



Short Communication

Physical and mental health among seasonal migrant farmworkers: Evidence from a survey conducted in northwestern Italy

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ABSTRACT

Objectives: Farmworkers exhibit a higher prevalence of musculoskeletal disorders, levels of anxiety, depression, and work-related stress compared with general population. However, few studies have investigated the main predictors of these outcomes. Therefore, this study aimed to identify the key factors associated with musculoskeletal and psychological conditions among farmworkers.

Study design: Cross-sectional study.

Methods: The data were collected from June 2025 to August 2025 through a voluntary survey conducted among farmworkers who operated in Saluzzo, Cuneo, Piedmont. Four outcomes were analyzed: musculoskeletal pain, work-related stress, depression, and anxiety. Age, length of service, working hours, smoking, physical activity, Body Mass Index (BMI), social support, and work-related stress were the predictors investigated. Multinomial logistic regression (through Odds Ratios (ORs)) and Poisson regression models (through Prevalence Ratios (PRs)) were used to analyze musculoskeletal pain and work-related stress, depression, and anxiety, respectively. Moreover, Spearman's correlation was measured among the outcomes.

Results: The population consisted of 155 male farmworkers of foreign origin. Smoking (musculoskeletal pain 2-4: OR:4.52; 95%CI:1.64-12.49) and higher BMI (musculoskeletal pain 2-4: OR:2.59; 95%CI:1.14-5.87) were identified as the main predictors of an increased risk of musculoskeletal disorders, while physical activity appeared to be protective (musculoskeletal pain 2-4: OR:0.31; 95%CI:0.12-0.84 considering 1-2 h). Moreover, physical activity was associated with higher levels of work-related stress (PR:1.90; 95%CI:1.15-3.14 and PR:2.82; 95%CI:1.62-4.92 considering 1-2 and 3+ hours, respectively). Finally, longer working hours (PR:2.33; 95%CI:1.61-4.66) and work-related stress (PR:16.48; 95%CI:2.12-128.32) were associated with increased anxiety levels, whereas social support had a protective effect (PR: 0.39; 95%CI:0.19-0.81).

Conclusions: Higher BMI and smoking were the main risk factors for musculoskeletal pain; physical activity was associated with higher work-related stress, while longer working hours and work-related stress with increased anxiety. In contrast, physical activity appeared protective against musculoskeletal pain, and social support was associated with lower anxiety levels. These findings highlight the need for preventive strategies tailored to this vulnerable population, including interventions aimed at reducing excessive physical workload, regulating working hours, improving psychosocial working conditions, and strengthening social support.

1. Introduction

According to the data, farmworkers were around 1 million in Italy at the end of 2024. However, one of the main issues in this sector is the high number of workers who are not formally employed and therefore

not included in official statistics, leading to a substantial underestimation of the total number of subjects employed in this sector. This issue is particularly relevant among migrant farmworkers, defined as agricultural workers of foreign origin working in the Italian agricultural sector. As a result, the reporting of occupational injuries and work-related

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illnesses to insurance authorities is severely affected, leading to a significant underestimation of the real number of cases.

One of the main health conditions affecting farmworkers is musculoskeletal disorders. According to the literature, farmworkers are primarily affected by low back, shoulder, and upper extremity disorders.¹ However, despite agriculture being one of the sectors with the highest incidence of musculoskeletal disorders, there is a substantial under-reporting of cases, especially among migrant farmworkers. Some studies conducted on this topic identified that more than 35% of farmworkers have developed musculoskeletal disorders.²

Additional conditions not captured in official statistics include psychological conditions. According to the literature, more than 25% of farmworkers presented depressive symptoms,² and more than 70% work-related stress,³ clearly showing that these subjects were more exposed to psychological disorders than the general population.

