of chemical mediators, and neurovascular ingrowth into the degenerated disc can all contribute to the onset of pain. Loss of disc structure also alters the loading response and alignment of other vertebrae, including the facet joints, ligaments, and paraspinal muscles, which can ultimately be an additional pain producer. At the beginning of the third decade of life, the nucleus pulposus gradually becomes less hydrated, and both the number of active cells and the concentration of proteoglycans decrease. The size of the outer annulus fibrosus remains the same, but the inner fibrocartilaginous lining of the annulus expands as the nucleus pulposus swells and becomes less hydrated. The following is the pathophysiology of aging and intervertebral disc degeneration as one of the factors underlying low back pain [19].

The field of study called ergonomics uses knowledge about human nature, abilities, and limitations to design work environments that are ENase (effective, enjoyable, safe, healthy, and efficient). The main principle of ergonomics is matching the job to the worker. To achieve an ENASE working attitude, applying the basic principles of ergonomics is necessary. There are 12 recommended ergonomic work principles, namely: a) Working in a normal position or posture; b) Reduce excessive load; c) Place equipment so that it is always within reach; d) Work according to the height of the body dimensions; e) Reduce repetitive and excessive movements; f) Minimization of static movement; g) Minimization of load points; h) Have sufficient clearance; i) Do movement, exercise and stretching while working; j) Creating a comfortable work environment; k) Make displays and examples easy to understand; l) Reduce stress by improving work organization.

Of the 12 principles mentioned, several are more related to working as an office employee whose daily work position is sitting, namely principles 1, 3, 4, 7, 9, 10, and 12. The first principle is working in a position or normal posture. The position is good for evaluating the work done. The best working position is one where the body remains neutral. Many office employees' sitting posture can be unergonomic, such as a hunched sitting posture, and several other unergonomic positions, such as a bent neck and long working duration with the back in a "C curve."

The Roland-Morris Disability Questionnaire (RMDQ) is an instrument that assesses the physical disability caused by low back pain. The disability in question is the inability to carry out normal daily activities due to lower back pain. In the RMDQ, respondents are asked to tick statements according to the complaints they experienced at that time or when filling out the questionnaire. The RMDQ is suitable for assessing acute low back pain because this questionnaire can detect rapid changes in symptoms that are often seen in symptoms due to response to treatment. RMDQ is also easy to use because it uses everyday language so respondents can easily understand and respond to each statement item. The RMDQ consists of 24 short statements that can usually be completed in five minutes, so it doesn't take long. RMDQ is taken from the Sickness Impact Profile (SIP). SIP measures health status consisting of 136 items covering all aspects of physical and mental function. The original authors selected the 24-item statements from the SIP because they relate specifically to the physical functions affected by low back pain. The Roland-Morris Disability Questionnaire (RMDQ) is an instrument that assesses the physical disability caused by low back pain [20].

3. METHODS

The research design uses an analytical survey with a cross-sectional approach and uses primary data obtained through questionnaires. The research was conducted at the Office of the Directorate General of New, Renewable Energy and Energy Conservation (EBTKE), Cikini, Central Jakarta. The research period was three weeks, from November to December 2022. The population in this study were employees of the Office of the Directorate General of New, Renewable Energy and Energy Conservation (EBTKE), which was divided into several work divisions, including secretariat division of the directorate general of EBTKE, division geothermal directorate, bioenergy directorate division, miscellaneous EBT directorate division, energy conservation directorate division, and EBTKE infrastructure planning and development directorate division. In this study, the population used was ten from each division, which means there were 60 employees with a sample size of 53. The data in this study is primary because it

was collected by the researcher and obtained directly from respondents.

Information is collected through a questionnaire sheet that will be given to respondents. Before completing the questionnaire, participants were asked to provide their identity and answer several questions about exclusion criteria. The instrument or tool used in this research is a questionnaire sheet consisting of two parts. The first section contains patient personal data, the variables studied, and questions regarding exclusion criteria. The second part of the questionnaire is the Roland-Morris Disability Questionnaire. In this second part, 17 questions function to determine whether or not there is a disability caused by low back pain. This study used the Roland-Morris Disability Questionnaire (RMDQ), which was translated into General Indonesian and passed the validity test by Ghina Widiasih in 2015. The researcher used a translated RMDQ, which has also passed the validity test from previous researchers, namely Heydi Amorina Abigail Saragi Napitu. It also showed the same results.

