DOI: 10.53660/CLM-4001-24R21

Is occupational fatigue associated with multisite pain in viticulture workers?

A fadiga ocupacional está associada com a dor multirregional em viticultores?

Received: 05-08-2024 | Accepted: 10-09-2024 | Published: 14-09-2024

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ABSTRACT

This study aimed to investigate the association between the occurrence of multisite pain and the presence of occupational fatigue among viticulture workers. 371 workers involved in grape cultivation in the São Francisco Valley were evaluated. Multisite pain was quantified according to previous literature using the Nordic Musculoskeletal Questionnaire, while occupational fatigue was assessed using the Need for Recovery Scale. The analysis revealed a high prevalence of multisite pain (61.4%). The most frequently affected painful regions were the upper and lower back (65.7%) and neck/shoulders (52.9%). Regarding fatigue, 73.9% exhibited a high need for recovery. However, 43.4% of workers were categorized as with multisite pain and a high level of need for recovery. A significant positive association was observed between multisite pain and a high perception of the need for recovery (OR 2.07, 95% CI 1.18 – 3.64).

Keywords: Agriculture; Agricultural Work; Ergonomics; Musculoskeletal Pain; Occupational Health

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RESUMO

Este estudo teve por objetivo investigar a relação entre a ocorrência de dor multirregional e a presença de fadiga ocupacional em trabalhadores da viticultura. Foram avaliados 371 trabalhadores envolvidos no cultivo de uvas no Vale do São Francisco. A dor multirregional foi quantificada de acordo com descrição prévia da literatura por meio do Questionário Nórdico de Sintomas Osteomusculares, enquanto a fadiga ocupacional foi avaliada pela Escala de Necessidade de Descanso. A análise dos resultados revelou uma alta prevalência de dor multirregional (61,4%). As regiões dolorosas mais frequentemente afetadas foram o tronco/coluna (65,7%) e pescoço/ombros (52,9%). Em relação à fadiga, 73.9% apresentaram alta necessidade de descanso. Porém, 43.4% dos trabalhadores apresentaram dor multirregional e tiveram alto nível de necessidade de descanso. Foi observada uma associação significativa positiva entre a presença de dor multirregional e alta percepção de necessidade de descanso (OR 2,07 e IC 1,18 – 3,64).

Palavras-chave: Agricultura; Dor musculoesquelética; Ergonomia; Saúde ocupacional; Trabalho agrícola

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INTRODUCTION

The agricultural sector represents a significant global workforce, encompassing more than 1 billion people and constituting the world's largest labor force (Ghafari; Cheraghi; Doosti-Irani, 2017). According to the International Labour Organization (ILO), agricultural workers are exposed to various occupational hazards, including physical, chemical, biological, mechanical, and ergonomic risks, resulting in a three times higher mortality risk than professionals in other fields.

The agricultural work environment is characterized by strenuous physical tasks and high manual labor loads, making it a high-risk occupation for the incidence of musculoskeletal disorders (Park; Lim; Lee, 2010; Rosecrance et al., 2006). Long working hours and excessive workloads impair workers' recovery capacity, affecting their well-being (Albulescu et al., 2022). In this context, the findings of this study highlight the urgent need to address occupational fatigue, especially for high-risk workers such as farmers (Cunningham et al., 2022). The adverse effects of fatigue include impairments in cognitive processing, mood changes, pain, illness, injuries, and human errors (Techera et al., 2016).

Studies have demonstrated a relationship between fatigue and health conditions characterized by pain, such as widespread pain (Burri et al., 2015), fibromyalgia (Dailey et al., 2016), and rheumatoid arthritis (Nikolaus et al., 2013). Pain and fatigue can synergistically contribute to the reduction of an individual's functional capacity (Snekkevik et al., 2014). However, the role of fatigue in musculoskeletal pain, especially concerning work-related musculoskeletal pain, remains poorly understood (Yamada et al., 2019).

