IS RESISTANCE TRAINING A PROTECTIVE FACTOR FOR MUSCULOSKELETAL INJURIES IN CROSSFIT PRACTITIONERS?

TREINAMENTO RESISTIDO É UM FATOR DE PROTEÇÃO PARA LESÕES MUSCULOESQUELÉTICAS NO CROSSFIT?

¿ES EL ENTRENAMIENTO DE RESISTENCIA UN FACTOR PROTECTOR DE LAS LESIONES MUSCULOESQUELÉTICAS EN CROSSFIT?

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ABSTRACT

Objective: To evaluate the prevalence and characteristics of musculoskeletal injuries associated with CrossFit® practitioners and the relationship of this prevalence among those who concomitantly perform resistance training (RT). Methods: Cross-sectional study in which adult participants of both sexes were included, who answered a mixed morbidity questionnaire adapted. The participants were allocated into groups according to whether or not they practiced another modality along with CrossFit®, with emphasis on RT. Analytical and descriptive statistics procedures were used, with a statistical significance level of 5% ($p<0.05$). Results: A total of 179 participants were included in the study. Prevalences of musculoskeletal injuries were observed in the overall study sample of 32.4% and in those who perform CrossFit® with RT of 30.8%. The injury prevalence ratio for this group was 0.95, with lower injury prevalence for the upper limbs ($p=0.03$) and lower limbs ($p=0.02$). It is worth noting that 96% of the CrossFit® and RT practitioners did strength training focused only on the upper and/or lower limb musculatures, without specific training for the anatomical segment of the Core (lumbar and pelvis). Conclusion: RT associated with CrossFit® and covering all anatomical segments, can be considered a protective factor for the occurrence of musculoskeletal injuries in CrossFit®. ***Level of Evidence IV; Case Series.***

Keywords: Injuries; Prevalence; Sports; Sports Injuries.

RESUMO

*Objetivo: Avaliar a prevalência e as características das lesões musculoesqueléticas associadas aos praticantes de CrossFit® e a relação dessa prevalência entre aqueles que realizam de forma concomitante o treinamento resistido (TR). Métodos: Estudo transversal, no qual foram incluídos participantes adultos de ambos os sexos, que responderam a um questionário misto de morbidade adaptado. Os participantes foram divididos em grupos de acordo com a prática ou não de outra modalidade juntamente ao CrossFit®, com destaque para o TR. Foram utilizados procedimentos de estatísticas analítica e descritiva, com um nível de significância estatística de 5% (p<0,05). Resultados: Foram incluídos no estudo 179 participantes. Observaram-se prevalências de lesões musculoesqueléticas na amostra geral do estudo de 32,4% e naqueles que realizam o CrossFit® com TR de 30,8%. A razão de prevalência de lesões para esse grupo foi de 0,95, com menor prevalência de lesões para os membros superiores (p=0,03) e inferiores (p=0,02). Vale a pena destacar que 96% dos praticantes de CrossFit® e TR realizaram treinamentos de força com foco apenas nas musculaturas dos membros superiores e/ou inferiores, sem realização de treinamento específico para o segmento anatômico do Core (regiões lombar e pelve). Conclusão: O TR associado ao CrossFit® e com abrangência a todos os segmentos anatômicos pode ser considerado um fator de proteção para a ocorrência de lesões musculoesquelética no CrossFit®. **Nível de Evidência IV; Série de Casos.***

Descritores: *Lesões; Prevalência; Esportes; Lesões Esportivas.*

RESUMEN

Objetivo: Evaluar la prevalencia y las características de las lesiones musculoesqueléticas asociadas a los practicantes de CrossFit® y la relación entre esta prevalencia y los que realizan simultáneamente entrenamiento de resistencia (ER). Métodos: Se trató de un estudio transversal en el que participaron adultos de ambos sexos que respondieron a un cuestionario adaptado de morbilidad mixta. Los participantes se dividieron en grupos según practicaran o no otro deporte junto con CrossFit®, en particular entrenamiento de resistencia. Se utilizaron procedimientos estadísticos analíticos y descriptivos, con un nivel de significación estadística del 5% (p<0,05). Resultados: Se incluyó en el estudio a un total de 179 participantes. Hubo una prevalencia de lesiones musculoesqueléticas en la muestra global del estudio del 32,4% y en los que practicaban CrossFit® con ER del 30,8%.El ratio de prevalencia de lesiones para este grupo fue de 0,95, con una menor prevalencia de lesiones en las extremidades superiores (p=0,03) y en las extremidades inferiores (p=0,02).Cabe destacar que el 96% de los practicantes de CrossFit® y ER realizaban entrenamientos de fuerza centrados únicamente en la musculatura de los miembros superiores y/o inferiores, sin realizar entrenamientos específicos

