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Original Article

Factors associated with shoulder pain and disability among Nepalese farmers

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ABSTRACT

Introduction: Shoulder pain (SP) is a common concern impacting the quality of life (QOL) and productivity of Nepalese farmers. However, the factors contributing to SP are not fully understood. This study aimed to identify the bio-psychosocial factors influencing SP and disability in Nepalese farmers.

Methods: A cross-sectional study was conducted using convenience sampling, involving 122 full-time farmers seeking treatment for SP. Data were collected from December 2022 to April 2023. The Nepalese version of the Shoulder Pain and Disability (SPADI-NP), Tampa Scale of Kinesiophobia (TSK-11-NP), and Pain Catastrophizing Scale (PCS-NP) were used for data collection. Univariate and multivariate linear regressions were performed to determine the contributing factors of SP and disability.

Results: TSK-11-NP, PCS-NP, age, gender, and education were significantly associated with SPADI-NP, with TSK-11-NP (R^2=0.42) and PCS-NP (R^2=0.40) demonstrating the highest association in univariate regression. In multivariate regression, the first model with a constant and TSK-11-NP explained 42% of the variance in SPADI-NP. Adding age, gender, and education sequentially, the model improved the ability to explain the variance in SPADI-NP to 46%, 48%, and 50%, respectively. The results indicated that psychological factors were the strongest factor associated with SP and disability.

Conclusion: Heightened kinesiophobia, pain catastrophization, advancing age, female gender, and low level of education significantly contributed to SP and disability in Nepalese farmers. A comprehensive approach addressing these bio-psychosocial factors would be necessary for managing SP and disability and possibly improving the QOL of the local farmers in the region.

Keywords: Catastrophization, Disability evaluation, Farmers, Kinesiophobia, Shoulder pain

Introduction

Shoulder pain (SP) is the third most prevalent work-related musculoskeletal disorder (WMSD) in occupational health and stands out as a common complaint, particularly in farming.[1] A systematic review indicated that the one-year prevalence of SP related to WMSDs ranges from 25.9% to 71.4%.[1] The prevalence of SP in farmers varied largely across countries, with 43%, 57.1%, and 90% among farmers in Korea,[2] India,[3] and Nigeria,[4] respectively. Likewise, the prevalence of SP was 10% and 94.8% among farmers from Bhaktapur, Nepal[5] and harvesters from eastern Nepal,[6] respectively. This high prevalence of SP among farmers directly affects their activities of daily living, work performance and quality of life (QOL). It also creates a substantial burden on healthcare systems and lowers productivity, highlighting the importance of understanding and addressing the factors contributing to SP in this population.

The varying prevalence of SP among farmers in different regions also suggests that location-specific factors play a crucial role. In Nepal, grain farming is the mainstay of the economy, with traditional labor-intensive practices being common. These practices involve prolonged sustained postures, repetitive and high-force movements, and heavy material handling, all of which contribute to SP.[4] South Asian farmers, including those in Nepal, work more than 48 hours a week,[3,7] much longer than farmers in developed countries. A mean daily working hour of 8.4 hours was associated with increased musculoskeletal pain in farmers, and Chinese farmers working for over 10 hours daily had 2.66 times higher odds of developing SP.[8]

Additionally, several other biological factors contribute to SP and disability. For example, age is a significant factor, with SP being more prevalent among farmers over 50 years.[9,10] Female farmers were more exposed to ergonomic risks, such as heavy workloads and tasks requiring arm elevation above shoulder height than their male counterparts.[9] Additionally, smoking significantly increased the risk of SP in workers, including farmers, with smokers being 6.8 times more likely to develop subacromial impingement syndrome (SIS) than non-smokers.[11] Obesity is another factor associated with SP, with obese individuals experiencing severe pain compared to those who are normal or overweight.[12]

Besides work-related and biological factors, socioeconomic factors have also been associated with SP. Education was identified as one of the most consistent predictors of pain and disability in patients with SIS.[13] In fact, lower education levels are correlated with poorer SP and disability outcomes.[13] Additionally, patients with SIS and low education levels were 4.3 times more likely to be unemployed after one year compared to those with higher education.[13] This highlights the role of educational attainment in influencing both health outcomes and work status among those with SP. However, evidence regarding the impact of education on SP and disability among farmers is limited.