Although literature does not clearly establish the determinants of these disorders, some authors suggested that factors such as age, smoking, educational level, underlying diseases, working climate safety, Body Mass Index (BMI), family distance, and climatic conditions may have a significant influence on all or some of the aforementioned conditions.^{2,4,5} In addition, the studies on this topic have been mainly conducted in United States.^{2,3}

Therefore, given the lack of clarity in literature and the scarcity of Italian data, this research aimed to describe musculoskeletal pain and psychological outcomes in a population of farmworkers employed in northwestern Italy regardless to their contractual status, and to investigate the key predictors of those outcomes in that population.

2. Methods

2.1. Study population

For the analysis, data were collected from June 2025 to August 2025 through a survey administered to farmworkers employed in Saluzzo (Cuneo, Piedmont, northwestern Italy), in which participation was voluntary. Saluzzo represents a major agricultural hub characterized by intensive fruit production, particularly apples, kiwis, and berries. This sector requires a substantial amount of seasonal labour, exceeding the locally available workforce, and employs thousands of workers each year, many of whom are migrants.

Because a substantial proportion of farmworkers may not be formally registered, official census data and a complete list of workers from which to draw a sample were not available; therefore, neither a census nor a probabilistic sampling approach was feasible. For these reasons, all farmworkers employed in Saluzzo who agreed to participate were included, without applying predefined exclusion criteria. Participants were recruited with the support of local institutions, associations, and non-governmental organizations involved in established projects aimed at providing assistance and accommodation to seasonal farmworkers. Recruitment activities were primarily conducted at temporary housing facilities, as well as in locations where workers gather for collective meals and social interaction. Workers were asked to participate anonymously and were assisted in completing the questionnaire by two local cultural mediators.

Initially, 160 farmworkers participated in the survey. Of these, 156 (97.5%) were male and 4 (2.5%) were female. Due to the low number of female participants, the analyses were restricted to male farmworkers only. Additionally, another participant was excluded due to missing information. [Supplementary Fig. 1](#) illustrates the process through which the final analytical sample was derived from all survey participants.

2.2. Variables

In this study, four different outcomes were analyzed. All outcomes were derived from questionnaires administered directly to farmworkers, representing self-reported measures.

The first was the musculoskeletal pain, defined as a composite variable derived from shoulder, elbow, wrist/hand, cervical, dorsal, low back, knee, foot, and acute low back pain, and daily and nocturnal paresthesia. It was subsequently categorized into three levels (0–1, 2–4, 5+), representing the number of body sites in which pain was reported by farmworkers.

The remaining outcomes were psychological. The first was work-related stress, measured using the Job Content Questionnaire and dichotomized at the median value. The second was depression, measured through the Patient Health Questionnaire-2, where scores of 3+ indicated the presence of depression. Finally, the last was anxiety, that was evaluated through the Generalized Anxiety Disorder-7. Scores of 10+ reflected the presence of anxiety symptoms.

Regarding the potential predictors, they included age, length of service as farmworker, number of hours worked, smoking, physical activity, BMI, and social support (assessed using the Copenhagen Psychosocial Questionnaire and dichotomized by the median). Furthermore, work-related stress was included as predictor in the analyses of the other outcomes investigated.

2.3. Statistical analyses

Variables were described using median and interquartile range (IQR) or frequencies and percentages. Moreover, for the four outcomes, 95% confidence intervals (CIs) for the proportions were also reported, calculated using the Wilson method.

A multivariable multinomial logistic regression model was performed to investigate the association between each predictor and musculoskeletal disorders, estimating the Odds Ratios (ORs) and 95% Confidence Intervals (CIs). This approach was chosen due to the categorical nature of the variable, which comprised three categories. For the psychological outcomes, multivariable Poisson regression models with robust variance were fitted, estimating Prevalence Ratios (PRs). This choice was driven by the cross-sectional study design, the fact that the outcomes were not rare, and the dichotomous nature of the outcome variables.

For each outcome, the final model included all exposure variables of primary interest. Therefore, no data-driven variable selection strategy (e.g., based on AIC or BIC) was applied. In fact, the aim of this study was to estimate the association between each exposure and the outcome, rather than to identify the model with the best statistical fit.

Spearman's correlations were calculated between all outcomes, visualizing the results through heatmaps.

