CHONSING SHIMRAH, SHANTI LAL MALIK, SHIVANI CHANDEL

SCARS OF BEING A FARMER: A STUDY ON MUSCULOSKELETAL DISORDERS AMONG A FARMING COMMUNITY OF HARYANA, INDIA

ABSTRACT: The present study aims to estimate the burden and risk of Musculoskeletal Disorders among Indian farmers in Haryana. A total of 634 participants were recruited in this present study. The Nordic Musculoskeletal Disorders Questionnaire was used to assess the prevalence of Musculoskeletal Disorders. A modified interview schedule was used to assess and identify the major socio-demographic and work-related variables of the participants. Further, the collected data were entered and cleaned using MS Excel. IBM SPSS vs.20 was used for statistical analysis. Description for continuous variables is presented as mean± SD and median. Categorical variables are reported as count (N) and percentage (%). T-test and chi-square were used to examine the significant differences between the groups. Binary logistic regression was run to find the risk of socio-demographic variables in Musculoskeletal Disorders. For all statistical analyses, the p-value of <0.05 was considered to be significant. The most common type of MSD in the studied populations was knee pain (48.3%) followed by lower back pain (38.6%) and shoulder pain (29.7%). Female and non-literate participants were found to be at higher risk for the development of MSDs as compared to their counterparts. Consumption of alcohol and smoking were found to have reduced the risk for the development of MSDs. Early ergonomic interventions in the form of the use of the right size of tool, good postural adaptation, and updated farm equipment among the farming communities will help them in combating Musculoskeletal Disorders.

KEY WORDS: Musculoskeletal disorders – Farmers – Haryana – Farmer – India

INTRODUCTION

Farming is commonly portrayed as idyllic, but in recent years it has been recognized as an occupation that is associated with a multitude of risk factors for chronic illness due to repeated exposure to occupational-related diseases and hazards (Das, Gangophadya 2011, Kolstrup 2012). Farmers are particularly at higher risk for the development of occupational diseases due to their nature of work, which includes a highly intensive work routine

(Crowley *et al.* 2007) at every stage of farming (Das *et al.* 2011). Such labor-intensive exposed them to adverse work-related risk factors such as repetition of working in awkward position, static posture, and long working hours (Holmberg *et al.* 2018, Jain *et al.* 2018a). Despite all these risk factors farming is still one of the major occupations in many middle and lower-income countries (International Labor Organization 2018), especially in countries like India, where more than 70% of rural families are dependent on agriculture for a living (Census of India 2011, Food and Agriculture Organization of the United Nations 2015).

Musculoskeletal disorders (MSDs) have become one of the leading occupational diseases among farmers "Musculoskeletal disorders can be defined as a wide scale of degenerative and inflammatory conditions that cause distress in joints, muscles, ligaments, tendons, supporting blood vessels and peripheral nerves" (Punnett, Wegman 2004, Walker-Bone, Palmer 2002). MSDs is a chronic condition with low mortality, but high morbidity (Bevan 2015). It has become a leading contributor to disability and chronic illness worldwide (Storheim, Zwart 2014, WHO 2019). Globally, the prevalence of MSDs ranges from 14% to 42%. In developing countries like India, the prevalence of MSDs in the adult population ranges from 6.92%–76.8% (Kumar 2019). There is an evidence of farmers showing severe symptoms of MSDs affecting their hands and forearms, lower back, and hip (Das *et al.* 2015, Jain *et al.* 2018(b), Mishra, Satapathy 2019, Holmberg *et al.* 2002). The common symptoms of MSDs, include pain, stiffness, reduced mobility, and decreased physical functioning, making it hard to carry out everyday tasks (Spiers *et al.* 2005). MSDs are the third leading cause of disability-adjusted life years (DALYs) and the highest single cause of years lived with disability (YLD) worldwide (Murray *et al.* 2010). The pain and discomfort at the later stage can develop into long-term illnesses such as osteoarthritis, osteoporosis, sarcopenia, and lupus erythematosus respectively (WHO 2019). As a result, these kinds of disabilities lead to extensive loss of productivity at the workplace and home, absenteeism, early retirement from work, and reduced ability to participate in social roles, reluctance to disclose the medical condition to avoid discrimination at work (Alexopoulos *et al.* 2004, Bevan 2015).

