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Relationship between work posture and core muscle endurance with lower back disability among farmers: a cross-sectional study

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ABSTRACT

Background: Farmers rely on physical performance for their livelihood, and non-ergonomic working postures can lead to lower back pain, reducing core muscle endurance and resulting in lower back disability. This study examines the relationship between work posture and core muscle endurance with lower back disability among farmers.

Methods: This research used an analytical observational design with a cross-sectional study. The sampling technique used was simple random sampling. The total sample obtained in this study was 106 participants. Data collection included posture assessment using the rapid entire body assessment (REBA), measurement of core muscle endurance using the prone bridge test, and measurement of lower back disability using the modified Oswestry disability index (MODI). The inclusion criteria for this study were farmers aged 26-45 working as farmers in Pancasari Village, Sukasada District, Buleleng Regency. Conversely, the exclusion criteria were the presence of a history of Spearman's rho and a condition of injury that limits the prone bridge test. Furthermore, the obtained data was analyzed using *Spearman's rho* test.

Results: The non-parametric analysis of work posture on lower back disability obtained a $p = 0.000$ ($p < 0.05$) and a correlation coefficient of $r = 0.849$. Core muscle endurance against lower back disability obtained a value of $p = 0.000$ ($p < 0.05$) and a correlation coefficient $r = -0.825$, which is statistically significant that the higher the work posture score of the subject has means the higher incidence of lower back disability and also the higher of core muscle endurance the subject has, mean lower incidence of lower back disability among farmers.

Conclusion: Based on the research results, it can be concluded that there is a significant relationship, with a high correlation, between work posture and core muscle endurance and the occurrence of lower back disability in farmers.

Keywords: core muscle endurance, farmers, lower back disability, work posture.
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INTRODUCTION

Farmers are part of the majority of the livelihoods of the Indonesian population to meet daily needs and demand for food. Based on data from the Central Statistics Agency of Indonesia in 2020, Indonesia's population was 270,203,917 people.[1] Internal factors in functional abilities and external factors in the form of exposure to solar heat, pests, and pesticides cause satisfaction with individual work results.[2] The duration and period of work of farmers at high frequency over a long period without significant rest periods is very dangerous because it can increase the potential for occupational diseases in the scope of musculoskeletal complaints, which has an impact on reducing work productivity.[3] Globally, musculoskeletal complaints are the highest contributor to medical rehabilitation services. Global Burden of Disease (GBD) reports that around 1.71 billion people worldwide experience musculoskeletal complaints. Low back pain contributes most to the prevalence of global musculoskeletal complaints, which is analyzed as occurring in 134 of 204 countries worldwide.[4] The World Health Organization Rehabilitation Needs Estimator states that there are 570 million common cases of low back pain globally, with a percentage of 7.4% years lived with disability (YLDs). The prevalence of low back pain sufferers in Indonesia is not significantly known. It is estimated to be at a percentage of 7.6% to 37% of the total population in Indonesia with unspecified causes.[5]

The main complaint of musculoskeletal disability as an occupational disease in farmers is usually in the form of acute pain that arises in the lower back or waist area due to continuous activity with unnatural body postures such as pushing, pulling, bending, squatting and lifting, which triggers complaints of lower back pain.[6] The pain sensation will limit daily activities and cause the inability to carry out work.[7] Disability caused by lower back pain (LBP) is a condition of reduced functional ability to carry out normal activities due to the pain felt in the lower back, specifically in the lower back area. Below the costal margin and above the gluteal margin, accompanied by spreading or not in the legs.[8] In general, NPB is influenced by

internal or individual risk factors and external or occupational factors.[9]

Factors that trigger NPB are also caused by mechanical factors, such as excessive work or other non-mechanical inflammation that causes tissue damage.[10] Muscle tissue has a role in the body's functional performance because static contraction of the muscles in the lower back area over a relatively long period will cause insufficiency in the blood flow that transports oxygen to the lower back muscles, which will be hampered, causing fatigue and fatigue. The feeling of tension in the muscles of the lower back.[11] Muscle endurance is the ability of the muscles to contract repeatedly for a certain period until the muscles feel weak. The performance of the core muscles as spinal stability, if the endurance function decreases, will cause muscle weakness.