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para el segmento anatómico del Core (regiones lumbar y pélvica). Conclusión: El ER asociado al CrossFit® y que cubre todos los segmentos anatómicos puede ser considerado un factor protector contra la ocurrencia de lesiones músculo-esqueléticas en CrossFit®. ***Nivel de Evidencia IV; Serie de Casos.***

Descriptores: *Lesiones; Prevalencia; Deportes; Lesiones en Deportes.*

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INTRODUCTION

CrossFit® is a very popular sport modality,[1] based on high-intensity, multi-articular functional training with participants of different biotypes.[2,3]

As for its dynamics, it is characterized by different exercises practiced quickly, repetitively, and with little or no break between sets.[2] The objective of its practitioners is usually the improvement of different physical abilities, especially strength, cardiorespiratory resistance, and power.[4]

Due to these particularities inherent to the sport, there is a concern about the potential emergence of musculoskeletal injuries related to its practice. In this sense, as a way to mitigate possible risks in sports, in general, parameters such as load control and preventive work should be routinely performed.[5,6]

As for sports prevention protocols, which aim to control certain intrinsic factors of the athlete, the goal is an overall improvement in functional capacity, with emphasis on the physical skills most demanded in the sport. In the case of CrossFit®, specific work on muscle strength stands out,[2] which will ensure a better capacity to accommodate tissue microtrauma, especially in those who start the sport directly in this modality.

To date, some data in the literature related to injuries and their variables in CrossFit® are discordant. Therefore, this study aimed to evaluate the prevalence and characteristics of musculoskeletal injuries associated with practitioners of the sport and the relationship of this prevalence among those who concomitantly perform resistance training (RT). Our hypothesis was that resistance training is a protective factor against the emergence of musculoskeletal injuries in CrossFit®.

MATERIALS AND METHODS

Study Design

A descriptive and observational cross-sectional study was conducted in gyms duly licensed by the CrossFit® brand in the municipality of Uberaba (Minas Gerais, Brazil) and region. The sample was by convenience, through the use of the 'snowball' technique (Figure 1). The study was approved by the Research Ethics Committee of the University of Uberaba (no. 4370713/2020) and conducted according to the principles established in the Declaration of Helsinki.

Participants

Adult athletes were included, aged between 18 and 50 years, of both genders, practicing the sport for a minimum period of six months. All participants signed the Free and Informed Consent Form. The exclusion criteria were the existence of orthopedic surgery prior to practicing CrossFit®, the presence of an active metabolic disease, chronic orthopedic alterations that could cause some considerable biomechanical repercussion (as an example, diagnosed ligament instability) and filling out the questionnaire in the study incorrectly and/or incomprehensibly.

The participants were allocated into groups, according to the practice of other sports. Group 1 was composed of the general sample of the study, Group 2 by CrossFit® and RT practitioners, and Group 3 by CrossFit® practitioners and other sports, except for RT.

Data Collection

Each participant answered a mixed morbidity questionnaire adapted, validated for use in sports traumatology[7] and used in studies with similar methodologies,[8,9] with proper explanations and supervision of completion by someone responsible for the study. The questionnaire was completed in person, in the athletes' training environment, six weeks after the initial visit to the gyms by one of the authors. This time was set based on previous studies, with the aim of getting the participants more familiar with the questionnaire. [8]

The retroactive period for injury analysis was three years, based on previous studies with the same methodology[8] and justified mainly because it is an individual sports modality, which requires a period longer than one year for investigation.

Musculoskeletal injury

The concept of injury was adopted based on previous studies,[8,10] in which it was considered as any pain or traumatic event caused by the training of the sport and requiring interruption of training for at least one week, or modification of the training characteristics due to the injury for at least two weeks, or a complaint serious enough to seek medical attention.

