

Injury prevalence and associated factors in runners from the city of Juiz de Fora (MG)

Prevalência de lesão e fatores associados em corredores de rua da cidade de Juiz de Fora (MG)

La prevalencia de lesión y los factores asociados en corredores callejeros de la ciudad de Juiz de Fora (MG)

Arlete dos Reis Roth¹, Wyngrid Porfirio Borel², Bárbara Palmeira Rossi², José Elias Filho², Eduardo José Danza Vicente³, Diogo Carvalho Felício³

ABSTRACT | In Brazil, running is the second most practiced sport, and it can cause musculoskeletal injuries. Studies on the subject are important to guide prevention and intervention strategies. Therefore, the objective of the study was to investigate the prevalence of injuries and associated factors in road runners in the city of Juiz de Fora-MG-Brazil. This is an observational cross-sectional study. A convenience sampling was adopted. This study included amateur runners of both sexes, aged between 18 and 60, training in the city of Juiz de Fora-MG. Participants with history of fracture and osteosynthesis in lower limbs or who performed sports practices other than weight training were excluded. Student's t-tests, Mann-Whitney and X^2 ($\alpha = 0,05$) were used to analyze the data. Participants were allocated in Injury Group (IG, n=37) and Without Injury Group (WIG, n=113). Injury prevalence was 24.7%. The IG had been practicing running for a longer time (76.2 ± 9.1 X 36.7 ± 39.0 months, $p < .01$); had their weekly training frequency increased (49.5% vs. 54.2%, $P = .04$); stretched less before training (48.6% X 75.2%, $P = .02$); presented a higher percentage of gait analysis for footwear selection (62.1% X 43.3%, $P = .04$) and insole use (35.1% X 14.1%, $P = < .01$). Injury prevalence was low and those who have been running longer than others had a higher risk of injury even without an increase in weekly frequency. Stretching was protective and the prescription of indiscriminate footwear and insole did not guarantee satisfactory results.

Keywords | Running/injuries; Prevalence.

RESUMO | No Brasil, a corrida de rua é o segundo esporte mais praticado; entretanto, pode ocasionar lesões musculoesqueléticas. Estudos sobre o tema são importantes para nortear estratégias de prevenção e intervenção. Assim, o objetivo foi investigar a prevalência de lesões e os fatores associados em corredores de rua da cidade de Juiz de Fora(MG). Trata-se de um estudo observacional do tipo transversal. A amostra foi selecionada por conveniência. Foram incluídos corredores amadores, entre 18 e 60 anos e que realizavam treinos em diferentes locais da cidade. Foram excluídos participantes com histórico de fratura e osteossíntese em membros inferiores ou que praticassem outro esporte que não fosse a musculação. Para analisar os dados, foram utilizados os testes t de Student, Mann-Whitney e X^2 ($\alpha = 0,05$). Os participantes foram alocados em grupo lesão (GL, n=37) e grupo sem lesão (GSL, n=113). A prevalência de lesão foi de 24,7%. O GL praticava a corrida há mais tempo ($76,2 \pm 9,1 \times 36,7 \pm 39,0$ meses; $P < .01$), teve menor aumento da frequência semanal do treinamento (49,5% \times 54,2%; $P = .04$), realizou menos alongamento prévio (48,6% \times 75,2%; $P = .02$), apresentou maior percentual de análise da marcha para escolha do calçado (62,1% \times 43,3%; $P = .04$) e uso de palmilha (35,1% X 14,1%; $P = < .01$). A prevalência de lesões foi baixa. Os que correm há mais tempo têm maior risco de contusão mesmo sem incremento na frequência semanal. O alongamento foi protetor e a prescrição

Laboratório de Análise do Movimento (LAM), Faculdade de Fisioterapia, Universidade Federal de Juiz de Fora (UFJF) – Juiz de Fora (MG), Brasil.

¹Graduanda do Departamento de Fisioterapia da Universidade Federal de Juiz de Fora (UFJF) – Juiz de Fora (MG), Brasil.

²Fisioterapeuta, discente do Programa de Pós-Graduação Strictu Senso em Ciências da Reabilitação e Desempenho Físico Funcional da Universidade Federal de Juiz de Fora (UFJF) – Juiz de Fora (MG), Brasil.

³Fisioterapeuta, Docente titular no Programa de Pós-Graduação Strictu Senso em Ciências da Reabilitação e Desempenho Físico Funcional da Universidade Federal de Juiz de Fora (UFJF) – Juiz de Fora (MG), Brasil.

de calçado e palmilha indiscriminados não garantiram resultados satisfatórios.

