

Relationship between Patellofemoral Pain and Foot Strike in Recreational Running

A Relação da Dor Patelofemoral do Joelho com o Tipo de Pisada na Corrida de Rua

Rodrigo Kancelskis Prado^{*a}; Tamires Passos^b; Alexandre Souza Cury^b

^aUniversidade Anhanguera-Uniderp, Orthopedics Department. MS, Brazil.

^bUniversidade Anhanguera-Uniderp, School of Medicine. MS, Brazil.

*Email: rodrigo27prado@hotmail.com

Abstract

Patellofemoral knee pain is one of the most common complaints among runners. This study has as objective to verify if patellofemoral pain (PFP) is related to foot strike during running. The project was a cross-sectional, primary and observational study with quantitative analysis, targeting 131 runners, lasting from August to December 2022. The instrument was carried out through an interview, in which a questionnaire was used and 131 runners were interviewed, 79 females and 52 males. Average age was 41 years. The average weight was 64 kilos. The average running experience was 6 years, the average cadence 176 steps/min and average pace 5:50 min/km. The average running kilometers per week was 25.68 km; 69 (52.67%) runners never had PFP, 80 (61.07%) runners use the forefoot to run while 15 (11.45%) use the rearfoot. Of the 80 runners who use the forefoot, 38 (29.01%) had PFP while of the 15 runners who use the rearfoot, 9 (6.87%) had PFP. 38 (29.01%) do not do muscle strengthening to help with running. Interpretation. The present study did not statistically prove whether the type of step (rearfoot or forefoot) is directly related to PFP; 27.38% of runners responded that they did not care about the type of step in running; 29.01% do not know how to use cadence or do not care about it.

Keywords: Knee. Patellofemoral Pain Syndrome. Patellofemoral Joint.

Resumo

A dor patelofemoral do joelho (DFP) é uma das queixas mais comuns entre corredores e este estudo tem como objetivo verificar se a DFP tem relação com o tipo de pisada durante a corrida de rua. Trata-se de um estudo transversal, primário e observacional, de análise quantitativa, tendo como sujeitos corredores amadores. Utilizou-se como instrumento de coleta de dados uma entrevista guiada por questionário padronizado. No período de agosto a dezembro de 2022 foram entrevistados 131 corredores, 79 do sexo feminino e 52 masculinos, com idade média de 41 anos. O peso médio do corredor foi 64 quilos. Os atletas possuíam, em média, seis anos de prática de corrida. A cadência média foi de 176 passos/min e pace médio de 5:50 min/km. A média semanal de quilômetros percorridos foi 25,68 km. Sessenta e nove (52,67%) corredores nunca tiveram DFP. Oitenta (61,07%) atletas utilizam o mediopé para correr enquanto 15 (11,45%) utilizam o retropé. Dos 80 corredores que usam o mediopé, 38 (29%) deles tiveram DFP, enquanto dos que usam o retropé, nove (6,87%) apresentaram dor patelofemoral. Trinta e oito sujeitos (29%) não realizam nenhum tipo de fortalecimento muscular para melhorar o desempenho e evitar lesões na corrida. O presente estudo não comprovou estatisticamente se o tipo de pisada (mediopé ou retropé) tem relação direta com DFP; além disso, 27,38% dos corredores entrevistados não se importam com tipo de pisada durante a corrida e 29% deles não sabem utilizar a cadência (passos por minuto) ou se preocupam com isso.

Palavras-chave: Joelho. Síndrome da Dor Patelofemoral. Articulação Patelofemoral.

1 Introduction

Street racing is the most popular physical activity practiced worldwide, mainly due to the ease of putting on a pair of sneakers and going to the street. It is a democratic sport practiced by any individual, athlete or not, and that has been gaining more fans over the years. Worldwide, the number of female participants in this modality and also that of older people grows. Consequently there is an increase in the number of injuries related to the activity in question¹.