The analyses were performed using STATA (V.19) and R (V.4.2).

3. Results

3.1. Descriptive statistics

The sample consisted of 155 male farmworkers of non-EU origin, with a median age of 36 years (IQR:30-42). Regarding musculoskeletal pain, 57 workers (36.8%) had scores ranging 2-4, while 12 (7.7%) 5+. Work-related stress symptoms were present in 62 subjects (40.0%), while depression and anxiety were observed in 9% and 11.7% of workers, respectively ([Supplementary Table 1](#)).

3.2. Musculoskeletal outcome

[Table 1](#) summarizes the relationship between each predictor and outcome.

Considering musculoskeletal pain, smoking (OR:4.52; 95%CI:1.64-12.49) and being overweight or obese (OR:2.59; 95%CI:1.14-5.87) significantly increased the risk of higher musculoskeletal pain scores, particularly for scores ranging 2-4. Moreover, engaging in 1-2 h of physical activity per week was associated with a reduced risk of musculoskeletal disorder (OR:0.31; 95%CI:0.12-0.84).

Table 1

Estimates of the association between the outcomes under investigation and each predictor included in the models.

Variable	Category	Work-related stress PR (95% CI)	Depression PR (95% CI)	Anxiety PR (95% CI)	Musculoskeletal pain (2-4 vs 0-1) OR (95% CI)	Musculoskeletal pain (5+ vs 0-1) OR (95% CI)
Age (years)	-	1.00 (0.98-1.02)	1.03 (0.95-1.11)	0.99 (0.92-1.06)	0.99 (0.94-1.03)	0.99 (0.93-1.06)
Length of service (years)	-	1.00 (0.94-1.07)	1.18 (0.99-1.39)	0.81 (0.65-1.03)	1.13 (0.98-1.30)	1.16 (0.98-1.39)
Hours worked	-	0.96 (0.66-1.40)	1.09 (0.24-4.91)	2.33 (1.61-4.66)	1.17 (0.48-2.85)	1.08 (0.27-4.25)
Smoking habit	No	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>
	Yes	0.99 (0.57-1.72)	1.82 (0.53-6.23)	2.37 (0.50-11.28)	4.52 (1.64-12.49)	1.31 (0.23-7.27)
Physical activity (hours)	0	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>
	1-2	1.90 (1.15-3.14)	1.25 (0.37-4.22)	4.49 (0.51-38.98)	0.31 (0.12-0.84)	0.01 (0.01-0.01)
	3+	2.82 (1.62-4.92)	1.20 (0.21-6.93)	2.18 (0.26-18.13)	0.34 (0.08-1.42)	0.10 (0.01-0.80)
Body Mass Index	Underweight-Normal weight	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>
	Overweight-Obese	1.07 (0.74-1.53)	0.70 (0.22-2.25)	0.64 (0.24-1.69)	2.59 (1.14-5.87)	1.41 (0.33-6.06)
Social Support	No	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>
	Yes	0.68 (0.44-1.04)	0.82 (0.26-2.56)	0.39 (0.19-0.81)	1.46 (0.56-3.79)	0.36 (0.09-1.42)
Work-related stress	No	-	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>	<i>Ref</i>
	Yes	-	2.61 (0.73-9.21)	16.48 (2.12-128.32)	0.89 (0.35-2.23)	1.00 (0.27-3.74)

3.3. Psychological outcomes

When focusing on work-related stress, it emerged that the main predictor was physical activity, with physically active individuals exhibiting higher stress scores (1-2 h: OR:1.90; 95%CI:1.15-3.14; 3+ hours: OR:2.82; 95%CI:1.62-4.92).

Regarding depression, length of service was at the borderline of significance, suggesting that longer service may increase the risk of developing depressive symptoms (PR:1.18; 95%CI:0.99-1.39).

Finally, considering anxiety, the number of hours worked (PR:2.33; 95%CI:1.61-4.66) and work-related stress (PR:16.48; 95%CI:2.12-128.32) were associated with an increased risk of developing anxiety symptoms. In contrast, receiving social support appeared to significantly reduce the risk of experiencing anxiety (PR:0.39; 95%CI:0.19-0.81).