Fear is one of the highlighted psychological factors in musculoskeletal pain. According to the fear-avoidance model, a maladaptive pathway related to the pain experience can lead to chronicity, increased perceived pain, hypervigilance, greater disability, and lower levels of QOL among those with chronic musculoskeletal pain.[14] A case-control study reported a significant association of fear of movement or kinesiophobia with higher levels of disability, pain, and anxiety in patients with chronic SP.[14] Furthermore, a systematic review has also documented that pain-related beliefs, including fear, can predict the progression of both pain intensity and disability in individuals with SP.[15] Fear of movement was reported as a barrier to patient participation in exercise and physical therapy programs.[14] Identifying these fear-related factors could, therefore, improve not only exercise compliance but also overall treatment adherence and outcomes.

Pain catastrophizing, another major psychological factor is an exaggerated negative mindset during painful experiences.[16] It has been linked to worse pain outcomes and higher disability in those with chronic pain.[16] Patients with chronic SP exhibited higher levels of pain catastrophization.[15,17,18] A significant association between pain intensity and catastrophization in patients with frozen shoulders was identified suggesting the need to address both psychosocial and biomedical factors in its management.[18]

However, the available information on these contributing factors predominantly comes from developed countries, covering diverse occupations and cultures. This creates a substantial gap in understanding the bio-psychosocial contributors to SP and disability specific to Nepalese farmers engaged in traditional manual farming on terraced fields. Identifying the factors contributing to SP and disability specific to Nepalese farmers is essential for creating a more comprehensive approach and/or strategy in reducing SP and improving the QOL of the local farmers in the region. Therefore, this study aimed to identify the bio-psychosocial factors associated with SP among Nepalese farmers.

Methods

A cross-sectional study was conducted at Dhulikhel Hospital in Kavrepalanchowk district and its outreach centers, including Dolakha Hospital and Kirnetar outreach center from Dolakha district. These locations are situated in the hilly regions of Nepal. Data were collected using convenience sampling from December 2022 to April 2023. Ethical approval was obtained from the institutional review boards of Mahidol University and Kathmandu University School of Medical Sciences.

The participants were full-time farmers seeking medical treatments for SP. Eligible participants were 18 years and above, had been involved in farming for at least two years, understood Nepali,

and experienced at least mild SP, as indicated by having ≥3 out of 10 on the numerical pain rating scale (NPRS). The sample size was calculated using the formula proposed by Green[19] to determine the minimum number of subjects required to conduct multiple regression analysis with 80% power and 0.05 alpha. The formula was N≥50 + 8 (m), where N was the total sample and m was the number of the predictor variables (9 variables). Based on this, the minimal number of participants required was 122.

A total of 157 consecutive farmers with SP were screened. Of these, 122 met the inclusion criteria and were enrolled in the study. Thirty-five potential participants were excluded for various reasons, including part-time farming, history of neck surgery or cervical radiculopathy, or non-farming occupations. Written and verbal informed consent were obtained from all participants. The study collected data on socio-demographic factors, work, and pain characteristics, range of motion (ROM) and psychosocial factors. The researcher was available to clarify the contents and read the questions for the participants when needed. The questionnaire collected information on age, gender, education level, smoking, type of farming, work duration, pain intensity, pain type and pain duration. Body mass index (BMI) was calculated and a bubble inclinometer was used to measure the ROM of the shoulder.

