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Self-reported prolonged standing work is not associated with lower back and lower extremity pain in viticulture workers

O trabalho em pé prolongado autorrelatado não está associado à dor na região lombar e nas extremidades inferiores em trabalhadores da viticultura.

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ABSTRACT

This cross-sectional study investigated the association between prolonged standing at work and pain in the lower back and lower limbs in viticulture workers. Prolonged standing was self-reported. Lower back and lower extremity pain were obtained using a 0-10 scale and categorized as “present” and “absent.” The association between standing work and the presence of pain was tested using binary logistic regression. 320 viticulture workers were evaluated. Participants were mainly female (78.4%), with a mean age of 36.2 (±9.1) years, 83.1% worked in the field, and 16.9% in packaging. The prevalence of pain was 50.3% for the lower back, 18.1% for the hip, 20.9% for the knee, and 24.4% for the ankle/foot. Logistic regression showed a negative association between dynamic standing at work and high-intensity pain in the lower back.

Keywords: Agriculture Work; Ergonomics; Occupational Health;

RESUMO

Este estudo transversal investigou a associação entre ficar em pé por períodos prolongados no trabalho e dor na região lombar e membros inferiores em trabalhadores da viticultura. O tempo prolongado em pé foi autorrelatado. A dor na região lombar e nas extremidades inferiores foi avaliada usando uma escala de 0 a 10 e categorizada como "presente" e "ausente". A associação entre trabalho em pé e a presença de dor foi testada usando regressão logística binária. Foram avaliados 320 trabalhadores da viticultura. Os participantes eram majoritariamente do sexo feminino (78,4%), com idade média de 36,2 (±9,1) anos, 83,1% trabalhavam no campo e 16,9% no empacotamento. A prevalência de dor foi de 50,3% para a região lombar, 18,1% para o quadril, 20,9% para o joelho e 24,4% para o tornozelo/pé. A regressão logística mostrou uma associação negativa entre ficar em pé de forma dinâmica no trabalho e dor de alta intensidade na região lombar.

Palavras-chave: Ergonomia; Saúde ocupacional; Trabalho agrícola

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INTRODUCTION

Prolonged standing at work occurs when at least 50% of the working time is spent in this position (ANDERSON et al., 2019) and it is a risk factor for low back and lower extremity pain (BALASUBRAMANIAN; ADALARASU; REGULAPATI, 2009; GABRIELA; MARGARET; THOMAS, 2017; JO et al., 2021; LOCKS et al., 2018, 2019; PEUNGSUWAN; CHATCHAWAN, 2019). However, there are conflicting findings regarding the type of standing work and the occurrence of pain. While static standing work (without displacement) induces pain and fatigue in the musculoskeletal system due to immobility (BALASUBRAMANIAN; ADALARASU; REGULAPATI, 2009; HALIM; OMAR, 2012; MCCULLOCH, 2002), dynamic standing work appears to be beneficial in breaking repetitive movement patterns (ANDERSON et al., 2019; LOCKS et al., 2018; LUNDE et al., 2021; NIELSEN et al., 2016).

On the other hand, the association between standing at work and lower back and lower extremity pain also depends on the type of tasks performed (JO et al., 2021; LUNDE et al., 2021). However, we are unaware of any study investigating this relationship in agriculture workers. This working sector is recognized for its high level of occupational injuries (BARNEO-ALCÁNTARA et al., 2021a; BERNARD et al., 2011a). The lifetime prevalence of musculoskeletal disorders in agriculture workers is 90.6% (JAKOB; SANTA; HOLTE, 2021).

Viticulture workers carry out their duties in the field predominantly standing up, with frequent displacement and strenuous working hours, especially at harvest time (BERNARD et al., 2011a; MIX et al., 2019a; REGEL; FORNECK; QUENDLER, 2020a). Also, in grape production processing, the packaging tasks highly expose the worker to static standing work. Thus, the present study evaluated whether packaging (static standing) or field (dynamic standing) tasks are associated with lower back and lower extremity pain in viticulture workers.

METHODS

This cross-sectional study was conducted on grape-producing farms in the São Francisco Valley (Petrolina – PE, Brazil). Viticulture workers of both genders, aged over 18 years, hired for field and packaging tasks, with at least six months of experience, who

could be evaluated during their working hours, were included. Those with temporary contracts, fever, or pregnancy were not included, and those with missing data were excluded. All study participants signed the Free and Informed Consent Form. The University Ethics Committee previously approved the study.

