

## Prevalence of work-related musculoskeletal disorders in women cultivators

## Prevalência de distúrbios musculoesqueléticos relacionados ao trabalho em mulheres agricultoras

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**ABSTRACT | INTRODUCTION:** Musculoskeletal disorder is one of the major health hazards among agricultural workers. Rural women contribute to agricultural development and household activities and pursue multiple livelihood strategies. Female cultivators' studies on work-related musculoskeletal disorders (WRMSDs) are limited. **OBJECTIVES:** To verify the prevalence of work-related musculoskeletal disorders in female cultivators from Ambala, Haryana, India. **MATERIALS AND METHODS:** 200 female cultivators aged 20-50 years with the ability to read and understand Hindi and having cultivation experience of more than two-year were recruited by non-probabilistic sampling for this cross-sectional study. Hindi version of the Nordic musculoskeletal questionnaire was used to study the prevalence of WRMSDs in female cultivators. Demographic characteristics were presented as mean  $\pm$  standard deviation. Prevalence of work-related musculoskeletal disorders was presented as frequency and percentage. A confidence interval was also reported. **RESULTS:** The yearly prevalence of musculoskeletal disorder in the female cultivators was highest in low back region (57.0%) followed by knee joint (30.5%), shoulder joint (16.5%), wrist/hand (9.5%), neck (9.0%), elbow (6.5%), ankle/foot (2.5%), thighs/pelvis (2.5%) and upper back (2.0%). **CONCLUSION:** The prevalence of WRMSDs in female cultivators of Ambala, Haryana, India, is high. Low back, knee and shoulder were the most affected regions among this population.

**KEYWORDS:** Farmers. Low back pain. Occupational stress. Women. Work.

**RESUMO | INTRODUÇÃO:** O distúrbio musculoesquelético é um dos principais agravos à saúde dos trabalhadores agrícolas. As mulheres rurais fazem contribuições essenciais para o desenvolvimento agrícola, atividades domésticas e buscam múltiplas estratégias de subsistência. Os estudos sobre distúrbios musculoesqueléticos relacionados ao trabalho (DORT) em cultivadoras são limitados. **OBJETIVOS:** Verificar a prevalência de distúrbios musculoesqueléticos relacionados ao trabalho em cultivadoras de Ambala, Haryana, Índia. **MATERIAIS E MÉTODOS:** 200 cultivadoras com idades entre 20-50 anos, com capacidade de ler e entender Hindi e com experiência de cultivo de mais de dois anos, foram recrutadas por amostragem não probabilística para este estudo transversal. A versão em hindi *Nordic Musculoskeletal Questionnaire* foi usada para estudar a prevalência de DORT em cultivadoras. As características demográficas foram apresentadas como média  $\pm$  desvio padrão. A prevalência de distúrbios osteomusculares relacionados ao trabalho foi apresentada como frequência e porcentagem. Intervalo de confiança também foi relatado. **RESULTADOS:** A prevalência anual de distúrbios musculoesqueléticos em cultivadoras foi maior na região lombar (57,0%) seguida pela articulação do joelho (30,5%), ombro (16,5%), punho / mão (9,5%), pescoço (9,0%), cotovelo (6,5%), tornozelo / pé (2,5%), coxas / pelve (2,5%) e parte superior das costas (2,0%). **CONCLUSÃO:** A prevalência de WRMSDs em cultivadoras de Ambala, Haryana, Índia é alta. Lombar, joelho e ombro foram as regiões mais afetadas nessa população.

**PALAVRAS-CHAVE:** Agricultores. Dor lombar. Estresse ocupacional. Mulheres. Trabalho.

## Introduction

Agriculture is considered the chief occupation of the poor and has been recognized as an engine of growth and poverty reduction. In many developing countries, women represent an essential resource in agriculture through their roles as labourers, farmers, and entrepreneurs.<sup>1</sup> Rearing poultry and minor livestock and growing crops, women are responsible for approximately 60% to 80% of food production in developing countries.<sup>2</sup> On average, women comprise 43% of the agricultural labour force in developing countries, ranging from 20% to 50%.<sup>1</sup>

Over the years, there has been a gradual realization of the key role of females in agricultural development and their vital involvement in the field of agriculture. Rural women often manage households and pursue multiple livelihood strategies. Their activities typically include producing agricultural crops, preparing food, collecting fuel and water, caring for family members, and maintaining their homes.