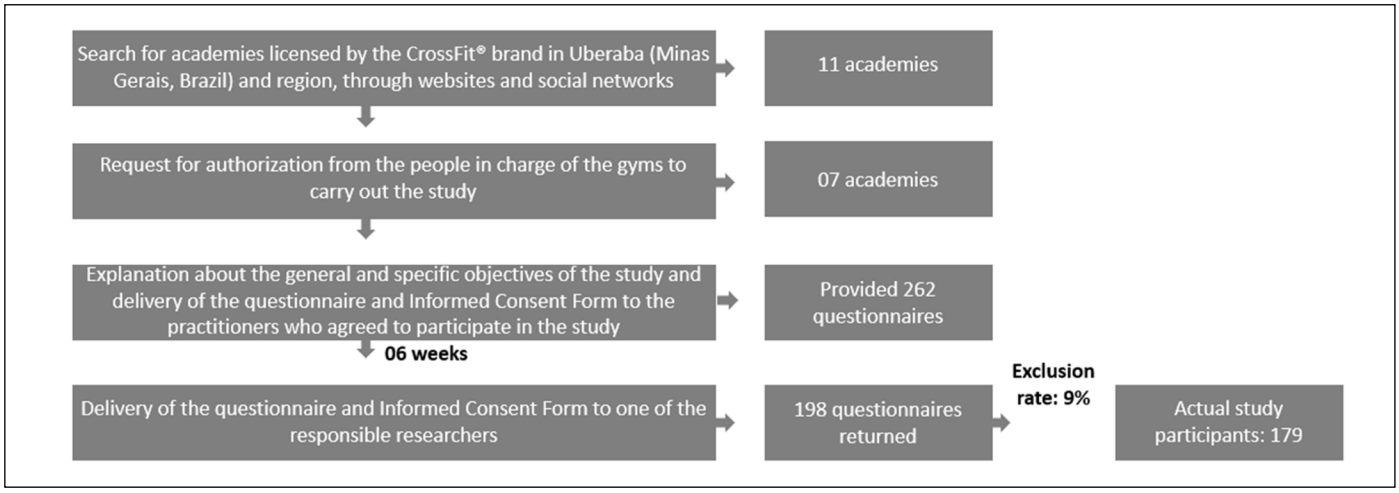

Figure 1. Representative flowchart of the study design.

They were self-reported and classified as contusion, nonspecific pain (non-traumatic origin), dislocation, muscle injury, fracture, and sprain.

All orthopedic anatomical segments of the appendicular axis, divided into lower and upper limbs, and of the axial axis, divided into trunk and pelvis, were considered. The injuries were divided anatomically in this way because, in the current literature, there is disagreement between the anatomical sites most affected by injuries in CrossFit®[2,9,11,12] and, in addition, the main objective of the study was to analyze the overall behavior of musculoskeletal injuries among the three study groups, without considering specific anatomical structures, but rather segments kinematically related to the biomechanics of movement in the sport. This anatomical division would be a reason for methodological bias if there were consolidated and concordant results regarding the sites most affected by the injuries.

Statistical Analysis

The collected data were processed in Excel® and the statistical analyses using the SigmaStat®2.0 program (GraphPad Software Jandel, SPSS, Chicago, IL, USA).

The Kolmogorov-Smirnov test was performed to assess the normality of data distribution. Normally distributed data were reported as arithmetic mean (± standard deviation). Categorical variables were expressed as absolute values and percentages.

For comparison between groups, unpaired Student's t-test (two-tailed) was used for quantitative variables. For the analysis of categorical variables, the chi-square test was used. The comparative evaluation of the presence of lesions in the different study groups was performed by calculating the prevalence and the prevalence ratio. As for the anatomical segments affected by the lesions, the Z test for two proportions was performed. Probability values <0.05 were considered statistically significant.

RESULTS

From the total pool of 198 initial participants, 179 were included in the study (exclusion rate of 9%). About 86% of this total started the CrossFit® practice as their first sport modality, all with the objective of losing weight and gaining cardiorespiratory conditioning.

Regarding the lower prevalence of injuries (Table 1), a statistical difference was found in favor of the female gender (p=0.011), of the younger population (p=0.002), of the shorter time practicing CrossFit (p<0.001) and of not using protective equipment (p=0.001).

We observed a prevalence of musculoskeletal injuries in this study sample of 32.4% (Table 2). Of this total, 63% required medical attention, but only 6.3% required surgical treatment.

However, when analyzed according to the variable of concomitant practice of RT, the rate was 30.8% for those who practiced TR and 33.3% for those who did not practice this modality together. The prevalence ratio of musculoskeletal lesions for CrossFit® and RT practitioners was 0.95. (Table 2)

The upper (p=0.03) and lower limbs (p=0.02) were the least injured anatomical segments in Group 2, compared to Group 1. (Table 3)

In addition, it was observed that 96% of CrossFit® and RT practitioners performed strength training focusing only on the upper and/or lower limb musculatures, without performing specific training for the anatomical segment of the Core (lumbar and pelvis regions).

Table 1. Characterization of the study sample, divided according to the occurrence of musculoskeletal injuries and analyzed for quantitative and qualitative variables.

Variables	Study Participants		p
Gender, n (%)	With injury	Without injury	
Male	28.0 (48.3)	35.0 (28.9)	0.011
Female	30.0 (51.7)	86.0 (71.1)	
Age, years, average (CI 95%)	32.2 (1.8)	28.7 (1.3)	0.002
BMI, kg/m2, average (CI 95%)	25.9 (0.9)	26.0 (3.3)	0.969
CrossFit® time, months, average (CI 95%)	32.2 (5.0)	21.7 (2.4)	<0.001
Joint practice of other sport modality, n (%)	26.0 (44.8)	54.0 (44.6)	0.980
Protective equipment, n (%)	42.0 (72.4)	55.0 (45.5)	0.001

n: absolute number; CI: confidence interval; BMI: body mass index; kg: kilogram; m: meters.