The test results showed that of the 24 statements, seven statements were considered invalid, so the statements used in Indonesia amounted to 17. Therefore, it can be stated that this translated RMDQ questionnaire can be trusted. The data processing technique used in the research is a quantitative data processing technique that involves editing, coding, tabulating, and cleaning processes. In this study, univariate and bivariate data analysis was carried out. Univariate analysis was conducted to explain the frequency distribution of each variable studied, which will be presented in percentage form using a table. Bivariate analysis was carried out to find the relationship between the potential incidence of lower back pain and sitting position in employees of the Cikini Directorate General of EBTKE office using a non-parametric statistical test, namely Chi-Square, the results of which were expressed in P value or P value using IBM Statistics SPSS version 25 software. In this research, researchers will ask employees of the EBTKE Directorate office to become respondents by filling out an informed consent form first to ensure the availability of respondents to fill out the questionnaire, and there is documentation with several respondents so that it can then be proof that the research is true. Respondent names will be changed to numeric codes, and respondent data will not be shared widely.

4. RESULTS AND DISCUSSION

The data that has been taken through the research instruments used is then described as follows:

Based on Table 1, it was found that the majority of respondents' gender were male, with a percentage of 62.3% or 33 people, and women, with a percentage of 37.7% or 20 people.

Table 1. Frequency distribution of respondents by gender

Gender	Frequency	Percentage (%)
Male	33	62.3
Female	20	37.7
Total	**53**	**100**

Table 2. Frequency distribution of respondents by age

Age	Frequency	Percentage (%)
25 – 34	17	32.1
35 – 44	28	52.8
45 – 54	6	11.3
>= 55	2	3.8
Total	**53**	**100**

In this study, age is expressed in age ranges with a gap of 9 years in each age group. Table 2 shows that the frequency distribution of respondents' age levels is mostly in the 35-44 year age group with a percentage of 52.8% or 28 people. Next in line for distribution is the 25-34 year age group with a percentage of 32.1% or 17 people. In third place is the 45-54 year age group with a frequency of 11.3% or six people. The frequency distribution in last place is the age group 55 years and above, with a percentage of 3.8% or two people.

Based on Table 3, the frequency of respondents' work divisions is equally distributed across five divisions: the secretariat division of the directorate general of EBTKE, the geothermal directorate division, the bioenergy directorate division, the miscellaneous renewable energy directorate division, and the energy conservation directorate division, each with a percentage of 10 people. 18.9%. In the division of the directorate of infrastructure planning and development, there are only three people, a percentage of 5.7%.

Table 3. Frequency distribution of respondents by job division

Employment Division	Frequency	Percentage (%)
Secretariat of the Directorate General of EBTKE	10	18.9
Geothermal Directorate	10	18.9
Bioenergy Directorate	10	18.9
Directorate of Various EBT	10	18.9
Directorate of Energy Conservation	10	18.9
Directorate of Infrastructure Planning and Development	3	5.7
Total	**53**	**100**

Table 4. Frequency distribution of respondents based on work posture

Working Posture	Frequency	Percentage (%)
Sit in a chair with a backrest	48	90,6
Sit in a chair without a backrest	5	9,4
Total	**53**	**100**

Based on Table 4, most respondents' posture when working is sitting in a chair with a backrest with a frequency of 90.6% or a total of 48 people. The sitting posture in a chair without a backrest was found by 9.4% or five people, and there were no respondents whose working posture was cross-legged.

Based on Table 5, most respondents work with a non-slouched posture with a frequency of 86.8% or 46 people, and 13.2% of respondents work with a slouched posture or seven people.

Based on Table 6, the majority of respondents' sitting duration is in the 6-9 hours per day group or the high-risk sitting duration. The percentage of respondents who sat for 6 to 9 hours a day was 75.5%, or 40 people, and those who sat for less than 6 hours a day was 24.5%, or 13 people.

Table 5. Frequency distribution of respondents based on stooped posture

Hunched Posture	Frequency	Percentage (%)
Hunched Over	7	13.2
Not Hunched Over	46	86.8
Total	**53**	**100**

Table 6. Frequency distribution of respondents based on sitting duration

Sitting Duration	Frequency	Percentage (%)
<6 hours	13	24.5
6 – 9 hours	40	75.5
Total	**53**	**100**

Table 7. Frequency distribution of respondents based on the incident of lower back pain in the last week

Lower Back Pain	Frequency	Percentage (%)
Lower Back Pain	10	18.9
No Lower Back Pain	43	81.1
Total	**53**	**100**

Table 8. Frequency distribution of respondents based on the incident of lower back pain in the last year

Lower Back Pain	Frequency	Percentage (%)
Lower Back Pain	10	18.9
No Lower Back Pain	43	81.1
Total	**53**	**100**

Based on Tables 7 and 8, it was found that the incidence of lower back pain in employees of the Directorate General of EBTKE in the last week and last year was the same, namely 10 cases or 18.9% of the total sample in the last week and year.

