



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; SP-9(1): 148-151
Received: 02-10-2025
Accepted: 09-11-2025

E Shirin Hima Bindu
Department of Resource
Management and Consumer
Science, College of Community
Science, PJTAU, Hyderabad,
Telangana, India

R Neela Rani
All India Coordinated Research
Project on Women in Agriculture,
PJTAU, Hyderabad, Telangana,
India

Technology deficit and occupational risk among farm women engaged in vegetable cultivation

E Shirin Hima Bindu and R Neela Rani

DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i1Sc.4664>

Abstract

Farm women constitute a major segment of the agricultural workforce and are extensively involved in labour-intensive vegetable cultivation. Despite their significant contribution, women predominantly rely on traditional tools and manual handling practices, which expose them to considerable occupational health risks. The present study aimed to assess technology gaps in farm operations and examine their association with injury incidence and musculoskeletal pain among farm women. A purposive sample of fifty farm women engaged in vegetable cultivation in a semi-arid region of Telangana was selected for the study. Data was collected using a structured interview schedule, tool-use inventory, injury recall schedule and musculoskeletal pain mapping. Statistical analysis included descriptive statistics, Chi-square test and Pearson's correlation analysis. The findings revealed complete dependence on traditional hand tools for most farm operations. A high incidence of minor work-related injuries was observed and a significant association was found between traditional tool use and injury occurrence. Manual handling activities were widespread and showed a significant positive correlation with musculoskeletal pain, particularly in the lower back, shoulders and wrists. The study highlighted technology deficit as a critical determinant of occupational risk among farm women and underscores the need for gender-responsive, ergonomically appropriate agricultural technologies to improve occupational safety and health.

Keywords: Technology deficit, traditional tools, manual handling, injury incidence, musculoskeletal pain, farm women

1. Introduction

Agricultural production in developing regions remains highly dependent on manual labour, with women playing a central role in crop cultivation, harvesting and post-harvest operations (Vemireddy & Choudhary, 2021) ^[17]. In vegetable cultivation, farm women are routinely engaged in repetitive and physically demanding tasks such as weeding, harvesting, carrying produce and post-harvest handling (Raney *et al.*, 2011) ^[13]. However, their work is predominantly carried out using traditional hand tools and manual handling methods that have undergone little technological adaptation to suit women's physical characteristics and work demands.

Traditional agricultural tools often require forceful exertion, repetitive gripping and awkward postures, increasing the likelihood of injuries and musculoskeletal disorders (Joshi *et al.*, 2024; Kwatra, 2017) ^[8, 9]. Manual handling of loads such as baskets, crates and harvested produce further compounds physical strain, especially in the absence of load-sharing or material-handling devices. Over time, these conditions contribute to cumulative trauma, chronic pain and reduced work capacity.

While earlier research has emphasized physiological workload and drudgery among farm women, limited attention has been given to technology deficit as a structural factor underlying occupational risk. Understanding how inadequate tool design and reliance on manual handling translate into injury incidence and musculoskeletal pain is essential for developing effective interventions (Zorrilla-Muñoz *et al.*, 2019) ^[18]. The present study therefore examined technology gaps in vegetable cultivation and their relationship with occupational health risks among farm women. Moreover, it explores the potential for policy and governmental intervention to establish dedicated task forces that address these occupational hazards and health concerns effectively (Mishra *et al.*, 2024) ^[10].

Corresponding Author:
E Shirin Hima Bindu
Department of Resource
Management and Consumer
Science, College of Community
Science, PJTAU, Hyderabad,
Telangana, India

2. Materials and Methods

2.1 Study Area and Sample

The study was conducted in a rural village of Rangareddy district, Telangana. Fifty farm women aged between 25 and 60 years, actively involved in vegetable cultivation and regularly participating in field operations, were selected using purposive sampling. Women with recent major illness or injury unrelated to farm work were excluded.

2.2 Tools and Techniques

Data was collected using the following tools:

- **Tool-use inventory:** A structured tool-use inventory was developed to document the types of tools employed by farm women during various farm operations such as weeding, harvesting, input application and post-harvest handling. The inventory recorded information on the nature of the tool (traditional or improved), frequency of use and perceived ease of handling. Traditional tools included hand hoes, sickles and baskets, while improved tools referred to women-friendly or ergonomically designed implements. The inventory enabled assessment of technology gaps and dependence on manual tools in vegetable cultivation.
- **Injury incidence schedule:** An injury incidence schedule was used to record the occurrence of work-related injuries experienced by farm women during the agricultural season. The schedule documented the type of injury (cuts, blisters, abrasions, sprains or strains), frequency of occurrence and the specific farm activity during which the injury was sustained.
- **Manual handling checklist:** A manual handling checklist was employed to identify farm operations involving physical load handling. The checklist included activities such as lifting harvested produce, carrying baskets or crates, repetitive load transfer and prolonged holding of loads.
- **Musculoskeletal pain mapping:** Musculoskeletal pain was assessed using a standardized body-region-wise pain mapping technique. A human body diagram was used to identify affected regions, including the lower back, shoulders, wrists/hands, knees and neck. Respondents rated the intensity of pain experienced in each body region using a five-point scale, where 1 indicated no pain and 5 indicated severe pain.

