



Prevalence and Factors Associated with Pain and History of Musculoskeletal Injuries in Skateboarders

Prevalência e fatores associados à dor e ao histórico de lesões musculoesqueléticas em skatistas

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Abstract

Objective (a) To identify the prevalence of current musculoskeletal pain and injury in the last year and (b) to verify the association of the presence of current pain and the history of injury with demographic, sports, and health characteristics in skateboarders.

Method A cross-sectional observational study was conducted with 64 skateboarders who answered a questionnaire addressing demographic, sports practice, and health characteristics. The Fisher exact test verified the association of these characteristics with the presence of current pain and with the report of injury in the last year. The chi-squared test verified whether there was a difference between the observed and expected distribution for the body segment reported with pain and history of injury, and with the type of injury.

Results The prevalence of pain was of 82.8%, and the observed frequency was higher than expected ($p < 0.01$) in the knee, the ankle, the lumbosacral region, and the foot. The presence of pain was associated with age ($p = 0.05$) and with whether the patient had already undergone physical therapy treatment ($p < 0.01$). The prevalence of injury in the last year was of 68.8%, and the frequency observed was higher than expected ($p < 0.01$) in the knee, the ankle, the wrist, the hand, the foot, and the shoulder. Sprain and fracture showed a higher frequency than expected ($p < 0.01$). The history of injury was associated with the use of protective equipment ($p = 0.01$), having already undergone surgery ($p = 0.02$), and physical therapy treatment ($p = 0.03$).

Conclusion The practice of skateboarding presents a high prevalence of pain and injuries in the last year. The findings may contribute to the planning of preventive strategies.

Keywords

- ▶ pain
- ▶ epidemiology
- ▶ sports
- ▶ musculoskeletal system/injuries
- ▶ skate

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Resumo

Objetivo (a) Identificar a prevalência de dor musculoesquelética atual e lesão no último ano e (b) verificar a associação da presença de dor atual e da história de lesão com características demográficas, da prática esportiva e da saúde em skatistas.

Método O presente estudo observacional transversal foi realizado com 64 skatistas que responderam a um questionário abordando características demográficas, da prática esportiva e da saúde. O teste exato de Fisher verificou a associação dessas características com a presença de dor atual e com o relato de lesão no último ano. O teste de qui-quadrado verificou se havia diferença entre a distribuição observada e a esperada para o segmento corporal relatado com dor e com histórico de lesão, e com o tipo de lesão.

Resultados A prevalência de dor foi de 82,8%, sendo a frequência observada maior do que a esperada ($p < 0,01$) no joelho, no tornozelo, na região lombossacra e no pé. A presença de dor foi associada à faixa etária ($p = 0,05$) e a tratamento fisioterápico prévio ($p < 0,01$). A prevalência de lesão no último ano foi de 68,8%, sendo a frequência observada maior do que a esperada ($p < 0,01$) no joelho, no tornozelo, no punho, na mão, no pé e no ombro. Entorse e fratura apresentaram uma frequência observada maior do que a esperada ($p < 0,01$). O histórico de lesão foi associado ao uso de equipamento de proteção ($p = 0,01$), cirurgia prévia ($p = 0,02$) e tratamento fisioterápico ($p = 0,03$).

Conclusão A prática de skate apresenta uma prevalência alta de dor e de lesões no último ano. Os achados podem contribuir com o planejamento de estratégias preventivas.

Palavras-chave

- ▶ dor
- ▶ epidemiologia
- ▶ esportes
- ▶ sistema musculoesquelético/lesões
- ▶ skate

Introduction

Data from emergency sectors indicate many injuries due to skateboarding.¹⁻³ This sport requires the generation of great propulsive force and the ability to handle high-magnitude impact forces.⁴ The high demand on the musculoskeletal system can contribute not only to the development of lesions, but also to pain. Few studies have investigated musculoskeletal pain in skateboarders.⁵ This condition can alter the performance of the athlete and, therefore, impact their sports practice.⁶ Nevertheless, it is observed that, usually, there is no preventive approach to skateboarding, in contrast with other sports. Thus, the expansion of the understanding of musculoskeletal injuries and pain in skateboarders can contribute to the necessary basis for the planning of preventive actions.