For farmers, physical well-being is a necessity to carry out daily tasks and any kind of pain or discomfort will have adverse effect on their productivity. Hence, MSDs not only affect their physical health but also their social, psychological, and environmental well-being.

Accumulation of all the costs of MSDs can give rise to reduced quality of life. The likelihood of a high prevalence of MSDs amongst farmers in India is highly expected as it predominantly an agriculturalist society. Several studies have reported a higher prevalence rate of MSDs among farmers as compared to other occupationally active groups (Holmberg *et al.* 2002, Ng *et al.* 2014). Therefore, the present aim of the study was to estimate the prevalence of MSDs among Indian farmers and to identify the key risk factors of MSDs.

MATERIAL AND METHODS

Study population and setting

This cross-sectional study among 634 farmers (252 males and 382 females) was recruited from 15 villages of Palwal District Haryana. These villages were predominantly inhabited by the Jat population and their primary occupation were farming. The participants in the studied population practice mixed crop and rotation farming. The major types of crops grown were cotton (band), wheat (keahu), sugarcane (kanna), rice (than), millet (bajra), sorghum (jowar), and vegetables. In addition, the dairy farming and related activities were also primary work for females' population.

Sample size calculation

The sample size for the study was estimated using Krejice and Morgan sample size criteria (1975)
$$S=X^2 NP (1-P) +d^2 (N-1) +X^2 P(1-P)$$
Where:
S: required sample size: the chi-square table value for one degree of freedom at the chosen confidence level (3.841)
N: the population size
P: the population proportion (assumed to be 0.50 since this would provide the maximum sample size) d: the degree of accuracy expressed as a proportion (0.05). The population size of the Jat population was 95% confidence interval and 5% allowable error and it comes out to 384. As a result, a minimum of 384 study individuals were required to carry out with statistical adequacy. However, it was decided to enrol as many individuals as possible during the fieldwork. A total of 634 participants was recruited for this study.

Inclusion Criteria and exclusion criteria

All Jat farmers above the age of 35 years (with at least 10 years of experience in farming) who voluntarily participated were included in the study. Farmers who

do not belong to the Jat community were excluded. Farmers with any physical or psychological problems will be excluded from the study.

Ethical approval

The study was conducted according to Helsinki guidelines for human participant research which was given in 1964. Ethical approval was obtained from the Ethical committee of the Department of Anthropology, University of Delhi. Permission to recruit the farmer participant was obtained from the village head (Sarpanch). The objectives of the study were explained orally to each participant. Written informed consent was obtained from each participant.

Data collection

Socio-demographic lifestyle assessment

Data was collected using paper-based questionnaire composed of two parts. The first part of the questionnaires consists of demographic data like name, age, sex, alcohol consumption, smoking and education. The second part of the questionnaire consist of questions that collect work-related information such as years of experience in farming, number of working hours, size of the farm, type of work, history of MSDs, and medication of MSDs.

Musculoskeletal disorders assessment

NMQ (Nordic musculoskeletal questionnaire) (Crawford 2007, Kuorinka *et al.* 1987) was used to examine reported musculoskeletal disorders symptoms in 9 body regions. Standardized Nordic Questionnaire evaluates pain and discomfort experienced by the individual at different positions on the body during the last 12 months and within the last 7 days before the survey.

Statistical analysis

In this study, data were analyzed using IBM SPSS software. Description for continuous variables such as age. On the other hand, categorical variables are reported as count (N) and percentage (%). A normality test was run to check whether the data were normally distributed and passed the Kolmogorov-Smirnov test before analysis. Skewed data were presented as a median and inter-quartile range. Cronbach alpha was calculated to tests the reliability of the questionnaires. The Chi-square and Man Whitney U-test were used to test the statistical significance between categorical and continuous variables. Binary logistic regression was run to to find the risk of socio-demographic variables on MSDs.