Descritores | Corrida/lesões; Prevalência.

RESUMEN | En Brasil, la carrera callejera es el segundo deporte más practicado; mientras tanto, puede ocasionar lesiones musculoesqueléticas. Estudios sobre el tema son importantes para orientar estrategias de prevención e intervención. Así, el objetivo ha sido investigar la prevalencia de lesiones y los factores asociados en corredores callejeros de la ciudad de Juiz de Fora (MG). Se trata de un estudio observacional del tipo transversal. La muestra ha sido seleccionada por conveniencia. Han sido incluidos los corredores amadores, entre 18 y 60 años y que realizaban entrenos en distintos locales de la ciudad. Han sido excluidos los participantes con historial de fractura y osteosíntesis en miembros inferiores o que practicaran otro deporte que no fuera la musculación.

Para analizar los datos, han sido utilizadas las pruebas t de Student, Mann-Whitney y χ^2 ($\alpha=0,05$). Los participantes han sido asignados en grupo lesión (GL, n=37) y grupo sin lesión (GSL, n=113). La prevalencia de lesión ha sido del 24,7%. El GL practicaba la carrera hacia más tiempo ($76,2 \pm 9,1 \times 36,7 \pm 39,0$ meses; $P<.01$), ha tenido menor incremento de la frecuencia semanal del entrenamiento (el 49,5% \times el 54,2%; $P=.04$), ha realizado menos tiramiento previo (el 48,6% \times el 75,2%; $P=.02$), ha presentado mayor porcentual de análisis de la marcha para escoja del calzado (el 62,1% \times el 43,3%; $P=.04$) y uso de plantilla (el 35,1% \times el 14,1%; $P=<.01$). La prevalencia de lesiones ha sido baja. Los que corren hace más tiempo tienen mayor riesgo de contusión aunque sin incremento en la frecuencia semanal. El tiramiento ha sido protector y la prescripción de calzado y plantilla indiscriminados no ha garantizado resultados satisfactorios.

Palabras clave | Carrera/lesiones; Prevalencia.

INTRODUCTION

Regular running practice improves cardiorespiratory fitness in inactive people, resulting in improved quality of life, reduction in the percentage of fat and in the concentration of blood elements¹⁻³. Its ease of execution and low cost⁴ helps making it the second most practiced sport in Brasil⁵. However, when practiced inappropriately or without guidance, it can cause lesions on the musculoskeletal system².

The increase in the number of sports injuries is closely related to intrinsic and extrinsic factors^{6,7}. The intrinsic factors are age, gender, experience, aptitude and anatomical changes. The extrinsic factors are, directly or indirectly, related to the preparation or practice of running, involving the activity type, footwear, surface on which training occurs, etc⁸.

Musculoskeletal impairment can be a challenge to regular practice and work leave for extended periods, in addition to high costs⁹. A prospective cohort study with 1,696 participants investigated the economic burden of lesions in runners. With converted values, health care costs and absenteeism of work activities reached R\$303.00¹⁰⁻¹². In Brazil, no data on the topic was found; therefore, it is not possible to infer that this value is approximate. Thus, the objective of this study was to investigate the prevalence of injuries and associated factors in road runners in the municipality of Juiz de Fora (MG).

METHODOLOGY

Study design and ethical aspects

This is an observational, cross-sectional study, approved by the Research Ethics Committee (CEP) from the Federal University of Juiz de Fora (UFJF) (registered No. 1.803.411/2016). All participants signed the Informed Consent Form (IFC).

Sample

Convenience sampling was performed. The sample size was calculated by using the formula $n = Z^2 P(1-P) / (D^2)$, where:

Z = Value of the standard normal distribution corresponding to the desired level of confidence (Z=1.96 for 95% Confidence Interval), P = Prevalence Expected and D = Maximum Acceptable Error for Estimate¹³. The expected prevalence was of 15% (P=0.15), with 95% CI range of 12% (D=0.06), this way: $n = 1.96^2 (0.15 (1-0.15)) / (0.06^2) = 136$ people.

Data collection was conducted at training sites and in competitions of the *Ranking de Corridas de Rua* (Road Running Ranking) of Juiz de Fora/MG. Amateur runners of both sexes were included, aged between 18 and 60 years and who were training in different places

of the city, and were excluded participants with prior history of fracture and internal fracture fixation in lower limbs or who performed non-bodybuilding-based sports. For analysis of associated factors, the participants were allocated into Injury Group (IG) and Without Injury Group (WIG).