In agricultural activities, females adopt awkward posture for a prolonged period and continue to work in the static postures for a longer duration, due to which they complain about severe musculoskeletal problems in different body regions.<sup>3</sup> Musculoskeletal disorders are injuries or pain in the musculoskeletal system, including the bones, muscles, tendons, ligaments, and blood vessels.<sup>4</sup> They can occur due to repetitive movements, extreme forces, immobile work, awkward postures, and lengthy sitting or standing.<sup>4</sup>

The prevalence of musculoskeletal disorders in agricultural workers is common. Agriculture work is remarkably physically demanding due to stressful activities, including lifting/carrying heavy loads, awkward postures, risk of accidents with machinery, and exposure to whole-body vibrations.<sup>5</sup> Several authors have categorized farming as hazardous and risky work.<sup>6</sup> At times, due to chronic musculoskeletal problems, disabilities can happen. It also affects the

psychological status of people, which affects their families and careers.<sup>7</sup>

The farming work has its own exclusive features. It is not a well-ordered sector and is threatened by various uncertainties like ergonomics stress, changing weather, and viruses associated with weather and new practices of fertilizers and insecticides. Environmental and daily life factors for illness prevalence among farmers are likely to differ between nations.<sup>8</sup> Overall, the labour burden of rural women exceeds that of men as it includes agriculture work as well as a higher proportion of unpaid household responsibilities related to preparing food and collecting fuel and water.<sup>1</sup>

India is one of the major agricultures producing country and 58.4% population of India is involved in agriculture.<sup>9</sup> In India, many states are involved in agriculture production. Haryana is the 15th largest state with total cultivators of 44.96%.<sup>10</sup> In Haryana, 32.5% are male cultivators, and 43.7% are female.<sup>10</sup> A study on rice farmers concluded that female farmers had significantly higher discomfort feeling than male farmers as females performed numerous household activities, which further enhanced their discomfort feeling in their different body parts.<sup>11</sup> Also, the literature indicates that rural women face higher risks because of strenuous physical work.<sup>12</sup> A systematic review identified the prevalence of musculoskeletal disorders by body region in farmers and pointed out that more studies are needed regarding upper and lower extremity musculoskeletal disorders, gender, workplace, and task context of musculoskeletal disorders.<sup>13</sup>

To the best of our knowledge, the literature is scarce in identifying the prevalence of work-related musculoskeletal disorders in female cultivators. Thus, we aimed to find the prevalence of work-related musculoskeletal disorders in female cultivators of Ambala, Haryana, India.

## Materials and methods

The study protocol was approved by the student project committee of the institute. The study was conducted following the Helsinki declaration (Revised, 2013) and National Ethical Guidelines for Biomedical and Health Research involving human participants' guidelines laid by the Indian Council of Medical Research (ICMR, 2017).

### Study design and sampling

After reviewing Ambala rural development block, the following villages were visited during the survey (Adhoya- Adhoyi, Buhawi, Bhudion, Kalarheri, Khojkipur, Mullana, Rao Majra, Shahpur, Punjokhara, Begumpur). The female cultivators were recruited from their homes by quota sampling method for this cross-sectional study.

### Sample size

The sample size was calculated by using the formula  $n = Z_{\alpha}^2 P(1-P)/d^2$  where  $n$  stands for a number of participants,  $Z_{\alpha}$  is level of significance set as 1.96,  $P$  stands for prevalence, and it was set as 85.6% (prevalence of musculoskeletal disorders in a farmer from the previous study).<sup>14</sup> And is an error set as 5%. The estimated sample size was 189. Considering 5% non-respondent rate ( $n=9$ ); sample of 198 was required. We collected a sample of 200 female cultivators.

### Study population

The participants included were female cultivators aged 20-50 years with a Body Mass Index (BMI) of  $<25 \text{ kg/m}^2$ , ability to read and understand Hindi, lifetime non-smokers, non-alcoholics, and having cultivation experience of more than two years.