The Nepali version of the shoulder pain and disability index (SPADI-NP)[20] was used to assess the level of pain and disability. The total score ranged from 0 to 130, with greater scores indicating a higher level of pain and disability. The level of kinesiophobia was assessed using the Tampa scale of kinesiophobia[21], which was translated in Nepali language (TSK-11-NP). A pilot study conducted at Dhulikhel Hospital among 30 participants with SP demonstrated adequate internal consistency of the tool. The total score of TSK-11-NP ranged from 11 to 44, with scores ≤ 22 indicating minimal, 23-28 indicating low, 29–35 indicating moderate, and >36 indicating high levels of kinesiophobia. The 13-item validated Nepali version of the pain catastrophizing scale (PCS-NP)[22] was used to identify the level of pain catastrophization. The total score on the scale was 52, with a higher score indicating a higher level of pain catastrophization.

The data were analyzed using SPSS version 25 (Armonk, NY: IBM). A multivariate linear regression analysis was used to identify the factors associated with SPADI-NP. Prior to regression analysis, multicollinearity and correlations were checked. Univariate regression analysis was conducted to identify the association of each independent variable with the dependent variable. The analysis showed significant associations of SPADI-NP with age, gender, education, TSK-11-NP, and PCS-NP scores. However, TSK-11-NP was selected over PCS-NP for multivariate linear regression for several reasons. Firstly, TSK-11-NP explained slightly better variation (42%) in SPADI-NP than PCS-NP (40%). Secondly, TSK-11-NP exhibited a better coefficient (1.52) with SPADI-NP, compared to the coefficient explained by PCS-NP (1.21). Lastly, TSK-11-NP had a lower variance inflation factor (5.53) compared to PCS-NP (5.56), which suggests that TSK-11-NP was less correlated with other independent variables in the model than PCS-NP. Subsequently, age, gender, education and TSK-11-NP were entered into a multiple linear regression. A stepwise strategy was used, and adjusted R^2 was calculated to evaluate the model fit. Statistical significance was set at $p<0.05$.

Results

Table 1 presents the socio-demographic and clinical characteristics of 122 farmers with SP. Among them, 67 (53%) participants were from Dhulikhel Hospital, and 55 (47%) were from the outreach centers. The median age was 55 (IQR 45-62) years, with 41 (34%) participants belonging to the 51-60 age groups. Among the participants, 80 (66%) were female, 120 (98%) were married and all followed Hinduism. The median BMI was 23 (IQR 22-24), 55 (45%) were illiterate and 44 (36%) were smokers. Hypertension was present in 33 (27%) individuals, while 10 (8%) had diabetes. Farmers had a relatively high mean SPADI-NP score of 75 ± 13. They exhibited a low level of kinesiophobia, with a median score of 25 (IQR 23-32). A clinically significant level of pain catastrophization was present, with a median score of 32 (IQR 25-38). This indicates that participants may exaggerate their pain to a degree that could potentially interfere with effective pain management.

As presented in Table 2, 96 (79%) participants relied entirely on manual farming, with nearly all engaged in repetitive farming activities. Among the participants, 62 (51%) performed heavy lifting tasks, while 99 (81%) were involved in overhead activities. All the participants reported working

seven days a week, with 107 (88%) experiencing moderate levels of chronic pain. The median pain score was 6 (IQR 5-7). Shoulder ROM was limited in all the directions.

Table 1. Socio-demographic and clinical characteristics of farmers (N=122)

Characteristics	Subcategory	n (%)
Age group, years	31-40	15 (12)
	41-50	30 (25)
	51-60	41 (34)
	61-70	36 (30)
Age, years, median (IQR)		55 (45-62)
Gender	Female	80 (66)
	Male	42 (34)
Educational level	No education	55 (45)
	Primary (</= grade 5)	25 (21)
	Secondary (= grade 6-10)	38 (31)
	Higher (> grade 11)	4 (3)
Body mass index, kg/m^2, median (IQR)		23 (22-24)
Smoking	Never smoked	70 (57)
	Currently smoking	44 (36)
	Used to but quit now	8 (7)
SPADI-NP, mean±SD	Total (0-130)	75 ± 13
	Pain (0-50)	30 ± 6
	Disability (0-80)	45 ± 10
TSK-11-NP, median (IQR)	Total (11-44)	25 (23-32)
	Somatic (11-20)	12 (10-14)
	Activity avoidance (11-24)	14 (13-18)
PCS-N, median (IQR)	Total (0-52)	32 (25-38)
	Rumination (0-16)	11 (8-12)
	Magnification (0-12)	7 (6-8)
	Helplessness (0-24)	14 (12-18)