Agricultural workers frequently face musculoskeletal disorders, predominantly in the upper limbs, encompassing a variety of inflammatory and degenerative conditions (Biazus; Moretto; Pasqualotti, 2017). These conditions can directly impact the worker's ability to perform occupational tasks, reducing their quality of life, functional capacity, and economic income, besides representing a risk of workplace accidents (Min et al., 2016).

Musculoskeletal pain is recognized as an everyday health condition among the working population, being one of the leading causes of work disability and absenteeism (Haukka et al., 2017; Oakman et al., 2017). The literature indicates that musculoskeletal pain referred to a single body site can increase the likelihood of pain occurring in other

regions (Fernandes et al., 2016; Fernandes; Burdorf, 2016). In this sense, the concept of multisite pain, defined by the presence of pain in two or more body regions simultaneously (Vieira; Sato, 2020), suggests that workers with multiple painful sites have a higher probability of prolonged absence from their occupational activities and decreased productivity (Neupane et al., 2013).

Although multisite pain is considerably reported in the literature, most studies involving this subject (Fernandes et al., 2016; Neupane et al., 2013; Oakman et al., 2017) have investigated industrial worker populations. Consequently, other classes of workers, such as those in agriculture, who also perform tasks with high exposure to physical demands, such as manual material handling and sustained and uncomfortable postures, have not yet been adequately investigated regarding multisite pain and its relationship with occupational fatigue.

Despite the growing social and economic importance of the agricultural sector, the complexity of investigating the agricultural occupational environment results in a scarce number of studies in this area (Faria; Meucci; Fassa, 2023). The current literature lacks information on how the perception of fatigue impacts the health of these professionals and the associated risks for workers and society. Specifically, the relationship between occupational fatigue and multisite pain in agricultural workers remains poorly explored, representing a significant gap in current knowledge.

Given this scenario, the present study aims to investigate the relationship between multisite pain and occupational fatigue in agricultural workers involved in viticulture in the São Francisco Valley. This research seeks to fill an essential gap in the literature, providing valuable insights into the interaction between fatigue and multisite pain in a specific agricultural context. It is hypothesized that multisite pain is positively associated with a higher perception of the need for recovery among viticulture workers. The results of this study may significantly contribute to the development of more effective prevention and intervention strategies aiming to improve occupational health and the quality of life of agricultural workers.

METHODS

This study is a cross-sectional observational study with a quantitative approach, conducted following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (Malta et al., 2010). The research protocol was

approved by the University Research Ethics Committee (Approval No. 3.494.076), and all participants provided written informed consent.

The target population consisted of viticulture workers from the São Francisco Valley, Brazil. The sample size was calculated considering an estimated prevalence of multisite pain of 50%, a 95% confidence level, and a 5% margin of error, resulting in a minimum sample size of 384 participants. Anticipating potential losses, 393 workers were recruited.

The inclusion criteria were: (1) age ≥ 18 years; (2) formal and fixed employment with the grape-producing farm; and (3) a minimum of six months of job experience. Exclusion criteria were: (1) workers with neuromuscular diseases (orthopedic, neurological, or rheumatological) with multisite pain symptoms; (2) temporary or seasonal workers; and (3) individuals with incomplete data in the assessment instruments.

Workers performing pruning, harvesting, thinning, tying, de-budding, clipping, and packing were evaluated. Except for packing, the other activities conducted by agricultural workers are done standing with arm elevation (above 90°) and repetitive manual activity (also requiring tools, such as scissors), in addition to being directly influenced by weather conditions. The packing activity is performed in a controlled environment, with workers standing in front of a bench, with the possibility of supporting their forearms. All workers in direct contact with grapes maintain an upright posture throughout the workday. 393 workers were evaluated, but 371 valid assessments were considered, with 22 participants excluded due to missing data in the instruments used.