The female cultivators with blood pressure  $\geq 139/89 \text{ mmHg}$ , heart rate  $\geq 100 \text{ bpm}$ , pregnant females, lactating females, females suffering from any

medical conditions like cardiovascular, neurological, psychiatric disorder, and individuals with recent surgeries, tumour, infection, or any major trauma to the spine causing fracture were excluded.

### Procedure

All the participants were explained in detail about the purpose of the study in the local language. All the participants provided written informed voluntary consent. Height and weight (Equinox, India) were recorded barefoot and minimal clothing. Then BMI was calculated by using the formula  $\text{BMI (Kg/ m}^2\text{)} = \text{Weight (kg) / Height}^2 \text{ (m}^2\text{)}$ .

Nordic musculoskeletal questionnaire (NMQ) is a validated questionnaire to assess musculoskeletal disorders.<sup>15</sup> Hindi version of the Nordic musculoskeletal questionnaire (NMQ) was selected to know the prevalence of work-related musculoskeletal disorders in female cultivators since Hindi is the national language of our country, India.<sup>16</sup> In a very simple way, the participants were asked about their musculoskeletal discomfort in every joints/region of the body, which restricted them from performing their daily living activities during the previous 12 months or in the recent seven days. A body chart was given to designate the chief nine symptom sites: neck, shoulder joint, elbow joint, upper and lower back, wrist/hands, pelvis/thighs, knee joint, and ankle/feet. Participants were then given unambiguous instruction for responding to the Nordic musculoskeletal questionnaire; there was no additional assistance or prompting.

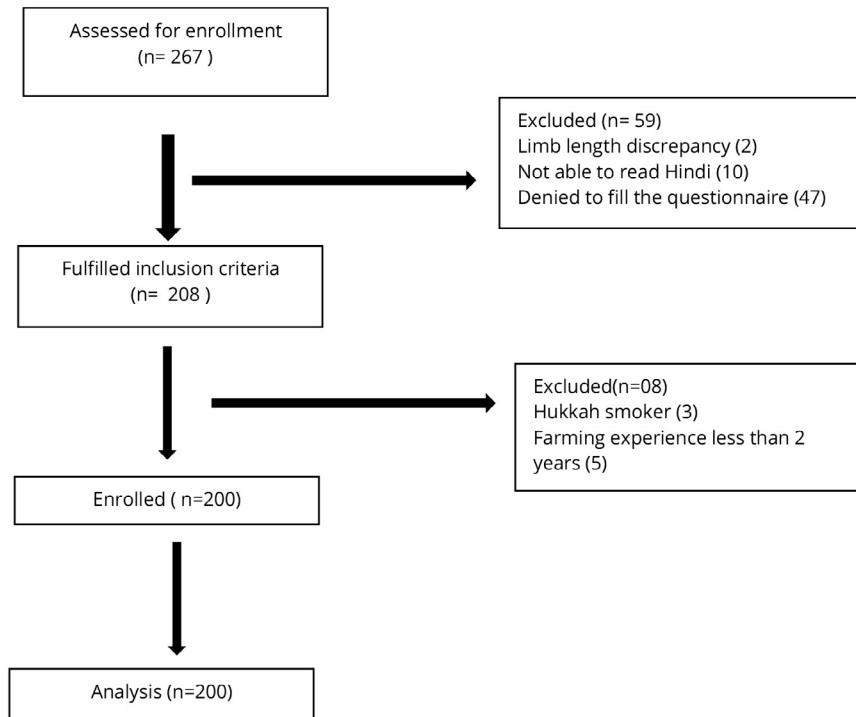
### Statistical Analysis

Statistical analysis was done by using statistical software SPSS 16.0 version. Descriptive statistics were presented. Demographic characteristics were presented as mean  $\pm$  standard deviation. Prevalence of work-related musculoskeletal disorders was presented as frequency and percentage. A confidence interval was also reported.

## Results

The descriptive statistical analysis of data (N=200, female cultivators) showed that the mean age was  $36.58 \pm 8.10$  years. Study flow chart is shown in figure 1.

**Figure 1.** Study flowchart



Demographic characteristics of the female cultivators are shown in Table 1. The cultivators were involved in the farming of different crops.

Out of 200 included female cultivators, 94 were involved in the farming of rice, followed by potato (n=44), sugarcane (n=36), and cauliflower (n=26). The number of days per month spent in cultivation was reported to be  $29.99 \pm 0.14$  days. The number of hours spent in cultivation activities per day was reported to be  $7.67 \pm 1.87$ .