Table 2. Work and pain characteristics of farmers (N=122)

Characteristics	Subcategory	n (%)
Numerical pain rating scale	Moderate pain (3-7)	107 (88)
	Severe pain (>7)	15 (12)
Type of farming	Manual	96 (79)
	Manual and mechanical	26 (21)
Type of work	Repeated work	121 (99)
	Heavy lifting	62 (51)
	Raising arm above shoulder	99 (81)
Type of pain	Acute (<90 days)	26 (21)
	Chronic (≥90 days)	96 (79)
Work/day, hours, median (IQR)		7 (7-8)
Work/week, hours, median (IQR)		49 (49-56)
Pain duration, days, median (IQR)		135 (90-210)
Range of motion, degrees, mean±SD	Flexion	134 ± 28
	Extension	41 ± 12
	Abduction	118 ± 33
	Internal rotation	54 ± 13
	External rotation	47 ± 16

Table 3 reported significant associations of SPADI-NP with age, gender, education, TSK-11-NP, and PCS-NP scores. Among these five variables, TSK-11-NP demonstrated the strongest

association with SPADI-NP followed by PCS-NP. Although increased age, lower level of education, and female gender were associated with higher scores of the SPADI-NP, they minimally explained the variance in SPADI-NP.

Four predictors, TSK-11-NP, age, gender, and education, sequentially entered multivariate linear regression analysis (Table 4). The first model, including a constant and TSK-11-NP, explained 42% of the variance in SPADI-NP. As age, gender, and education sequentially entered the model, the ability of the model to explain the variance in SPADI-NP improved to 46%, 48%, and 50%, respectively. The final model explained 50% of the variance, which was considered acceptable, particularly when all the predictor variables were statistically significant.[23] These results indicated that TSK-11-NP was the strongest factor associated with SPADI-NP.

Table 3. Association of factors with SP and disability in univariate linear regression analyses (N=122)

Characteristics	Coefficient (SE)	Adjusted R^2	p-value
Age	0.30 (0.11)	0.04	0.01*
Gender			
Male	Reference	0.03	0.02*
Female	5.91 (2.51)		
Education			
No education	Reference	0.04	0.03*
Primary (≤ grade 5)	-7.21 (3.15)		
Secondary (grade 6-10)	-6.66 (2.76)		
Higher (≥ grade 11)	3.04 (6.77)		
Body mass index	0.16 (0.53)	0.00	0.76
Type of Farming			
Both (Manual and Mechanical)	Reference	0.01	0.11
Manual	4.74 (2.94)		
Smoking history			
Never smoked	Reference	0.00	0.40
Currently smoking	-3.41 (2.58)		
Used to but quit now	0.02 (5.01)		
Work duration per week	-0.15 (0.13)	0.00	0.26
PCS-NP	1.21 (0.13)	0.40	0.01*
TSK-11-NP	1.52 (0.16)	0.42	0.01*

Note: *$p < 0.05$, SE=Standard error

Table 4. Multivariate linear regression analysis of associated factors with SP and disability (N=122)

