BJCMR Brazilian Journal of Clinical Medicine and Review

PCAA PUBLICAÇÕES CIENTÍFICAS DE ACESSO ABERTO

Original Research

Comparison by Gender of Muscle Power of Knee Extensors and Flexors of Athletics Athletes from the National Training and Athletics Center of the University of Fortaleza, Ceará, Brazil

Francisco Rafael Oliveira da Silva [1], Danilo Figueiredo de Lima [1], Mônica Helena Neves Pereira Pinheiro [1]

[1] Universidade de Fortaleza – UNIFOR, Fortaleza, CE, Brazil.

* Correspondence: rafael7personal82@gmail.com.

Abstract: The objective of this study was to compare the muscular power of the extensors and flexors of track and field athletes from the National Training and Athletics Center of the University of Fortaleza by male and female gender and not by event. Ten women and six men were evaluated, totaling 16 athletes, using the Cybex® brand isokinetic. The isokinetic evaluation has been used in many studies to evaluate the potency among other valences.

Keywords: Power; Knee joint; Athletics.

Citation: Silva FRO, Lima DF, Pinheiro MHNP. Comparison by Gender of Muscle Power of Knee Extensors and Flexors of Athletics Athletes from the National Training and Athletics Center of the University of Fortaleza, Ceará, Brazil. Brazilian Journal of Clinical Medicine and Review. 2023 Jan-Mar;01(1):24-29.

Received: 1 January 2023
Accepted: 25 January 2023
Published: 29 January 2023

1. Introduction

Power is the ratio between work and the time required to do it. The greater the work performed per unit of time, the greater the power, expressed by the Watt (W) unit [1]. Sports in general depend on strength gain for better performance in their training. Athletics is a sport that requires a lot of strength, inter and intramuscular coordination from the athlete, aiming to overcome opponents in speed or resistance, distance, or height [2]. Athletics is a basic sport for all others, as it works with global movements, such as jumping, throwing, throwing, and running, that is, natural movements that are included in the daily life of anyone who can do physical activity, being practitioner or not. Easy access sports modality can be practiced by any individual [2]. It is observed in the various athletics modalities such as races, launches, jumps, and throws, the following of technological advances and the development of specific equipment for each event, which have become more sophisticated, together with the need for athletic performance and body demand in due to high yield.

The isokinetic dynamometer used for the development of this research is an electromechanical instrument with objective, reliable and valid measurements, which provides resistance to angular joint movement, both in flexion and in extension of the knee along a certain amplitude, at predetermined constant angular velocity. - determined, enabling the evaluation of parameters related to muscle power dynamically [3]. In the isokinetic evaluation, it is possible to measure muscle parameters such as torque (strength), work, power, anteroposterior muscle imbalance and fatigue [3-4]. In addition, isokinetic dynamometers propose reference values of muscle function related to asymmetries between limbs (right and left) and the imbalance of agonists and antagonists for certain populations [5].

The first National Center for Athletics Training was established in the Olympic Village of Manaus, in 1995, under the name of Centro de Training de High Level of Athletics

of Manaus – CETAN and operated until December 31, 2002. Within the goals of the CNTA we find the desire to spread the practice of athletics throughout the national territory, therefore, the National Athletics Training Center of the University of Fortaleza - UNIFOR is a realization of this goal. The great scarcity of research carried out previously on the subject is the great cause of the relevance of the present study and with the objective of contributing to this understanding, power tests were carried out in the isokinetic dynamometer in knee extensors and flexors with track and field athletes from the CNTA/ UNIFOR [6].

2. Methods

This research was characterized as a descriptive, cross-sectional, and quantitative study carried out at the University of Fortaleza. The sample was intentional, consisting of 10 men and 6 women, totaling 16 track and field athletes from the National Center for Athletics Training/University of Fortaleza, regardless of age and gender. The inclusion criteria for the study were athletes who were affiliated with the CNTA/UNIFOR, who were not competing, had no injuries during the test period and had no history of orthopedic, rheumatological or neurological pathology related to the lower limbs.

A questionnaire was applied containing information about health and important data for the characterization of the sample, such as age, time of practice of athletics and injuries resulting from athletics, gender, body mass and height. The methodology applied was through the isokinetic dynamometer of the brand Cybex® 1200 to evaluate the muscle power of the lower limbs predicted by the isokinetic parameter given in Watts (W) and the agonist and antagonist muscle imbalance indexes of the right and left leg applied by a formula numeric predicted by the equipment. The isokinetic evaluation started with the entry of data into the computer (name, age, body mass, height, gender, dominant side of the LL). Afterwards, the athlete was asked, before the evaluation, to do a muscle warm-up of the lower limbs on the ergometric bicycle with a maximum duration of 5 minutes.