**Table 1.** Demographic characteristics of female cultivators

N= 200	Mean deviation $\pm$ standard deviation	Confidence interval 95%
Age (years)	$36.58 \pm 8.10$	35.457 - 37.703
Height (meters)	$1.56 \pm 0.127$	1.542 - 1.578
Weight (kg)	$51.94 \pm 7.62$	50.884 - 52.996
BMI (kg/m <sup>2</sup> )	$21.22 \pm 1.85$	20.964 - 21.476
Type of cultivators	Percentage	Confidence interval 95%
Rice	47	0.4008, 0.5392
Potato	22	0.1626, 0.2774
Sugarcane	18	0.1268, 0.2332
Cauliflower	13	0.0834, 0.1766

N= Number of participants, BMI=Body Mass Index

The female cultivators reported various musculoskeletal disorders in the last 12 months and the recent seven days. The most frequent site is the low back, Table 2 and 3.

**Table 2.** Body region-wise analysis of the prevalence of work-related musculoskeletal disorders in 12 months of female cultivators

Prevalence of MSDs (N=200)	Frequency (n)	Percentage (%)	CI 95%
NMQ response: neck	18	9.0	0.570 - 0.1385
NMQ response: shoulder joint	33	16.5	0.1196 - 0.2230
NMQ response: elbow joint	13	6.5	0.0374 - 0.1090
NMQ response: wrist/hand	19	9.5	0.0610 - 0.1443
NMQ response: upper back	4	2.0	0.0060 - 0.0521
NMQ response: lower back	114	57.0	0.5007- 0.6367
NMQ response: thighs/pelvis	5	2.5	0.0091-0.0588
NMQ response: knee joint	61	30.5	0.2453- 0.3721
NMQ response: ankle/foot	5	2.5	0.0091- 0.0588

N= Number of participants, MSDs= Musculoskeletal Skeletal Disorders, NMQ = Nordic Musculoskeletal Questionnaire.

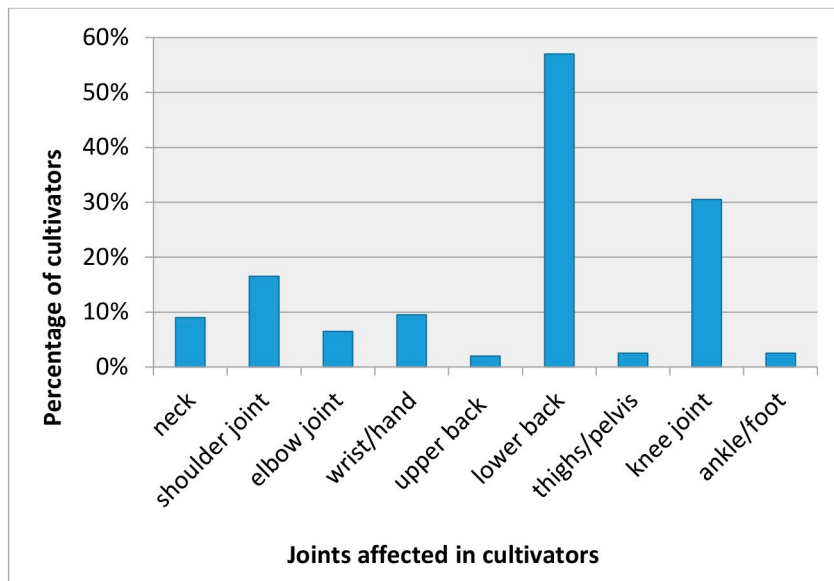
**Table 3.** Body region-wise analysis of the prevalence of work-related musculoskeletal disorders in 7 days of female cultivators

Prevalence of MSDs (N=200)	Frequency (n)	Percentage (%)	CI 95%
NMQ response: neck	18	9.0	0.570- 0.1385
NMQ response: shoulder joint	33	16.5	0.1196-0.2230
NMQ response: elbow joint	13	6.5	0.0374- 0.1090
NMQ response: wrist/hand	19	9.5	0.0610- 0.1443
NMQ response: upper back	4	2.0	0.0060- 0.0521
NMQ response: lower back	114	57.0	0.5007- 0.6367
NMQ response: thighs/pelvis	6	3	0.0123- 0.0654
NMQ response: knee joint	60	30	0.2406- 0.3669
NMQ response: ankle/foot	5	2.5	0.0091- 0.0588

N= Number of participants, MSDs= Musculoskeletal Skeletal Disorders, NMQ = Nordic Musculoskeletal Questionnaire.

