Original Research Article

Occupational Health Challenges Faced by Farm Women During Brinjal Harvesting in Telangana

ABSTRACT

Aim: The study aimed to assess the drudgery experienced by women farmers during brinjal harvesting, focusing on musculoskeletal challenges, postural risks, and occupational health hazards. It sought to evaluate the ergonomic risks involved and suggest interventions to reduce physical strain.

Study Design: The study employed an explanatory research design to analyze the ergonomic challenges and health hazards faced by women during brinjal harvesting.

Place and Duration of Study: The study was conducted in Kaveliguda village, Shamshabad Mandal, Rangareddy District, Telangana, during the brinjal harvesting season in 2023.

Methodology: Thirty farm women engaged in brinjal harvesting were purposively selected as respondents. Data were collected using structured schedules, including self-reported health symptoms, and evaluated using the Rapid Upper Limb Assessment (RULA) for postural analysis. Quantitative data were analyzed through frequency distributions and percentages.

Results: The study revealed significant musculoskeletal issues, including pain, stiffness, and cramps in the back, neck, legs, and arms. RULA scores indicated high ergonomic risks, necessitating immediate corrective actions. Minimal use of personal protective equipment (PPE) exposed workers to various occupational hazards.

Conclusion: The study concluded that ergonomic interventions, such as improved tools and increased PPE usage, were essential to reducing drudgery, enhancing productivity, and improving the well-being of women farmers.

Keywords: *Brinjal harvesting, Women farmers, Drudgery assessment, Musculoskeletal disorders (MSDs), Ergonomics, Occupational health*

1.INTRODUCTION

Brinjal (Solanum melongena), commonly known as eggplant, is a widely cultivated vegetable crop in India and a vital component of the agricultural economy. Known for its nutritional value and culinary versatility, brinjal is grown extensively by small and marginal farmers, especially in regions like Southern Telangana, where its large-scale cultivation contributes significantly to rural livelihoods. However, the process of harvesting brinjal is labor-intensive and time-consuming, often performed manually by women farmers. These activities involve repetitive movements and sustained awkward postures, which pose significant physical and ergonomic challenges.

Brinjal harvesting primarily entails picking mature fruits from plants of varying heights, requiring farm workers to perform repetitive motions such as bending, twisting, and gripping. These movements, coupled with prolonged exposure to harsh weather conditions, can lead to occupational health hazards. Women farmers, who constitute a major proportion of the agricultural labor force, often bear the brunt of these challenges. The combination of physical strain, inadequate tools, and suboptimal working conditions increases their risk of musculoskeletal disorders (MSDs) and other health problems. Despite the critical role of women in agriculture, their contributions often go unrecognized, and their needs for safer and more efficient tools remain largely unmet.

Ergonomic evaluation is vital to addressing the challenges faced by women farmers in agriculture, particularly in labor-intensive tasks like brinjal harvesting (Shah and Mehta, 2010). Ergonomics, the scientific study of designing tools and processes to fit the user's capabilities, plays a pivotal role in mitigating the physical and occupational risks associated with agricultural activities. For tasks such as brinjal harvesting, ergonomic interventions can help reduce drudgery, improve work efficiency, and minimize health risks (Singh and Gite, 2007). By analyzing factors such as posture, workload, and the physical demands of harvesting, ergonomic studies provide insights into the root causes of discomfort and injury among workers (Saygılı and Çakmak, 2021). Incorporating ergonomics into agricultural practices is not just a matter of enhancing worker safety but also of improving productivity and sustainability. For instance, using women-friendly tools like improved ring cutters can significantly reduce the physical effort required during harvesting, enabling women to adopt safer postures and work more comfortably. Such interventions not only reduce the risk of chronic injuries but also increase work output, thereby benefiting both workers and agricultural productivity. Brinjal crops are particularly vulnerable to pest infestations. Farmers frequently apply chemical pesticides such as organophosphates, synthetic pyrethroids and carbamates to protect the crop. These chemicals, though effective in managing pests are highly toxic and pose serious risks to both human health and the environment. Prolonged exposure to pesticides can lead to acute health effects such as nausea, dizziness, skin irritation, and respiratory problems. The problem is aggravated by the lack of protective clothing and awareness about safe handling practices (Mrema *et al.,* 2017).

Given the dual importance of worker health and agricultural efficiency, ergonomic studies are essential in designing and promoting tools that cater specifically to the needs of women farmers (FAO, 2011; Tewari and Deb, 2014). The objective of this study is to identify the postural challenges and health

hazards experienced during traditional brinjal harvesting. The findings underscore the need for widespread adoption of ergonomic tools and practices to empower women farmers, enhance their productivity and ensure their well-being.