Demographic, sports, and health characteristics may be associated with musculoskeletal injuries and pain in skateboarders. Demographic characteristics such as sex and age are indicated in studies on injuries, with the suggestion that younger people tend to get injured more often.^{2,3} While studies indicate that lesions are common in male skateboarders,^{2,3} a recent study suggests that sprains may be more frequent in females.⁷ The characteristics of sports practice, such as level of experience and use of protective equipment, are also commonly raised in studies describing the injury profile.⁷⁻⁹ Healthcare characteristics such as performing preventive activity and having health professional care are less studied, although they are related to sports injuries.¹⁰ Thus, studies on musculoskeletal injuries and pain

in skateboarders should consider possible associations with demographic, sports, and health characteristics.

Skate has recently been recognized as an Olympic sport and, therefore, there is a need to expand the evidence on the profile of injuries.⁸ The establishment of the characteristics of the lesion and its extension are understood in the field of sports medicine as the first step for the planning of preventive actions.¹¹ Therefore, the objectives of the present study were to (a) identify the prevalence of current musculoskeletal pain and injury in the last year in skateboarders, and (b) to verify the association of the presence of current pain and injury in the last year with the demographic, sports practice and health characteristics of skateboarders.

Methods

A cross-sectional observational study was conducted. The sample was recruited by convenience, in competitions and skate tracks in the metropolitan region of Belo Horizonte, state of Minas Gerais, Brazil. To participate in the present study, the volunteer should be a skateboarding practitioner. Underage participants had to have the consent of the guardian. Volunteers who practiced the sport less than once a week were excluded. The present study was approved by the Research Ethics Committee of the institution (CAAE 21230919.9.0000.5093), and all participants signed a free and informed consent form.

A questionnaire was applied by 2 researchers during the 2nd semester of 2019 containing questions grouped into demographic characteristics, sports practice, and health.

The demographic characteristics investigated were age and sex. The characteristics of sports practice investigated were modality and category described by the Brazilian Skate Confederation,¹² amount of time of sports practice, frequency of weekly practice, number of hours per day of practice, objective of practice (fun, competition or both), and use of protective equipment during practice. The health characteristics investigated were presence of pain at the time of questionnaire application and, in case of a positive answer, the part of the body in which they felt pain; history of musculoskeletal injury in the last year and, in case of a positive answer, the injured body part and the type of injury. The injury was defined as any physical complaint due to the practice of skateboarding that resulted in a modification of sports practice or in nonparticipation in training or competition.^{7,13} For the categorization of the part of the body that felt pain and was injured, as well as the type of injury, the guidelines of the International Olympic Committee Injury and Illness Epidemiology Consensus Group were followed.¹⁴ In addition, it was investigated whether the participant had already undergone any surgery or physical therapy treatment resulting from the injury generated by the practice of skateboarding, as well as any activity that they considered preventive.

Statistical Analysis

The prevalence of pain at the time of application of the questionnaire, as well as the history of injury in the last year, was calculated. The Fisher exact test was performed to verify the association between the presence of pain, as well as the presence of injury in the last year, and the variables investigated in the questionnaire. In the presence of a significant association, analysis of the adjusted residual was performed to identify which cell in the contingency table made a significant contribution to the result. In this analysis, if the value of the adjusted residual is beyond ± 1.96 , there is an indication that the number of cases in the contingency table cell was different from the expected. A goodness of fit chi-squared test was performed to verify whether the observed distribution was different from that expected in the responses related to the segment of the body with pain and with a history of injury, as well as the type of injury. A significance level (α) of 0.05 was established for all tests.

Results

Sixty-four skaters participated in the present study. Demographic characteristics are shown in ► **Table 1**. The frequency observed in each response related to the characteristics of sports and health practice are presented in ► **Tables 2** and **3**.

Current pain

The prevalence of pain at the time of application of the questionnaire was 82.8% (53 skaters). The body segments reported with pain are presented in ► **Table 4**. The chi-squared test revealed that the distribution of the responses was not uniform and, therefore, it was different from the expected for the body segment with pain ($\chi^2 [10] = 74.91$; $p < 0.01$). The knee, the ankle, the lumbosacral region, and

Table 1 Demographic characteristics

	n (%)
Age	
11–16 years old	3 (4.7%)
17–22 years old	17 (26.6%)
23–28 years old	16 (25.0%)
29–34 years old	11 (17.2%)
35–40 years	8 (12.5%)
41–46 years old	6 (9.4%)
> 46 years old	3 (4.7%)
Sex	
Male	53 (82.8%)
Female	11 (17.2%)

the foot presented a higher frequency than expected, while the other segments presented a lower frequency than expected.