Even among amateur racing practitioners, the search for the best performance often makes the athlete exceed his or her limits to achieve excellence, even at the expense of sacrifices and possibilities of injuries². A study on the causes

and consequences of the end of the sports career showed that high-performance athletes are subjected to exhausting and excessive routines that increase the chance of injury occurrence³. It is common that together with physical pain there is a feeling of anxiety, sadness and negative emotional reactions in the athlete who suffers an injury, because of the fear of not being able to return to the sport with the same performance or for fear of a new accident⁴.

Lopes et al.⁵ In a systematic review of the main musculoskeletal injuries in runners, the knee patellofemoral pain (PFP) is one of the most common pathologies. According to another study, a medium-income recreational runner has an incidence of 37% to 56% of injuries during one year of training, with the knee being the most commonly affected site,

with 25% of these lesions being DFP⁶.

The classifications for the DPF are based on the respective radiographic findings and degree of extension of the chondral lesion or patellar position. There may be several degrees of dysplasia of the trochlea and patella. Asymmetry of the patellar facets also affects patellar congruence^{7,8}. Factors such as anatomical variations of the femoral trochlea, muscular weakness of the femoral quadriceps and shortening of the muscles related to kinesiology of the knee joint also favor the emergence of DPF⁹. The patellofemoral joint has overload during daily activities such as walking, climbing stairs and running, and can overload the joint by 11 times the body weight¹⁰.

Considering DPF as one of the most frequent pains in runners, it is important to recognize the types of stepping in running and their influence on patellofemoral pain¹¹. Although the injuries related to running still present unknown causes, there is a theory suggesting that these injuries come from the high impact forces received when the foot touches the ground, overloading the joints¹². According to Schache et al.¹³, methods to evaluate the initial contact phases of the foot in the race may differ from the methods that evaluate the walk. In the case of the race, it is considered a step when the same foot touches the ground again, either with a back foot or a mid-foot.

It is speculated that in the evolution of the human species runners should run barefoot or wear minimalist shoes with little or no cushioning; in a running style that would encourage the use of the midfoot to land first, generating a lower impact on the joints^{14,15}. Recent studies have shown that 95% of runners have initial contact in the back foot and a greater amount of musculoskeletal injuries when compared to athletes who land with the midfoot^{16,17}.

In this sense, this study aims to analyze if the type of foot during the race influences the occurrence of patellofemoral pain.

2 Material and Methods

This work is characterized by a cross-sectional, primary and observational study, of quantitative analysis, with 131 amateur street runners carried out in the city of Campo Grande, MS, from August to December 2022.

This research was approved by the Ethics Committee in Research with Human Beings under CAAE number 60999422.6.0000.5162.

All amateur runners invited to race counselors in the city in that period were included in the study, who met the inclusion criteria and who agreed to participate in the research signing the Free and Informed Consent Form (TCLE). Runners aged between 18 and 75 years were included, both sexes and answered the full interview. People who have undergone musculoskeletal surgery in the lower limbs and spine in the last five years were excluded.

In this study, the individual who runs at least once a week for at least three months, with weekly mileage greater than or equal to one kilometer per week, was defined as an amateur runner.

The data collection instrument used was an interview prepared using a sociodemographic questionnaire and carried out personally, by email or *WhatsApp*.

In this interview, we collected the following information: age, sex, running time, type of stepping in the race, average pace, cadence, weekly mileage running, strengthening exercises, performing musculoskeletal surgery in the lower limbs and spine in the last five years. The personal and specific information of this study is confidential and exclusively used by the researchers involved, in compliance with the General Data Protection Law (LGPD) and the ethical principles of confidentiality and privacy of the participants.

The information obtained were inserted and tabulated in Excel spreadsheet and analyzed statistically.

For the evaluation of the results obtained with the selected subjects, Risk Ratio, attributable risk and Odds Ratio were considered for statistical analysis, in order to evaluate the existence of a relationship between the type of foot (midfoot or hindfoot with patellofemoral pain (DPF) of the knee of the runner.