Based on a preliminary study by the author, farmers in Pancasari Village are characterized by work cycle habits such as carrying out land preparation, seeding, planting, and maintenance consisting of watering, fertilizing, spraying pesticides, cleaning weeds, harvesting, and transporting the harvest. It is feared that farmers will carry out work postures in the wrong pattern, such as when planting. Farmers squat for long periods and repeatedly to fill seeds in previously prepared seed holes and during periods of plant care, harvesting, and lifting crops. Farmers tend to bend their bodies when working in the maintenance phase; apart from bending their bodies, they also lift heavy weights for maintenance purposes, sit when clearing weeds, twist their waists when harvesting vegetables and strawberries, carry things beyond their capabilities, such as pushing vegetables and strawberries using a wheelbarrow. So, this can trigger subjective complaints in the farmer's lower back and result in pain. The prevalence of farmers with NPB complaints in Pancasari Village was 80% of the 40 subjects interviewed who complained of experiencing pain in the lower back area.

This result is the highest percentage compared to musculoskeletal complaints in other body regions. The principles of good working posture based on ergonomics will affect the body's functionality when working. Body posture, when working, will determine the joints and muscles that work in a movement. The amount of force generated in a movement is also influenced by body posture when working. For example, lifting, pushing, or squatting movements with a bent or twisted back posture will cause excessive pressure on the lower back region and affect the performance of the muscles and joints, causing complaints in the form of pain.[12] Decreased muscle endurance results in muscle weakness, which triggers fatigue and fatigue. Painful. The core muscles play an important role in proximal stabilization for distal spinal mobility during long-term physical activity when the static phase changes to dynamic.[13]

The research aimed to increase knowledge from previous research and serve as a reference for new expertise in the health sector. The community becomes a form of education regarding the relationship between work posture, core muscle endurance, and the incidence of lower back disability in farmers.

METHODS

The research method used in this study was an analytical observational research design with a cross-sectional study approach. The study was conducted in Pancasari Village, Sukasada District, Buleleng Regency, from May 21, 2023, to June 17, 2023. The research subjects comprised 106 respondents who were obtained using a simple random sampling technique. The collected data were analyzed using IBM SPSS Statistics 26. The data obtained were tested for normality using Kolmogorov-Smirnov and hypothesis testing using Spearman's Rho correlation test.

The inclusion criteria for this study were residents working as farmers in Pancasari Village, Sukasada District, Buleleng Regency, aged 26-45 years. In contrast, the exclusion criteria were a history of injury conditions that limited the prone bridge test based on the physical examination results. This study used REBA and MODI as measurement tools, and the prone bridge test measured core muscle endurance. The research procedure involved obtaining ethical code authorization first. Subsequently, the researcher created an informed consent form that had to be signed by the subjects, indicating their willingness to participate in the study until its completion. The researcher provided information about the benefits, objectives, and how the research was conducted. Then, the researcher gave the subjects a personal data form to fill out, administered the MODI questionnaire, conducted core muscle measurements, and documented the farmers' working postures for inclusion in the REBA questionnaire.

The REBA instrument was used to assess the risk of injury due to the posture of farmers while working. Based on the REBA worksheet, the level of risk and required actions varied according to the score obtained. A score of 1 indicated negligible risk and did not require improvement. Scores of 2 to 3 indicated low risk with potential for improvement. Scores of 4 to 7 indicated medium risk that necessitated improvement. Scores of 8 to 10 indicated high risk, requiring immediate improvement. Meanwhile, scores of 11 to 15 indicated a very high risk that demanded immediate corrective action. MODI was a tool used to measure the functional disability level in patients with lower back pain. The questionnaire consisted of 10 sections, each with 6 statements, rated from 0 to 5. The total score was calculated by summing the values of each section and converting them into percentages. Score interpretation was as follows: 0-20% (minimal disability), 21-40% (moderate disability), 41-60% (severe disability), 61-80% (very severe disability), and 81-100% (bed-bound or completely incapacitated). MODI was used to assess the impact of lower back pain on a patient's daily life and to guide treatment decisions by monitoring changes in the patient's functional status over time.

The Ethics Commission of the College of Medicine, Udayana University, approved this study with decree 540/UN14.2.2.VII.14/LT/2023 after a thorough review process. Each participant willingly agreed to participate, providing their voluntary consent. Additionally, respondents signed an informed consent document acknowledging their comprehension of the study's objectives, methodologies, and potential risks.

RESULTS

Based on Table 1, which contains the results of the analysis of respondent characteristics, it can be seen that the dominant age of respondents is in the early adulthood category, with an average age of 30.61 years. The work posture of respondents is predominantly included in the medium risk category, with a total of 44 respondents. The posture in group A of the REBA form, which consists of the position of the neck, back, and legs, contributes more than the posture in group B in adding to the REBA score of all respondents. Respondents' working posture was predominantly in squatting, sitting, and bending positions. The average level of lower back disability that respondents have is included in the minimum category, with the number of respondents being 46 people. Thirty-nine respondents who had moderate to severe disabilities were used to taking anti-pain medication in the appropriate dosage recommended on the medication packaging. Pain relievers are considered to be able to reduce some or all of the intensity of pain felt by respondents based on the results of the MODI questionnaire. Table 1 contains the research results on core muscle endurance characteristics. The lowest core muscle endurance score was 10 seconds, while the highest was 101 seconds, with an average score of 44.95 seconds and a standard deviation of 18.076.