2.MATERIAL AND METHODS

The present study employed an explanatory research design to assess the drudgery faced by farm women in brinjal harvesting. This design was chosen to examine existing practices causing drudgery. The study was conducted in Kaveliguda village, located in Shamshabad Mandal of Rangareddy District in the Southern Telangana Zone. This area was selected due to its extensive cultivation of brinjal over large acres, making it an ideal site for studying harvesting practices and challenges. A total of 30 farm women were selected as respondents for the study, representing those actively engaged in brinjal harvesting activities. Participants were selected who are directly involved in brinjal harvesting activities. This ensures that the data collected is highly relevant and specific to the occupational health challenges under investigation. The sample was chosen purposively to include women from various socio-economic backgrounds who frequently performed this labor-intensive task.

To collect comprehensive data, a structured schedule was developed. The tools and techniques used in the study included: Self-reported data on pain intensity and symptoms of health hazards, such as cuts, numbness, muscle discomfort, and swelling were gathered. Psychophysical parameters, including work demand and feelings of exhaustion, were assessed using Likert scales to record the intensity of effort and fatigue experienced during traditional and improved methods of harvesting. For Posture analysis, Rapid Upper Limb Assessment (RULA) tool was utilized to evaluate the working postures of women during harvesting. This standardized tool provided scores indicating the risk levels associated with different postures. The RULA scores were interpreted to determine the severity of postural risks and recommend corrective measures. Quantitative data were analyzed using frequency distributions and percentages.

3. RESULTS AND DISCUSSION

The postural problems faced by workers while harvesting brinjal crop were studied. Brinjal harvesting can be done in two types like as manual method and mechanized type. Presently the farmers were performing harvesting activity in manual method by the usage of both the hands. The harvesting of brinjal crop is demanding in work, time and energy. At the same time, labor will be used who will be working in different postures that may cause discomfort and pain in their body and if not addressed with suitable intervention it may lead to MSD's.

3.1. General profile of the workers:

3.1.1. Age of the respondents

The findings as presented in Figure 1, indicated that fifty per cent of the farm women belonged to the age group of 31-40 years where as thirty per cent of the farm women were of young age group i.e., < 30 years of age. Only twenty percent of the farm women were between the age group of more than 40 years. Thus the study sample i.e farm women in highly productive period of their life were found to be involved more in brinjal harvesting activity. A study by Rao and Rani (2019) found that middle-aged women in India are more actively engaged in physically demanding agricultural tasks, attributed to their established roles within both their households and the farming community.

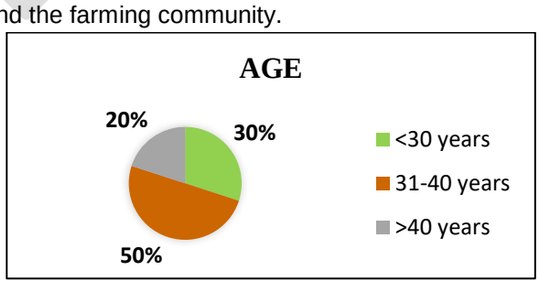

Fig 1. Age of the respondents

3.1.2. Number of years of work experience

The results of number of years of work experience, revealed that nearly sixty three per cent of the farm women had work experience below 10 years and whereas (26%) of farm women had between 11-20 years. Only 10 per cent had above 20 years work experience.

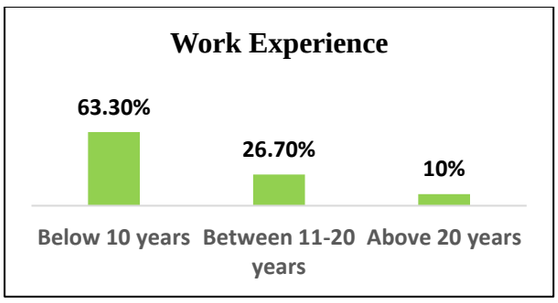

Fig 2. Work experience of the respondents

3.1.3. Height of the respondents:

Human height or stature is the distance from the bottom of the feet to the top of the head in a human body, standing erect, usually measured in centimeters (cm), feet and inches. The height of the females found to be between 145 to 175cms, in which nearly half of the sample (50%) ranged between 156-165, whereas thirty seven percent of women were between 145-155cm and remaining sample (13%) were between 166-175 cm.

