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Determination of Isokinetic Strength of Upper and Lower Body of Elite Male Boxers

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Abstract

It is well known that punching force is highly important to boxers for winning and one of the key components of amateur boxing. Boxing needs also get blocking position, after throwing a punch to not receive a punch.The aim of the study was to determine the dominant internal-external shoulder muscles and dominant extension-flexion leg muscles strength of the elite boxers at 60° and 180° sec-1. In the study, 10 male elite boxers 22.10 ± 1.37 years, height 174.60 ± 6.41 cm and 72.60 ± 10.74 kg participated in the study. The isokinetic knee and shoulder strength tests were performed with an isokinetic dynamometer (Cybex, Humac Norm 2004) in the kinanthropometry laboratory of Selcuk University. Statistical analysis of the data was performed using SPSS 22 package program. Descriptive data of the participants were given as mean, minimum, maximum and standard deviation. it was determined that the peak dominant leg strength of elite boxers were found for extension 224,900 nM (60 °/s) and 135,70 nM (180 °/s). The peak dominant leg strength of elite boxers found for flexion 120,50 nM and 72,30 nM at 60 °/s and 180 °/s respectively. Elite boxers' leg strength was similar to literatür. As a result of the study, it can be said that the internal muscle group of boxers produce more power than external muscle group. It can be concluded that the boxers have better punching strength than defense.

Keywords: Box, isokinetic strength, knee, shoulder.

INTRODUCTION

The human body is in physical, physiological, biomotoric and psycho-mental forms with a great balance (homeostasis) and adaptation. Also, boxing needs adaptation to strength, dynamic and static features (15). As a full-contact martial arts game, it is possible to throw a clear and accurate punch to the opponent without getting a punch in the face of amateur boxing intent (6). In an amateur boxing match, competitors are allowed to use their glove's fingertip area and their punches toward the target area (i.e., side to side or from the front and above the belt) (2).

Boxing demands a high-developed technical, tactical ability and a high physical and physiological fitness level to succeed. The high-intensity performance in the period of rounds, with insufficient breaks for maintaining, is identified with amateur boxing (2). It is reported that the higher anaerobic threshold you have, the more you can succeed in boxing (17). it has been observed that amateur boxing (a form of 3X3) demands durability in the period of a boxing match (2). Boxers should have well-developed muscle strength and power to sufficiently manage the physical and technical-tactical needs (10, 11).

A typical boxing event is held over 3x2 minutes for the novice and 4x2 minutes for the middle boxer, while open-class boxers can take 3x3 or 4x2 minutes rounds depending on the coach's agreement. The intervals between the rounds are usually 1 minute (16). Boxing fitness components include cardiovascular endurance, muscle strength, muscle endurance, flexibility, and body composition. Skill related components include speed, agility, strength, balance, coordination, and response time. Most combat sports require a mix of technical, strength, aerobic fitness, power and speed. Often a single performance feature is not dominant in martial sports. The physiological responses, especially the heart rate and the maximum oxygen uptake (VO2max), the blood lactate values vary even according to the weight category and the rounds (14).

Muscules generate high-intensity force in a short time. It is well known that punching force is highly important to boxers for winning and one of the key components of amateur boxing. Not only speed but also power are needed to be effective for throwing a punch (2). In boxing also after throwing a punch, boxers have to get blocking position to not receive a punch. In this study, shoulder and leg strength of the boxers will be determined.

MATERIAL & METHOD

A total of 10 elite male boxers studying in Selçuk university at Sports Science Faculty were recruited to participate voluntarily in the study. All subjects were first informed about the aim and possible risks of the study. All subjects provided written informed consent. Data of 10 boxers (age: 22.10±1.37 years, height: 174.60±6.41 cm, weight: 72.60±10.74 kg). Subjects participated in national and international championship repeatedly.

Study design

Participants were taken to the sports science faculty laboratory at 09.00 am. Participants were warned to not participate in any exercise in the past 48 hours until the end of the test section. Participants were informed about the amount and type of food (55% carbohydrates, 25% lipids and 20% protein due to energy metabolism) that they had to take 24 hours prior to the trial day (17). Subjects were applied to standard warm-up including stretching movements. Following that, participants were taken to the isokinetic knee strength test. 1-minute rest was given between the velocities and 5-minutes were given between limb changes (13).

Isokinetic Strength Exercise

The isokinetic knee and shoulder strength tests were performed with an isokinetic dynamometer (Cybex, Humac Norm 2004) in the kinanthropometry laboratory of Selcuk University. Boxers participating in the study were taken to the isokinetic knee exercise after warming up. Participants are seated in the correct position in the test seat. The participants' holders and the middle sections of the thighs were stabilized to the seat by the tapes. In addition, they were allowed to support by holding the handles on the right and left sides of the seat during the test.