3 Results and Discussion

131 street runners were interviewed, 79 female and 52 male, with an average age of 41 years (23 to 71 years). The mean weight of these subjects was 64 kilograms (49 kg to 133 kg). On average these runners have been running for six years (0.5 to 40 years).

The average runner cadence in a running run (moderate running) was 176 steps/min (85-200 steps/min). However, 38 of them did not look at this tool to run or did not know its goal. The average pace (time to complete one kilometer) was 5:50 min/km (4:10 to 9:20 min/km). The average kilometers traveled per week was 25.68 km (5-100 km/week). Sixty-nine (52.67%) runners never had patellofemoral pain, while 62 (47.33%) had at least one episode of DPF. Eighty (61.07%) runners use the midfoot in the first touch of the foot to the ground while 15 (11.45%) use the back foot; however, 36 (27.38%) of them reported not caring about this issue at the time of the race. Of the 80 runners who use the midfoot, 38 (29.01%) had PFP while of the 15 runners who use the rearfoot, 9 (6.87%) had PFP.

Of the 131 subjects, 38 (29.01%) do not do any type of muscle strengthening to improve performance and prevent injuries in running, while 93 (70.99%) perform some kind of adjuvant muscle strengthening for this sports practice.

This research investigates the relationship between the types of stepping in the race (when the foot initially touches the ground), with a back foot or medium, and the DPF of the knee of the runner.

A study of Lima¹⁸ in 2018 investigated the type of static trampling as deformity found in the feet of the street runners, such as toe gait, toe-in gate, cavus foot or foot valgus, evaluating the types of lesions found, the most common being stress fracture (27.3%), followed by joint sprains and bruises. He concluded that there are many variables involved and relates toe gate with twice the chance of soft tissue lesions, compared to toe-in gate. However, for joint sprains, lesions were more common in cases of toe-in gate¹⁸.

Previous studies suggest that decreased knee flexion during running may be a protective mechanism against pain in runners with DPF¹⁹⁻²¹.

According to Bramah²² in 2019, the type of gate has an influence on biomechanics and knee flexion during running. The maximum knee flexion in the support phase in the race (*stance phase*) showed the influence on the reaction force of the patellofemoral joint, explaining more than 64% variance in the load of this joint^{22,23}. Identifying risk factors that can be modified in biomechanics during training or during running would be coherent measures to prevent injury, according to several studies^{14,16,24-29}.

A study by Stankievicz³⁰ in 2018 showed a higher number of female lesions, possibly related to physiological factors related to female body composition. Women have, on average, 25% less muscle mass than men, in addition to lower bone density, wider pelvis and excess flexibility, which can lead to biomechanical abnormalities due to pathological laxity of support of a joint by ligaments. In the present study, it was not possible to statistically differentiate the occurrence of DPF by the sex of the corridor.

Muscle motor exercises lead to a decrease in statistically relevant lesions when compared to only stretching exercises among adults with musculoskeletal injuries³¹. This was particularly important in this study, where almost 30% of runners reported not performing muscle strengthening exercise to improve running performance and prevent injuries.

The present study did not show statistically whether the type of step (midfoot or hindfoot) has a direct relationship with DPF. Some research has demonstrated the biomechanical and other consequences for the body according to the type of stepping in race^{14,32}.

However, this particular study showed that 27.38% of runners interviewed do not care about the type of stepping during the race; 29% of them do not know how to analyze the meaning of cadence (steps per minute) or worry about this marker. It should be noted that 29% of them, perhaps because they are amateurs and recreational, do not pay attention to the importance of muscle strengthening specific to running.

The present study presents limitations for using a convenience sample, in view of the ease of access to the respondents and the availability of each of them to participate in the research. It is suggested, therefore, to carry out more studies, with a greater number of participants, in order to obtain more robust and conclusive results, which allow to

prevent and guide on possible injuries in this sport.

4 Conclusion

This study allowed us to conclude that patellofemoral pain (PF) is a very common dysfunction in amateur street corridors, and that probably the type of foot, in addition to factors such as gender and the non-performance of muscle strengthening, may be factors that should be considered as causes of PF.

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