Pain intensity in the lower back and lower extremity (hip, knee, ankle/foot) was obtained using a 0-10 scale, in which 0 means “no pain” and 10 means “worst pain possible” (GUPTA et al., 2015). The viticulture workers were asked to indicate the highest pain level for each region considering the last three months (RASMUSSEN et al, 2018). Pain was then categorized as “absent” (equal to zero) or “present” (1-10). The working sector was obtained by asking, “What is your current working sector?”. Participants then indicate whether they work in the field (working in cultivating and maintaining grapevines, including pruning, thinning, harvesting, and pest management, to optimize grape quality and yield) or in the packaging house. Standing at work was quantified based on workers' self-report in hours considering time spent standing and walking, with the questions “How much of your work do you spend standing (in hours)?” and “How much of your work time do you spend walking (in hours)?”. Time spent on static standing and dynamic standing (walking) were then categorized into “low” and “high” based on their median.

A self-designed questionnaire was used to record information on sociodemographic and occupational characteristics. Sociodemographic variables included age (years); gender (male/female); Body Mass Index (BMI) (kg/cm2), calculated through self-report of body weight and height; smoking (yes/no) and alcohol consumption (yes/no) with the questions “Do you smoke?” and “Do you drink alcohol?” respectively (GUPTA et al., 2015); and level of leisure-time physical activity.

For the latter, there was quantification through self-report in hours per week, according to the questions: (1) “During your leisure time, on average, how much time do you spend sitting or lying down?”, (2) “During your leisure time, on average, how much time do you spend walking, cycling or doing light physical activities?”, (3) “During your leisure time, on average, how much time do you spend on recreational activities?” and (4) “During your leisure time, on average, how much time do you spend in vigorous activities or competitive sporting activity?”. Then, participants were classified as active or insufficiently active according to the recommendations of the World Health Organization

(WHO, 2020). All activities carried out outside the work environment were considered leisure activities.

Occupational characteristics included seniority ("How long have you worked on this task in months?"); current self-perception of health ("How do you rate your current health?", in which participants could have responded "Very good", "Good", "Relatively good", "Bad" or "Very bad"); absenteeism ("In the last three months, how many days did you need to be absent from work because of muscle or joint pain?"); workability ("How do you quantify your work ability?", in which participants rated their workability in a 0-10 scale, 0 meaning "worst possible" and 10 meaning "best possible") and work productivity ("Over the past three months, how would you quantify your productivity?", in which participants rated their self-perception of work productivity in a 0-10 scale, 0 meaning "worst possible" and 10 meaning "best possible") (HAUKKA et al., 2017). Occupational fatigue was assessed through the Brazilian Version of the Need for Recovery Scale (MORIGUCHI et al., 2010). Psychosocial work characteristics were assessed through the Brazilian version of the Job Stress Scale (ALVES et al., 2004; ARAÚJO, T. M. DE; KARASEK, 2008).

Self-perception of workload was assessed by self-reporting time pulling/pushing loads and lifting/carrying loads, using the following questions: "How much time during your work do you spend pulling or pushing loads?" and "How much of your work do you spend carrying or lifting loads?". These questions had six possible answers, and they were categorized into three groups: high handling ("Almost all the time", "Approximately ¾ of the time", and "Approximately ½ of the time"), moderate handling ("1/4 of the time") and low handling ("Rarely and never") (GUPTA et al., 2015).

Statistical analysis was performed using the Statistical Package for the Social Science (SPSS) software version 22.0 for Windows (SPSS Inc. Chicago, IL, USA). Descriptive statistics were used to describe individual, occupational, and pain characteristics. Normality and heteroscedasticity were tested using the Kolmogorov-Smirnov and multicollinearity tests, respectively.

To list the possible confounding variables, a bivariate model was constructed to associate the dependent variable pain (lower back, hips, knees, and ankles) with each independent variable. A significance value of 20% ($p < 0.2$) was considered for this stage. The multicollinearity of the chosen variables was tested, considering the tolerance (<1) and IVF (Variance Inflation Factor) values (<10). To test the association between the

lower back and lower extremities pain and standing time (static and dynamic), a binary multivariate logistic regression was performed in crude and adjusted models (considering the confounding variables). This analysis used the odds ratio estimate (Odds Ratio = OR) and 95% confidence intervals (CI) to express the degree of association between the dependent and independent variables.

RESULTS

Of the 394 workers invited to participate in the study, 81.2% were eligible, and 18.7% (n=74) participants were excluded for not presenting missing data on self-reported standing or walking time and for pain. Thus, a total of 320 viticulture workers were included. The average age of the was 32.2 (±9.1) years. Most of the workers worked in the field (83.1%), were female (78.4%), non-smokers (75.6%), consumed alcohol (58.8%), were overweight/obese (61.6%), and were classified as sedentary during leisure time (54.4%). Table 1 demonstrates the sociodemographic and occupational characteristics of eligible participants.