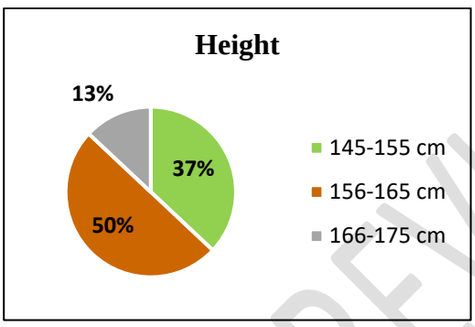

Fig 3. Height of the respondents

3.1.4. Weight of the respondents:

The weight of the person is the heaviness of the body measured while a person is in standing posture. The weight of the respondents was evaluated, where it was found that half of the sample (50%) were between 50-60 kg, which suggests that, women are of normal weight and (43%) were greater than 60kgs of their body weight and very less sample (7%) were <50kgs of body weight.

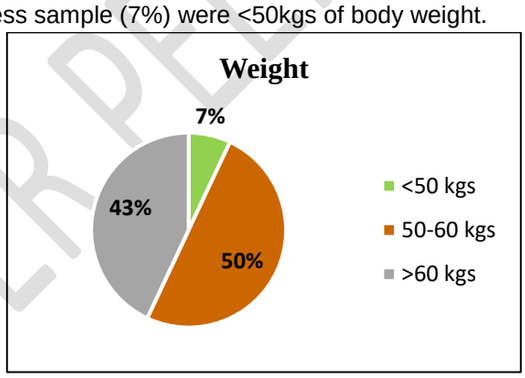

Fig 4. Weight of the respondents

3.1.5. BMI of the respondents:

The BMI of the respondents was categorized using standard classification. The 66.67 per cent of the sample were found to be less than underweight, and 26.67 per cent falls under normal weight range of BMI i.e. 18-25. The overweight respondents were of 6.67 per cent only. The findings indicate that, study sample were under weight.

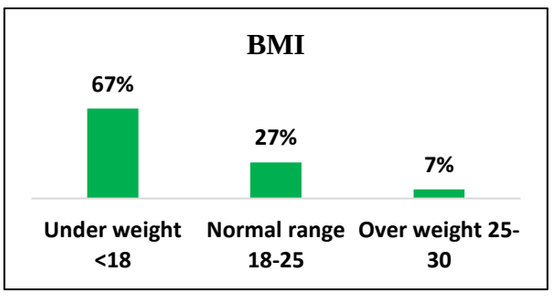

Fig 5. BMI of the respondents

3.2 Assessing Musculoskeletal Symptoms experienced by respondents during brinjal

harvesting

Musculoskeletal disorders (MSD) have been shown to be the most common occupational injury among farmers and elimination of harmful working postures was recommended to improve working conditions. The frequency of experiencing the musculoskeletal symptoms in neck, shoulder, back, legs, fingers and feet varies from never to always. The frequency of symptoms was assessed as never if symptoms were not present. The frequency of symptoms was assessed as rare if prevalence of symptoms was existent for few hours in a week. The frequency of symptoms was assessed as sometimes if prevalence of symptoms was there for 1-2 days in a week. The frequency of symptoms was assessed as frequent if prevalence of symptoms was for 3-4 days in a week. The frequency of symptoms was assessed as always if prevalence of symptoms was present throughout the week.

Table.1: Musculoskeletal Symptoms in different body parts experienced by respondents during brinjal harvesting (N=30)

Body parts	Symptoms	Always (%)	Frequent (%)	Sometimes (%)	Rare (%)	Never (%)
Neck	Feeling of pain	16.6	0	83.3	0.0	0.00
	Occurrence of cramps	0	0	0.0	73.3	26.6
	Feeling of pain radiating to head causing head ache	0	0	47.0	13.0	40
Shoulder	Feeling of pain	16.60	0	66.6	16.6	0
	Occurrence of cramps	10	77	13	0	0
	Feeling Soreness	0	0	10	7	83
Back	Feeling of pain	100	0	0	0	0
	Feeling of stiffness	0	40	37	23	0
	Feeling Soreness	0	47	0	53	0
Fingers	Feeling of pain	30	37	30	3	0
	Feeling of stiffness	0	13	80	7	0
	Occurrence of cramps	23	44	20	13	0
	Feeling of numbness	0	0	7	83	10
	Feeling of burning	0	0	4	70	26
Knees	Feeling of pain	0	0	43	43	14
	Feeling Soreness	0	0	60	0	40
Legs	Feeling of pain	100	0	0	0	0
	Feeling of stiffness	0	40	43	10	7
	Appearance of swelling	3	7	20	30	40
	Occurrence of cramps	54	13	33	0	0
	Feeling of numbness	0	0	10	20	70
	Tingling sensations	0	0	13	87	0
	Feeling of burning	0	0	83	17	0
Feet	Feeling of pain	33	10	57	0	0
	Feeling of stiffness	0	0	20	70	10
	Appearance of swelling	0	0	53	37	10
	Occurrence of cramps	0	0	43	33	23
	Feeling of numbness	0	0	7	0	93
	Feeling of burning	0	0	57	10	33