Initially, a pilot study was conducted with 20 workers to refine the instruments and data collection procedures. Trained interviewers collected the primary data in a private environment on the farms during working hours. Information on sociodemographic and occupational data, as well as general health and absenteeism, was collected using an instrument developed by the researchers. The variables recorded were sex (female/male), Body Mass Index (BMI – kg/m²), age (years), alcohol consumption (yes/no), smoking (yes/no), seniority (job experience in months), and absenteeism (days absent in the last three months).

Musculoskeletal symptoms were determined using an adapted version of the Brazilian version of the Nordic Musculoskeletal Questionnaire (Barros; Alexandre, 2003). The adaptation of the questionnaire required respondents to identify the intensity of musculoskeletal pain using the body map proposed by the questionnaire, considering the three months and seven days before the assessment date. To determine the intensity

of pain, a scale from 0 to 10 was used, where 0 means "no pain" and 10 means "worst imaginable pain" (Andersen et al., 2012; Gupta et al., 2015). Additionally, we used the three months before the assessment since the literature indicates a risk of recall bias when using this instrument in its original version, i.e., considering the last 12 months (Rasmussen et al., 2018).

The quantification of multisite pain followed protocols already described in the literature through the grouping of body regions: 1. neck and shoulders; 2. hands and upper extremities (elbows, wrists, and hands); 3. upper and lower back; 4. feet and lower extremities (hips, knees, and ankles). First, individuals were asked about the presence of pain in the four described regions, with a response scale ranging from 0 (no pain) to 10 (worst imaginable pain). The responses from each body region were dichotomized based on the median (less than the median = 0 - no pain; and greater than or equal to the median = 1 - with pain). All dichotomized variables were summed, and thus, the number of painful areas was expressed (0 = no pain to 4 = 4 pain sites). The dichotomous variable "multisite pain" was created by combining two or more pain sites (0 and 1 pain site = no multisite pain) (Neupane et al., 2013; Neupane et al., 2015).

Occupational fatigue was assessed using the Brazilian version of the Need for Recovery Scale (Moriguchi et al., 2010). The final score obtained on this instrument can range from 0 to 100. The higher the score, the greater the amount of emotional, cognitive, and behavioral symptoms related to fatigue, indicating a greater need for recovery for workers. A high need for recovery was considered for those who scored > 45 (Kiss; De Meester; Braeckman, 2008). The criterion validity of the scale in Brazilian workers is comparable to other versions of the Need for Recovery scale, meeting the criteria for excellent criterion validity (Brusaca et al., 2022).

Statistical analyses were performed using SPSS version 23.0. Descriptive statistics were calculated for all variables. The normality of the data distribution was verified using the Kolmogorov-Smirnov test. The association between multisite pain and occupational fatigue was investigated through binary logistic regression. Initially, bivariate models were constructed, followed by a multivariate model adjusted for potential confounders (sex, BMI, age, alcohol consumption, smoking, and seniority). Odds Ratios (OR) with 95% confidence intervals (CI) were calculated. The significance level was set at $p < 0.05$.

RESULTS

371 viticulture workers were included in the final analysis after excluding 22 participants due to incomplete data. Table 1 presents the sociodemographic and occupational characteristics of the sample. The mean age of the participants was 35.0 ± 9.17 years, with a predominance of females (78.5%, n = 291). The mean body mass index (BMI) was 26.9 ± 4.85 kg/m², indicating overweight in the studied population. Notably, workers reporting multisite pain had a slightly higher BMI (27.4 ± 5.05 kg/m²) compared to those without multisite pain.

Regarding lifestyle habits, 22.0% (n = 82) of the participants reported smoking, while 58.7% (n = 218) reported alcohol consumption. The median seniority was 28 months, with most workers (52.3%, n = 196) having less job experience than the median. The mean absenteeism was 0.92 (± 0.11) days, significantly higher in workers with multisite pain (1.36 ± 0.17) compared to those without multisite pain (0.2 ± 0.07, $p < 0.001$).

