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RESEARCH ARTICLE

Occupational work-related health hazards among workers involved in weeding activity

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ABSTRACT

Occupational health hazards in agriculture, particularly during weeding activities, pose significant risks to farmers' well-being. Most of the work in the agriculture field are performed manually using traditional hand tools. These hand tools lack ergonomic design, causing excessive strain on workers and leading to musculoskeletal disorders (MSDs) throughout their bodies. The study aims to identify and analyze the occupational health hazards faced by workers involved in manual weeding activities in agriculture. Data showed that 94% of respondents experienced muscle fatigue and pain, 88% reported reduced grip strength, and 79% had tingling sensations in fingers. The most frequent health issues included pain in fingers, shoulders, and wrists (mean score 2.22), muscle fatigue (2.16), and reduced grip strength (2.13). Perceived exertion during weeding was rated as moderately heavy by 44.5% of respondents. The highest joint discomfort was in the back (mean rating 4.08) and lower back (4.03). Work-Related Musculoskeletal Disorders (WMSDs) were common, with the lower back, knee, and shoulder being most affected. Acute pain was prevalent in the lower back (75%), upper back (65%), and knee (60%). These findings highlight the need for better ergonomic tools and practices in agriculture.

Keywords: Musculoskeletal disorders, Occupational health hazards, Perceived discomfort, Weeding activity

INTRODUCTION

Occupational well-being is essential for farm workers in the agricultural sector, as it significantly affects their health, safety, and productivity (Reed and Wachs 2004). Ergonomics is pivotal in this context, influencing workers' well-being through the design of tools, workstation arrangements, and ergonomic practices. By addressing factors such as posture, repetitive movements, and tool design, the risk of musculoskeletal disorders (MSDs) is reduced, leading to enhanced job satisfaction. Customizing tools to match individual physical capabilities improves comfort and efficiency, thereby promoting job retention and skill development. This holistic approach not only fosters a healthier workforce but also supports sustainable agriculture and strengthens the resilience of farming communities. Ergonomic disorders are currently the fastest-growing category of work-related illnesses, accounting for 56-63 percent of illnesses reported to OSHA, according to the latest statistics from the U.S. Bureau of Labor Statistics (Tarlengco 2024).

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Manual weeding remains a common practice in Indian agriculture, particularly in North East India and Assam, due to factors such as unreliable labor and increasing wages (Yaka, 2017). This method is predominantly employed by small-scale and subsistence farmers with limited land holdings, exposing workers to various health risks including musculoskeletal disorders (MSDs) and general discomfort. These risks are often exacerbated by the design of traditional tools, such as hoes, sickles, and weeding hooks, which do not always consider the ergonomic needs of users (Khayer *et al.* 2019). Despite these challenges, manual weeding plays a crucial role in weed control and provides significant employment opportunities, especially for rural women and marginalized communities, thus making a substantial contribution to Assam's agricultural sector.

Workers engaged in weeding face multiple challenges affecting their well-being and productivity. Studies have highlighted issues such as musculoskeletal problems, exhaustion, and pain (Singh 2007, Parvez 2017). Extreme weather conditions, including heat stress in summer and cold in winter, further complicate their work, while the use of traditional tools and poor posture during weeding exacerbate these problems, leading to increased physical strain and musculoskeletal disorders

(Burman *et al.* 2020). The lack of ergonomic tools designed specifically for weeding tasks contributes to poor work postures and repetitive strain injuries, reducing efficiency. Additionally, insufficient training and awareness about safe weeding practices lead to a higher incidence of work-related injuries and health issues.

The physical demands of weeding, involving manual handling of materials, often lead to musculoskeletal disorders (MSDs) such as lower back, shoulder, and upper limb strains and sprains (NIOSH, 2007). Addressing these occupational risks through ergonomic interventions is essential for reducing adverse health effects and enhancing worker well-being. Integrating ergonomic principles into agricultural tasks, including wedding, can significantly lower injury rates and boost job satisfaction. By applying ergonomic design to tools, workstations, and processes, agricultural organizations can create safer, more sustainable work environments, helping to prevent work-related musculoskeletal disorders (Aptel *et al.* 2002).

MATERIALS AND METHODS

Study design

This study employed a cross-sectional design to explore the occupational health hazards associated with manual weeding activities among agricultural workers. Data were collected through a combination of surveys, interviews, and direct observations to gain comprehensive insights into the musculoskeletal problems and perceived exertion faced by workers.

Time period of Study: 2022-2024

Sample selection

The study sample consisted of 200 agricultural workers engaged in manual weeding activities across various farms in Assam. Participants were selected using purposive sampling to ensure a representative mix of gender, age, and work experience. The inclusion criteria required participants to have at least one year of experience in weeding activities, ensuring familiarity with the tasks involved.