Musculoskeletal discomfort that affected the activities of daily living in multiple areas was reported by the female cultivators, Figure 2.

**Figure 2.** Musculoskeletal discomfort in every joints/region of the body restrict them from performing their daily living activities during the previous 12 months in female cultivators



## Discussion

This is the first cross-sectional study to report the prevalence of work-related musculoskeletal disorders in female growers in Ambala, Haryana, India. Our results revealed a high prevalence of musculoskeletal disorders, the lumbar region being the most frequent site.

The burden of musculoskeletal disorders likely varies in different parts of the world.<sup>16</sup> Living, social and working architecture in rural areas varies from the urban or developed area. Women in rural areas, being involved in agriculture and the family's nucleus, are exposed to very diverse tensions and their impact on health.

Our research focused on 20-50 years of rural females having cultivation experience of more than two years in order to improve the representativeness of active agriculture workers. In the present study, women reported that they were involved in cultivation works for approximately 7 hours per day for around 30 days in a month. So, the high prevalence of work-related musculoskeletal disorders in the present study may be due to the greater length of exposure among females for longer work hours. The women do jobs that are time and labour intensive such as sowing, transplanting, harvesting, weeding, and threshing; post-harvest operations like shelling, cleaning, grading, and processing.<sup>17</sup> Also, rural women spend more time than men in domestic work, including time spent in obtaining fuel and water, caring for family, and processing food due to poor rural infrastructure as well as culturally assigned roles. In developing countries: Africa, Asia, and the Pacific, females usually work 12 to 13 hours per week more than males; yet, females' contributions are frequently 'invisible' and unpaid.<sup>18</sup>

The region-wise yearly prevalence of musculoskeletal disorders in female cultivators differed from that of male farmers. In the present study, 57% of female cultivators suffered from low back disorders followed by knee joint pain, shoulder joint pain, wrist/hand pain, neck pain, elbow joint pain, ankle/foot pain, and pelvis/thighs, and upper back pain. However, scholars concluded from a study on male farmers involved in potato cultivation from West Bengal, India, that most farmers suffered discomfort at different parts of the body, especially in the lower back, knee, ankle, and feet regions.<sup>11</sup> The lower-back region of the body was the most affected part, with 100% of male potato cultivators; followed by the ankles (54%), wrists (53%), upper back (37%), and feet (36%) and pain in the hands (74%).<sup>11</sup>



During working hours, cultivators are susceptible to a high risk of adapting work-related musculoskeletal disorders due to repetitive movements, stooped postures, excessive turning, and twisting. During cultivation, falls and slipping on uneven areas can also be the reason for the development of musculoskeletal disorders.<sup>19</sup> It could also be due to different tasks and postures adopted while cultivating different crops. The women reported that the number of days per month spent in cultivation was reported to be 29.99±0.14 days, and the number of hours spent in cultivation activities per day was reported to be 7.67±1.87. The women also reported being involved in activities like spading, planting seeds, picking crops, sprinkling water, and weeding. India is a less developed country; not many resources are available for farmers, lack of machinery and more manual labor leads to increased risk of falls and trips.

Most authors reported low back pain as the most prevalent musculoskeletal disorder. The authors of a systematic review identified the prevalence of musculoskeletal disorders by body region in farmers and established that low back pain was the most common musculoskeletal disorder and 1-year low back pain prevalence was 47.8% (95% CI 40.2-55.5).<sup>13</sup> In the present study, 57.0% of women were suffering from low back region disorder. The probable reason for the high prevalence of low back pain could be forward bending posture for long hours. The present study's findings agree with the previous literature on females.<sup>11</sup>