Procedures

Analysis of injury prevalence

To categorize the sample, information regarding age, gender, education level, height and body mass was collected. For analysis of injury prevalence, any pain or injury that has limited or prevented the athlete from participating in training and/or competitions in the last six months was considered⁸.

Analysis of associated factors

With respect to the associated factors, data was collected on the variables of training. Investigation was focused on whether there was an increase in weekly frequency, distance traveled and duration of daily practice, in addition to the practice time, distance and average daily duration, use of specific shoes for running, period shoes were used, if the period corresponded to kind of footstep and if there was more than a pair, plus the use of orthopedic insole, during the last six months. Stretching and warm-ups before

practice, cooldown after practice, weight training and whether the participant had guidance for training were also aspects analyzed. If true, which professional(s) were involved and whether assessment regarding the identification of risk factors for injury while running was made.

Statistical analysis

The characterization of the sample was conducted by descriptive statistics. To evaluate the differences between groups, Student’s t-test, Mann-Whitney U and Chi-squared were used for independent groups. For inferential analyses, a significance level of 0.05% was considered. The data were analyzed using the software SPSS® version 15.0.

RESULTS

Figure 1 represents sample recruitment.

A total of 150 individuals participated in this study, the majority males (52%). Table 1 presents demographic and anthropometric characteristics of the sample. Injury prevalence was of 24.7% (n=37)

Table 2 presents the differences between the characteristics of training of the IG and WIG.

Table 3 presents the factors associated with injuries.

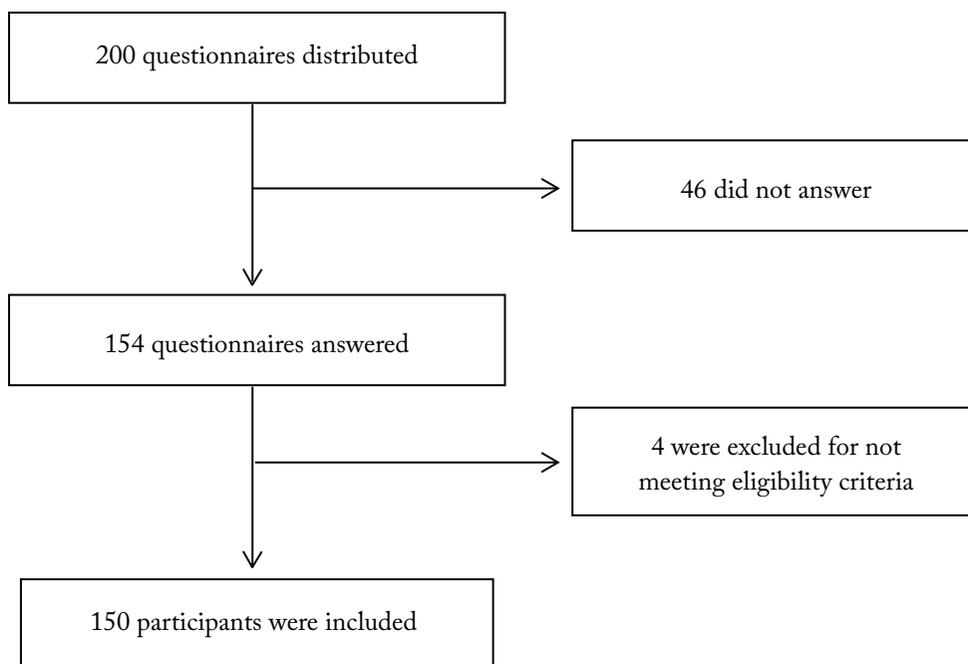


Figure 1. Flowchart depicting the sample selection

Table 1. *Mann-Whitney* U test used to verify demographic and anthropometric characteristics (n = 150)

	IG (n=37)	WIG (n=113)	P-value
Age (years)	34±11.1	35.8±9.9	0.52
Education level (years)	15.5±4.8	14.7±3.5	0.52
BMI (Kg/m ²)	23.8±3.9	23.7±3.4	0.49

Caption: IG = Injury Group; WIG = Without Injury Group; BMI = Body Mass Index

Table 2. *Mann-Whitney* U test used to verify training characteristics (n = 150)

	IG (n=37)	WIG (n=113)	P-value
Practice time (months)	76.2±99.1	36.7±39.0	0.01*
Weekly frequency (days)	3.5±2.0	3.3±1.3	0.51
Training distance (km)	11.6±14.8	9.0±5.8	0.61
Training time	230.5±98.7	56.6±25.4	0.33