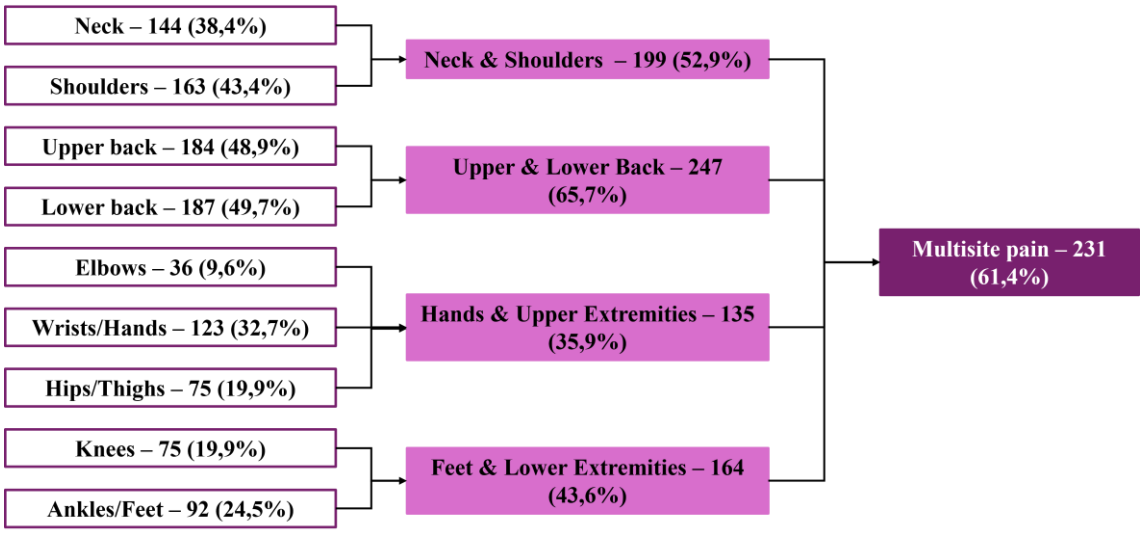
Table 1. Sociodemographic and Occupational Characteristics of Viticulture Workers (N = 371)

Variable	Total	With Multisite Pain	Without Multisite Pain	p
Age (years), M ± SD	35 ± 9.17	34.6 ± 9.37	35.8 ± 8.82	0.22*
Sex, n (%)				0.75**
Female	290 (78.2)	183 (49.4)	107 (28.8)	
Male	81 (21.8)	51 (13.7)	30 (8.1)	
BMI (Kg/m^2), M ± SD	26.9 ± 4.85	27.4 ± 5.05	26.3 ± 4.46	0.03*
Smoking, n (%)				0.92**
Yes	81 (21.8)	52 (14)	29 (7.8)	
No	290 (78.2)	182 (49.1)	108 (29.1)	
Alcohol consumption, n (%)				0.04**
Yes	209 (58.1)	140 (38.9)	69 (19.2)	
No	151 (41.9)	85 (23.6)	66 (18.3)	
Seniority (months), n (%)				0.75**
≤ 28	194 (52.3)	120 (32.3)	74 (19.9)	
> 28	177 (47.7)	114 (30.7)	63 (17.1)	
Absenteeism (days absent in the last three months), M ± SD	0.92 ± 0.11	1.36 ± 0.17	0.2 ± 0.7	0.01***

M: Mean; SD: Standard deviation; * Student's t-test; **Chi-square test; ***Mann-Whitney U test.

The overall prevalence of multisite pain in the sample was 61.4%. Figure 1 illustrates the distribution of pain by body regions and the prevalence of multisite pain. The most affected individual regions were the lower back (49.7%), upper back (48.9%), and shoulders (43.4%). For grouped areas, the upper and lower back had the highest prevalence (65.7%), followed by the neck and shoulders (52.9%).

Figure 1. Flowchart of Pain Distribution by Body Regions and Prevalence of Multisite Pain Among Viticulture Workers (N = 371).