Five repeats maximal contractions knee extension (hamstring) and flexion (quadriceps) torque values were obtained at 60° sec-1 speed. In addition, 15 repeats maximal contractions exercise were done at 180° sec-1 speed. 1-minute rest was given between the velocities and 5-minutes were given between knee changes (12). Peak power of the dominant leg was recorded during the test. Participants were supported by verbally encouraging expressions in order to achieve higher performance during the test. Also, the best values were recorded during the exercise.

Statistical Analyses

Statistical analysis of the data was performed using SPSS 22 package program. Descriptive data of the participants were given as mean, minimum, maximum and standard deviation.

RESULT

Table 1. Descriptive information of the participants

		N	Minimum	Maximum	Mean	sd
Boxing group	**Age (year)**	10	20.00	24.00	22.10	1.37
	Height (cm)		165.00	184.00	174.60	6.41
	Body Weight (kg)		58.00	85.00	72.60	10.74

Table 2. Isokinetic leg strength outputs of the participants

		Movement	Minimum	Maximum	Mean	sd
Leg strength	60°/s	Extension (Nm)	16.00	286.00	224.90	40.18
		Flexion (Nm)	91.00	148.00	120.50	19.81
	180°/s	Extension (Nm)	84.00	165.00	135.70	25.25
		Flexion (Nm)	42.00	98.00	72.30	18.74

Table 3. Isokinetic shoulder strength outputs of the participants

		Movement	Minimum	Maximum	Mean	sd
Shoulder strength	60°/s	Internal (Nm)	50.00	84.00	63.70	10.49
		External (Nm)	34.00	56.00	40.90	6.78
	180°/s	Internal (Nm)	42.00	85.00	56.20	13.89
		External (Nm)	24.00	43.00	31.80	6.67

In Table 2-3, the dominant arm and leg 60°/s and 180 °/s isokinetic strength levels of the boxers are given. At 60°/s rotation, the average extension was 224.90±40.18 and the flexion average was 120.50±19.81, 180°/s rotation, the average extension was 135.70±25.25 and the flexion average was 72.30±18.74, 60 °/s rotation, internal mean was 63.70±10.49 and external mean was 40.90 ± 6.78, 180 °/s rotation, internal mean was 56.20 ± 13.89 and external mean was 31.80 ± 6.67.

DISCUSSION & CONCLUSION

In this study, isokinetic strength measurements of the dominant arm and dominant leg in arm and leg rotation of 60 °/s and 180 °/s were performed to volunteer individuals engaged in active sports at elite boxing level.

As a result of findings, the peak dominant leg strength of elite boxers found for peak extension 224.900 nM and 135.70 nM at 60 °/s and 180 °/s respectively. The peak dominant leg strength of elite boxers found for flexion 120.50 nM and 72.30 nM at 60 °/s and 180 °/s respectively. Similarly, Kocahan et al. (9) stated in their study that, the peak dominant leg strength of elite boxers found for extension 212 nM at 60 °/s and 123 nM at 240 °/s. The flexion measurements of the legs were found 114 nM at 60 °/s and 85 nM at 240 °/s. Lower extremity muscle strength is a key determinant of performance for boxing. The knee flexor and extensor muscles stabilize the knee joint and play an important role in lower extremity-related movements to perform spore-specific activities such as acceleration, deceleration and change direction Kocahan et al. (9). As a result of literature, we could not find any studies about the isokinetic strength of lower extremity of amateur elite boxers. However, there are studies in the literature that determine the knee joint isokinetic muscle strength profile in handball, volleyball, sailing, football, judo and wrestling athletes (1,5,18, 19). In the literature, it is emphasized that the most appropriate angular velocity is 60 ° / s to determine the force difference of the knee flexion/extension ratio and it is stated that this ratio increases when the angular velocity increases (8). Hammami et al. (7) stated in their study that, the peak dominant leg strength of elite taekwondo players found for extension 231 nM at 60 °/s and 132 nM at 180 °/s. The flexion measurements of the legs were found 129 nM at 60 °/s and 95 nM at 180°/s. The study results of Hamami and Kocahan are similar to our results. It can be said that taekwondo and boxing have similar energy metabolism, similar spore-specific activities, and spores that require similar physiological requirements. That is why similar outputs were found.

The findings of dominant shoulder peak internal strength of elite boxers were 63.70 nM and 56.20 nM at 60 °/s and 180 °/s respectively. dominant shoulder external strength of elite boxers was 40.90 nM and 31.80 nM at 60 °/s and 180 °/s respectively. Similarly, Kocahan et al. (9) stated in their study that, the peak dominant shoulder strength of elite boxers found for internal 67 nM at 60 °/s and 65 nM at 240 °/s. The external measurements of the shoulders were found 33 nM at 60 °/s and 27 nM at 240 °/s. Isokinetic muscle strength of the shoulder joint and IR-ER (internal, external) movement was evaluated in most studies determining the upper extremity muscle strength profile (4). To the literatüre, it is determined that internal muscle strength is stronger than external. In the present study, IR is stronger than EX as in the literature. The reason can be that the IR muscles group is numerically more and bigger (3). According to present studies finding, IR also has more strength than EX. This can be due to the adaptation of the muscles to the box-specific jabs and hooks.