The subjects sat on the isokinetic dynamometer chair and their position was stabilized with belts placed at the level of the trunk and thigh, to prevent inappropriate movements during the movement. The backrest angle of the chair is placed at an angle greater than 90º and the axis of the knee joint is aligned with the axis of the device lever. The popliteal fossa of the tested knee was in a position in contact with the seat and the distal stop of the isokinetic lever arm is attached five centimeters above the lateral malleolus of the ankle. The evaluated knee was positioned at 90° of flexion and the axis of rotation of the dynamometer lever arm aligned with the lateral part of the femoral condyle. Before starting the test, the subjects were instructed to exert as much force as possible, both in extension and in flexion of the knee, being verbally encouraged. The test started with the dominant leg identified by the volunteer as being the dominant one. Before beginning the evaluation, the subject was asked to perform 3 sub-maximal repetitions of knee extension/flexion for adaptation and knowledge of the machine. After adaptation, 18 concentric contractions were performed at high speed at 240°/s for knee extension/flexion to measure maximum power.

After completing the assessment of the dominant limb, the same test procedures were performed on the contralateral limb. After finishing both legs and removing the athlete from the isokinetic dynamometer, finally, an isokinetic evaluation report was printed, referring to the equipment, and an explanation of the results to the athlete. Data were organized with the help of the Statistical Package for Social Sciences (SPSS) 16.0 for Windows program, using descriptive statistical treatment (mean, standard deviation, minimum and maximum) and inferential (One-Sample Kolmogorov-Smirnov Test, Independent -Sample T test, Anova One-Way, Post Hoc Scheffe), with a significance level of 5% ($p<0.05$). The results were presented in tables and figures. This study was approved by the Ethics and Research Committee of the University of Fortaleza - COÉTICA/UNIFOR.

2. Results

Table 1 highlights anthropometric and age characteristics and does not show significant differences in age (Tcal: 0.19; p>0.05), body mass (Tcal: 0.30; p>0.05), height (Tcal: 1.613; p> 0.05) and BMI (Tcal: 1.188; p>0.05) based on these results, the other data can be analyzed without gender distinction. The table 2 indicates that the T-test for samples (p<0.05) characterizes the muscle power by gender of the knee extensors and flexors. Table 03 shows that the T test for independent samples (p<0.05) indicated that male athletes have greater power in the flexors than female athletes.

Table 1. Descriptive and inferential statistics (T test) of age, body mass, height, and body mass index (BMI) of CNTA/UNIFOR athletes, according to gender.

	Sexo	N	Média	Desvio Padrão	t_{cal}	
Idade (anos)	Masculino	6	16,67	3,20		
	Feminino	10	16,90	1,73	0,191	p>0,05
Massa Corporal (kg)	Masculino	6	66,67	12,58		
	Feminino	10	68,80	14,33	0,301	p>0,05
Estatura (cm)	Masculino	6	176,33	8,59		
	Feminino	10	169,00	8,92	1,613	p>0,05
IMC (kg/m^2)	Masculino	6	21,36	2,80		
	Feminino	10	24,26	5,52	1,188	p>0,05

t_{cal}= valores calculados pelo One-Samples T Test

Table 2. Comparison of knee extensor power in track and field athletes between male and female. CNTA/UNIFOR.

		Extensores Perna Direita		Extensores Perna Esquerda	
Sexo	N	Média	Desvio Padrão	Média	Desvio Padrão
Masculino	6	345,00*	99,92	323,17*	79,39
Feminino	10	263,40	50,18	238,30	49,96
Sig(Teste t independente)		0,046		0,019	

*p<0,05

Table 3. Comparação da potência dos flexores dos joelhos dos atletas de atletismo entre o sexo masculino e feminino. CNTA/UNIFOR.

		Flexores Perna Direita		Flexores Perna Esquerda	
Sexo	N	Média	Desvio Padrão	Média	Padrão
Masculino	6	292,17	106,86	280,33*	73,19
Feminino	10	240,80	56,45	208,30	51,32
Sig(Teste t independente)		0,225		0,036	

*p<0,05

As figuras 1 e 2, que relacionam a potência dos extensores e flexores dos joelhos evidenciam a maior capacidade de potência dos joelhos direitos dos atletas em relação aos dos joelhos esquerdos, sem distinção de gêneros.