The presence of pain was associated with age group ($p = 0.05$). The analysis of the adjusted residual indicated that, in the category between 11 and 16 years old, there was a greater contribution to this association from those who did not present pain ($Z = 3.9$), and a lower contribution from those who did ($Z = -3.9$). The presence of pain was also associated with having already undergone physical therapy treatment ($p < 0.01$). The adjusted residual analysis indicated that, among those who had not undergone treatment, there was a greater contribution to this association from those who did not have pain ($Z = 4.1$), and a lower contribution from those who had pain ($Z = -4.1$). Among those who underwent physiotherapeutic treatment, there was a greater contribution from those who feel pain ($Z = 4.1$), and a lower contribution from those who did not feel pain ($Z = -4.1$).

There was no association between the presence of pain and the following variables: sex ($p = 0.67$), skate modality ($p = 0.23$), amount of time of sports practice ($p = 0.67$), frequency of weekly practice ($p = 0.74$), hours per day of practice ($p = 0.20$), practice objective ($p = 0.67$), skateboarder category ($p = 0.87$), use of protective equipment ($p = 0.47$), history of injury in the last year ($p = 0.30$), history of surgery ($p = 1.00$), and if there was any activity that the skater considered that prevented injuries ($p = 1.00$).

Injury history in the last year

The prevalence of injury in the last year was 68.8% (44 skaters). The body segments reported with a history of injury and the type of injury are presented in ► **Tables 5** and **6**, respectively. The chi-squared test revealed that the distribution of the answers was not uniform and, therefore, it was different from the expected for body segment ($\chi^2 [12] = 48.94$; $p < 0.01$) and the type of injury ($\chi^2 [6] = 44.39$; $p < 0.01$). The frequency observed was higher than expected in the knee, the ankle, the wrist and hand, the foot, and the shoulder, while in the other segments it was lower than expected. The

Table 2 Characteristics of sports practice

	<i>n</i> (%)		<i>n</i> (%)
Mode		Weekly training frequency	
Banks	1 (1.6%)	1x	7 (10.9%)
Bowl	3 (4.7%)	2x	12 (18.8%)
Overall	9 (14.1%)	3x	16 (25.0%)
Park	2 (3.1%)	4x	9 (14.1%)
Street	46 (71.9%)	5x	11 (17.2%)
Vertical	3 (4.7%)	6x	5 (7.8%)
Category		7x	4 (6.3%)
Amateur	30 (46.9%)	Hours per workout	
Grand Legend	1 (1.6%)	< 1 h	1 (1.6%)
Grand Master	1 (1.6%)	1–2h	22 (34.4%)
Beginner	13 (20.3%)	3–4h	25 (39.1%)
Legend	4 (6.3%)	> 5h	16 (25.0%)
Master	4 (6.3%)	Objectives of the practice	
Under 12	1 (1.6%)	Competition	1 (1.6%)
Professional	9 (14.1%)	Fun	29 (45.3%)
Vintage	1 (1.6%)	Fun and Competition	34 (53.1%)
Amount of time of sports practice		Use of protective equipment	
< 1 year	2 (3.1%)	No	38 (59.4%)
1–5 years	15 (23.4%)	Yes	15 (23.4%)
6–10 years	10 (15.6%)	Only in competitions	11 (17.2%)
> 10 years	37 (57.8%)		

type of lesion presented a higher frequency than expected for sprain, fracture, and for those who could not specify, while in the other types the frequency was lower than expected.

The presence of injury in the last year was associated with the use of protective equipment ($p = 0.01$). The analysis of the adjusted residual indicated that, in the response “used only in competition”, there was a greater contribution to this association from those who had no history of injury ($Z = 3.3$), and a lower contribution from those who had a history of injury ($Z = -3.3$). There was also an association between

history of injury and history of surgery due to skateboarding injury ($p = 0.02$). The analysis of the adjusted residual indicated that among those who did not report a history of surgery, there was a greater contribution to the association from those who had no history of injury ($Z = 2.3$), and a lower

Table 4 Body segment reported as with pain at the time of questionnaire application, ordered from the most frequent segment to the least frequent

Table 3 Health-related characteristics

	<i>n</i> (%)
History of surgery due to sports injury	
No	54 (84.4%)
Yes	10 (15.6%)
History of physical therapy treatment	
No	28 (43.8%)
Yes	36 (56.3%)
Performs activity that considers as preventive	
No	22 (34.4%)
Yes	42 (65.6%)