DISCUSSION

The main findings of the present study were the lower proportion of musculoskeletal injuries in the upper and lower limbs of the participants who train CrossFit® together with RT, the association of these strength trainings was a protective factor against the risk of injury, and the high rate of athletes who started practicing CrossFit® as their first sport modality.

The overall prevalence of injuries in the study sample is close to the results found in other studies.[11-13] It is worth mentioning that, in general, epidemiological studies in sports traumatology usually lack methodological standardization, requiring the attempt to create standardized assessment methodologies. In this sense, prevalence as high as 73.5% of practitioners has been found in a previous study.[14] Therefore, in the current study, we sought to use concepts similar to those of others with similar themes and methodologies.[8,10]

People's search for healthier lifestyle habits must be done carefully so that no deleterious consequences to health occur. In this sense, in sports modalities such as CrossFit®, characterized by repetitive and pliometric movements, there is a potentially increased risk of musculoskeletal injuries in participants without the proper joint and muscle capacity to support this demand of exercises.[15]

Common movements in the sport, such as jumps, landings, and squats, if repetitively performed, can trigger the appearance of injurious vectors for the joints of the lower limbs.[16] Within this scenario, injuries such as inguinomalacia,[17] muscular injuries,[11,13] tendinopathies,[11,13] among others, appear with worrying rates among the practitioners of the sport. That is why the hypothesis of this study was that RT, by providing a more effective musculoskeletal base to support the overload of the sport and by ensuring conditions to balance agonist and antagonist musculatures,[18] is related to a lower prevalence of injuries.

Indeed, RT was associated with the lowest findings of injuries in the segments of the upper and lower limbs. It is noteworthy that a considerable portion (96%) of the RT practitioners did not perform specific training

Table 2. Characterization of the study participants regarding prevalence and prevalence ratio in relation to the general sample (Group 1), CrossFit® and RT (Group 2) and CrossFit® and other modality (Group 3).

	Participants with musculoskeletal injury (n)	Total of participants (n)	Prevalence (%)	Prevalence Ratio
Group 1	58	179	32.4%	Reference
Group 2	8	26	30.8%	0.95 (0.52 a 1.75)
Group 3	18	54	33.3%	1.03 (0.67 a 1.59)

n: absolute number.

Table 3. Characterization of the anatomical location of the musculoskeletal injuries in Groups 1 and 2, in absolute values and percentages.

		Group 1		Group 2		p
		n	%	n	%	
Location of injury	Lower limb	38	38	03	11	0.02
	Upper limb	36	36	03	11	0.03
	Trunk/ pelvis	26	26	12	66	1.99

n: absolute number.

for the core segment, which is why similar findings to those of the limbs were not observed in this segment. With this, it is supposed that if the group of CrossFit® and RT practitioners also did training focused on the core muscles, the findings of the general prevalence of injuries in this group would be lower.

As a way of approaching injury prevention in sports, most protocols highlight the importance of training this central segment of the body,[19,20] essential for body stability and an important site of injury in CrossFit®.[11-13] A longitudinal study performed by Szeles et al,[13] with the participation of 406 practitioners of the sport, observed that the trunk and pelvis segment was the second most common site of musculoskeletal injuries (29.1%), behind the upper limbs (39.3%). Similar findings were observed in other epidemiological studies with similar methodologies.[11,12]

Some results of the current study should be interpreted cautiously. We observed, for example, higher injury rates among the more experienced practitioners of the sport and those who use protective equipment. It is known that in other modalities, and this can be extended to CrossFit® athletes, advanced athletes present more injuries due to the higher level of competitiveness and higher volume in the sport practice.[8] This same characteristic may justify the finding of more injuries in the group of those who use protective equipment.

The main limitations of this study were its cross-sectional design and the potential forgetfulness of some injury by the practitioner, a fact minimized when considering the previous period of three years. In addition, not all injuries reported by the participants were medically diagnosed. However, all questionnaires were filled out with the help of one of the study participants.

This study provided important data about the benefits of concomitant RT training with CrossFit® practice, with the goal of preventing musculoskeletal injuries. Through it, this training can be stimulated in a more systematized way by the instructors of the modality.

CONCLUSION

Resistance training associated with CrossFit® and encompassing all anatomical segments can be considered a protective factor against the occurrence of musculoskeletal injuries in CrossFit®.

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