Caption: IG = Injury Group; WIG = Without Injury Group; KM = Kilometers

Table 3. Chi-squared test to verify factors associated with injuries (n=150)

	IG (n=37)		WIG (n=113)		P-value
	Yes	No	Yes	No	
Increase in training time	20 _{54.1%}	17 _{45.9%}	69 _{61.1%}	44 _{38.9%}	0.45
Increase in distance run	21 _{56.8%}	16 _{43.2%}	81 _{71.7%}	32 _{28.3%}	0.09
Increase in weekly frequency (days)	15 _{49.5%}	22 _{50.5%}	67 _{54.2%}	46 _{45.8%}	0.04*
Runs in the same location	16 _{43.2%}	21 _{56.8%}	34 _{30%}	79 _{70%}	0.09
Use of specific shoes	36 _{97.3%}	1 _{2.7%}	102 _{90.2%}	11 _{9.8%}	0.17
Footwear prescribed for footstep	23 _{62.1%}	14 _{37.9%}	49 _{43.3%}	64 _{56.7%}	0.04*
Uses more than one pair of shoes	28 _{75.6%}	9 _{24.4%}	82 _{72.5%}	31 _{27.5%}	0.71
Prior stretching	18 _{48.6%}	19 _{51.4%}	85 _{75.2%}	28 _{24.8%}	0.02*
Prior warm-ups	26 _{70.3%}	11 _{29.7%}	93 _{82.3%}	20 _{17.7%}	0.11
Cooldown	25 _{67.6%}	12 _{32.4%}	75 _{66.4%}	38 _{33.6%}	0.89
Bodybuilding	23 _{62.2%}	14 _{37.8%}	70 _{61.9%}	43 _{38.1%}	0.98
Insole	13 _{35.1%}	24 _{64.9%}	16 _{14.1%}	97 _{85.9%}	<0.01*
Professional guidance	24 _{64.8%}	13 _{35.2%}	62 _{54.8%}	51 _{45.2%}	0.24
Physiotherapeutic Assessment	24 _{64.8%}	13 _{35.2%}	67 _{59.3%}	46 _{40.7%}	0.48

Caption: IG = Injury Group; WIG = Without Injury Group; * = Significant Difference

DISCUSSION

The objective of this study was to investigate the prevalence of injuries and associated factors in road runners in the municipality of Juiz de Fora (MG). Injury prevalence was of 24.7%. Among the associated factors, the IG had practiced running for a longer time; increased weekly training less (49.5% × 54.2%); had less prior stretching (48.6% X 75.2%); showed higher percentage of gait analysis for shoes choice (62.1% X 43.3%) and use of insoles (35.1% X 14.1%).

The sample was constituted by 150 volunteers, where most were of male sex. This higher percentage was observed in prior studies^{7,14} and is related to social construction, since women present double work shift¹⁵.

Injury prevalence was 24.7% and the literature presents a variability between 24 and 65%¹⁶, explained by the distinct characteristics of the samples and by the definition of injury. Injury rates can be overestimated or underestimated by using a broad definition. It is therefore necessary that there be a standard term¹⁷.

With respect to the training characteristics, it was observed that the IG has been running for a longer time, which corroborates with the study by Rangel et al.¹⁸ stating a positive relationship between practice time and injury occurrence. There is evidence that running for a longer period is an important predictive factor of injury, as it is associated with overlapping repeated trauma^{2,19}.

There is a directly proportional relationship between increase in weekly training and risk of musculoskeletal

injury, due to a chronic state of fatigue caused by imbalance between regeneration time and the sports practice^{2,19}. In this study, WIG participants increased the percentage of weekly training. The descriptive data explain the occurred since, despite having increased the training week in the past six months, the average of WIG was 3.3 days in week (sustainable period for tissue recovery).

In this study, 62.1% of IG wore footwear prescribed for their kind of footstep. Systematic reviews have concluded that no injury can be prevented with the use of specific footwear^{20,21}. These findings are contradictory, given that other studies have concluded that the use of specific shoes for different types of footsteps prevents injuries due to the cushioning and absorption of impact forces between foot and soil²². A review study with a sample of 423 individuals concluded that the use of specific shoes offers a protective effect only on volunteers with flatfeet, while those with neutral footstep and talipes cavus did not have any benefits. It can be concluded that there are gaps on the subject¹⁸.