Source: Authors, 2024

The assessment of occupational fatigue revealed that 73.9% (n = 274) of the workers had a high need for recovery. Among workers with multisite pain, the proportion of individuals with a high need for recovery was significantly higher (43.4%, n = 161) compared to those without multisite pain (30,5%, n = 30) ($\chi^2 = 8.37$, p = 0.004). Among those with low need for recovery, 19,7% (n = 73) had multisite pain and only 6.5% (n = 24) did not have multisite pain.

The binary logistic regression analysis (Table 2) demonstrated a significant association between a high need for recovery and the presence of multisite pain. In the unadjusted model, workers with a high need for recovery were 2.15 times more likely to report multisite pain (OR = 2.15; 95% CI: 1.27 - 3.51; p = 0.004). After adjusting for potential confounders (sex, BMI, age, alcohol consumption, smoking, and job

experience), the association remained significant, with an adjusted Odds Ratio of 2.01 (95% CI: 1.16 - 3.46; p = 0.012).

Table 2. Association Between High Need for Recovery and Multisite Pain Among Viticulture Workers (N = 371)

Model	OR	95% CI	p
Non-adjusted	2.13	1.27 – 3.59	0.01
Adjusted*	2.07	1.18 – 3.64	0.01

OR: Odds Ratio; CI: Confidence Interval; * Adjusted for sex, BMI, age, alcohol consumption, smoking, and seniority.

DISCUSSION

This cross-sectional study investigated the prevalence of multisite pain and its association with occupational fatigue among viticulture workers in the São Francisco Valley, Brazil. The results revealed a high prevalence of multisite pain (61.4%), a high need for recovery (73.9%), and a significant association between occupational fatigue and multisite pain, even after adjusting for potential confounders.

The prevalence of multisite pain found in our study (61.4%) is considerably high compared to other studies with agricultural workers. Osborne et al. (2012) reported a prevalence of 33% of musculoskeletal pain in multiple locations among farmers in Ireland. This discrepancy may be attributed to differences in working conditions, viticulture-specific agricultural practices, and climatic factors characteristic of the São Francisco Valley.

The most affected body regions in our sample were the lower back (49.7%), upper back (48.9%), and shoulders (43.4%). These findings are consistent with previous studies on agricultural workers. Kolstrup (2012) observed that the most commonly affected regions in dairy farm workers were the shoulders (47%) and lower back (32%). The high prevalence of pain in these regions may be related to the specific physical demands of viticulture, such as sustained postures, repetitive movements, and load handling.

Our analysis revealed a significant association between a high need for recovery and the presence of multisite pain (adjusted OR = 2.07; 95% CI: 1.18 – 3.64). This result corroborates previous studies investigating the relationship between fatigue and musculoskeletal pain in different worker populations. For example, Skarpsno et al. (2019)

found that prolonged fatigue was associated with an increased risk of chronic musculoskeletal pain in a cohort of Norwegian workers.

The relationship between fatigue and multisite pain may be bidirectional. Fatigue can predispose workers to adopt inadequate postures or reduce their capacity to cope with the physical demands of work, increasing the risk of pain. Conversely, pain in multiple regions can contribute to increased fatigue, creating a vicious cycle (Madeleine et al., 2018).

In addition to occupational fatigue, our study identified other factors associated with multisite pain, including elevated BMI, alcohol consumption, and higher absenteeism. Elevated BMI has been consistently associated with a higher risk of musculoskeletal pain in various studies (Viester et al., 2013). Alcohol consumption as a risk factor for multisite pain is an interesting finding that warrants further investigation, as it may be related to inadequate coping mechanisms or direct effects of alcohol on the musculoskeletal system.

The higher absenteeism observed among workers with multisite pain (1.36 ± 0.17 vs. 0.2 ± 0.7 days, $p < 0.001$) highlights the economic and social impact of this health problem. This finding aligns with previous studies that demonstrated the impact of musculoskeletal pain on productivity and absenteeism (McDonald et al., 2011). However, our study presents a relatively low number of days absent from work despite the high prevalence of multisite pain. This points to a probable occurrence of presenteeism, a phenomenon where workers attend work even under health conditions that would justify their absence.