Table 1. Sociodemographics and occupational descriptive data on the 320 viticulture Workers.

Variable	Total	Field	Packaging
n	320	266	54
Age (years); M (SD)	36.2 (9.1)	36.7 (8.9)	33.3 (9.3)
Gender; n (%)			
Female	251 (78,4)	197 (61,1)	54 (16,9)
Male	69 (21,6)	69 (21,6)	0,0 (0,0)
BMI (kg/m²); M (SD)	26,9 (4,6)	26,5 (4,5)	29,0 (4,7)
Overweight/Obesity; n (%)	197 (61,6)	160 (53,2)	37 (12,3)
Normal; n (%)	104 (32,5)	93 (30,9)	11 (3,7)
Leisure Time Physical Activity Level; n (%)			
Insufficiently active	174 (54,4)	148 (46,4)	26 (8,2)
Active	145 (45,3)	117 (36,7)	28 (8,8)
Smoking; n (%)			
Yes	78 (24,4)	64 (20)	14 (4,4)

No	242 (75,6)	202 (63,1)	40 (12,5)
Alcohol consumption; n (%)			
Yes	188 (58,8)	159 (51,5)	29 (9,4)
No	121 (37,8)	97 (31,4)	24 (7,8)
Seniority (Months); M (SD)	41,8 (45,9)	41,6 (47)	42,9 (40)
Current health self-perception; n (%)			
Very good	127 (39,7)	107 (34)	20 (6,3)
Good	121 (37,8)	101 (32,1)	20 (6,3)
Relatively good	55 (17,2)	45 (14,3)	10 (3,2)
Bad	9 (2,8)	9 (2,9)	0,0 (0,0)
Very bad	3 (0,9)	0,0 (0,0)	3 (1)
Absenteeism (days); M (SD)	1,1 (1,4)	1,04 (2,4)	1,5 (2,7)
Workability (0-10); M (SD)	9,3 (0,9)	9,3 (0,9)	9,3 (1,1)
Self-perception of work productivity (0-10); M (SD)	9,4 (1,2)	9,3 (1,3)	9,5 (0,7)
Pulling/pushing loads; n (%)			
Never	225 (70,3)	201 (63,6)	24 (7,6)
Rarely	32 (10)	24 (7,6)	8 (2,5)
Approximately ¼ of the time	5 (1,6)	4 (1,3)	1 (0,3)
Approximately ½ of the time	9 (2,8)	5 (1,6)	4 (1,3)
Approximately ¾ of the time	4 (1,3)	2 (0,6)	2 (0,6)
Almost all the time	41 (12,8)	26 (8,2)	15 (4,7)
Lifting/carrying loads; n (%)			
Never	201 (62,8)	191 (60,4)	10 (3,2)
Rarely	30 (9,4)	28 (8,9)	2 (0,6)
Approximately ¼ of the time	13 (4,1)	2 (0,6)	11 (3,5)
Approximately ½ of the time	15 (4,7)	7 (2,2)	8 (2,5)
Approximately ¾ of the time	7 (2,2)	4 (1,3)	3 (0,9)
Almost all the time	50 (15,6)		
Occupational fatigue; M (DP)	37,2 (19,1)	37,9 (20)	33,2 (12,6)
Psychosocial work characteristics; n (%)			
High-Strain Job	89 (27,8)	61 (19,9)	28 (9,1)
Passive Job	69 (21,6)	58 (18,9)	11 (3,6)
Active Job	91 (28,4)	78 (25,4)	13 (4,2)
Low-Strain Job	58 (18,1)	56 (18,2)	2 (0,7)

***M**: Mean; **SD**: standart deviation; **n**: number of participants.

Lower back pain was the most prevalent in the population, affecting 50.3% of workers, of which 39.4% worked in the field and 10.9% in the packaging house. The hip region had the lowest prevalence in the population (18.1%), 12.8% of those working in the field, and 4.1% in packaging houses. The prevalence of knee pain was 20.9%. Of these, 18.8% were field workers, and 2.2% were packaging workers. Ankle pain was the most prevalent in the lower extremities, affecting 24.4% of workers, 19.7% in the field, and 4.7% in packaging. The absolute and relative values of the "absence" and "presence" of pain by region and sector are shown in Table 2.

Table 2. Pain characteristics according to body region and working sector.