In the present study, we found that most women were involved in rice cultivation. During rice cultivation, the seeds are sown in the ground in the forward bending posture. Frequent back discomfort may be due to pathological discs or spinal column degeneration.<sup>20</sup> Postures like forwarding, bending, and squatting, wore out the discs and induced threats on the supporting system of the spine.<sup>11</sup> The pressure inside the discs may extensively increase when the trunk bends forward compared withstanding in an upright position. The intra-disc pressure is also higher in the sitting than in the standing posture.<sup>21</sup> An excessive increase in intra-disc pressure has an unnecessary load and strain on the discs. Also, prolonged heavy manual work might encourage the development of degenerative changes in the joints.<sup>13</sup>

The knee joints, followed by the low back region, are the second most prevalent disorder. The females involved in potato cultivation usually work in squatting positions for prolonged hours, leading to high pressure on their knee joints. Prolonged squatting position causes knee pain and increases the risk of musculoskeletal dysfunction.<sup>22</sup> Quadriceps muscle impairment has been strongly associated with stooping with twisting; stooping with twisting and carrying heavy loads is associated with hamstring muscle impairment.<sup>23</sup>

The prevalence of shoulder joint disorders found in this study was 16.5% and in the neck was 9.0%. In the present study, we also found that women who reported more problems in the shoulder and neck region were involved in sugarcane cultivation, which agrees with previous literature.<sup>22-24</sup> The cultivators prepare the land first, and because of the lack of knowledge about new devices, they still work manually, which requires more shoulder and neck movements. Inherent gender bias in the economic system, especially true for female farmers in developing countries where cultural customs and absence of collateral often prevent women from borrowing money and hence female cultivators are less likely than men to use sustainable agricultural practices, and other advanced farming techniques and tools.<sup>24</sup>

The prevalence of wrist/hand, elbow joint, and upper back disorders were 9.5%, 6.5%, and 2%, respectively. The female cultivators do most of the works manually, and the reason for pain in these joints could be the repetitive movements of arms.<sup>22</sup>

The least prevalent work-related musculoskeletal disorder found in our study was ankle/foot and thighs/pelvis. Working in squat sitting is a common tradition in India. Ankle/foot and thighs/pelvis disorders are more susceptible to long-standing posture during work.<sup>22</sup>

In the present study, disorders reported by females were almost the same for the short and long term. Also, the number of women who reported that they had been prevented from carrying out normal activities in 12 months was the same as the number

reporting about the trouble in different body regions in 12 months. This indicates the high prevalence of work-related musculoskeletal disorders in female cultivators. It can also be speculated that once the pain is established, it tends to remain for a year or more, leading to the development of chronic work-related musculoskeletal disorders. Furthermore, the scarcity of ergonomic awareness and knowledge of modernized equipment adds to the disorders.

The limitations of the present study should be acknowledged when interpreting the results. Though blinding was not performed, and the sampling method was non-random, and with quota sampling, external validation cannot be discussed. Nevertheless, the present study's findings provide important information regarding musculoskeletal disorders in female farmers. We could not collect the data on the previous orthopaedic disease, but we had strict inclusion and exclusion criteria to rule out other pathology, but the other factors such as parity and menopausal status were not recorded, which may affect physical health. The postural and ergonomic stress on different muscle groups involved in cultivation activities has not been assessed for this study as these require resources that were not available to us. Also, data on time spent in domestic chores and type of chores could not be assessed, which should be considered in future studies. In future studies, it is important to focus on postural training and raising ergonomic awareness to prevent the development of work-related musculoskeletal disorders in female cultivators. This study sets the backdrop for future studies, including assessing postural stress and the impact of socio-psychological factors on musculoskeletal disorders in female farmers and their cross-cultural comparison.

## Conclusion

The present study's findings suggest that the prevalence of work-related musculoskeletal disorders in female cultivators of Ambala, Haryana, India, is high. The most prevalent regions affected by the work-related musculoskeletal disorder in the female cultivators are the low back, followed by the knee joint and shoulder joint.

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## Authors' contributions

Kaur P designed the experiments, collected the data, and wrote the manuscript. Vaish H designed the experiment, analyzed the data, contributed critical intellectual content, and wrote the manuscript.

## Competing interests

No financial, legal, or political conflicts involving third parties (government, corporations and private foundations, etc.) have been declared for any aspect of the submitted work (including, but not limited to grants and funding, advisory board participation, study design, preparation of the manuscript, statistical analysis, etc.).

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