In addition, in the IG, the percentage of insole use was higher, thus being shown as a factor associated with injury. Considering that the purpose of the insole is to generate corrective reflexes, it is not always prescribed judiciously and individually²³.

In this research, stretching was a protective factor. This occurs because stretching retracted muscles increases their ability to generate force and torque, which benefits amateur runners²⁵. This discussion still has gaps, since other studies have indicated that stretching done immediately before training leads to injury predisposition, since it decreases muscle performance²⁵⁻²⁹.

Among the limitations of this study there is the use of structured questionnaire, which is susceptible to memory bias and misinterpretation. Future studies are encouraged to evidence the causality relationship between these elements.

CONCLUSION

The prevalence of injuries in amateur runners in Juiz de Fora/MG was low. Having practiced running for longer time increases the risk of injury even when there is no increase in weekly frequency. Stretching was a protective measure against injury prevalence. Among associated factors that influence the appearance of lesions are: practice time of running, increase in weekly training frequency, indiscriminate prescription of footwear and insoles.

REFERENCES

1. Aaltonen S, Karjalainen H, Heinonen A, Parkkari J, Kujala UM. Prevention of sports injuries: systematic review of randomized controlled trials. *Arch Intern Med*. 2007;167(15):1585-92. doi: 10.1001/archinte.167.15.1585
2. Augusti M, Aguiar CM. Corrida de rua e sociabilidade. *Lect educ fis deportes* [Internet]. 2011 [citado em 5 set. 2018];16(159). Disponível em: <<https://bit.ly/Q5AadE>>.
3. Baxter C, Naughton LRM, Sparks A, Norton L, Bentley D. Impact of stretching on the performance and injury risk of long-distance runners. *Res Sports Med*. 2017;25(1):78-90. doi: 10.1080/15438627.2016.1258640
4. Bonanno DR, Landorf KB, Munteanu SE, Murley GS, Menz HB. Effectiveness of foot orthoses and shock-absorbing insoles for the prevention of injury: a systematic review and meta-analysis. *Br J Sports Med*. 2017;51(2):86-96. doi: 10.1136/bjsports-2016-096671.
5. Dallari MM. Corrida de rua: um fenômeno sociocultural contemporâneo. [dissertação]. São Paulo: Universidade de São Paulo; 2009. doi: 10.11606/T.48.2009.tde-02092009-145957
6. Feitoza JE, Martins J. Lesões desportivas decorrentes da prática do atletismo. *Rev Educ Fis* 2000;11(1):139-47.
7. Fernandes D, Lourenço TF, Simões EC. Fatores de risco para lesões em corredores de rua amadores do estado de São Paulo. *RBPFE* [Internet]. 2014 [citado em 6 set. 2018];8(49):656-63. Disponível em: <<https://bit.ly/2NUaMpi>>.
8. Ferreira AC, Dias JMC, Fernandes RM, Sabino GS, Anjos MTS, Felício DC. Prevalência e fatores associados a lesões em corredores amadores de rua do município de Belo Horizonte, MG. *Rev Bras Med Esporte*. 2012;18(4):252-5. doi: 10.1590/S1517-86922012000400007
9. Hespanhol Junior LC, van Mechelen W, Verhagen E. Health and economic burden of running-related injuries in Dutch trailrunners: a prospective cohort study. *Sports Med*. 2017;47(2):367-77. doi: 10.1007/s40279-016-0551-8.
10. Hespanhol Junior LC, van Mechelen W, Postuma E, Verhagen E. Health and economic burden of running-related injuries in runners training for an event: a prospective cohort study. *Scand J Med Sci Sports*. 2016;26(9):1091-9. doi: 10.1111/sms.12541.
11. Hespanhol Junior LC, Huisstede BM, Smits DW, Kluitenberg B, van der Worp H, van Middelkoop M, et al. The NLstart2run study: economic burden of running-related injuries in novice runners participating in a novice running program. *J Sci Med Sport*. 2016;19(10):800-4. doi: 10.1016/j.jsams.2015.12.004.
12. Hespanhol Junior LC, Costa LOP, Carvalho ACA, Lopes AD. A description of training characteristics and its association with previous musculoskeletal injuries in recreational runners: a cross-sectional study. *Rev Bras Fisioter*. 2012;16(1):46-53. doi: 10.1590/S1413-35552012000100009
13. Lucas-Cuevas AG, Pérez-Soriano P, Priego-Quesada JI, Llana-Belloch S. Influence of foot orthosis customisation on perceived comfort during running. *Ergonomics*. 2014;57(10):1590-6. doi: 10.1080/00140139.2014.938129
14. Lun V, Meeuwisse WH, Stergiou P, Stefanyshyn D. Relation between running injury and static lower limb alignment in recreational runners. *Br J Sports Med*. 2004;38(5):576-80. doi: 10.1136/bjsm.2003.005488

