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Analysis of working posture and risk of musculoskeletal complaints among vegetable farmers

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ABSTRACT

Background: Musculoskeletal disorders (MSDs) are disorders of body tissue that are related to movement, such as muscles, tendons, ligaments, nerves, or spinal joints. Farmers often experience these musculoskeletal complaints. This study aims to determine the risk level of working postures, the distribution of musculoskeletal complaints, and the risk level of musculoskeletal complaints among vegetable farmers.

Methods: The research method used is descriptive observational. The sampling technique used was total sampling. The number of samples obtained in this research was 147 samples. Data collection was conducted at Banjar Taman Tanda, Batunya Village, Baturiti District, Tabanan Regency. Data collection was carried out by measuring work posture with rapid entire body assessment (REBA) and measuring musculoskeletal complaints with a Nordic body map (NBM). The data analysis technique in this research is univariate analysis, namely age, gender, smoking habits, work duration, work period, work posture, and musculoskeletal complaints.

Results: The research results showed that the majority of respondents had a risk level of work posture. The majority of respondents were classified as a medium risk level, 90 people (61.2%), a low-risk level, 24 people (16.3%), a high-risk level, 30 people (20.4%). %), and the risk level is very high, with the minimum number of people being three people (2.0%). The results of measuring the level of musculoskeletal complaints with NBM found that the majority of complaints were not painful in the right elbow of the body, as many as 120 people (81.6%), the majority of complaints of slight pain were in the right leg, 51 people (34.7%), the majority of complaints of pain were in. The right shoulder of the body was 43 people (29.3%), and the majority of complaints of severe pain were in the waist, 58 people (39.5%). The highest risk level for musculoskeletal complaints was at a moderate risk level, 84 people (56.5%).

Conclusion: There were differences in the risk level of musculoskeletal complaints and work posture among vegetable farmers.

Keywords: farmer, musculoskeletal complaints, work posture.
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INTRODUCTION

Ergonomics is an art, an application of technology, and a branch of science that utilizes information about human nature, abilities, and limitations to design a working system properly between all the tools needed in activities and rest.[1] Discomfort in activities is an ergonomic factor that results in incorrect work postures and causes musculoskeletal complaints. It can reduce productivity at work.[2] Musculoskeletal complaints are one of the problems caused by work; these complaints involve joints, muscles, tendons, cartilage, ligaments, and nerves workers feel, from mild pain to severe pain.[3]

Badan Pusat Statistik in 2020 described that farmers in Bali were around 92.82%, and in 2021, the number of farmers in Bali increased by 1%, so that around 93.73% of male and female farmers.[4] Working as a farmer has a risk of developing musculoskeletal complaints or MSDs because it has activities that have unergonomic postures, such as bending, lifting, transporting loads, and sometimes doing awkward postures that are done for a long time. Musculoskeletal complaints are one of the problems caused by work involving joints, muscles, tendons, muscles, cartilage, ligaments, and nerves workers feel, from mildly painful to very painful complaints.[5] Activities that can cause musculoskeletal complaints, such as doing work for a long time accompanied by awkward postures carried out every day, will cause pressure on the muscles, which can interfere with nerve function, cause muscle weakness, and cause pain.[6] Farmer's activities in farming are one of the things that need to be considered regarding the work safety and health of farmers because the work postures of farmers, such as lifting, pushing, pulling, raising, transporting, and lowering, are some of the risks factors such as

musculoskeletal complaints.[7,8] Work that can make work postures that are not ergonomic trigger fatigue, indirectly increasing the workload. It is advisable to apply for work positions based on government regulations related to work safety, which can reduce workload, reduce fatigue, and make workers comfortable.[9]

Farmers in Batunya Village are one example of agricultural land that is still maintained beautifully seen from the data mentioning that Batunya Village has agricultural land that has a high potential to produce quality food products; these food products are assisted by Banjar Taman Tanda farmers who are one of the banjars from Batunya Village. The village's geographical location is in a highland area with many hills around it, causing most villagers to work as farmers.[10]

Based on the description above, the authors are interested in researching the analysis of work postures on musculoskeletal complaints in vegetable farmers. Research needs to be done to find out the description of the level of risk of work postures and the distribution of musculoskeletal complaints of vegetable farmers so that prevention can be carried out on farmers to improve work postures and know the level of complaints if it is felt that it has caused complaints can be handled before things get worse.

METHODS

This study used descriptive observational research methods. It was conducted in Banjar Taman Tanda, Batunya Village, Baturiti District, Tabanan Regency, from July to December 2023. The population in this study was all Banjar Taman Tanda vegetable farmers, and the number of people who actively worked as vegetable farmers was 147. The sample in this study was taken using total sampling.