2.3 Statistical Analysis

Descriptive statistics (frequency, percentage, mean and standard deviation) were used to analyze the data. Chi-square test was applied to examine the association between tool type and injury incidence. Pearson's correlation analysis was used to assess the relationship between manual handling intensity and musculoskeletal pain. Statistical significance was tested at the 5 per cent level.

3. Results and Discussion

3.1 Tool Use Patterns and Technology Gap

The distribution of respondents according to the type of tools used for major farm operations is presented in Table 1. All respondents relied on traditional hand tools for weeding, harvesting and post-harvest handling. Adoption of improved or women-friendly tools was negligible, indicating a pronounced technology deficit in women's agricultural work.

Table 1: Distribution of Farm Women According to Type of Tools Used (N = 50)

Farm operation	Traditional tools (%)	Improved / women-friendly tools (%)
Weeding	100.0	0.0
Harvesting	100.0	0.0
Post-harvest handling	100.0	0.0
Input application	96.0	4.0

Descriptive analysis of tool use revealed complete dependence on traditional tools for major farm operations. All respondents (100%) reported using traditional hand tools for weeding, harvesting and post-harvest handling. Only a small proportion (4%) reported limited use of improved tools for input application, while 96 per cent continued to rely on traditional methods. The findings indicated minimal adoption of women-friendly or improved agricultural tools among the respondents. This pervasive use of traditional, often ergonomically unsuitable, tools significantly contributed to musculoskeletal disorders and chronic pain among women agricultural workers (Pawlak *et al.*, 2017) ^[12]. Indeed, agricultural labor-saving technologies have overlooked women's specific production processes and activities, contributing to a lack of suitably adapted implements that consider their physiology, time use, and socio-cultural context (Joshi *et al.*, 2024) ^[8].

3.2 Traditional Tools and Injury Incidence

Work-related injuries reported by farm women are presented in Table 2. Cuts and lacerations were the most common injuries, followed by blisters and abrasions. Although most injuries were minor, their frequent occurrence contributes to discomfort, reduced efficiency and increased risk of infection.

Table 2: Incidence of Work-Related Injuries among Farm Women (N = 50)

Type of injury	Frequency	Percentage (%)
Cuts / lacerations	18	36.0
Blisters	14	28.0
Abrasions	10	20.0
Sprains / strains	8	16.0
Total	50	100.0

A Chi-square test revealed a statistically significant association between reliance on traditional tools and injury incidence ($\chi^2 = 6.21$, $df = 1$, $p < 0.05$), indicating that exclusive use of traditional tools was linked to higher occurrence of work-related injuries.

Analysis of injury incidence data showed that cuts and lacerations were the most frequently reported injuries, accounting for 36.0 per cent of total cases. Blisters constituted 28.0 per cent of reported injuries, followed by abrasions (20.0%) and sprains or strains (16.0%). The results indicated a high occurrence of minor but recurrent work-related injuries among farm women during vegetable cultivation activities. This aligned with broader trends in agricultural settings where hand tools are a primary source of injury, particularly cuts and wounds to the fingers and hands (Bhattarai *et al.*, 2016) ^[1]. Such injuries were often aggravated by the lack of personal protective equipment and proper training on tool use, further increasing vulnerability to occupational hazards (Bhattarai *et al.*, 2016) ^[1]. The sustained engagement in hard agricultural tasks using outdated implements has been consistently linked to chronic pain and musculoskeletal

disorders in various anatomical regions, including the neck, shoulders, and lower back (Tripathi *et al.*, 2021) ^[16].

3.3 Manual Handling Practices

Manual handling activities performed by the respondents are presented in Table 3. The majority of farm women were involved in lifting and carrying harvested produce and repetitive load transfer without mechanical aids.

Table 3: Manual Handling Activities Performed by Farm Women (N = 50)

Manual handling activity	Respondents (%)
Lifting harvested produce	92.0
Carrying baskets / crates	88.0
Repetitive load transfer	76.0
Prolonged holding of loads	70.0

Descriptive statistics indicated that a majority of the respondents were engaged in manual handling activities. Lifting harvested produce was reported by 92.0 per cent of the respondents, while 88.0 per cent were involved in carrying baskets or crates. Repetitive load transfer was reported by 76.0 per cent, and prolonged holding of loads by 70.0 per cent of the respondents. These findings suggested widespread exposure to physically demanding manual handling tasks. This extensive reliance on manual handling, particularly involving heavy loads and awkward postures, is a significant contributor to musculoskeletal disorders, generalized body ache and joint pain, which are highly prevalent among female agricultural workers (Halder *et al.*, 2024; Jena *et al.*, 2015; Shin & Jeong, 2022) ^[4, 7, 14].