Presenteeism has been increasingly recognized as a significant problem in occupational health. The high prevalence of multisite pain associated with low absenteeism in our sample suggests that many workers may be facing their work tasks even with significant pain. This behavior may be motivated by various factors, including economic pressures, fear of job loss, organizational culture, or lack of adequate substitutes (Aronsson et al., 2000).

Presenteeism related to musculoskeletal pain can have severe consequences for both the worker and the organization. For the worker, continuing to work with pain can exacerbate symptoms and lead to chronic health conditions (Skagen and Collins, 2016). For organizations, although presenteeism may seem beneficial in the short term due to reduced absenteeism, in the long term, it can result in productivity loss and increased health costs (Hemp, 2004).

Therefore, our findings underscore the importance of addressing not only absenteeism but also presenteeism in managing the occupational health of viticulture workers. Strategies that promote a work environment that allows workers to take necessary leave without fear of repercussions and provide adequate support for pain management can be crucial for improving long-term health and productivity in this population.

Our results have important implications for occupational health in viticulture. The high prevalence of multisite pain and its association with occupational fatigue suggest the need for ergonomic and organizational interventions to reduce physical demands and improve workers' recovery periods. Health promotion programs addressing weight control and alcohol consumption may also be beneficial.

Future longitudinal studies are necessary to establish causal relationships between occupational fatigue and multisite pain. Additionally, research on specific interventions to reduce fatigue and prevent multisite pain in viticulture workers is crucial for improving health and productivity in this sector.

This study has some limitations that should be considered. First, its cross-sectional design does not allow for causal inferences. Second, the assessment of pain and fatigue was based on self-report, which may be subject to recall bias. However, using validated instruments and considering a three-month period for pain assessment partially mitigates this limitation. Third, psychosocial work factors were not evaluated, which could influence both pain perception and fatigue.

CONCLUSION

This study provides robust evidence of the high prevalence of multisite pain and its significant association with occupational fatigue among viticulture workers. These findings highlight the need for comprehensive occupational health strategies that address both the physical and organizational aspects of work in viticulture. Interventions focused on reducing occupational fatigue and promoting adequate recovery periods can be crucial for reducing the burden of multisite pain in this population.

ACKNOWLEDGEMENT

We gratefully acknowledge the support of the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), and the Fundação de Amparo a Ciência e Tecnologia do Estado de Pernambuco (FACEPE) in conducting this research.

REFERENCES

ALBULESCU, P. et al. "Give me a break!" A systematic review and meta-analysis on the efficacy of micro-breaks for increasing well-being and performance. PLOS ONE, v. 17, n. 8, p. e0272460, 31 ago. 2022. DOI: 10.1371/journal.pone.0272460

ANDERSEN, L. L. et al. A prospective cohort study on musculoskeletal risk factors for long-term sickness absence among healthcare workers in eldercare. International Archives of Occupational and Environmental Health, v. 85, n. 6, p. 615–622, 2012. DOI: 10.1007/s00420-011-0709-5

ARONSSON, G.; GUSTAFSSON, K.; DALLNER, M. Sick but yet at work. An empirical study of sickness presenteeism. Journal of Epidemiology & Community Health, v. 54, n. 7, p. 502-509, 2000. DOI: 10.1136/jech.54.7.502

BARROS, E. N. C.; ALEXANDRE, N. M. C. Cross-cultural adaptation of the Nordic musculoskeletal questionnaire. International nursing review, v. 50, n. 2, p. 101–108, 2003. DOI: 10.1046/j.1466-7657.2003.00188.x

BIAZUS, M.; MORETTO, C. F.; PASQUALOTTI, A. Relationship between musculoskeletal pain complaints and family agriculture work. Revista Dor, v. 18, n. 3, 2017. DOI: 10.5935/1806-0013.20170107