Data collection tools

Questionnaire: A structured questionnaire was developed based on the Standard Nordic Musculoskeletal Questionnaire (SNQ) to assess musculoskeletal problems. The questionnaire included sections on demographic information, work history, types of tools used, and detailed questions on the frequency, severity, and location of musculoskeletal pain.

Three-point rating scale: To assess the severity of pain, a three-point rating scale was used, categorizing the pain as acute (3), less acute (2), and negligible (1).

Perceived exertion scale: A five-point rating scale (Very Light, Light, Moderately Heavy, Heavy, Very Heavy) was used to evaluate the perceived exertion during weeding activities.

Observation checklist: An observation checklist was used to record the postures adopted by workers during weeding and the types of tools used. This helped in correlating the postural data with the reported musculoskeletal problems.

RESULTS AND DISCUSSION

Health hazard faced by workers

The findings revealed that the majority of respondents experienced significant muscle fatigue and pain in various body parts, including fingers, shoulders, and wrists, with 94% reporting these issues. Other common complaints included reduced grip strength (88%) and tingling sensations in the fingers (79%). To assess the frequency of these health hazards, a three-point rating scale was employed, with results indicating that pain in the hands and fingers was the most frequently reported issue, achieving the highest mean score of 2.22. This was closely followed by muscle fatigue with a mean score of 2.16 and reduced grip strength with a mean score of 2.13. Additional complaints, ranked by frequency, included tingling sensations, changes in skin color, joint swelling, blisters, cut injuries, and muscle numbness (**Table 1**). These results align with previous research highlighting similar occupational

Table 1. Frequencies of health hazards faced by workers while using hand tools during weeding

Health hazards	Often (3)	Sometimes (2)	Never (1)	Wt. score	Mean	Rank
Tingling of finger	64	76	60	404	2.02	IV
Swelling in the joints	29	32	139	290	1.45	VI
Reduced grip strength	73	80	47	426	2.13	III
It causes muscle fatigue	70	92	38	432	2.16	II
Cut injuries	18	26	156	262	1.31	VIII
Blisters on palm skin	30	23	147	283	1.415	VII
Numbness of muscle	0	32	168	232	1.16	IX
Change in skin colour of hands and fingers	0	110	90	310	1.55	V
Pain in fingers, shoulder, wrist and other body parts	83	79	38	445	2.225	I

health challenges, such as pain and fatigue, experienced by agricultural workers (Kalyani *et al.* 2008, and NAG *et al.* 2016). Despite advancements in mechanization and automation, manual labor remains a significant part of agriculture in Assam tasks (Brahma and Daimary 2017), where hand tools are essential for tasks like weeding. This manual labor results in notable perceived exertion among workers.

Table 2 reveals that 44.5% of workers considered weeding activity to be moderately heavy, while 32% perceived it as heavy, and 23.5% found it to be very heavy. Despite the continuous and intensive nature of weeding, which occurs from morning until evening throughout the year, most workers viewed the task as involving relatively light to moderate exertion. This perspective aligns with findings reported by Hasalkar *et al.* (2004), which also suggested that, although labor-intensive, weeding is often perceived as less strenuous compared to other activities.

Rating of joint discomfort perceived by the workers involved in weeding activity

According to Strasser (2009), joints are essential connections between bones that support movement and maintain skeletal structure, facilitating activities like sitting, walking, and running. Results, presented in Table 3, indicated that the highest mean rating of perceived joint discomfort occurred in the back (4.08), followed by the lower back (4.03) and knee (3.58). In contrast, the elbow reported the least discomfort (1.91), with the neck and fingers also experiencing relatively lower discomfort (2.34 and 2.55, respectively). These findings are consistent with prior research by Khogare and Borkar (2011) and Rosa *et al.* (2023), which similarly identified significant joint discomfort in the neck, wrist, shoulder, and knee during weeding activities.

Work related musculoskeletal disorder faced by the respondents

Work-Related Musculoskeletal Disorders (WMSDs) are common among agricultural workers, particularly those engaged in weeding activities, as noted by Shivakumar *et al.* (2023) and Varghese and Panicker (2022). These disorders affect various body parts, including muscles, bones, joints, and connective tissues, and are often linked to high-risk activities such as heavy lifting and repetitive movements. Agricultural workers frequently face health issues due to poorly designed machinery and tools, leading to symptoms like body pain, fatigue, numbness, cramps, and tingling. Initially presenting as vague pain, these symptoms can worsen over time, resulting in severe musculoskeletal illnesses that reduce productivity and performance. Workers commonly adopt unfavorable postures, such as squatting or stooping, which contribute to these disorders. To assess the prevalence and severity of musculoskeletal problems, the Standard Nordic Musculoskeletal Questionnaire (SNQ) was utilized. This tool categorizes issues into three areas: trouble in the past 12 months, interruptions to normal work over the last 12 months, and recent discomfort experienced in the last 7 days. The findings highlight the impact of prolonged, repetitive tasks and poor ergonomics on workers' musculoskeletal health.