Based on Table 2, which contains the results of the variable correlation test, it is known that the significance value of the correlation between the work posture variable and lower back disability is 0.000, where $p< 0.05$, which means there is a significant relationship between work posture and the incidence of lower back disability among farmers. This analysis test also shows that the correlation coefficient value for the work posture variable on lower back disability is 0.849, which is very high. A positive correlation value indicates that the relationship between the two variables is straight.

Based on Table 2, which contains the results of the variable correlation test, it is known that the correlation significance value of the core endurance variable on the incidence of lower back disability is known to be that the correlation value is 0.000 where $p< 0.05$, which means there is a significant relationship between core muscle endurance and the incidence of disability. Lower back of farmers in. The results of this analysis test also show that the correlation coefficient value for the core muscle endurance variable on lower back disability is -0.825. The correlation coefficient value shows negative results, meaning that the relationship between the two variables is inversely proportional with a very high level of correlation.

Figure 1. A. Measurement of working posture; B. Implementation of the prone bridge test; C. Filling out the modified Oswestry disability index questionnaire.

Table 1. Results of analysis of respondent characteristics

Variable	n or mean (SD)	Percentage (%) or min - max
Age (years)		
26-35	99	93.4
36-45	7	6.6
Work posture		
Intermediate	44	41.5
Tall	43	40.6
Very high	19	17.9
Lower back disabilities		
Minimal	46	43.4
Currently	41	38.7
Critical	19	17.9
Durability core muscles (s)	44.95 (18.1)	10 - 101

min, minimum; max, maximum; n, frequency; s, second; sd, standard deviation

Table 2. *Spearman's Rho* correlation test results between working posture, core muscle endurance, and lower back disability

Variable correlation	r	p
Working posture and lower back disability	0.849	0.000
Core muscle endurance and lower back disability	-0.825	0.000

DISCUSSION

The subject's age is included in the adult age category, specifically early adulthood at 26-35 and late adulthood (36-45 years). It is included in the productive work age group to have relatively the same work frequency, abilities, and skills. Conditions of physiological capacity and neurological and physical abilities peak at the age of 25 years and above so that they have endurance and excellent health. Meanwhile, peak productivity can be found in middle-aged adults aged 40 - 45.[14] After reaching the peak, it declines with a different rhythm for each person.[15] Degeneration occurs at the age of 30 in the form of tissue damage, replacement of tissue into scar tissue, and reduction of fluid that causes stability in bones and muscles to decrease. The older a person gets, the higher the risk of experiencing a decrease in bone elasticity, which triggers LBP symptoms.[16] Respondents' working posture was predominantly in squatting, sitting, and bending positions. The load on the spine will increase when the back

is not straight. Work carried out with unergonomic postures also puts excessive pressure on muscles and joints, causing complaints of lower back pain.[12]

Lower back disability is a limitation of daily activities arising from pain in the lower back area. Lower back pain can range from mild to severe. Individuals who complain of lower back pain often complain of a decrease or even inability to carry out daily activities. Individuals who have a higher level of disability will have greater physical limitations and limitations. The focus of disability is on what the individual cannot do due to the low back pain they are experiencing. This correlates with physical activity, which shows that a high disability score results in low physical activity limitations.[17] Work posture is The risk factor that influences external low back pain. Poor body posture can cause problems that affect work results and performance.[18] The principles of good work posture based on ergonomics will affect body function when working because it can reduce excessive loading and contraction of muscles and joints when doing work.

Body posture determines the joints and muscles that work in a movement.[19,20] Pressure on the vertebrae occurs more often when lifting, bending, or twisting the back than when the back posture is neutral, which will trigger complaints of lower back pain.[12] This is related to this research, which shows several things, one of which is that the higher the risk of the subject's work posture, the higher the level of lower back disability they have. This research is in line with research by Sumardiyono et al. in 2022, which found that work posture results had a significant relationship and influenced the occurrence of low back pain in tea pickers by 3.9 times greater with a value of $p = 0.014$ ($p < 0.05$) and direction positive correlation with a value of $r = 0.410$ using the Somer'd23 correlation test. This research also states that bending work posture when reaching for tea leaves when picking and lifting baskets from the floor are the highest complaints causing NPB. Lifting heavy weights and doing it repeatedly with an unnatural posture causes a tendency towards a hunched posture. Working postures that are not ergonomic for a relatively long time can cause complaints of low back pain, so stretching the muscles or carrying out regular morning exercise activities to reduce muscle fatigue and obstructed blood flow is necessary.[21]