Variables		Constant	TSK-11-NP	Age	Gender	Education (Primary)	R^2	Adjusted R^2	p-value
Model 1	B	33.18	1.52				0.43	0.42	0.01*
	(SE)	(4.48)	(0.16)						
	β		0.65						
Model 2	B	18.87	1.50	0.27			0.47	0.46	0.01*
	(SE)	(6.23)	(0.15)	(0.08)					
	β		0.65	0.21					
Model 3	B	14.89	1.43	0.33	4.44		0.49	0.48	0.02*
	(SE)	(6.37)	(0.15)	(0.08)	(1.96)				
	β		0.61	0.25	0.15				
Model 4	B	17.31	1.45	0.29	4.08	- 4.50	0.51	0.50	0.04*
	(SE)	(6.39)	(0.15)	(0.09)	(1.94)	(2.18)			
	β		0.62	0.22	0.14	-0.13			

Note: * $p < 0.05$, B=Unstandardized coefficient, β=Standardized coefficient

Discussion

This study aimed to identify the factors contributing to SP and disability among Nepalese farmers. The univariate regression showed significant associations of age, gender, education, TSK-11-NP, and PCS-NP with SPADI-NP. However, the multivariate linear regression showed that higher levels of kinesiophobia, increasing age, lower education, and female gender significantly contributed to increased SP and disability in Nepalese farmers. TSK-11-NP explained a relatively larger amount of variance in SPADI-NP than the other three variables. These findings signify the importance of incorporating psychosocial factors, in addition to biological factors, into the overall management approach of SP.

To the best of our knowledge, this is the first study to investigate kinesiophobia and pain catastrophization in farmers with SP. Kinesiophobia was identified as the strongest factor contributing to SP and disability in our participants. Previous studies have highlighted a link between kinesiophobia with pain intensity and disability in individuals experiencing chronic SP, explaining 19% to 33% of the variability in SPADI.[24,25] Our analysis showed a strong association between SPADI-NP and TSK-11-NP, explaining 42% of the variance, which is relatively greater than in previous studies.[24,25] This difference could be attributed to cultural factors, which are known to influence pain beliefs/appraisal, coping responses, and catastrophizing, leading to potential variations in pain-related domains across different countries.[26] Pain experience promotes hypervigilance and avoidance behaviors, leading individuals to fear movements and immobilize their shoulders to avoid specific painful movements.[27] Kinesiophobia has been associated with limited shoulder ROM, which is further associated with greater levels of SP and disability.[24,25] This could be one of the reasons for limited ROM in all directions in our participants. Addressing fear-avoidance behaviors through patient education focusing gradually on building their confidence in movement and exercise could enhance patient compliance with physical therapy interventions.[14] In fact, a recent randomized controlled trial has reported that pain neuroscience education effectively reduced kinesiophobia and improved various aspects of illness perceptions across different educational levels, indicating its broad applicability and potential benefits for individuals with lower levels of education,[28] as observed in our study.

In addition to kinesiophobia, another psychological factor, pain catastrophization, was also significantly associated with SP and disability in our participants. This result aligns with previous studies, which reported that patients with chronic SP tended to exhibit relatively high catastrophizing scores.[15,17] In our study, PCS-NP and TSK-11-NP were found to be correlated, consistent with previous research that reported a strong correlation between pain-related fear and pain catastrophizing.[29] Several factors, including gender, socioeconomic conditions, pain and disability severities, and fear, were associated with higher pain catastrophization. It has been suggested that females, especially those from lower socioeconomic backgrounds, like our participants, are believed to exhibit higher catastrophization levels.[30] There have been notable associations identified between pain catastrophizing and various pain-related outcomes like pain severity and disability, lower pain thresholds, and poor prognosis.[16] In such situations, clinicians should employ intervention strategies which can help shift the patients' focus from pain, reduce the perceived threat and foster coping abilities.[31]