Based on Table 9, of the six departments, there were four who experienced lower back pain during the last week, consisting of 4 people from the Secretariat department of the Directorate General of EBTKE, three people from the Geothermal Directorate department, one person from the Aneka EBT Directorate department, and two people from the department Directorate of Energy Conservation with a P value of 0.68.

Table 9. Relationship between departmental divisions and the incidence of lower back pain during the last week

	Lower Back Pain Over the Past Week		
Department	**Yes**	**No**	**Total**
Secretariat of the Directorate General of EBTKE	4	15	19
Geothermal Directorate	3	16	19
Bioenergy Directorate	0	5	5
Directorate of Various EBT	1	6	7
Directorate of Energy Conservation	2	0	2
Directorate of Infrastructure Planning and Development	0	1	1
Total	**10**	**43**	**53**
P Value	**0.68**		
Odd Ratio	**0.92**		

Table 10. Relationship between sitting position while working and the incidence of lower back pain during the last week

	Lower Back Pain Over the Past Week		
Sitting Position	**Yes**	**No**	**Total**
Sit in a chair with a backrest	9	38	47
Sit in a chair without a backrest	2	4	6
Total	**11**	**42**	**53**
P Value	**<0.001**		
Odd Ratio	**0.004**		

Table 11. Relationship between hunched posture while working and the incidence of lower back pain during the last week

	Lower Back Pain Over the Past Week		
Hunched Posture	**Yes**	**No**	**Total**
Yes	2	5	7
No	9	37	46
Total			**53**
P Value	**0.605**		
Odd Ratio	**0.555**		

Based on Table 10, the number of respondents who experienced lower back pain during the last week was nine sitting in a chair with a backrest and two sitting without a backrest. Shows P value <0.001.

Based on Table 11, two respondents with a bent posture and nine with a non-slouched posture experienced lower back pain in the last week, with a P value below 0.001.

Based on Table 12, there were 11 respondents with a sitting duration of 6-9 hours a day or a duration with a high risk of experiencing lower back pain during the last week, with a P value of 0.105.

Table 12. Relationship between duration of sitting while working and incidence of lower back pain over the past week

	Lower Back Pain Over the Past Week		
Sitting Duration	**Yes**	**No**	**Total**
6-9 hours	11	29	40
<6 hours	0	13	13
Total	**11**	**42**	**53**
P Value	**0.105**		
Odd Ratio	**0.029**		

Table 13. Relationship between departmental division and incidence of lower back pain during the last year

Department	Lower Back Pain Over the Past Year		Total
	Yes	No	
Secretariat of the Directorate General of EBTKE	3	12	15
Geothermal Directorate	2	17	19
Bioenergy Directorate	0	4	5
Directorate of Various EBT	1	6	7
Directorate of Energy Conservation	2	1	3
Directorate of Infrastructure Planning and Development	1	4	5
Total	**9**	**44**	**53**
P Value	**0.236**		
Odd Ratio	**0.313**		

Table 14. Relationship between sitting position while working and the incidence of lower back pain over the past year

Sitting Position	Lower Back Pain Over the Past Year		Total
	Yes	No	
Sit in a chair with a backrest	10	37	47
Sit in a chair without a backrest	0	6	6
Total	**10**	**43**	**53**
P Value	**0.210**		
Odd Ratio	**0.102**		

Table 15. Relationship between hunched posture while working and the incidence of lower back pain during the last year

Hunched Posture	Lower Back Pain Over the Past Year		Total
	Yes	No	
Yes	2	8	10
No	5	38	43
Total	**7**	**46**	**53**
P Value	**0.481**		
Odd Ratio	**0.501**		

Table 16. Relationship between duration of sitting while working and incidence of lower back pain over the past year

Sitting Duration	Lower Back Pain Over the Past Year		Total
	Yes	No	
6-9 hours	9	31	40
<6 hours	1	12	13
Total	**10**	**43**	**53**
P Value	**0.236**		
Odd Ratio	**0.201**		

Based on Table 13, of the six departments, there were five who experienced lower back pain during the last year consisting of 3 people from the Secretariat department of the Directorate General of EBTKE, two people from the Geothermal Directorate department, one person from the Aneka EBT Directorate department, two people from the Directorate department Energy

Conservation, and one person from the Directorate of Infrastructure Planning and Development department with a P value of 0.236.

Based on Table 14, 10 respondents who experienced lower back pain in the last year sat in a chair with a backrest and showed a P value of 0.210.

Based on Table 15, two respondents with a bent posture and five with a non-slouched posture experienced lower back pain in the last year, with a P value of 0.481.

Based on Table 16, nine respondents with a sitting duration of 6-9 hours a day or a high-risk duration and one respondent with a sitting duration of less than 6 hours a day experienced lower back pain during the last year with a P value of 0.236.