This study aimed to assess the risk of work postures using the REBA questionnaire and identify musculoskeletal complaint locations using the NBM questionnaire. The REBA instrument evaluated the injury risk from farmers' work postures. Scores ranged from 1 (negligible risk) to 15 (very high risk), with higher scores indicating a greater need for improvement. The NBM questionnaire included 28 questions about pain in different body parts, rated on a 4-point Likert scale from 1 (no pain) to 4 (severe pain). The total NBM score determined the respondents' risk levels.

The Ethics Commission of the College of Medicine, Universitas Udayana, endorsed the research under approval number 1039/UN14.2.2.VII.14/LT/2023 following a comprehensive evaluation. All participants voluntarily consented to partake in the study, expressing their willingness. Furthermore, they signed an informed consent document confirming their understanding of the research's aims, approaches, and possible risks.

RESULTS

Based on Table 1, the respondents were mostly 30-40 years old, with as many as 57 people (38.8%) and dominated by male gender as many as 78 people (53.1%). At that age, they are prone to musculoskeletal complaints. In smoking habits, as many as 75 people do not smoke (51.0%) and smoke 72 people (49.0%). Farmers with work duration predominantly worked for 8 hours, as many as 55 people (44.2%). Based on the mass of work obtained, farmers with a working period of less than 15 years, as many as 50 people (34.0%).

Based on Table 2 below, the results of work posture analysis using REBA (Rapid Entire Assessment) obtained in the high category 30 people (20.4%) and low 24 people (16.3%) are also quite significant. The very high category is only found in 3 people (2.0%), and no farmers are categorized as very low. The existence of high and very high categories indicates that some farmers have work postures that are at high risk of causing musculoskeletal injuries.

Based on Table 3, it was found that the majority of farmers had no complaints on the right elbow 120 people (81.6%), left elbow 114 people (77.6%), and right forearm 110 people (74.8%). The most

Table 1. Distribution of farmer characteristics

Characteristics	Frequency	Percentage (%)
Age		
30-40	57	38.8
41-50	42	28.6
51-60	27	18.4
> 60	21	14.3
Gender		
Male	78	53.1
Female	69	46.9
Smoking habit		
Smoke	72	49.0
Do not smoke	75	51.0
Working duration		
<8 hours	53	36.1
8 hours	55	44.2
>8 hours	29	19.7
Working period		
<15 years	50	34.0
16-25 years	31	21.1
26-35 years	34	23.1
36-45 years	15	10.2
46-55 years	17	11.6

Table 2. Distribution of REBA analysis results

Score REBA	Frequency	Percentage (%)	Category
1	0	0	Very low
2-3	24	16.3	Low
4-7	90	61.2	Currently
8-10	30	20.4	High
11-15	3	2.0	Very high

REBA, rapid entire body assessment

Table 3. Distribution of musculoskeletal complaints among farmers

No	Pain	NP		SP		MP		VP	
		n	%	n	%	n	%	n	%
0	Upper neck	92	62.6	30	20.4	18	12.2	7	4.8
1	Lower neck	72	49.7	35	23.8	29	19.7	10	6.8
2	Left shoulder	57	38.8	28	19.0	39	26.5	23	15.6
3	Right shoulder	51	34.7	29	19.7	43	29.3	24	16.3
4	Left upper arm	90	61.2	23	16.3	25	17.0	8	5.4
5	Back	70	47.6	22	15.0	30	20.4	25	17.0
6	Right upper arm	96	65.3	17	11.6	22	15.0	12	8.2
7	Waist	39	26.5	11	7.5	39	26.5	58	39.5
8	Buttock	84	57.1	14	9.5	23	15.6	26	17.7
9	Bottom	98	66.7	20	6.8	17	11.6	22	15.0
10	Left elbow	114	77.6	18	12.2	8	5.4	7	4.8
11	Right elbow	120	81.6	19	12.9	7	4.8	1	7
12	Left lower arm	108	73.5	26	17.37	13	8.8	0	0
13	Right lower arm	110	74.8	26	17.7	11	7.85	0	0
14	Left wrist	112	76.2	23	15.6	8	5.4	4	2.7
15	Right wrist	104	70.7	25	17.0	11	7.5	7	4.8
16	Left hand	108	73.5	23	15.6	13	8.8	3	2.0
17	Right hand	105	71.4	24	16.3	14	9.5	4	2.7
18	Left thigh	101	68.7	28	19.0	16	10.9	2	1.4
19	Right thigh	100	68.0	26	17.7	15	20.3	6	4.1
20	Left knee	65	44.2	29	19.7	34	23.1	19	12.9
21	Right knee	59	40.1	33	22.4	33	22.4	22	15.0
22	Left calf	69	46.9	36	24.5	33	22.4	9	6.1
23	Right calf	66	44.9	37	25.2	35	23.8	9	6.1
24	Left ankle	87	59.2	46	31.3	12	8.2	2	1.4
25	Right ankle	83	58.5	47	32.0	14	9.5	3	2.0
26	Left foot	77	52.4	47	32.0	19	12.9	4	2.7
27	Right foot	71	48.3	51	34.7	19	12.9	6	4.1
	Total Pain	2408	58.3	793	19.2	600	14.5	323	8.0