Age was a biological factor identified to increase SP and disability among Nepalese farmers. However, it accounted for a minimal amount of variance in SPADI-NP in both univariate and multivariate analyses of this study, suggesting that while age was significant, it had less impact than the psychological factors. Approximately two-thirds of our participants were above the age of 50, aligning with reports that farmers in Southeast Asia are typically 40 years and older.[32] A systematic review has also reported SP to be increasingly common among those over the age of 50 who are involved in physically demanding occupations like farming.[10] Advancing age is reported as a risk factor for greater levels of SP and disability.[33] A few reasons could explain the increasing levels of SP and disability with aging. Firstly, the degenerative changes of muscles, tendons, ligaments, and joints could contribute to the pathogenesis of shoulder disorders. Secondly, with an increasing number of years in service, aging workers are exposed to harmful work demands and are at increased risk of disorders. Additionally, the aging population may suffer chronic overload due to an imbalance between their workload and work capacity with advancing age.[34] A direct relationship between the severity of pain and shoulder disability reinforces the notion that increased pain with aging contributes to greater disability.[35] Therefore, the strong link

between age and SP and disability underscores the importance of targeted interventions for older adults, especially those involved in physically demanding occupations like farming.

Female gender, another biological factor, was a significant contributor to SP and disability in our participants, although it accounted for only two percent of the additional variance in SPADI-NP. Females experienced significantly higher levels of SP and disability than males, as females tend to have a lower pain threshold and tolerance than males.[36] Particularly females with musculoskeletal issues describes pain with longer duration and increased intensity compared to males.[36] The higher SPADI-NP scores in females could be due to the substantial workload on the female population in Nepal.[37] In addition to their daily seven hours of farm work, our female farmers were responsible for managing household chores, caring for their families, and looking after their children.[37] Nepalese females were overburdened with physical work due to the migration of their husbands for better employment opportunities.[37] These dual roles of females could contribute to an increased likelihood of increased pain and disability suggesting a need for gender-sensitive approaches in addressing pain and disability, particularly in communities where women shoulder dual responsibilities.

Education was another predictor identified, though significant, it added only two percent to the variance in SPADI-NP. The literacy rates in Dolakha and Kavrepalanchowk districts ranged from 70% to 76%.[38] However, nearly half of our participants had no education and "no education" was reported as the strongest predictive factor for pain and disability in patients with SIS.[13] Indian farmers with lower schooling were less aware of ergonomic principles and suitable work techniques,[3] which could contribute to chronic pain. A study has hypothesized that there is an increased tendency of people with low education to consume strong pain killers to alleviate their musculoskeletal pain.[39] This would, in the long term, reduce the pain threshold, contributing to increase in pain and disability levels.[39] Moreover, studies have emphasized that educated individuals adopt healthy behaviors with better socio-psychological well-being. Therefore, they could promptly recognize signs of illness and access appropriate medical assistance, resulting in better health and longer lifespans.[13,40] Thus, by fostering a better understanding of ergonomic principles, healthy behaviors, and appropriate medical care, the burden of SP on less educated rural farmers could be alleviated.

This study has some limitations. Its cross-sectional design cannot establish causality, though it identifies the factors influencing the levels of SP and disability. The data was collected from health care settings, limiting generalizability of the results to farmers from rural areas with limited or no access to medical facilities. Geographically, this study was limited to the hilly region of Nepal, and findings may differ for farmers from the plains and mountainous regions of the country.

Conclusions

The results of this study have provided insights into the factors contributing to SP and disability in Nepalese farmers. Key factors identified included kinesiophobia, pain catastrophization, female gender, older age, and lower education. The findings emphasized the importance of adopting a comprehensive management approach addressing the bio-psychosocial factors, including age and gender-specific pain programs, such as pain neuroscience education along with psychological interventions for the treatment of chronic pain, pain catastrophization, and kinesiophobia. These approaches potentially lead to better outcomes and QOL of Nepalese farmers with SP. Therefore, training health professionals to enhance their knowledge and skills in these advanced evaluation and treatment approaches is essential. The fact that the majority of our participants relied on manual farming technologies could be leveraged to advocate policymakers regarding the pressing need for the implementation of modern mechanized technologies in farming to ensure occupational health and safety, particularly in physically demanding occupations like farming.

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