Based on the research table regarding the relationship between departmental divisions and the incidence of lower back pain, out of 53 respondents, ten were present during the last week, and nine experienced lower back pain during the last year. The results of bivariate analysis tests on the learning posture variable with the incidence of lower back pain during the last week or year did not show a significant relationship. The P-value results were P=0.68 in research during the last week and P=0.236 in research during the last year, indicating that P>0.05 or the p-value is greater than the standard value, meaning the research results have no significant relationship.

Of the 53 respondents, 11 experienced lower back pain during the last week, of which nine respondents worked sitting in a chair with a backrest, and two worked in a sitting position without a backrest. Ten respondents experienced lower back pain during the last year, of which ten worked sitting in a chair with a backrest. The results of the bivariate analysis test on the variable sitting position at work with the incidence of lower back pain during the last week showed that there was a significant relationship with the P value being P<0.001, while there was no significant relationship between the variable sitting position at work and the incidence of lower back pain for the last one indicated by the P value is P=0.210.

Incorrect sitting position or sitting in a chair that is not ergonomic can trigger back pain. Sitting positions that are not ergonomic are 40 times more likely to cause complaints of lower back pain, and complaints of lower back pain are also felt more often in individuals with a sitting working posture than standing [21]. The spine, tendons, and muscles are forced to maintain the upper body excessively, and this will cause fatigue in the back muscle tissue, especially the muscles around the lumbar spine [22]. The workplace and appropriate seating must be arranged so that there is no influence, which is dangerous for health, and the emergence of potential dangers due to ergonomic factors must be minimized [23].

The results of the bivariate analysis test show that several results in this research are the same as those in Nilfa Sambo's research in 2021, namely that the P value obtained by Nilfa was 0.629 in the last year [24]. There are also research results from Heydi Amorina Abigail Saragi Napitu in 2022, with the P value obtained being 0.528, which means there is no significant relationship [25].

From the analysis over the past week, there were 11 out of 53 respondents experienced lower back pain, of which two respondents worked with a bent posture, and 9 respondents worked without a bent posture. In the last year, seven respondents experienced lower back pain, of which two worked with a bent posture, and five worked without a bent posture. The bivariate analysis test results showed no significant relationship between hunched posture and the incidence of lower back pain during the past week or year. The P value of P=0.605 shows it in the last week and P=0.481 in the last year.

Bad posture when working, such as a bent posture, can trigger lower back pain. Generally, slouching posture occurs when the chair used while working does not meet ergonomic standards, such as not having a back support or poor sitting posture habits. Inadequate workplace design, such as chairs without wheels or back and arm support, can make workers less free to move, resulting in frequent twisting movements of the upper body [26].

Of the 53 respondents, 11 respondents experienced lower back pain during the last week, of which 11 respondents worked sitting for 6 to 9 hours a day. Ten respondents experienced lower back pain during the last year, of which nine respondents worked sitting for 6 to 9 hours a day, and one respondent worked sitting for less

than 6 hours a day. Sitting for 6 to 9 hours is high risk because there is no rest. The bivariate analysis test results show no significant relationship between the variable duration of sitting at work and the incidence of low back pain, with the P value P = 0.105 for the last week and P = 0.236 for the last year.

Workers who work 41-48 hours per week or 7-8 hours a day cause reduced rest time and heavier muscle work, increasing the risk of lower back pain. Sitting for too long causes the body to be in a static position, so blood flow does not run well. When blood flow is not running well, it will produce localized lactic acid from anaerobic metabolism, which then causes pain [27].

5. CONCLUSION

This study used 53 respondents as samples. This research was mostly attended by male employees (62.3%), employees with an age range of 35 to 44 years (52.8%), employees with a sitting posture when working in a chair with a backrest (90.6%), employees who do not work with a posture bent over (46%), and employees who work 6 to 9 hours a day (75.5%). The results of this research are: a) There is no significant relationship between work department divisions and lower back pain in EBTKE office employees in 2022 from the analysis results over the past week or year; b) There is a significant relationship between sitting position at work and lower back pain in EBTKE office employees in 2022 from the analysis results during the last week, but there is no relationship in the last year; c) There is no significant relationship between slouched posture while working and lower back pain in EBTKE office employees in 2022 from the analysis results during the last week or year; and d) There is no significant relationship between the duration of sitting while working and lower back pain in EBTKE office employees in 2022 from the analysis results for the past week or year. Thus, it is hoped that future researchers will carry out this research and produce better and more in-depth research, be able to test other variables that can cause low back pain, and are expected to use chairs that comply with ergonomic standards and pay more attention to a sitting position and body posture while working.

CONSENT

As per international standards or university standards, respondents' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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