RESULT

The distribution of MSDs across various demographic and work-related variables is given in *Table 1*. The result reveals that the prevalence of MSDs was higher among married participants (87.0%) as compared to unmarried and widow/divorced participants (13.0%). The literacy rate of the total participants was
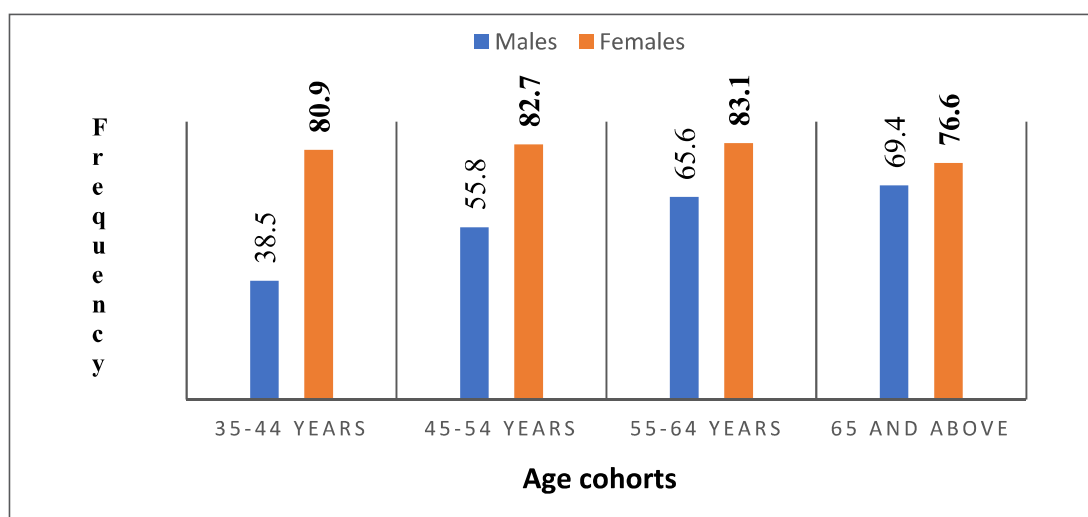

FIGURE 1: Distribution of MSDs in various age cohorts.

TABLE 1: Distribution of MSDs in various socio-demographic and work-related variables.

Variables		Total n (%)	No MSDs n (%)	MSDs n (%)	p-value
Median Age (QR)		54.07 (35.0–62.8)	54.4 (48.4–62.3)	53.9 (47.9–62.8)	0.770[1]
Marital Status	Married	554 (87.4)	147 (88.6)	407 (87.0)	0.552
	Widow/Divorced/Unmarried	80 (12.6)	19 (11.4)	61 (13.0)	
Education	Non- literate	372 (58.7)	83 (50)	289 (61.8)	0.026*
	Literate	262 (41.3)	83 (50)	179 (38.2)	
Dietary pattern	Vegetarian	626 (98.7)	164 (98.8)	462 (98.7)	0.939
	Non- vegetarian	8 (1.3)	2 (1.2)	6 (1.3)	
Alcohol	No	559 (88.2)	133 (80.1)	429 (91.0)	<0.001**
	Yes	75 (11.8)	33 (19.9)	42 (9.0)	
Smoking	No	626 (98.7)	70 (42.2)	245 (52.4)	0.024*
	Yes	8 (1.3)	96 (57.8)	223 (47.6)	
Farm size	>1 acre	38 (6.0)	5 (3.0)	33 (7.1)	0.148
	1–5.0 acres	460 (72.6)	122 (73.5)	338 (72.2)	
	5.1–10.0 acres	89 (14.0)	25 (15.1)	64 (13.7)	
	10.1–15.0 acres	27 (4.3)	6 (3.6)	21 (4.5)	
	15.1 acres and above	20 (3.2)	8 (4.8)	12 (2.6)	
Hours of working (per day)	>1 hour	4 (0.6)	3 (1.8)	1 (0.2)	0.593
	1–3 hours	162 (25.6)	38 (22.9)	124 (26.5)	
	4–6 hours	293 (46.2)	79 (47.6)	214 (45.7)	
	7–9 hours	117 (18.5)	28 (16.9)	89 (19.0)	
	10 hours and above	58 (9.1)	18 (10.8)	40 (8.5)	
Farming experience (years)	10–20 years	209 (33.0)	56 (33.7)	153 (32.7)	0.217
	21–30 years	187 (29.5)	48 (28.9)	139 (29.7)	
	31–40 years	150 (23.7)	43 (25.9)	107 (22.9)	
	41–50 years	74 (11.7)	13 (7.8)	61 (13.0)	
	51 and above	14 (2.2)	6 (3.6)	8 (1.7)	
Hire farm worker	No	346 (54.6)	87 (52.4)	259 (55.3)	0.514
	Yes	288 (45.4)	79 (47.5)	209 (44.6)	
Distance of farm	>1 km	82 (12.9)	12 (8.9)	49 (13.0)	0.643
	1.0–2.4 km	502 (79.2)	110 (81.5)	287 (76.1)	
	2.5–3.4 km	36 (5.7)	10 (7.4)	28 (7.4)	
	3.5–4.4 km	5 (0.8)	1 (0.7)	6 (1.6)	
	4.5 and above	9 (1.4)	7 (1.9)	7 (1.9)	
Operate farming machinery	No	413 (65.1)	115 (69.2)	298 (63.6)	<0.001**
	Yes	221 (34.9)	51 (30.7)	170 (36.3)	