Body region	**Total**		**Field**		**Packaging**	
n (%)	Absence	Presence	Absence	Presence	Absence	Presence
Lower back	159 (49,7)	161(50,3)	140 (43,8)	126 (39,4)	19 (5,9)	35 (10,9)
Hips	262 (81,9)	58 (18,1)	221 (69,1)	45 (14,1)	41 (12,8)	13 (4,1)
Knees	253 (79,1)	67 (20,9)	206 (64,4)	60 (18,8)	47 (14,7)	7 (2,2)
Feet/Ankles	242 (75,6)	78 (24,4)	203 (63,4)	63 (19,7)	39 (12,2)	15 (4,7)

*__n__: number of participants.

The total population spent an average of approximately 7 hours working standing. While field workers spent almost 94.2% of the time in dynamic standing (6.6 hours walking), in the packaging, it was approximately 0.9 hours (12.8%). Based on their median, static standing time was considered "high" when it was higher than 7 hours. Participants were labeled "high" dynamic standing time when they had more than 6 hours of walking time.

Table 3 shows the binary association between pain in the lower back and lower extremities with all the independent variables. As no significant associations were found between pain in the lower extremities and time standing (static or dynamic), these independent variables' final models of association will be presented only for pain in the lower back. The preliminary bivariate analysis showed an association between low back pain with the following predictors: sector ($p = 0.02$; OR = 0.48), walking time ($p = 0.05$; OR = 1.64), absenteeism ($p = 0.01$; OR = 0.84), workability ($p = 0.07$; OR = 1.25), current health self-perception ($p = 0.01$; OR = 0.65), occupational fatigue ($p = 0.01$; OR = 0.98) and psychosocial work characteristics ($p = 0.03$; OR = 1.01). Except for walking time,

those variables were chosen as confounding variables to be used in the adjusted model of the binary logistic analysis between low back pain and walking time. As no preliminary association was found between static standing and any body region pain, no further analysis was made for this variable.

Table 3. Binary logistic regression between lower back and lower extremities pain with all independente variables.

Variable	**Lower Back**		**Hips**		**Knees**		**Feet/Ankles**	
	p	OR	p	OR	p	OR	p	OR
Static standing time	0,21	1,72	0,31	0,64	0,69	1,21	0,68	0,83
Dynamic standing time	0,05	1,64	0,61	0,86	0,58	1,18	0,12	0,66
Sector	0,02	0,48	0,21	0,64	0,12	1,95	0,52	0,80
Age	0,44	0,99	0,05	0,97	0,05	0,97	0,46	1,01
Gender	0,93	0,97	0,38	0,74	0,01	0,46	0,37	1,34
BMI	0,61	1,13	0,14	1,63	0,01	2,60	0,01	2,74
Leisure Time Physical Activity Level	0,47	1,17	0,85	0,94	0,34	1,30	0,36	1,26
Smoking	0,94	0,98	0,05	1,85	0,83	1,07	0,36	0,74
Alcohol consumption	0,38	1,22	0,33	1,35	0,62	1,15	0,03	1,86
Current health self-perception	0,01	0,65	0,49	1,12	0,10	0,77	0,37	0,87
Seniority	0,69	1,00	0,17	1,00	0,99	1,00	0,07	1,00
Absenteeism	0,01	0,84	0,01	0,79	0,01	0,84	0,01	0,82
Workability	0,07	1,25	0,65	1,07	0,20	1,18	0,29	1,14
Self-perception of work productivity	0,93	1,00	0,79	0,96	0,58	0,93	0,66	1,04
Pulling/pushing loads	0,56	0,96	0,07	0,87	0,84	0,89	0,05	0,87
Lifting/carrying loads	0,97	1,00	0,50	0,95	0,29	1,08	0,54	0,96
Occupational fatigue	0,01	0,98	0,09	0,98	0,01	0,97	0,01	0,98
Psychosocial work characteristics	0,03	1,01	0,48	1,10	0,58	0,93	0,23	1,15

The last analysis was a binary multivariate logistic regression between high-intensity lower back pain and high dynamic standing time. On the crude model, there was a negative association between lower back pain and high dynamic standing time (OR: 0.48; IC: 0.26-0.89). However, no association was found in the adjusted model (OR: 0,58; CI 0.19-1.75), as shown in Table 4.

Tabela 4. Binary multivariate logistic regression between low back pain and walking time

	Crude Model			**Adjusted Model[a]**		
	p	OR	95% CI	p	OR	95% CI
Lower back pain						
High dynamic standing	0.02	0.48	0.26-0.89	0.33	0.58	0.19-175
Low dynamic standing	-	-	-	-	-	-

[a]Adjusted for sector, absenteeism, workability, current health, occupational fatigue, and psycho
work characteristics.