The data analysis in **Table 4** highlights that in the past 12 months, the most frequently affected regions for work-related musculoskeletal disorders (WMSDs) among workers were the lower back (31%), knee (30%), shoulder (29%), upper back (24%), and neck (20%). These findings are consistent with the study by Gowri S et al. (2015), which also reported a high incidence of lower back problems (29%), knee issues (28%), leg pain (28%), and headaches (25%) among agricultural workers. The table further reveals that a significant number of workers were unable to work in the past 12 months due to lower back (15%), shoulder (14%), upper back (12%), and knee issues (11%). In the last 7 days, the most commonly affected regions were the lower back (38%), knee (33%), upper back (25%), shoulder (13%), and neck (5%). Workers have reported experiencing pain in the lower back and spinal region, attributing it to difficulties in gripping tools during their daily activities, as shown in Figure 1. The repetitive nature of their tasks, the exertion

Table 2. Distribution of respondents according to exertion perceived in performance of weeding activity

Activity	Rating of perceived exertion				
	Very light (1)	Light (2)	Moderately heavy (3)	Heavy (4)	Very heavy (5)
Weeding	-	-	89	64	47
	-	-	(44.5)	(32)	(23.5)

Table 3. Distribution of respondents according to joint discomfort perceived while performing weeding activity

Activity	Joint involved	Rating of perceived joint discomfort
Weeding activity	Back	4.085±1.077
	Shoulder	3.455±1.070
	Neck	2.34±1.062
	Leg	2.595±1.054
	Elbow	1.91±1.046
	Hand	3.335±1.038
	Finger	2.555±1.029
	Knee	3.58±1.020
	Lower back	4.03±1.011

Table 4. Distribution of respondents based on musculoskeletal problems by using Standard Nordic Musculoskeletal Questionnaire (SNQ)

Body parts	Frequency and extent of musculoskeletal problems		
	Trouble (pain, pain, discomfort and numbness) in the last 12 months f (%)	Prevented from doing normal work in last 12 months due to trouble (pain, pain, discomfort and numbness f (%)	Trouble in the last 7 days f (%)
Neck	100 (50)	13 (6.5)	2 (1)
Shoulders	150 (75)	22 (11)	5 (2.5)
Elbows	50 (25)	9 (4.5)	-
Wrist/hands	80 (40)	7 (3.5)	-
Upper back	120 (60)	19 (9.5)	10 (5)
Lower back	158 (79)	24 (12)	15 (7.5)
Hips/thighs	70 (35)	4 (2)	-
Knees	152 (76)	17 (8.5)	13 (6.5)
Ankles/feet	60 (30)	6 (3)	-

*Figures in parentheses show percentage and figures without parentheses shows frequency

required, and the force needed to carry out work for extended periods daily, involving movements of the spine, hands, and legs, contribute to this issue. As a result, workers frequently suffer from musculoskeletal pain in areas such as the lower back, neck, knees, and shoulders.

Severity and frequency of pain

From **Figure 2**, 75% of workers reported acute lower back pain, 65% reported upper back pain, and 60% reported knee pain. Less acute pain was noted in the shoulders and hands (45%), hips/ thighs (38%), and elbows and upper back (35%). These results align with Gowri *et al.* (2015), which found significant discomfort in the lower back, knees, and legs among agricultural workers. The majority of respondents experienced acute pain in the lower back, knees, neck, shoulders, and hands, likely due to forward bending, squatting postures, and repetitive hand movements.

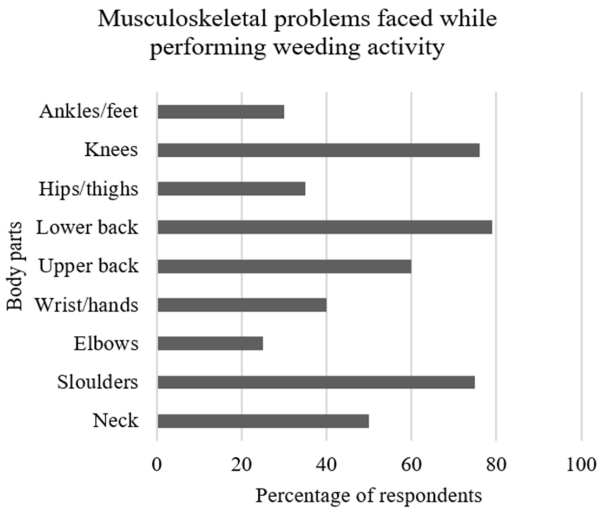

Figure 1. Percentage distribution of the respondents according to musculoskeletal problems faced in performance of weeding activity

The analysis revealed that back pain was the most commonly experienced issue, with 70% of respondents consistently experiencing lower back pain, followed by knee pain (68%), upper back pain (63%), and neck pain (55%). Additionally, 45% of workers reported sometimes experiencing MSDs in the shoulders and hands, followed by hips/thighs (38%), upper back (37%), and elbows (35%). These occurrences are likely due to the various awkward postures (such as squatting, bending, and standing) and repetitive movements required by different weeding tools (**Figure 3**).