[1]Mann Whitney U test. *p-value 0.05 considered significant; ** p-value 0.001 considered significant.

comparatively low. Therefore, non-literate participants were found to have a higher prevalence of MSDs (61.8%) as compared to literate (38.2%). In the study population, only a negligible percentage of participants were non-vegetarian as a result participant with MSDs and without MSDs were higher among vegetarians. Consumption of alcohol was higher among participants without MSDs (19.9%) as compared to participants with MSDs (9.0%). Further, the result shows that participants who do not indulge in smoking have a significantly higher prevalence of MSDs (57.8%) as compared to smokers (47.6%) in the study population.

The result reveals that the prevalence of MSDs was highest among farmers who works for 4–6 hours per day. The prevalence of MSDs was found to be highest among farmers with 10–20 years of farming experience. Farmers who did not hire farm workers had a higher prevalence of MSDs (55.3%) as compared to those farmers who do not hire farm workers (44.6%). In the present study, it was very common for farmers especially those farmers without vehicles or tractors to walk 1.0–2.4km. Farmers without machines for farm work have a higher prevalence of MSDs.

The distribution of MSDs in the different age cohorts is given in *Figure 1*. The result reveals that females have

TABLE 2: Sex-wise distribution of MSDs prevalence in various body parts.

Body parts	MSDs			χ^2 p-value
	Total n (%)	Males n (%)	Females n (%)	
Neck	99 (15.6)	31 (12.3)	68 (17.8)	0.062
Shoulder	188 (29.7)	48 (19.0)	140 (36.6)	<0.001**
Elbow	134 (21.1)	35 (13.9)	99 (25.9)	<0.001**
Wrist	134 (21.1)	35 (13.9)	99 (25.9)	<0.001**
Upper back	59 (9.3)	14 (5.6)	45 (11.8)	0.008**
Lower back	245 (38.6)	57 (22.6)	188 (49.2)	<0.001**
Thigh	57 (9.0)	17 (6.7)	40 (10.5)	0.109
Knee	306 (48.3)	113 (44.8)	193 (50.5)	0.161
Ankle	118 (18.6)	24 (9.5)	94 (24.6)	<0.001**

*p-value 0.05 considered significant; ** p-value 0.001 considered significant.

TABLE 3: Risk of socio-demographic and lifestyle factors on MSDs.

Variables		Odds ratio		
		β	95% CI	p-value
Sex	Males	Referent		
	Females	2.650	(1.845–3.808)	<0.001**
Marital status	Married	0.862	(0.498–1.492)	0.597
	Widow/Divorced/ Unmarried	Referent		
Education	Literate	Referent		
	Non-literate	1.615	(1.130–2.307)	0.009*
Dietary pattern	Non-vegetarian	Referent		
	Vegetarian	0.939	(0.188–4.699)	0.939
Alcohol consumption	No			
	Yes	0.397	(0.242–0.652)	<0.001**
Smoking status	No	Referent		
	Yes	0.664	(0.464–0.949)	0.025*

*p-value 0.05 considered significant; ** p-value 0.001 considered significant.

a higher prevalence of MSDs in all age cohorts as compared to males. Further, among the female participants the prevalence of MSDs was highest in the 55–64 years age group. Whereas, in the case of males, the prevalence of MSDs linearly increase as age increases and peaked in the 65 years and above age group.