3.4. Association between musculoskeletal and psychological outcomes

From the heatmaps assessing the correlations between musculoskeletal pain and psychological outcomes, it emerged that musculoskeletal pain was significantly and negatively correlated with work-related stress, depression and anxiety, whereas these three psychological outcomes were positively correlated with each other (Supplementary Fig. 2).

4. Discussion

This cross-sectional study described for the first time in Italy prevalence of musculoskeletal pain and psychological outcomes in a population of migrant farmworkers in Italy, regardless their contractual status and identified the main predictors which had a significant impact on the outcomes investigated. Moreover, we observed that more than 45% of farmworkers reported musculoskeletal pain, 40% experienced work-related stress, and around 10% depressive or anxiety symptoms. As the survey included farmworkers regardless of their contractual status, these estimates are particularly relevant, as they reflect the true prevalence of the outcomes in a population that is often not fully captured in official statistics.

Regarding musculoskeletal pain, the survey found a positive association with BMI and smoking, and negative with physical activity. The

associations with smoking and BMI are consistent with the literature.^{5,6} Possible mechanisms include smoking-related muscle tissue damage and reduced nerve response to pain,⁷ while higher BMI may contribute via an increased risk of conditions such as lumbar disc degeneration, particularly among overweight and obese workers.⁶ Relating to physical activity, the results in literature are unclear, even if it was widely accepted as effective in the treatment and prevention of musculoskeletal disorder.⁵

When analyzing work-related stress, PR estimates suggested that physical activity was a risk factor. Although few studies addressed this association among farmers, this finding contrasts with the literature from other occupational sectors.⁸ A possible explanation is reverse causality, whereby workers experiencing higher levels of work-related stress engage in greater physical activity.

Regarding anxiety, the results showed that work-related stress and longer working hours were significant risk factors, while social support was protective. Although few studies have examined these relationships, evidence suggests that higher farm workload, which is associated with longer hours and greater stress, is linked with anxiety.⁹ One possible explanation is the combined effects of high physical workload and psychosocial stressors, which activate chronic physiological stress responses and increase vulnerability to anxiety. Finally, the results related to social support are consistent with the literature.¹⁰ This association may be due to the fact that social support helps farmers cope with stress by providing emotional and practical resources, reducing its negative effects and protecting psychological well-being.

This study has some limitations and strengths.

Its cross-sectional design prevents causal inference and raises the possibility of reverse causality. Moreover, the sample was entirely composed of foreign non-EU workers, and data on potentially relevant predictors, such as family distance or country of origin, were not collected. In particular, information on the participants' country of origin was not collected because of restrictions imposed by the Ethics Committee. Nevertheless, this is one of the first surveys in Italy to focus exclusively on farmworkers, examining multiple outcomes and predictors in a sample of over 150 subjects.

Although this study was conducted in a specific Italian agricultural setting and should not be considered representative of all migrant farmworkers, the relatively large sample provides valuable evidence on

a population that is often difficult to recruit. Therefore, our findings may be generalizable to comparable migrant farmworker populations in other European agricultural settings with similar working and living conditions, such as some agricultural hubs in Spain, southern France, Greece, and Portugal.

4.1. Conclusions

This study identified a high prevalence of musculoskeletal and psychological disorders. Moreover, among farmworkers, higher BMI and smoking are risk factors for musculoskeletal pain, while physical activity was protective. Furthermore, work-related stress and longer working hours were observed to be strong risk factors for anxiety symptoms, while social support can improve psychological wellbeing. Finally, physical activity and longer length of service seemed to increase the risk of developing work-related stress and depression, respectively.

Given the high prevalence of musculoskeletal and psychological conditions among farmworkers, this research highlights the need for preventive strategies tailored to this population. Interventions should address both physical workload and psychosocial stressors, promoting social support to protect mental well-being. Furthermore, workplace policies aimed at regulating working hours, reducing excessive physical demands, and providing resources for coping with stress may help mitigate anxiety and musculoskeletal pain.