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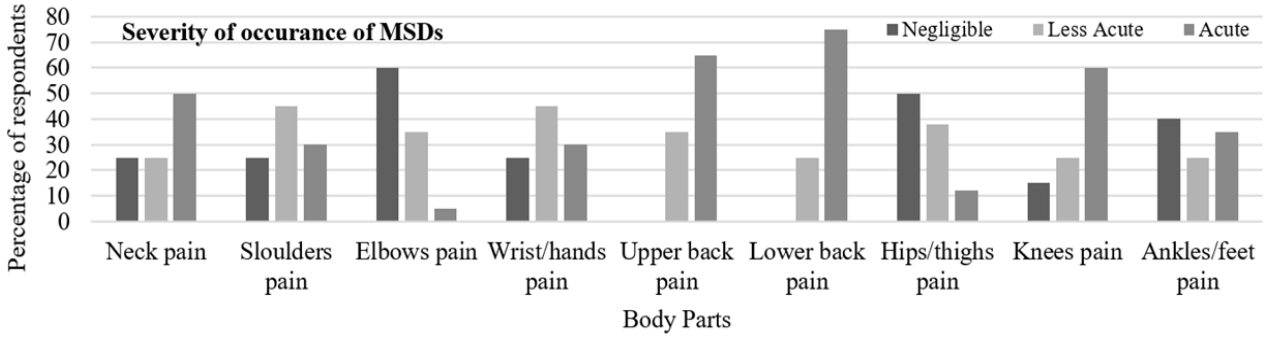

Figure 2. Severity of MSDs faced by respondents while performing weeding activity

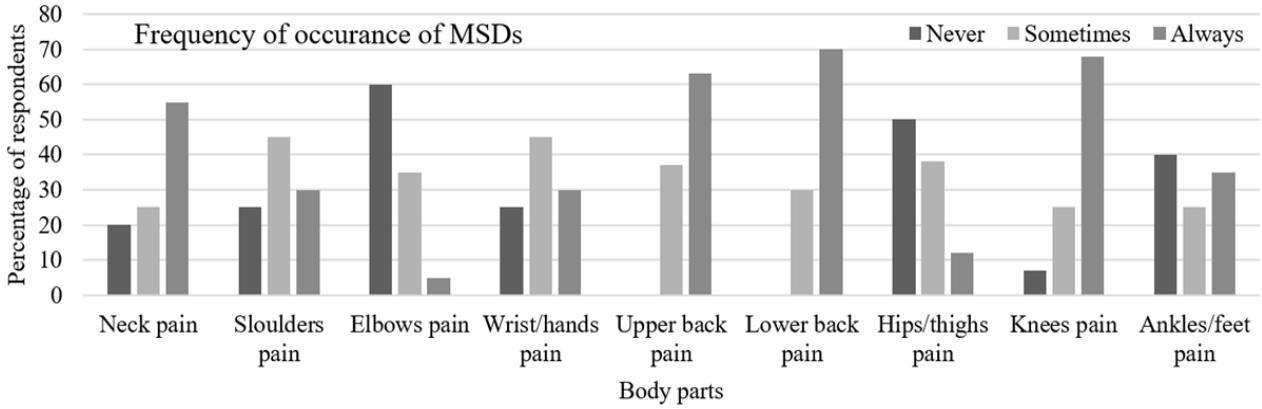

Figure 3. Frequency of MSDs faced by respondents while performing weeding activity

Conclusion

This study sheds light on the occupational health hazards faced by workers engaged in manual weeding activities in agriculture. The findings underscore the significant physical exertion, joint discomfort, and musculoskeletal problems experienced by these workers, highlighting the need for targeted interventions to improve their safety and wellbeing. From ergonomic tool design to comprehensive training on safe work practices, addressing these challenges necessitates a holistic strategy encompassing ergonomic tool design, comprehensive training on safe work practices, and ongoing health monitoring, emphasizing the collective responsibility of employers, regulators, and health professionals in safeguarding the wellbeing of agricultural workers. By prioritizing worker safety and health, we can create a safer and more sustainable agricultural workforce, ultimately contributing to the overall wellbeing of agricultural communities.

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