3.4 Manual Handling and Musculoskeletal Pain

Musculoskeletal pain distribution by body region is presented in Table 4. The lower back recorded the highest mean pain score, followed by shoulders and wrists. These findings reflect the biomechanical stress associated with repetitive lifting and carrying tasks.

Table 4: Distribution of Musculoskeletal Pain by Body Region (N = 50)

Body region	Mean pain score (1–5)	Severity level
Lower back	4.4 ± 0.6	Severe
Shoulders	3.8 ± 0.7	Moderate–severe
Wrists / hands	3.6 ± 0.8	Moderate
Knees	3.2 ± 0.7	Moderate

Correlation analysis (Table 5) revealed a significant positive relationship between manual handling intensity and musculoskeletal pain, particularly in the lower back and shoulders. Musculoskeletal pain assessment revealed variation in pain intensity across different body regions. The highest mean pain score was observed in the lower back (4.4 ± 0.6), followed by shoulders (3.8 ± 0.7) and wrists/hands (3.6 ± 0.8). The knees recorded a mean pain score of 3.2 ± 0.7. The results indicated that the lower back and upper limb regions were most affected by musculoskeletal discomfort among the respondents. These findings aligned with prior research indicating that continuous engagement in physically demanding agricultural tasks exacerbates musculoskeletal issues, particularly in the lower back, knees, shoulders, and fingers, with increasing age contributing to greater severity of these disorders (Gurnani *et al.*, 2022; Jena *et al.*, 2015) ^[3, 7]. Specific tasks such as mango harvesting, which involve awkward postures and repetitive

movements, are known to induce pain and fatigue in the neck, shoulders, elbows and lower back (Boriboonsuksri *et al.*, 2022) ^[2]. The findings in Table 5. were consistent with studies highlighting that women in agricultural labor frequently experience a higher prevalence of musculoskeletal symptoms, particularly in the wrists and hands, due to repetitive tasks and the physical demands of their work (Sombatsawat *et al.*, 2019) ^[15].

Table 5: Correlation between Manual Handling Intensity and Musculoskeletal Pain (N = 50)

Variable pair	Correlation coefficient (r)
Manual handling and Lower back pain	0.58*
Manual handling and Shoulder pain	0.51*
Manual handling and Wrist pain	0.47*

* Significant at 5% level

Pearson’s correlation analysis revealed a statistically significant positive relationship between manual handling intensity and musculoskeletal pain. Manual handling showed a moderate positive correlation with lower back pain (r = 0.58, p < 0.05), shoulder pain (r = 0.51, p < 0.05) and wrist pain (r = 0.47, p < 0.05). These results indicated that increased involvement in manual handling activities was associated with higher levels of musculoskeletal pain among farm women. Such prevalence extended to other regions like the lower back, fingers, and shoulders, with factors such as age, daily working hours and farming experience further intensifying these conditions (Jain *et al.*, 2018) ^[6].

3.5 Technology Deficit as a Source of Occupational Risk

The results clearly indicated that technology deficit manifested as dependence on traditional tools and absence of material-handling aids played a critical role in increasing occupational risk among farm women. Frequent injuries and widespread musculoskeletal pain reduced work efficiency and may lead to long-term health consequences, reinforcing occupational vulnerability. This deficit contributed to chronic conditions such as generalized body ache, back pain, neck pain, joint pain, and stiffness, which are widely reported among women in agricultural and fishery sectors (Halder *et al.*, 2024; Jena *et al.*, 2015) ^[5, 7]. This vulnerability is often compounded by prolonged static postures, such as squatting for extended periods during harvesting, which significantly contributes to severe low back pain and knee discomfort (Tripathi *et al.*, 2021) ^[16].

4. Conclusion

The study demonstrates that reliance on traditional agricultural tools and extensive manual handling significantly increase occupational risk among farm women engaged in vegetable cultivation. High injury incidence and prevalent musculoskeletal pain were strongly associated with technology gaps in women’s farm work. Addressing occupational health risks among farm women therefore requires targeted technological interventions, including the development and dissemination of women-friendly, ergonomically appropriate farm tools and material-handling devices. Reducing technology deficit is essential for improving safety, health and sustainability of women’s participation in agriculture.