The frequency of experiencing the musculoskeletal symptoms in neck, shoulder, back, legs, fingers and feet varies from never to always. The frequency of symptoms was assessed as 'never' if symptoms were not present. The frequency of symptoms was assessed as 'rare' if prevalence of

symptoms was existent for few hours in a week. The frequency of symptoms was assessed as 'sometimes' if prevalence of symptoms was there for 1-2 days in a week. The frequency of symptoms was assessed as 'frequent' if prevalence of symptoms was for 3-4 days in a week. The frequency of symptoms was assessed as 'always' if prevalence of symptoms was present throughout the week.

The study revealed significant prevalence of musculoskeletal symptoms among women engaged in brinjal harvesting, highlighting the occupational health risks associated with the activity. The findings indicate that specific body parts such as the neck, back, legs, and feet were particularly affected, with varying degrees of discomfort reported.

Neck Symptoms

Approximately 83.3% of respondents reported neck pain occurring *sometimes*, and 16.6% experienced pain *always*. Cramps in the neck were rarely observed in 73.3% of the sample. Neck pain radiating to the head, causing headaches, was reported *sometimes* by 47% of the respondents. These findings align with the work of Bernard (1997), who identified prolonged awkward neck postures during repetitive tasks as a significant contributor to musculoskeletal disorders (MSDs) in agricultural workers.

Shoulder and Back Symptoms

Pain in the shoulders was frequently noted, with 66.6% of respondents experiencing it *sometimes* and 16.6% reporting it *always*. Additionally, 77% reported frequent cramps in the shoulders, while soreness was less prevalent. For the back, 100% of the respondents reported persistent pain. Stiffness and soreness in the back were also reported frequently (40% and 47%, respectively). These results are consistent with Hildebrandt (2003), who found that repetitive manual labor in agriculture significantly increases the risk of shoulder and back pain due to static and awkward postures.

Leg Symptoms

Leg pain was a major concern, with 100% of respondents experiencing it *always*. Stiffness and swelling were reported by 43% and 20%, respectively, while 54% experienced cramps frequently. This aligns with findings by Osborne et al. (2012), who identified prolonged standing and repetitive motion as major contributors to lower limb MSDs among agricultural workers.

Fingers and Feet Symptoms

Pain and stiffness in the fingers were reported by 30% of respondents *always* and *sometimes*. Burning and numbness were reported less frequently. Similarly, 57% of respondents experienced pain in the feet *sometimes*, while 73.3% reported it *always*. Swelling and cramps in the feet were noted by 53% and 43%, respectively. The repetitive gripping and sustained weight-bearing postures required for harvesting may have contributed to these symptoms, as supported by the work of Punnett and Wegman (2004) and Ekale *et al.,* (2018), who emphasized the link between repetitive tasks and extremity MSDs in agricultural work.

3.3. Usage of Personal Protective Equipment (PPE) by respondents

Personal protective equipment are those that reduces the risk of diseases caused to activities performed. They include face shields, respiratory masks, safety glasses, clean and washable long sleeve clothing, hats that are protective of the eyes and face, chemically resistant boots, gloves, goggles, etc. In this study, it was observed whether the samples are using any PPE while working in the field.

Table 2: Usage of Personal Protective Equipment (PPE) by respondents during brinjal Harvesting (N=30)

			Usage			
S.no	Body parts	**Protective aids**	**Yes**		**No**	
			F	**%**	**F**	**%**
1.	Head	Turban	-	-	30	100
		Hat	-	-	30	100
		Scarf	11	36.6	19	63.3
2.	Upper and Lower arms	Full sleeve shirt	23	76.7	7	23.3
		Gloves	-	-	30	100
		Mittens	-	-	30	100
3.	Foot	Shoes	-	-	30	100
4.	Fingers	Finger guards	-	-	30	100
		Finger caps	-	-	30	100

The findings reveal limited usage of Personal Protective Equipment (PPE) among farm women involved in brinjal harvesting. This low adoption rate exposes them to various occupational hazards such as cuts, sunburn, and chemical exposure, highlighting significant gaps in safety practices.

Head Protection

None of the respondents used turbans or hats for head protection, and only 36.6% used scarves. This insufficient use leaves workers vulnerable to heat and dust exposure, increasing the risk of heatstroke and respiratory issues.

