

**Research Article**

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# Epidemiological Evaluation of Running: Clinical Parameters and Main Pathologies of the Lower Limbs in Amateur Runners

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## Abstract

**Objective:** To analyze the epidemiological profile of lower limb pathologies in road runners assessed in a Brazilian private orthopedics and physical therapy service.

**Method:** Retrospective analysis of 197 medical records of runners undergoing a running assessment in an Orthopedics and Physical Therapy clinic in Campinas, state of São Paulo, Brazil, in 2017 and 2018.

**Results:** Of the total number of runners evaluated, 59.9% were male, mean age 38.1 years and the majority (88.3%) ran weekly between 1 and 35 km; 52.2% had specific pathologies of the lower limbs, the most prevalent (48%) was patellofemoral dysfunction, followed by iliotibial band syndrome (22%), medial tibial stress syndrome (17%), plantar fasciitis (9%) and Achilles tendonitis (4%).

**Conclusion:** Most amateur runners are young men (between 30 and 45 years old) and run up to 35 km/week. In addition, the major lower limb pathologies found, such as patellofemoral dysfunction, iliotibial band syndrome, medial tibial stress syndrome, plantar fasciitis and Achilles tendinitis confirm the literature.

**Keywords:** Road running; Lower limbs; Amateur runners; Running epidemiology.

## Introduction

Road running is a growing sport in Brazil, with an estimated 4 million runners who move a market of 3.1 billion reais (620 million dollars) [1]. Due to its characteristics, road running can be practiced by any individual, athlete or not, and the runner does not necessarily need to have a specific skill to practice it [2]. In addition, the number of female participants in this modality is growing all over the world, as well as that of progressively older members

[3]. Studies highlight the popularity of running and, consequently a greater demand for the analysis of exercise-related pathologies.

The risk of developing injuries due to the mechanical impact of physical activities such as running increases when this is done without adequate professional supervision, and in this sport, they mainly occur in the lower limbs.

A Brazilian study that evaluated 3,786 recreational road run-

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ners indicates a higher prevalence of injuries in male runners, with 28.3% (95% CI 22.5-35%), with a prevalence for females of only 9.1% (95% CI 5.3-15.2%). Regarding the most injured site, the knee has a predominance of 32.9%, a result similar to that reported by Van Gent et al.[4] on injuries in the lower limbs of long-distance runners. Muscle injuries, such as strains, had a predominant number of 27.9%, while ligament injuries, such as dislocations, followed with 27.8%. Finally, inflammatory lesions had a prevalence of 26.5% and bone lesions, including fractures, had a prevalence of 5.6% [5].

Therefore, it is important to consider the risk factors for a runner to develop injuries resulting from physical exercise, the main factors are previous injuries, weekly distance covered and age [6].

The greater the weekly distance covered, the greater the risk of injury due to a chronic state of fatigue, since the muscular and skeletal system do not have enough time to regenerate from the minor injuries caused by the practice. There is a directly proportional relationship between increased weekly training and the risk of musculoskeletal injury, a consequence of a chronic state of fatigue caused by the imbalance between recovery time and sports practice [7].

Furthermore, Hreljac [8], analyzed the risk factors for injuries in road runners and found that 64.5% individuals practiced more than one physical exercise and overloaded the body, increasing the chance of injuries. Moreover, the lack of professional monitoring is an important factor analyzed by Pazin et al. [9] and Barsottini et al. [10], who found that 57% runners did not have the guidance of a physical educator [11].

Thus, the goal of this study was to analyze clinical parameters such as gender, age, weight, height, weekly mileage covered and its association with lower limb pathologies in amateur runners evaluated in 2017 and 2018 in a private orthopedics and physical therapy service.

### Material and Methods

Retrospective cross-sectional study covering the period 2017 and 2018 in a physical therapy clinic in Campinas, state of São Paulo, Brazil, in which 197 running assessing records were selected and analyzed. A total of 197 runners were evaluated, who had ankle and foot complains. Amateurs runners over 18 years of age, both genders, who sought the service with complaints of discomfort or pain in the musculoskeletal system were considered.