DISCUSSION

This study aimed to investigate the association between standing at work (static and dynamic) and lower back and lower extremity pain in viticulture workers. The hypothesis that standing work could influence the presence of pain in the aforementioned locations, especially those with static characteristics, was partially rejected.

In the lower extremities, the prevalence of pain in the total sample was 18.1% for hips, 20.9% for knees, and 24.4% for ankles/feet. Pain in the hip and knee regions is generally associated with joint degeneration that develops due to heavy work, especially in agricultural and construction workers, and its prevalence varies from 5-11% and 8-33%, respectively (HUNTER; BIERMA -ZEINSTRA, 2019). In the present study, the prevalence of hip pain was higher than previous findings, while knee pain was consistent. Meanwhile, the prevalence of ankle pain, which may be associated with the risk of slipping on unstable terrain (BARNEO-ALCÁNTARA et al., 2021) was higher than that found by Jo et al. (2021) with people who work standing (9-20%).

However, for the study population, the findings indicate that there was no significant association between the sector (fiel dor packing) and the presence of pain in the lower limbs (hip, knee, ankle/foot), which may be associated with issues related to

age, such as joint degenerations (PEREIRA et al., 2011). Our total sample was relatively young (36.2 ± 9.1 years), especially in the packaging house.

Furthermore, high physical demands of work markedly reduce life expectancy at work (PEDERSEN et al., 2020), and the average work exposure time of viticulture workers was low (41.7±46 months) in relation to studies carried out with other populations (D'ERRICO et al., 2022). This may indicate a high turnover in hiring in the local sector, difficulty for older people to carry out activities, or the lack of studies with populations with these same occupational characteristics for longer exposure.

Low back pain was the most prevalent condition in the sample, affecting 50.3% of viticulture workers. This is analogous to the general agricultural scenario in which the lower back region is the most affected among farmers (BALAGUIER et al., 2017; BARNEO-ALCÁNTARA et al., 2021; OSBORNE et al., 2012). A negative association was found between high dynamic standing time and high lower back pain in the crude model only. This can be interpreted, with caution, that dynamic work activities might benefit their workers' lower back pain-intensity.

Even though there was no significant association in the present study between standing at work and lower back pain in the adjusted model, Picon et al. (2022) found an association between the type of work (packaging and field) and the presence of lower back pain in fruit workers. Their findings indicated that packaging workers would be 1.53 times more susceptible to pain in this region (95% CI 1.09-2.15) when compared to field workers. However, in their sample of 180 fruit workers (72% field; 28% packing), those with “presence” of low back pain walked an average of 1.19 hours longer than those categorized as “absence” of low back pain, thus dynamic factor may have contributed to the outcome presented (PICÓN et al., 2022).

Studies on standing time and health outcomes can be self-reported or quantified by objective measures. Subjective measures are cheaper, less complex in their execution and more common, especially in research in developing countries, such as the present study. However, self-reported data present memory biases and a tendency to under- or overestimate reported values (COENEN et al., 2017). Therefore, studies with objective measurements are recommended to investigate the relationship between time spent standing and the occurrence of pain in viticulture workers better, especially in longitudinal studies.

Other important factors were the rates of overweight/obesity (61.6%), the tendency towards low levels of leisure-time physical activity (54.4%), and the low rate of absenteeism (1.1±1.4 days) in the studied population. Previous reports in the literature indicate that spending long periods standing and walking at work causes compensatory sedentary behavior during leisure time (GARCIA et al., 2016; HOLTERMANN et al., 2012; RASMUSSEN et al., 2018), and the sedentary lifestyle contributes to the development of chronic pain throughout aging (ABNER; SLUKA, 2017).

Furthermore, even with a low average of absenteeism (1.1 ± 1.4 days), pain was present in up to 50.3% of viticulture workers, indicating the occurrence of presenteeism. This can lead to complications such as depression, exhaustion, mental health problems, and economic burdens (SZEWCZYK et al., 2022). Therefore, preventive actions are recommended, including moments of rest at work and increasing time spent in leisure-time physical activities to reduce the tendency to a sedentary lifestyle, overweight/obesity, musculoskeletal disorders, and other morbidities, and reduce absenteeism and/or presenteeism rates.

CONCLUSION

Despite a higher occurrence of lower back and lower extremity pain, a negative association was only found in the crude model between lower back pain and dynamic standing at work among viticulture workers in São Francisco Valley.Os artigos devem conter no máximo 10 mil palavras em folha tamanho A4. As margens laterais devem estar em 3cm e as margens superior e inferior, 2,5cm.

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