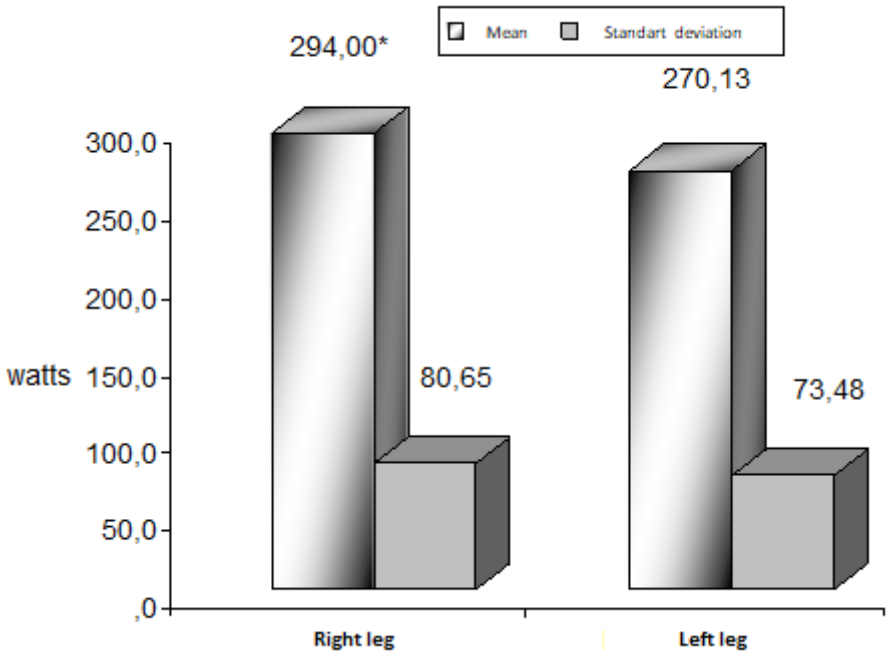

Figure 1. Comparison of the muscle power of the right and left knee extensors in track and field athletes.

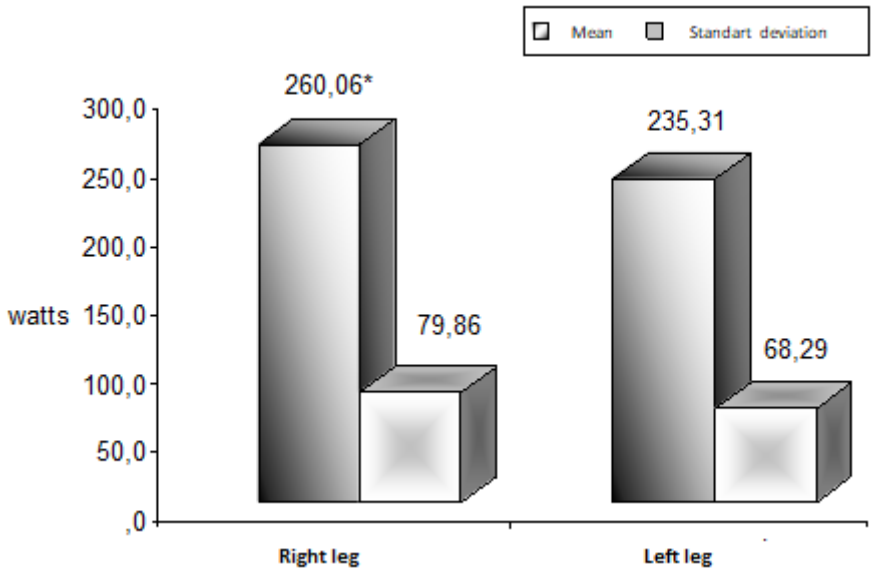

Figure 2. Comparison of the muscle power of the right and left knee flexors in track and field athletes.

3. Discussions

In recent decades, there has been a significant increase in the number of imaging tests performed on pregnant patients. This increase includes different modalities such as ultrasonography, computed tomography and magnetic resonance imaging. Imaging methods free of ionizing radiation are preferred during pregnancy. Ultrasonography and MRI have advantages over CT. However, CT can provide important data, contributing to the diagnosis in some situations. It is important to remember the fundamental principles of

radiation protection, to reduce the risks to which the pregnant woman and the fetus will be exposed.