BRUSACA, A. L. et al. Brazilian version of need for recovery scale: Assessment of structural validity, criterion validity, and internal consistency. Brazilian Journal of Physical Therapy, v. 26, n. 6, p. 100465–100465, 1 nov. 2022. DOI: 10.1016/j.bjpt.2022.100465

BURRI, A. et al. The Association between Chronic Widespread Musculoskeletal Pain, Depression and Fatigue Is Genetically Mediated. PLOS ONE, v. 10, n. 11, p. e0140289, 24 nov. 2015. DOI: 10.1371/journal.pone.0140289

CUNNINGHAM, T. J. et al. Work-related fatigue: A hazard for workers experiencing disproportionate occupational risks. American Journal of Industrial Medicine, v. 65, n. 11, p. 913–925, 27 jan. 2022. DOI: 10.1002/ajim.23326

DAILEY, D. L. et al. Perceived function and physical performance are associated with pain and fatigue in women with fibromyalgia. Arthritis Research & Therapy, v. 18, n. 1, 16 mar. 2016. DOI: 10.1186/s13075-016-0954-9

FARIA, N. M. X.; MEUCCI, R. D.; FASSA, A. G. Estudos epidemiológicos ocupacionais em área rural: desafios metodológicos. Revista Brasileira de Saúde Ocupacional, v. 48, p. edcinq7, 4 set. 2023. DOI: 10.1590/2317-6369000032022

FERNANDES, R. C. P.; BURDORF, A. Associations of multisite pain with healthcare utilization, sickness absence and restrictions at work. Int Arch Occup Environ Health, v. 89, n. 7, p. 1039–1046, 2016. DOI: 10.1007/s00420-016-1141-7

FERNANDES, R. C. P.; PATARO, S. M. S.; CARVALHO, R. B.; BURDORF, A. The concurrence of musculoskeletal pain and associated work-related factors: a cross sectional study. BMC Public Health, v. 16, n. 1, p. 1-9, 2016. DOI: 10.1186/s12889-016-3306-4

GHAFARI, M.; CHERAGHI, Z.; DOOSTI-IRANI, A. Occupational risk factors among Iranian farmworkers: a review of the available evidence. Epidemiology and Health, v. 39, p. e2017027, 2 jul. 2017. DOI: 10.4178/epih.e2017027

GUPTA, N. et al. Is objectively measured sitting time associated with low back pain? A cross-sectional investigation in the NOMAD study. PloS one, v. 10, n. 3, p. e0121159, 2015. DOI: 10.1371/journal.pone.0121159

HEMP, P. Presenteeism: at work-but out of it. Harvard Business Review, v. 82, n. 10, p. 49-58, 2004.

KISS P.; DE MEESTER M.; BRAECKMAN L. Differences between younger and older workers in the need for recovery after work. International Archives of Occupational and Environmental Health. v. 81, n.3, p. 311-20, 2008. DOI: 10.1007/s00420-007-0215-y

KOLSTRUP, C. L. Work-related musculoskeletal discomfort of dairy farmers and employed workers. Journal of Occupational Medicine and Toxicology, v. 7, n. 1, p. 23, 2012. DOI: 10.1186/1745-6673-7-23

MADELEINE, P. et al. Chronic neck-shoulder pain and its association with physical and mental health status among Danish workers. Journal of Occupational and Environmental Medicine, v. 60, n. 9, p. e442-e450, 2018. DOI: 10.1097/JOM.0000000000001412

MALTA, M. et al. STROBE initiative: guidelines on reporting observational studies. Revista de Saúde Pública, v. 44, n. 3, p. 559-565, 2010. DOI: 10.1590/S0034-89102010000300021

MCDONALD, M. et al. The impact of musculoskeletal pain on health-related quality of life among fishing sector workers. Occupational Medicine, v. 61, n. 8, p. 517-522, 2011. DOI: 10.1093/occmed/kqr087