Body segment	<i>n</i> (%)
Knee	32 (23.0%)
Ankle	24 (17.3%)
Lumbosacral spine	23 (16.5%)
Foot	15 (10.8%)
Wrist/Hand	10 (7.2%)
Shoulder	10 (7.2%)
Lower Leg	8 (5.8%)
Hip	7 (5.0%)
Arm	4 (2.9%)
Thigh	4 (2.9%)
Elbow	2 (1.4%)
Total	139 (100.0%)

Table 5 Body segment with history of injury in the last year, ordered from the most frequent segment to the least frequent

Body segment	n (%)
Knee	14 (21.9%)
Ankle	13 (20.3%)
Wrist/Hand	8 (12.5%)
Foot	7 (10.9%)
Shoulder	6 (9.4%)
Lumbosacral spine	4 (6.3%)
Hip/Groin	3 (4.7%)
Head	3 (4.7%)
Lower Leg	2 (3.1%)
Thigh	1 (1.6%)
Trunk	1 (1.6%)
Elbow	1 (1.6%)
Forearm	1 (1.6%)
Arm	1 (1.6%)
Total	64 (100.0%)

Table 6 Type of injury suffered in the last year, ordered from the most frequent type to the least frequent

Type of injury	n (%)
Joint sprain (ligament tear or acute instability episode)	22 (42.3%)
Fracture	11 (21.2%)
Cartilage injury	4 (7.7%)
Muscle injury	3 (5.8%)
Tendinopathy	2 (3.8%)
Bone stress injury	1 (1.9%)
Could not say	9 (17.3%)
Total	52 (100.0%)

Note: The categories follow those recommended by the *International Olympic Committee Injury and Illness Epidemiology Consensus Group*,¹⁴ in which sprain includes partial or complete rupture as well as nonspecific ligament and joint capsule injuries, dislocation and joint subluxation; fracture is a traumatic injury that includes avulsion and dental fracture; cartilage injury includes meniscal, labral, articular cartilage and osteochondral cartilage injury; muscle injury includes strain and rupture; tendinopathy includes paratendon, related bursa, fasciopathy, partial tear, tendinous subluxation, and enthesopathy; bone stress injury includes bone marrow edema, stress fracture, and periostitis.

contribution from those with a history of injury ($Z = -2.3$). Among those who reported a history of surgery, there was a greater contribution to the association from those with a history of injury ($Z = 2.3$), and a lower contribution from those without a history of injury ($Z = -2.3$).

The presence of injury in the last year was also associated with having already undergone physical therapy treatment ($p = 0.03$). The analysis of the adjusted residual indicated

that, among those who did not undergo physical therapy, there was a greater contribution to the association from those who had no history of injury ($Z = 2.3$), and a lower contribution from those with a history of injury ($Z = -2.3$). Among those who underwent physical therapy, there was a greater contribution to the association from those with a history of injury ($Z = 2.3$), and a lower contribution from those without a history of injury ($Z = -2.3$).

There was no association between the presence of injury in the last year and the following variables: age group ($p = 0.83$), sex ($p = 0.73$), skate modality ($p = 0.79$), amount of time of sports practice ($p = 0.97$), frequency of weekly practice ($p = 0.16$), hours per day of practice ($p = 0.47$), practice objective ($p = 0.20$), skater category ($p = 0.86$), and performance of some activity that the skater considered that prevented injuries ($p = 0.58$).

Discussion

The present study identified the prevalence of current musculoskeletal pain and sports injury in the last year in skateboarders and verified the association of pain and injury with demographic, sports practice, and health characteristics. The prevalence of pain was high and more frequent in the knee, the ankle, the lumbosacral region, and the foot. The comparison of these findings with others is restricted due to the limited number of studies on musculoskeletal pain in skateboarders. The results partially corroborate another study that did not identify an association between skate practice and pain in three body segments investigated: the shoulder, and the cervical and lumbar spine.⁵ Thus, the high prevalence of pain, especially in the lower limbs, reinforces the understanding that skateboarding is a sport that exerts great overload to the musculoskeletal system.