As a result of the study, it can be said that boxers have stronger IR muscle group than EX this gives boxers a good attack. However, the weaker EX can not give boxers a good defense so boxers need to put more IR muscle strength movement in their training program.

REFERENCES

1. Andrade MS, Vancini RL, de Lira CA, Mascarin NC, Fachina RJ, da Silva AC. Shoulder isokinetic profile of male handball players of the Brazilian National Team. *Braz J Phys Ther*. 2013;17(6):572-8.
2. Chaabène H, Tabben M, Mkaouer B, Franchini E, Negra Y, Hammami M, *et al.* Amateur boxing: physical and physiological attributes. *Sports Med*, 2015;45:337-52.
3. Dark A, Ginn KA, Halaki M. Shoulder muscle recruitment patterns during commonly used rotator cuff exercises: an electromyographic study. *Phys Ther*. 2007;87(8):1039-46.
4. Ferreira-Júnior JB, Vieira CA, Soares SRS, Magalhães IEJ, Rocha- -Júnior VA, Vieira A, Bottaro M. Effects of different isokinetic knee extension warm-up protocols on muscle performance. *J Sports Med Phys Fitness*. 2013;53(Suppl 1 to No 3):25-9.
5. Ghrairi M, Hammouda O, Malliaropoulos N. Muscular strength profile in Tunisian male national judo team. *Muscles Ligaments Tendons J*. 2014;4(2):149-53.
6. Guidetti L, Musulin A, Baldari C. Physiological Factors in Middleweight Boxing Performance. *Journal of Sports Medicine and Physical Fitness*, 2002; 42(3), 309.
7. Hammami N, Zinoubi B, Hamdi F, Nouri A, Zouita A, Dziri C. Profil isocinétique des muscles du genou chez des taekwondoïstes élites olympiques. *Science & Sports*, 2013:28(4), 188-195.
8. Houweling TA, Head A, Hamzeh MA. Validity of isokinetic testing for previous hamstring injury detection in soccer players. *Isokinet Exerc Sci*. 2009;17(4):213-20.
9. Kocahan T, Akınoğlu B, Yıldırım NÜ. Türkiye Erkek Boks Milli Takım Sporcularının Omuz ve Diz Eklemi İzokinetik Kas Kuvvet Profilinin Belirlenmesi. *Fizyoterapi Rehabilitasyon*, 2018: *29*(2), 37-43.
10. Kravitz L, Greene L, Burkett Z, et al. Cardiovascular response to punching tempo. *J Strength Cond Res*. 2003;17(1):104–8.
11. Pierce J, Reinbold K, Lyngard B et al. Direct measurement of punch force during six professional boxing matches. *J Quant Anal Sports*. 2006;2.
12. Rahnama N, Lees A, Bambaecichi E. Comparison of muscle strength and flexibility between the preferred and non-preferred leg in English soccer players. *Ergonomics*, 2005; 48(11-14), 1568-1575.
13. Ringsberg K, Gerdhem P, Johansson J, Obrant KJ. Is there a relationship between balance, gait performance and muscular strength in 75-year-old women?, *Age and ageing*, 1999; 28: 289-293.
14. Slimani M, Chaabène H, Davis P, Franchini E, Cheour F, Chamari K. Performance Aspects and Physiological Responses in Male Amateur Boxing Competitions: A Brief Review. *The Journal of Strength & Conditioning Research*, 2017;31(4), 1132-1141.
15. Soslu R, Güler M, Ömer, Ö, Devrilmez M, Cincioğlu G, Doğan, Esen Ht, Doğan AA . Boksörlerde Akut Yorgunluğun Statik Dengeye Etkisi. *Sportif* , 2018; *1* (1), 19-30.
16. Tatlıcı A. Elit boksörlerde akut besinsel nitrat takviyesinin anaerobik güç üzerine etkisi, Selçuk Üniversitesi Sağlık Bilimleri Enstitüsü, Yüksek Lisans Tezi 2017.
17. Tatlici A, Cakmakci O . "The effects of acute dietary nitrate supplementation on anaerobic power of elite boxers." *Medıcına Dello Sport* 72, no. 2 2019: 225-233.
18. Xaverova Z, Dirnberger J, Lehnert M, Belka J, Wagner H, Orechovska K. Isokinetic strength profile of elite female handball players. J Hum Kinet. 2015;49(1):257-66.
19. Zi-Hong H, Lian-Shi F, Hao-Jie Z, Kui-Yuan X, Feng-Tang C, Da-Lang T, et al. Physiological profile of elite Chinese female wrestlers. J Strength Cond Res. 2013;27(9):2374-95.