The present study compared the muscle power between males and females of CNTA/Unifor track and field athletes. The balance relationship between extensors and flexors was evaluated using lower speeds for peak torque and work and using higher speeds for power analysis. Among the speeds mentioned above, we used the data provided at the highest speed (240º) for our evaluation. The index of muscle strength imbalance between the hamstrings and quadriceps femoris I/Q of the right and left legs of the CNTA track and field athletes is represented by Figures 1 and 2. The (I/Q) is calculated by the flexors multiplied by 100 and divided by the extenders.

In a similar study, Pinho et al. [7], found the results of muscular power of the extensors and flexors of the knees of track and field athletes from CNTA-UNIFOR. Of the extensors of the male right leg, the mean power was 336.58 of the left leg it was 308.5. In the female gender, the average power value of the right leg extensors was 259.89 and the left leg was 231.89. In terms of flexors, the power results found for the right leg were 286.58 and 263.92 for the left leg. In the female gender, the average power of the flexors in the value of 240.11 in the right leg and 203.44 in the left leg was included in the analysis. In the present study, we found power values for the right and left leg extensors, respectively, 345.00 and 323.17 in males and 263.40 and 238.30 in females. In the flexors, the results of the right and left leg, respectively, were 292.17 and 280.33 for males and 240.8 and 208.30 for females. No significant differences were found in the values compared.

Goulart, Dias and Altimari [8] reported that in the soccer team of their study, the forwards and laterals obtained, respectively, the maximum power of the right flexors of 368.0W and 304.3W; and the left flexors were 313.7W and 295.1W. In a study carried out in Fortaleza with 15 male jiu-jitsu athletes aged between 15 and 30 years with practice between 6 months and 10 years, results were found for power of ex-tensors and flexors, respectively, 286W and 252W.

It is concluded that the comparison made between the muscle power of the knee extensors and flexors of the CNTA/UNIFOR athletes of the male and female genders found a significant difference The imbalance index, comparing the right and right knees left is within normal limits. The present study found limitations, as it is a general assessment of the muscle power of the lower limbs of all CNTA athletes regardless of competition, and because the sample has a small number, thus, it was only possible to evaluate the power of one general form of all athletes. It is suggested new research that evaluate the muscular power of the limbs that are directly linked to the sporting gesture of the athletics and to make in this way, a comparison for category and not general.

Funding: None.

Research Ethics Committee Approval: None.

Acknowledgments: None.

Conflicts of Interest: The authors declare no conflict of interest.

Supplementary Materials: None.

References

1. Terreri A, Greve J, Amatuzzi M. Avaliação isocinética no joelho do atleta. Revista Brasileira de Medicina do Esporte. 2001;5(7):170-174.
2. Frometa E, Takahaski K. Guia Metodológico de Exercícios em Atletismo, Formação, Técnica e Treinamento. São Paulo: Artmed, 2004.
3. Aquino CF, Vaz DV, Brício RS, Silva PLP, Ocarino JM, Fonseca ST. A Utilização da Dinamometria Isocinética nas Ciências do Esporte e Reabilitação. Revista Brasileira de Ciência e Movimento. 2007;15(1):93-100.
4. Assis M, Gomes M, Carvalho E. Avaliação isocinética de quadríceps e ísquios-tibiais nos atletas de jiu-jitsu. Revista Brasileira de Promoção da Saúde.2005;18(2):85-89.

5. D'Alessandro RL, Silveira EAP, dos Anjos MTS, da Silva AA, da Fonseca ST. Análise da associação entre a dinamometria isocinética da articulação do joelho e o salto horizontal unipodal, hop test, em atletas de voleibol. Rev Bras Med Esporte. 2005;11(5).
6. CBAt – Confederação Brasileira de Atletismo. Centro Nacional de Treinamento em Atletismo – CNTA. Disponível em: <http://www.cbat.org.br/acbat/projeto/centro_nacional.asp>.
7. Pinho ACN, Rodrigues RM, Costa RG, Lamboglia CMGF, Santos PN, Pinheiro MHNP, Vasconcelos-Carneiro RF. Avaliação isocinética dos membros inferiores dos atletas do Centro Nacional de Treinamento de Atletismo/UNIFOR. Revista Brasileira de Ciência e Movimento. 2010;18:247-247.
8. Goulart L, Dias R, Altimari L. Variação do equilíbrio muscular durante uma temporada em jogadores de futebol categoria sub-20. Revista Brasileira de Medicina do Esporte. 2008;1(14):17-21.