The category between 11 and 16 years old was less associated with pain reports. Other studies indicate greater hospitalization in this age group and hypothesize that the reason would be the worse coordination among young people.^{8,15} Younger skateboarders are possibly seeking care for trauma rather than for overuse injuries. In addition, the category between 11 and 16 years old was one of the categories with the lowest number of skateboarders recruited. Since the sampling method used was nonprobabilistic, the recruited skaters may present some overrepresented or underrepresented characteristic of the population.¹⁶ Therefore, future studies may verify whether any other characteristics influenced the identified association.

The presence of pain was also associated with having already undergone physical therapy treatment. Due to the cross-sectional design of the present study, it is not possible to verify whether pain was present before or if it began after physical therapy treatment. The association identified may suggest that the factors related to the presence of pain are similar to the musculoskeletal condition that led the skater to be treated by a physical therapist.

The prevalence of injuries in the last year was also high, but lower than those observed in other studies.^{7,17} Injuries occurred more frequently in the knee, the ankle, the wrist

and hand, the foot, and the shoulder. This result corroborates studies that indicate that most lesions occur in the lower^{7,15,17} and upper limbs.^{8,18–20} In the lower limbs, knee injuries are usually the result of direct impact, overload (for example, patellofemoral pain), as well as meniscus and cruciate ligament injuries.¹⁸ These injuries are probably the result of the characteristics of sports maneuvers, which demand a lot of from the knee extensor mechanism.^{20,21} These maneuvers also involve jumping (for example, ollie), and direction changes that include rotational movements in the knee (for example, body varial), a pattern typically associated with ligament and meniscus injuries.^{22,23} The literature also indicates that one of the mechanisms of ankle injury is when it is trapped between the skate board and the ground or by collision with vehicles.⁸ In the upper limbs, there is emphasis on the wrist and hand region,^{8,19,24} commonly injured due to fall on the upper limb with the elbow and wrist extended.^{8,9} In addition, sprain and fracture injuries were the most frequent, which corroborates other findings.^{2,7,8,15,20,24} The literature suggests that sprains often occur in the ankle due to the maneuvers performed.²³ Thus, the history of injury reinforces that the practice of skateboarding has a profile of serious injuries to the musculoskeletal system.

The absence of injury in the last year was associated with the use of protective equipment during competitions. This result corroborates the recommendation of the use of these equipment as a preventive strategy.⁸ Despite this, many skaters choose not to wear protective equipment.⁹ Thus, despite common arguments for non-use, such as discomfort and appearance,⁸ the results reinforce that the use should be encouraged. It is noteworthy that protective equipment may not be sufficient to prevent all injuries, such as those caused by high load magnitude (for example, severe knee sprains).

Skateboarders who reported having undergone surgery and physical therapy were more associated with a history of injury. These findings reinforce the interpretation that, possibly, the factors that led to the development of the injury also favored the emergence of the musculoskeletal condition that led the skater to seek healthcare. In addition, there was no association between the performance of an activity that the skater considered preventive and the presence of injury or pain. Nevertheless, studies indicate that training to improve physical performance and dynamic joint stability is a strategy to avoid and minimize injuries in skateboarders.⁸ One of the reasons for not observing this association may be beliefs to what would be preventive activity, since we have observed reports that mentioned that stretching would be a preventive strategy. The low knowledge of what is considered a preventive activity reinforces the importance of greater support from health professionals through educational actions and evaluations to trace possible causative factors.

The present study has some limitations. Most of the skateboarders recruited were street skateboarders. In addition, the injury registry may present memory bias,¹⁶ in which skaters tend to report only the lesions that most impacted their practice. The restriction of injuries to the

last year instead of investigating a longer period was a strategy adopted to minimize this bias. In addition, the current pain record was investigated through a questionnaire applied at skate tracks and competitions. The investigation of this variable at other times could result in different findings. Therefore, future prospective studies that consider greater participation of other modalities and the influence of different contexts may contribute to the understanding of pain and injuries in skaters.

Conclusion

The high prevalence of current pain and injury in the last year corroborates the understanding that skateboarders are exposed to several risks in their practice. Pain was more frequent in the knee, the ankle, the lumbosacral region, and the foot, and it was associated with age group and with having already undergone therapeutic treatment. The injuries in the last year were more frequent in the knee, the ankle, the wrist and hand, the foot, and the shoulder. The most common types of injury were sprain and fracture. A history of injury was associated with the use of protective equipment and with having undergone surgery and physical therapy treatment.

Note

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Conflict of Interests

The authors have no conflict of interests to declare.

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