Distribution of MSDs in various body parts are given in *Table 2*. The most common MSDs experience by the studied population was on the knee, lower back, and shoulder. It was found that 48.3% of total participants had MSDs on the knees. 50.5% of females and 44.8% of males were found to have knee pain. Lower back pain was the second most prevalent MSD among the Jat farmers. 49.2% of females and 22.6% of males were found to have lower back pain. Further, results reveal that 36.6% of females and 19.0% of males were found to have MSDs on the shoulder.

The risk of various socio-demographic variables on MSDs is given in *Table 3*. Binary logistic regression analysis was done to find the risk of socio-demographic variables on MSDs. The test result reveals that sex and education pose a significant risk of OR 2.650 and OR 1.615 respectively, for the development of MSDs. Furthermore, smoking and drinking alcohol were found to have reduce risk for the development of MSDs by OR 0.664 and OR 0.397 for the development of MSDs respectively.

DISCUSSION

MSDs were higher among married participants as compared to unmarried and widow/divorced participants. The absence of spouse support and lack of interaction might be the reason for the high MSDs prevalent among widows/ divorced. The role of couple functioning has been known to play a vital role in the context of pain in terms of receiving marital satisfaction, spouse responses to pain, spousal support, and marital interaction (Leonard *et al.* 2006). The previous study has reported that marital status was also associated (p < 0:001) with all musculoskeletal pain variables, osteoarthritis, osteoporosis, and rheumatoid arthritis (Rehling *et al.* 2019). Studies have described that in the context of pain, satisfaction in marital relationships are a protective factor (Reese *et al.* 2010). Therefore, unmarried individuals might be more at risk for development of MSDs as compared to married individuals.

Further, in the present study, non-literate participants were found to have a higher prevalence of MSDs. The previous study among the adult population also recorded higher prevalence of chronic pain among the lower level of education (Dahlhamer *et al.* 2018). A higher prevalence of MSDs in the present population could be explained as literate participants were more likely to have a job other than farming. As a result, they tend to engaged in only few hours a day in farming or work during weekends only. However, non-literate participants engage solely in farming activities resulting in longer working hours and a more intense workload exposing them to the more physical risk factor of MSDs. In addition, literate farmers have better knowledge regarding more productive farming, the use of machinery, advanced methods in farming, and redeem benefits from government policies and also have the financial capability to employ labourer for their farm work.

In the present study population, only a negligible percentage of participants were non-vegetarian as a result participant with MSDs and without MSDs were higher among vegetarians. The bone health of vegetarians is still a topic of interest for many years but the data and findings are inconclusive. The high prevalence of MSDs might be explained as vegans usually have a substantially lower Ca intake unless they consume a lot of Ca-rich plant foods such as dark-green vegetables due to a plant-based diet that lacks Vitamin B12, and Iron (Key *et al.* 2006). However, the role of diet needs to be elucidated further in future with larger sample size.

Consumption of alcohol was higher among participants without MSDs as compared to participants with MSDs in the studied population. To date, there are limited research conducted on relation between alcohol use and pain (Lawton, Simpson 2009). Few studies have explained that diagnoses of both alcohol abuse/dependence and depression are common in chronic pain patients (Bacon *et al.* 1994, Katon *et al.* 1985). However, in contrast to this Booker *et al.* (2003) concluded that fear and avoidance of pain, commonly observed in pain patients, had been disinhibited by alcohol use and over a period of time patients had obtained a higher fitness level. Although some studies indicate that drinking alcohol may have a positive effect, with frequent consumption protecting against the development of chronic widespread pain (Bergman 2002, Castillo 2006). However, a longitudinal follow-up study with large sample size is required to find the mechanism of the relationship between alcohol used and MSDs.

Further, the result shows that participants who do not indulge in smoking have a significantly higher prevalence of MSDs (57.8%) as compared to active smokers (47.6%) in the study population. There are

debates over whether smoking acts as a protective or a risk factor for the development of MSDs (Goldberg *et al.* 2000, Weingarten *et al.* 2011). A study has reported that smokers had a decreased prevalence of knee osteoarthritis compared with non-smokers (Felson *et al.* 1989). However, a meta-analysis on this issue concludes that the protective effect of smoking on Osteoarthritis observed in some epidemiological studies is likely to be false (Hui *et al.* 2011). Therefore, the result is inconclusive and there is a need to study a larger sample size to find out the risk of smoking on MSDs. In addition, the frequency and quantity of alcohol consumption should be correlated with MSDs in order to get conclusive results to find what unit/level of alcohol consumption plays a protective role for MSDs till becoming a threat to health.