Patients under 18 years of age were excluded; practitioners of less than 1 km per week and asymptomatic subjects.

This study was approved by the Human Research Ethics Committee and registered at Plataforma Brasil with CAAE 88812818.3.0000.5481.

For this research, injury related to running was defined as any physical complaint developed in relation to running activities, causing restriction in running distance, speed, duration or frequency [12]. In this study, we defined the runner as the individual who runs at least three times a week for at least 6 months, with weekly mileage greater than or equal to 6 km per week, regardless of experience (amateur, experienced, professional, etc.).

Amateur runners over 18 years of age, both genders, who sought the service with complaints of discomfort or pain in the musculoskeletal system were included in the sample. Patients under 18 years of age, practitioners of less than 1 km per week and asymptomatic individuals were excluded from the research.

This study analyzed factors influencing the runner's performance, namely: gender, age, weight, height, weekly mileage covered and injuries. All variables in this study were obtained from patients medical records.

**Informed consent:** Informed consent was obtained from all subjects included in this study.

**Ethical approval:** The study was approved by the Human Research Ethics Committee registered at Plataforma Brasil with CAAE 88812818.3.0000.5481.

### Results

In this evaluation, an analysis of the functional assessment records of running of amateur runners was carried out, considering factors that can influence the runner's performance, such as gender, age, weight, height, weekly mileage covered and injuries.

Information from 197 road runners was analyzed, being 118 (59.9%) males and 79 (40.1%) females. Mean age was 38.1 years (ranging from 18 to 60 years). Mean weight was 70.4 kg (ranging from 41 to 105 kg) and mean height was 171.4 cm (ranging from 153 to 193 cm). The weekly mileage covered ranged from one to 100 km per week, with 174 (88.3%) runners covering between 1 and 35 km; 18 (9.1%) runners ran between 36 and 70 km and five (2.5%) of them ran between 70 and 100 km Table 1.

**Table 1:** Characteristics.

			Total
<b>Sex</b>	Male 118 (60%)	Female 79 (40%)	197
<b>Age (years)</b>	Mean 38,1		
<b>Weight (kg)</b>	Mean 70,4		
<b>Height (m)</b>	Mean 1,71		
<b>Cadence (Steps per minute)</b>	Mean 169,8		
<b>Milage per Week</b>	1-35 km 174 (88%)	36-70 km 18 (9%)	71-100 km 5 (3%)
<b>Dominat Member</b>	Right 176 (89%)	Left 21 (11%)	
<b>Specific Pathology of the Lower Limb</b>	No 94 (48%)	Yes 103 (52%)	

In total, one hundred and three (52.2%) individuals showed specific pathologies of the lower limbs and 94 (47.7%) did not. Among these pathologies of the lower limbs, patellofemoral dysfunction was the most frequent in 49 cases (48%), followed by iliotibial band syndrome with 23 cases (22%), medial tibial stress syndrome (shin splints) in 18 (17%), plantar fasciitis in nine cases (9%) and Achilles tendonitis in four subjects (4%).

## Discussion

Analyzing clinical parameters and the main pathologies of the lower limbs in runners is important to develop ways of prevention and define their treatment, aiming at achieving better performance and lower incidence of predictable injuries.

Literature data indicate a high incidence of lower limb injuries in runners, with numbers ranging between 26% and 92.4% [4]. This study confirmed this finding, with a prevalence of 52.2% runners with lower limb injuries.

The greater number of injuries in male runners in this study is also in line with the literature, which shows a predominance of injuries in males short-distance runners [13] although some authors have not found this difference [14]. The literature still discusses that women and men demonstrate different magnitudes of muscle strength, synchronization and variability during running, which can result in different types of injuries in the lower limbs [15]. Studies show a predominance of injuries to the Achilles tendon in men [16], this being the fifth most frequent lesion in our study, and patellofemoral dysfunction in women [17].