Ethical approval

The study was conducted in accordance with the declaration of Helsinki and it was approved by the Ethical Committee of the University of Turin.

Data availability

Raw data cannot be openly shared. However, researchers can obtain aggregated data by reaching out to the corresponding author upon request. Additionally, statistical code and programming scripts used for the analyses are not publicly available but are available from the corresponding author upon request.

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Declaration of competing interests

The authors declare no conflict of interests.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhe.2026.106472>.

References

1. Davis KG, Kotowski SE. Understanding the ergonomic risk for musculoskeletal disorders in the United States agricultural sector. *Am J Ind Med*. 2007 Jul;50(7): 501–511. <https://doi.org/10.1002/ajim.20479>. PubMed PMID: 17506508.
2. Arcury TA, O'Hara H, Grzywacz JG, Isom S, Chen H, Quandt SA. Work safety climate, musculoskeletal discomfort, working while injured, and depression among migrant farmworkers in North Carolina. *Am J Publ Health*. 2012 May;102(Suppl 2): S272–S278. <https://doi.org/10.2105/AJPH.2011.300597>. PubMed PMID: 22401520; PubMed Central PMCID: PMC3358567.
3. Clouser JM, Bush A, Gan W, Swanberg J. Associations of work stress, supervisor unfairness, and supervisor inability to speak Spanish with occupational injury among Latino farmworkers. *J Immigr Minor Health*. 2018 Aug;20(4):894–901. <https://doi.org/10.1007/s10903-017-0617-1>. PubMed PMID: 28643172.
4. Keeney AJ, Quandt A, Meng Y, et al. “We all have a job to Do in this world, it's up to us”: farmworker and farmer mental health in a rural US-Mexico border region. *J Agromed*. 2023 Jul;28(3):365–377. <https://doi.org/10.1080/1059924X.2022.2154298>. PubMed PMID: 36525583; PubMed Central PMCID: PMC12121372.
5. Luangwilai T, Norkaew S, Siri Wong W. Factors associated with musculoskeletal disorders among rice farmers: cross sectional study in Tarnlalord sub-district, Phimai district, Nakhonratchasima Province, Thailand. *J Health Res*. 2014;28(Suppl): S85–S91.
6. Udom C, Janwantanakul P, Kanlayanaphotporn R. The prevalence of low back pain and its associated factors in Thai rubber farmers. *J Occup Health*. 2016 Nov 29;58(6): 534–542. <https://doi.org/10.1539/joh.16-0044-OA>. PubMed PMID: 27725486; PubMed Central PMCID: PMC5373904.
7. Oktaviano H, Helmi ZN, Setyaningrum R. The correlation between smoking status and BMI with the complaints of musculoskeletal disorders on palm farmers. *Int J Publ Health Sci*. 2015 Jun 1;4(2):140–144. <https://doi.org/10.11591/ijphs.v4i2.4724>.
8. Abe T, Okuyama K, Motohiro A, Shiratsuchi D, Isomura M. Association between different types of physical activity and occupational stress in Japanese workers: a cross-sectional study. *Ind Health*. 2024 Jul 24;62(4):227–236. <https://doi.org/10.2486/indhealth.2023-0092>. PubMed PMID: 38233117; PubMed Central PMCID: PMC11292311.
9. Keeney AJ, Ciro D, Meng Y, Coco L, Ekonomo K. Depression, anxiety, and coping strategies among farmworkers exposed to substance use at work. *J Agromed*. 2025 Jan 2;30(1):105–113. <https://doi.org/10.1080/1059924X.2024.2407384>. PubMed PMID: 39314086.
10. Deegan A, Dunne S. An investigation into the relationship between social support, stress, and psychological well-being in farmers. *J Community Psychol*. 2022 Sep;50(7):3054–3069. <https://doi.org/10.1002/jcop.22814>. PubMed PMID: 35132638; PubMed Central PMCID: PMC9545128.