%, percentage; n, number of participants; NP, no pain; MP, moderate pain; SP, slight pain; VP, very painful

Table 4. Distribution of risk levels for musculoskeletal complaints

Complaints of Musculoskeletal Pain	n	Percentage (%)
Low	55	37.4
Moderate	83	56.5
High	9	6.1
Very High	0	0

n, frequency

commonly complained body parts with mild pain are most of the right foot, 51 people (34.7%), the left foot, 47 people (32.0%), and the right ankle. As many as 47 people (32.0%). The body parts most frequently complained of pain by farmers were the right shoulder, 43 people (29.3%), the left shoulder, 39 people (26.5%), and the waist, 39 people (26.5%). The most common body parts that complained of severe pain were the waist 58 people (39.5%), the pelvis 26 people (17.7%), and the back 25 people (17.0%).

Based on Table 4, an analysis of musculoskeletal complaints based on risk levels with moderate categories dominating, 84 people (56.5%) have a moderate risk of experiencing musculoskeletal complaints. The low category is quite significant. Fifty-five people (37.4%) have a low risk. A high category minority of 9 people (6.1%) had a high risk, and no farmers were categorized as very high.

DISCUSSION

The results of the study found a diversity in the age of respondents. Still, the age of the majority of respondents averaged 30-40 years, with as many as 57 respondents out of a total of 147 respondents as farmers. This study has similarities with research conducted by Sumigar et al. (2022); it is explained that most working farmers are aged 35-50 years (29.8%), with as many as 14 respondents.[11] The older a person gets, the degenerative process will occur in tissue regeneration into scar tissue, tissue damage, and decreased fluid, resulting in reduced stability in muscles and bones.[12]

Respondents in this study were women and men: 78 men (53.1%) and 59 women (46.9%). The majority of respondents are men who are productive at work. This study adds to evidence supporting the findings of Sumigar et al. (2022). The

study showed a higher proportion of men working as farmers than women male respondents, with a percentage of 51.1% or 24 respondents. The number of female and male samples is almost balanced due to the balance of female and male samples reflecting the actual farmer population.[11,13]

Farmers in this study smoke and do not smoke; respondents who smoke are 75 people (51.0%), almost half of the total sample, while for those who do not smoke, as many as 72 people (49.0%). Afro & Paskarini's (2022) study showed that 42.4% of the farmers in their study sample had a smoking habit. The proportion of smokers among the farmers studied was significant, at almost half the total respondents. The majority of farmers in this study, although fewer, chose not to smoke, but in this study, it was explained that respondents who were smokers had a high category of musculoskeletal complaints compared to respondents who did not smoke.[13]

The majority of Farmers in this study worked for 8 hours. Working for 8 hours or more a day does not increase productivity. Instead, it can lead to fatigue, illness, and accidents. Therefore, farmers must take a break of at least 1 hour every 6 hours.[14,15] The Working period is related to the experience a person has over a long period. Research by Sumigar et al. (2022) shows that many farmers have a long working period, which can potentially cause MSDs in their bodies.[11] This finding is in line with the research of Salcha et al. (2021), which states that farmers who work for a long time have a higher risk of MSDs. The reason is that farmers often do the same activities repeatedly every day, which can cause muscles and joints to become tired and painful. The study provided additional evidence validating this study of 147 respondents. As many as 50 people (34.0%) had a tenure of fewer than 15 years.[2]

The REBA analysis found that the majority of the 90 respondents (61.2%) had a moderate risk level with a score range of 4-7. This indicates that the farmer's work posture needs to be changed to prevent an increased risk of injury. This category requires further action regarding changes to work positions so as not to increase the level of risk experienced by farmers. A total of 30 respondents (20.4%) were classified as having a high-risk level with actions that may be required. This shows that the respondent's work posture is at high risk of causing injury and requires immediate action to correct. The respondent's posture when performing harvesting activities is hunched.[16]