Upper and Lower Arm Protection

While 76.7% of respondents wore full-sleeve shirts, no respondents used gloves or mittens. This lack of hand protection increases the risk of injuries, particularly during tasks requiring repetitive motions or contact with plants and tools. Studies by Nguyen and Tsai (2024) emphasize that gloves are critical in reducing exposure to agricultural hazards and preventing musculoskeletal strain

Foot Protection

None of the respondents wore protective footwear, such as shoes or boots. This omission exposes them to risks such as sharp objects, insect bites, and soil-transmitted infections. According to Sapbamrer and Thammachai (2020), the use of boots significantly reduces injuries and enhances worker safety, yet remains underutilized due to economic and cultural factors.

Finger Protection

No respondents used finger guards or caps, leaving their hands unprotected from cuts and abrasions. Nguyen and Tsai (2024) highlighted that inadequate finger protection is a common issue, often due to the perception that these protective devices hinder efficiency, despite their proven benefits in preventing injuries

3.4. Postural evaluation of workers using RULA

The Rapid Upper Limb Assessment (RULA) is widely used for the investigations of the work posture. RULA was developed specifically to examine the level of risk associated with upper limb of individual. Using the RULA worksheet, a score was assigned for each of the following body regions i.e. wrists, forearms, elbows, shoulders, neck, trunk, back, legs. After the data for each region is collected and scored, tables on the form were then used to compile the risk factor variables, generating a single score that represents the level of MSD risk.

Table 3:Postural evaluation with Rapid Upper limb Assessment (RULA) Scale

RULA	Postural Evaluation	Postural Score
A.	**Arm& Wrist Analysis**	
Step 1	Locate upper Arm Position	1
Step 2	Locate Lower Arm Position	2
Step 3	Locate Wrist Position	4
Step 4	Wrist Twist	**+1**
Step 5	Posture score(Table A)	3
Step 6	Muscle use score	+1
Step 7	Addition of Force/load score	0
Step 8	Table C Row	3+1+0=4
B.	**Neck, trunk and legs analysis**	
Step 9	Locate Neck Position	+3
Step 10	Locate Trunk Position	+4
Step 11	Legs score	+2
Step 12	Posture score(Table B)	**6**
Step 13	Addition of Muscle use score	+1
Step 14	Addition of Force/load score	0
Step 15	Table C	6+1+0=7
	Neck trunk & leg score (Addition of Values from 12 to14)	7
	Table C score=Final RULA Score	**6**

The Rapid Upper Limb Assessment (RULA) results for brinjal harvesting indicate a significant ergonomic risk associated with the postures adopted during the activity. The final RULA score of 6 suggests a high level of musculoskeletal disorder (MSD) risk, necessitating immediate investigation and intervention to improve working conditions.

Upper Arm, Wrist, and Forearm Analysis:The posture score for arm and wrist movements (4) highlights the repetitive and strained upper limb positions required during harvesting. Tasks such as gripping and cutting contribute to cumulative strain. The added muscle use score (+1) reflects sustained force application, indicating fatigue risk.

Neck, Trunk, and Leg Analysis:A high score of 7 in this category reveals significant strain on the neck and trunk due to prolonged bending and twisting postures. Leg postures scored 2, reflecting the impact of prolonged standing, which aligns with findings of discomfort reported by workers during the study.

The results align with global findings where manual agricultural tasks frequently lead to ergonomic challenges. Kakaraparthi et al. (2023) emphasized the effectiveness of RULA in evaluating MSD risks in various occupational tasks, including farming. Their analysis supports using RULA as a diagnostic tool for identifying high-risk postures in repetitive, forceful activities like brinjal harvesting. Jayadi et al. (2020) noted the critical role of ergonomic tools like RULA in preventing work-related musculoskeletal disorders in agriculture

4.CONCLUSION

The study concluded that brinjal harvesting was a labor-intensive activity that imposed significant physical strain on women farmers. Repetitive motions, awkward postures and prolonged work durations led to musculoskeletal discomfort including pain, stiffness and cramps in various body parts. The Rapid Upper Limb Assessment (RULA) scores confirmed high ergonomic risk levels, indicating the necessity for immediate intervention. The use of personal protective equipment (PPE) was found to be minimal, making the workers exposed to occupational hazards such as cuts, sunburn, and fatigue.

Despite their pivotal role in agriculture, the needs of farm women for safer tools and better working conditions were often overlooked. Ergonomic tools and protective measures would have alleviated their drudgery, improved productivity, and reduced health risks. The study highlighted the importance of integrating ergonomic principles into agricultural practices, aiming to enhance both the efficiency and well-being of women engaged in farming activities.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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