As for the age group, 69% runners were between 30 and 45 years old. The literature points to evidence that young age is a protective factor for injuries related to running [18], and there are also studies demonstrating the limited evidence between high ages and a higher risk for Achilles tendinopathies [19]. Our findings confirm previous studies that also pointed out more injuries in the age group between 30 and 45 years old [20], in others, the most affected age group was that of runners between 18 and 30 years old [21].

The present study indicates an average weight of 70.4 kg (ranging from 41 to 105 kg) and an average height of 171.4 cm (ranging from 153 to 193 cm). The literature that correlates anthropometric values with injuries in runners indicates that overweight runners tend to have a higher prevalence of shin and foot injuries compared to ideal weight amateur runners [22]. A common etiological cause affecting the shin in runners is the lateral tibial stress syndrome; this was the third most frequent lesion in our study (17%), and plantar fasciitis, a possible etiology for foot lesions, the fourth most frequent lesion (9%) found.

Regarding the weekly mileage covered, 88.3% analyzed runners covered between 1 and 35 km. Previous studies have correlated distance covered as a risk factor for injuries in runners. Studies indicate a distance greater than 20 km per week as a predictive factor for injuries in runners [23]. However, in another study, when comparing short- and long-distance event amateur runners, the distance covered was not the main risk factor for lower limb injuries, with previous injuries and weekly training volume being the main risk factors [24].

There are also studies that corroborate the four lesions most found in our study, such as patellofemoral syndrome, iliotibial band syndrome, medial tibial stress syndrome and plantar fasciitis [21,25].

Patellofemoral syndrome was the most frequent lesion in the runners studied, found in 48% patients with specific pathologies of the lower limbs. The high incidence of this injury brings a warning for runners, since a previous retrospective study reported that 74% athletes with patellofemoral syndrome limited or discontinued sports practice due to the painful symptom [26]. For this type of injury, an important risk factor is the quadriceps angle (Q angle), which may be increased in runners with patellofemoral syndrome and is significantly altered in patients with chronic patellofemoral instability compared to healthy controls [27].

Lateral tibial stress syndrome was identified in 17% evaluated runners, being the third most frequent injury. These data are in line with previous studies that demonstrated a rate ranging from 13.2% to 17.3% [28]. There are two possible explanations for the high incidence of lateral tibial stress syndrome. The first is that it occurs during propulsion and landing on the ground. Repetitive contractions of the tibialis posterior, soleus, and flexor digitorum longus muscles could generate excessive stress on the tibia, which would result in inflammation of the periosteum insertion. The second explanation is the insufficient tibia remodeling, caused by the repetitive and constant stress of muscle contractions and by the vertical reaction of the ground during the landing phase of the running [29].

The fourth most frequent lesion of the lower limbs in the present study was plantar fasciitis. Although it is a frequent injury related to running, its etiology and precise mechanism are not fully known. Weak intrinsic foot musculature is identified in the literature as one of the causes of plantar fasciitis: an insufficient dynamic structure to support the medial longitudinal arch of the foot can lead to increased tension in the plantar fascia, causing plantar fasciitis [30].

Achilles tendonitis, on the other hand, the fifth most frequent injury in the study, is caused mainly by the excessive load generated in the gastrocnemius and soleus muscles during running [29].

The present study has limitations, given the bias in the selection of participants, since all patients analyzed come from the same private clinic. Also, as this was a retrospective analysis that depended on information from medical records, it was impossible to confirm any unfilled information in the patient's medical record.

## Conclusion

Running injuries seem to have a multifactorial origin, but on the basis of our findings, efforts to prevent injury should focus on runners, especially young men, with a history of run up to 35 km/week and provide customized training and/or specific exercises seeking to prevent the most prevalent injuries found.

**Conflict of interest:** There are no conflicts of interest.

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