MIN, D. et al. Prevalence and Characteristics of Musculoskeletal Pain in Korean Farmers. Annals of Rehabilitation Medicine, v. 40, n. 1, p. 1, 2016. DOI: 10.5535/arm.2016.40.1.1

MORIGUCHI, C. S. et al. Need for recovery assessment among nursing professionals and call center operators. Work, v. 41, n. Supplement 1, p. 4838–4842, 2012. DOI: 10.3233/WOR-2012-0776-4838

NEUPANE, S. et al. Multi-site pain and working conditions as predictors of work ability in a 4-year follow-up among food industry employees. European Journal of Pain, v. 17, n. 3, p. 444-451, 2013. DOI: 10.1002/j.1532-2149.2012.00198.x

NEUPANE, S. et al. Does the association between musculoskeletal pain and sickness absence due to musculoskeletal diagnoses depend on biomechanical working conditions? Int Arch Occup Environ Health, v. 88, n. 3, p. 273-279, 2015. DOI: 10.1007/s00420-014-0957-2

NIKOLAUS, S. et al. Fatigue and Factors Related to Fatigue in Rheumatoid Arthritis: A Systematic Review. Arthritis Care & Research, v. 65, n. 7, p. 1128–1146, jul. 2013. DOI: 10.1002/acr.21949

OSBORNE, A. et al. Prevalence of musculoskeletal disorders among farmers: A systematic review. American Journal of Industrial Medicine, v. 55, n. 2, p. 143-158, 2012. DOI: 10.1002/ajim.21033

PARK, J.-H.; LIM, H.-S.; LEE, K. Work-Related Musculoskeletal Symptoms Among Dairy Farmers in Gyeonggi Province, Korea. Journal of Preventive Medicine and Public Health, v. 43, n. 3, p. 205, 2010. DOI: 10.3961/jpmph.2010.43.3.205

RASMUSSEN, C. D. N.; HOLTERMANN, A.; JØRGENSEN, M. B. Recall Bias in Low Back Pain Among Workers Effects of Recall Period and Individual and Work-Related Factors. Spine, v. 43, n. 12, p. 727-733, 2018. DOI: 10.1097/BRS.0000000000002457

ROSECRANCE, J.; RODGERS, G.; MERLINO, L. Low back pain and musculoskeletal symptoms among Kansas farmers. American Journal of Industrial Medicine, v. 49, n. 7, p. 547–556, 2006. DOI: 10.1002/ajim.20324

SKAGEN, K.; COLLINS, A. M. The consequences of sickness presenteeism on health and wellbeing over time: A systematic review. Social Science & Medicine, v. 161, p. 169-177, 2016. DOI: 10.1016/j.socscimed.2016.06.005

SKARPSNO, E. S. et al. Physical work exposure, chronic musculoskeletal pain and risk of insomnia: longitudinal data from the HUNT study, Norway. Occupational and Environmental Medicine, v. 76, n. 3, p. 179-184, 2019. DOI: 10.1136/oemed-2018-105341

SNEKKEVIK, H. et al. Fatigue and Depression in Sick-Listed Chronic Low Back Pain Patients. Pain Medicine, v. 15, n. 7, p. 1163–1170, 9 abr. 2014. DOI: 10.1111/pme.12435

TECHERA, U. et al. Causes and Consequences of Occupational Fatigue: Meta-Analysis and Systems Model. Journal of Occupational & Environmental Medicine, v. 58, n. 10, p. 961–973, out. 2016. DOI: 10.1097/JOM.0000000000000837

VIEIRA, L. M. S. M. A.; SATO, T. O. Prevalence of multisite pain and association with work ability – Cross-sectional study. Musculoskeletal Science and Practice, v. 50, n. 5, 102279, 2020. DOI: 10.1016/j.msksp.2020.102279

VIESTER, L. et al. The relation between body mass index and musculoskeletal symptoms in the working population. BMC Musculoskeletal Disorders, v. 14, n. 1, p. 238, 2013. DOI: 10.1186/1471-2474-14-238