Implications

- Promotion of women-centric, ergonomically designed farm tools

- Subsidized access to improved tools for small and marginal farm women
- Training programmes on safe tool use and manual handling techniques
- Integration of occupational health considerations into agricultural technology dissemination

References

1. Bhattarai D, Singh SB, Baral D, Sah RB, Budhathoki SS, Pokharel PK. Work-related injuries among farmers: a cross-sectional study from rural Nepal. *J Occup Med Toxicol*. 2016;11(1):13. doi:10.1186/s12995-016-0137-2
2. Boriboonsuksri P, Taptagaporn S, Kaewdok T. Ergonomic task analysis for prioritization of work-related musculoskeletal disorders among mango-harvesting farmers. *Safety*. 2022;8(1):6. doi:10.3390/safety8010006
3. Gurnani U, Singh SK, Sain MK, Meena ML. Musculoskeletal health problems and their association with risk factors among manual dairy farm workers. *Evergreen*. 2022;9(4):950-956. doi:10.5109/6622881
4. Halder CE, Das PP, Rahman SMT, Bhounick LC, Tassdik H, Hasan MA, Mithun SN. Occupational hazards and risks among the women in fisher communities in Cox's Bazar and Chattogram. *medRxiv*. 2024. doi:10.1101/2024.01.08.24300962
5. Halder CE, Das PP, Rahman SMT, Bhounick LC, Tassdik H, Hasan MA, *et al*. Occupational hazards and risks among the women in fisher communities in Cox's Bazar and Chattogram, Bangladesh. *PLoS ONE*. 2024;19(7):e0297400. doi:10.1371/journal.pone.0297400
6. Jain R, Meena ML, Dangayach GS, Bhardwaj A. Risk factors for musculoskeletal disorders in manual harvesting farmers of Rajasthan. *Ind Health*. 2018;56(3):241-249. doi:10.2486/indhealth.2016-0084
7. Jena S, Kumar A, Singh JK. Assessment of manual load carrying and health status of women farm workers of district Sonapat (Haryana), India. *J Appl Nat Sci*. 2015;7(1):229-235. doi:10.31018/jans.v7i1.595
8. Joshi P, Mahra GS, Jethi R, Satyapriya, Singh R, Bishnoi S, *et al*. Ergonomics assessment of drudgery in rice-wheat production system in India: a case study of women farmers. *Front Sustain Food Syst*. 2024;8:1346980. doi:10.3389/fsufs.2024.1346980
9. Kwatra POS. Comparative ergonomic assessment of the male and female farm workers involved in rice cultivation. *Int J Curr Microbiol Appl Sci*. 2017;6(9):3439-3447.
10. Mishra S, Bhagat D, Borah S. Ergonomic studies on occupational health of women workers involved in agricultural industries: a systematic review. *Res World Agric Econ*. 2024;5(4):110-120. doi:10.36956/rwae.v5i4.1207
11. Moharana G, Bal SK, Sharma P, Sandhya. Technological need of women workers involved in turmeric cultivation: an exploratory study. *Int J Res Agron*. 2024;7:130-136. doi:10.33545/2618060x.2024.v7.i1sb.269
12. Pawlak H, Petkowicz B, Maniak B, Kuna-Broniowska I, Petkowicz J, Buczaj A, *et al*. Severity of work in opinions of rural women living in the Bieszczady region of south-eastern Poland. *Ann Agric Environ Med*. 2017;25(1):145-152. doi:10.26444/aaem/75595
13. Raney T, Anríquez G, Croppenstedt A, Gerosa S, Lowder SK, Matuschke I, *et al*. The role of women in agriculture. *RePEc Res Pap Econ*. 2011;289018.
14. Shin DS, Jeong BY. Older female farmers and modeling of occupational hazards, wellbeing, and sleep-related problems on musculoskeletal pains. *Int J Environ Res Public Health*. 2022;19(12):7274. doi:10.3390/ijerph19127274
15. Sombatsawat E, Luangwilai T, Ong-Artborirak P, Siri Wong W. Musculoskeletal disorders among rice farmers in Phimai District, Nakhon Ratchasima Province, Thailand. *J Health Res*. 2019;33(6):494-502. doi:10.1108/jhr-01-2019-0009
16. Tripathi SP, Somvanshi SPS, Singh SRK, Mishra A. A review of ergonomic evaluation of occupational hazard of Indian agriculture farm and allied activities. *IntechOpen*; 2021. doi:10.5772/intechopen.98705
17. Vemireddy V, Choudhary A. Labor-saving technologies designed for women can reduce their drudgery. *CGIAR Repository*. 2021;10568/114807.
18. Zorrilla-Muñoz V, Sedano TG, Tomás MSA. Análisis socio ergonómico en la agricultura. *Evaluación del sector oleico desde una perspectiva de género y envejecimiento*. *Inform Tecn Econ Agrar*. 2019. doi:10.12706/itea.2019.005