The results of this study show similarities with the results of research by Pramana & Cahyani (2022), using harvesting work postures, where when standing, one leg is bent to form an angle of 30º-60º, the position of the back when bending >60º accompanied by a head that also bends >20º towards the intended object. The upper arm and forearm also have similar results to this study with a 45º-90º flexion position with flexion movements at the elbow joint; most activities require 100º flexion and extension at the elbow, especially between 30º, 130º and 100º in forearm rotation, which is divided between pronation and supination. The work posture when harvesting as a whole is not given a load on the wrist, as most respondents have a high level of risk due to static work postures (bending and standing) when carrying out hoeing, planting, and harvesting activities.[17,18]

Farmers' posture while working, such as anterior bending or flexion, if done repeatedly, may cause hyperflexion and can tear ligaments and muscles, causing pain to arise; if bending plus compression, such as lifting weights simultaneously and exceeding normal physiological limits, can cause injury. Repeated loading can create microscopic damage in the material or tissue that increases until more significant failure occurs.[19]

The results of this study show similarities with the results of research by Sutami et al. (2021) in that the majority of respondents' work postures have moderate and high-risk levels based on the results of REBA measurements. The details are moderate risk 16 respondents (42.1%) and high risk 12 respondents (31.6%).[14] The bent position, when working with this position, makes the trunk muscles withstand static loads continuously for a long time while the primary function of the trunk muscles is as stabilization to provide a stable basis for the extremity muscles; the muscles are core muscles consisting of m. multifidus, m. transversus abdominis, m. diaphragm, m. pelvic floor and deep neck flexor muscles.[14,20] In addition to bending over, much of the work of farm laborers is done standing, either using one foot or two feet. When standing, the body's stability is greatly influenced by the position of both feet. The ideal leg position is straight parallel with a distance according to the width of the hip bone. This position will maintain the alignment between the upper and lower body so that it remains ergonomic.[21] The results of filling out the NBM questionnaire showed that musculoskeletal complaints were dominated by no pain in the right elbow with 122 respondents (82.3%). Respondents had the most complaints of mild discomfort in the body of the right calf, as many as 37 people (25.2%); respondents who had the most complaints of pain on average in the body of the right shoulder, as many as 39 people (26.5%), respondents with very painful complaints on average in the body of the waist as many as 47 people (32.0%). A study conducted by Punusingon et al. (2017) showed similar results, namely, in the majority of farmers in Tosuraya Selatan Village, the body parts that experienced low musculoskeletal complaints were in the right elbow and moderate musculoskeletal in the right shoulder area and high-risk in the waist and buttocks area. A combination of physical and non-physical factors causes musculoskeletal complaints in farmers.[22] Research conducted by Rovendra et al. (2021) explained that in the field results with NBM measurements, it was found that 57 farmers experienced musculoskeletal complaints, and the majority complained of back pain (62%) and legs (57%). Musculoskeletal complaints generally occur due to excessive muscle contraction due to poor work attitudes, given too heavy a workload with a long work duration, which reduces blood circulation to the muscles so that oxygen to the muscles decreases and lactic acid buildup occurs, causing pain.[3] Complaints in farmers can be caused by several risk factors that make these complaints appear: increasing age, male, working period of more than five years, work postures such as bending, standing on unstable surfaces, lifting and holding loads for too long, and repetitive work attitudes plus the duration of work

on farmers is determined when farmers carry out cultivation activities, planting, fertilizing, spraying and harvesting garden products.[23]

This study has a significant limitation as it does not further analyze the correlation between different risk factors and the level of musculoskeletal complaint risk among vegetable farmers in the researched location. Understanding this correlation is crucial to comprehend the factors contributing to musculoskeletal health issues in this population, enabling more precise preventive measures and interventions.

CONCLUSION

The conclusion was that vegetable farmers differ in the risk level of musculoskeletal complaints and work posture.

ETHICAL CLEARANCE

The Research Ethics Commission, College of Medicine, Universitas Udayana, stated that this research is ethically feasible with number 1039/UN14.2.2.VII.14/LT/2023.

CONFLICT OF INTEREST

No conflict of interest in this study.

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AUTHOR CONTRIBUTIONS

NLPCD prepares study designs, collects data, processes data, and writes manuscripts. GPK, NLPGKS, and NKAJA direct data collection and revise the manuscript.

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