In the present study, the prevalence of MSDs is very high as they are exposed to a multitude of risk factors of MSDs (Das *et al.* 2013). However, the prevalence of MSDs in the present study is higher than to farmers in Trinidad (61%) (Baksh *et al.* 2015) and Malaysia (43.4%) (Ng et al. 2014) but less prevalent compared to farmers of Rajasthan (77.9%) (Jain *et al.* 2018), Tamil Nadu (83.6%) (Vasanth *et al.* 2015), West Bengal (90%) (Das *et al.* 2011). Therefore, the prevalence of MSDs is higher among Indian farmers as compared to farmers in other countries. In many rural areas in India, despite advancements in farming tools and technologiesfarmer still rely on traditional tools and techniques. This traditional farming method demands physically exhausting tasks such as the repetition of awkward working positions, static posture, long working hours, and rigorous work routines (Walker-Bone, Palmer 2002, Davis, Kotowski 2007, Osborne *et al.* 2010). Further, it was found that females have a significantly higher prevalence of MSDs as compared to males. According to clinical research, females are more prone to MSDs since their bone mass is weaker (Lips 1997) and they have a lower bone density (BMD). In addition, reproductive events such as menopause can give rise to an imbalance between resorption (dissolution of bone minerals and destruction of organic bone matrix) and bone production rates (Clarke *et al.* 2010). Moreover, the health burden of females multiplies in the farming community because they perform all the tedious work and back-breaking tasks on the farm (Moharana *et al.* 2015) as well as perform numerous household activities which further heightened their discomfort feeling in their various body's parts (Das 2015).

Although there was a high prevalence of MSDs only few participants proper seek medical attention for MSDs. Farmers tend to be deprived of seeking basic medical attention, as they are bound to work throughout the year. Farmers are self-employed with limited manpower to take over their work tasks. They often lived in an area located far from medical institutions which is why they used painkillers for short-term relief. However, the use of short-term relief, in the long run, may lead to the development of many additional health risks such as gastrointestinal problems, renal failure, liver failure, and heart failure (Voaklander *et al.* 2006).

The most common MSDs experience by the study population was on the knee, lower back, and shoulder. Similarly, a previous study among Thai farmers has reported a high prevalence (54.04%) of knee pain (Puntumetakul *et al.* 2018). The task carried out by the farmer involves a lot of squatting during harvesting, milking, planting, and weeding. This repetitive and prolonged squatting posture could explain the development of knee pain (Gupta, Nandini 2015). A high prevalence of knee pain might be associated with physical activity risk factors such as prolonged walking, standing, and side sitting. It might also be linked to their inability to maintain a weight-bearing stance.

Future research should focus on the effect of alcohol and smoking with case and control research design to elucidate etiological role of smoking and drinking alcohol on chronic pain and illnesses.

CONCLUSION

The present study on farmers and their health is important especially in a country like India where 70% of the population engages in agriculture. MSDs seriously hamper the Quality of life and reduce efficiency at work as well as at home. This would lead to less yield of agricultural produce which will adversely affect farmers social, financial and mental wellbeing. Therefore, MSDs studies are extremely valuable and awareness programs should be conducted among farming communities regarding the risk factors of MSDs. Early ergonomic interventions in the form of use of the right size of the tool, good postural adaptation, clothing, and updated farm equipment among the farming communities will help them in combating MSDs.

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Chonsing Shimrah[1], Shanti Lal Malik[2,]
Shivani Chandel[3*]

[1]Performance Analyst-Anthropometry,
 Sports Authority of India, NSRC
 Lucknow, Uttar Pradesh-226008
 E-mail: chonsingshimrah14@gmail.com
[2]Department of Anthropology,
 University of Delhi, Delhi-110007
 E-mail: slmalik@yahoo.com
[3]Department of Anthropology,
 University of Delhi, Delhi-110007
 E-mail: vs.shivani@gmail.com

*Corresponding author.