15. Macera CA, Pate RR, Powell KE, Jackson KL, Kendrick JS, Craven TE. Predicting lower-extremity injuries among habitual runners. *Arch Intern Med*. 1989;149(11):2565-68. doi:10.1001/archinte.1989.00390110117026
16. Malisoux L, Chambon N, Delattre N, Gueguen N, Urhausen A, Theisen D. Injury risk in runners using standard or motion control shoes: a randomised controlled trial with participant and assessor blinding. *Br J Sports Med*. 2016;50(8):481-7. doi: 10.1136/bjsports-2015-095031.
17. Murley GS, Landorf KB, Menz HB, Bird AR. Effect of foot posture, foot orthoses and footwear on lower limb muscle activity during walking and running: a systematic review. *Gait Posture*. 2009;29(2):172-87. doi: 10.1016/j.gaitpost.2008.08.015.
18. Rangel GMM, Farias JM. Incidência de lesões em praticantes de corrida de rua no município de Criciúma, Brasil. *Rev Bras Med Esporte*. 2016;22(6):496-500. doi: 10.1590/1517-869220162206128114
19. Oliveira DG, Santo GE, Souza IS, Floret M. Prevalência de lesões e tipo de treinamento de atletas amadores de corrida de rua. *Corpus sci [Internet]*. Jun. 2012 [citado em 6 set. 2018];8(1):51-9. Disponível em: <<https://bit.ly/2wOdKFq>>.
20. O'Leary K, Vorpahl KA, Heiderscheid B. Effect of cushioned insoles on impact forces during running. *J Am Podiatr Med Assoc*. 2008;98(1):36-41. doi: 10.7547/0980036
21. Pazin J, Duarte MFS, Poeta LS, Gomes MA. Corredores de rua: características demográficas, treinamento e prevalência de lesões. *Rev Bras Cineantropom Desempenho Hum*. 2008;10(3):277-82.
22. Pileggi P, Gualano B, Souza M, Caparbo VF, Pereira RMR, Pinto ALS, Lima FR. Incidência e fatores de risco de lesões osteomioarticulares em corredores: um estudo de coorte prospectivo. *Rev Bras Educ Fis Esporte*. 2010;24(4):453-62. doi: 10.1590/S1807-55092010000400003
23. Smits DW, Huisstede B, Verhagen E, van der Worp H, Kluitenberg B, van Middelkoop M, et al. Short-term absenteeism and health care utilization due to lower extremity injuries among novice runners: a prospective cohort study. *Clin J Sport Med*. 2016;26(6):502-9. doi:10.1097/JSM.0000000000000287
24. Schelde J. Facts and fiction about running shoes. *Ugeskr Laeger*. 2012;174(48):3011-3.
25. Saragiotto BT, Yamato TP, Lopes AD. What do recreational runners think about risk factors for running injuries? A descriptive study of their beliefs and opinions. *J Orthop Sports Phys Ther*. 2014;44(10):733-8. doi: 10.2519/jospt.2014.5710.
26. Shehab R, Mirabelli M, Gorenflo D, Fethers MD. Pre-exercise stretching and sports related injuries: knowledge, attitudes and practices. *Clin J Sport Med*. 2006;16(3):228-31. doi: 10.1097/00042752-200605000-00007
27. Silva SPS, Sandre-Pereira G, Salles-Costa R. Fatores sociodemográficos e atividade física de lazer entre homens e mulheres de Duque de Caxias/RJ. *Cienc Saude Colet [Internet]*. 2011 [citado em 6 set. 2018];16(11):4493-501. Disponível em: <<https://bit.ly/2wQkZg6>>.
28. Simões NVN. Lesões desportivas em praticantes de atividade física: uma revisão bibliográfica. *Rev Bras Fisioter*. 2005;9(2):123-28.
29. Yamato TP, Saragiotto BT, Hespanhol Junior LC, Yeung SS, Lopes AD. Descriptors used to define a running-related musculoskeletal injury: a systematic review. *J Orthop Sports Phys Ther*. 2015;45(5):366-74. doi: 10.2519/jospt.2015.5750