Another research conducted by Amalo & Lestari in 2022 obtained the results of a significant relationship between work attitudes and the occurrence of complaints of low back pain (NPB) in farmers in the Kupang City and Regency areas with a p-value = 0.030 with the chi-square correlation test.[22] When working, farmers tend to carry out risky activities such as bending, repetitive movements, and holding body weight statically by sitting for long periods, which will indirectly affect the spinal discs, leading to mechanical and biological damage to the bones, giving rise to NPB complaints which result in conditions of lower back disability.[23]

Core muscle endurance is an internal factor that influences the incidence of low back disability. Core muscles help control movement, transfer energy, shift, and distribute weight-bearing stress. Muscle fatigue causes a decrease in muscle endurance. Coordination of the core muscles as the core muscles of the body functions to stabilize the vertebrae. Poor core muscle endurance has the risk of causing lower back pain.[24] This research is in line with the findings of Alghadir et al. In 2019, it was found that the relationship between core muscle endurance and the level of lower back disability varied depending on the group being observed. In the group of women who experienced LBP and Stress Urinary Incontinence (SUI), the relationship with core muscle endurance was quite strong and negative. Spearman correlation coefficient value in the LBP group (rs = −0:54) and the SUI group as the control group (rs = −0:44). The weaker the core muscle endurance and the stronger the severity of SUI, the higher the level of disability the subject feels related to LBP, and the stronger the impact on quality of life. It has been assumed that if a person wants to avoid the risk of LBP and be able to control incontinence, core muscle endurance must function optimally.[25]

Another study conducted in 2020 by Sibson et al. obtained a positive correlation between trunk extensor strength and endurance ($r = 0.271$, $p \leq 0.05$). Although the study did not measure LBP, it was suggested that high trunk extensor endurance and strength in a group of rural female farmers may have important benefits in helping prevent LBP, given the evidence that low trunk extensor endurance is the best predictor of LBP.[26] Physical activity levels are high among farmers and are related to higher endurance and trunk muscle strength. In particular, the lumbar vertebrae are affected by heavy lifting, harvesting, and planting. The back muscles, as part of the core muscles, play an important role in maintaining the stability of the lumbar vertebrae, so that trunk muscle weakness is associated with chronic LBP.[27] The work of the abdominal muscles, which are shortened to support body weight forward, and the paravertebral muscles, which are lengthened to maintain a balanced body position, can control the load and movements carried out in a bent position.[28] Weak trunk muscles will influence the pressure on the lower back. Decreased trunk muscle endurance as a core muscle group has been associated with LBP in the general population.[29] Good core muscle endurance will influence the work of the global muscle group to be more optimal and improve postural control because the muscle's ability to maintain body position in the lower extremities becomes stable.[28] Good stability in the core causes the body to be better able to maintain the center of gravity (COG) position above the base of support (BOS).[30]

The weaknesses of this study were the researcher was unable to control the activities of each subject, resulting in varying levels of fatigue among the subjects during the prone bridge test, which could affect the scores obtained. However, the researcher made efforts to ensure the test performance remained good by providing explanations on how to perform the test. Smoking habits, body mass index, gender, work tenure, and work duration were not controlled. Still, they should be considered, as these uncontrolled variables could potentially influence the subjects and introduce bias, thereby affecting the study's results. Additionally, the researcher faced limitations in collecting subjects, having to visit each subject individually

at their work sites. To address this, the researcher divided the data collection period into four days to reach all subjects.

CONCLUSION

there was a very high, significant, and directly proportional relationship between working posture and the incidence of lower back disability among farmers. Additionally, there is a very high, significant, and inversely proportional relationship between core muscle endurance and the incidence of lower back disability among these farmers.

ETHICAL CLEARANCE

This study received approval from the Research Ethics Commission, Faculty of Medicine, Udayana University under registration number 540/UN14.2.2.VII.14/LT/2023. Informed agreement from the respondents to the survey was also provided, which approved the use of sampling.

CONFLICT OF INTEREST

This study has no conflicts of interest.

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This study received no grants from any institution.

AUTHOR CONTRIBUTIONS

KNA prepares study designs, collects data, processes data, and writes manuscripts. MHSN, AW, and IGAA direct data collection and revise the manuscript.

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