EFFECT OF BADMINTON SPECIFIC TRAINING VERSUS BADMINTON MATCH ON AEROBIC FITNESS

Mert AYDOĞMUŞ[1], Erkal ARSLANOĞLU[2], Tarık ÖZMEN[3]

[1] Hasan Doğan School of Physical Education and Sports, Karabuk University, Karabük, TURKEY. aydogmus1978mert@gmail.com

[2] Sarıkamış School of Physical Education and Sports, Kafkas University, Kars, TURKEY. erkaloglu@gazi.edu.tr

[3] Department of Physiotherapy and Rehabilitation, School of Health, Karabuk University, Karabük, TURKEY. tarikozmen@karabuk.edu.tr

Abstract: The aim of the present study was compared to effect of badminton-specific training and badminton match on aerobic fitness. Thirty adolescents (age = 11,83 ± 0,69 years; height = 140,13 ± 5,15 cm, weight = 32,36 ± 4,82 kg) badminton players volunteered to participate in the study. All subjects performed the 20 m shuttle run test (20-MST) to determine aerobic fitness. All participants were randomly divided into two groups after pre-test. One of groups played only badminton match six times per week for 12 weeks. Other group exposed to badminton-specific training six times per week for 12 weeks. Each session lasted 60 to 90 minutes. There were significant differences between pre-test and post-test in both badminton-specific training (p=0.001) and match group (p=0.001). However, there were no significant differences in 20-MST between badminton-spesific training and match groups (p>0.05). In the present study, both badminton-specific training and badminton match six times per week for 12 weeks increased aerobic fitness level.

Key Words: Badminton, Aerobic fitness, VO_2Max.

Introduction

Badminton is today one of the most popular played racquet sports in the world. The decision to include badminton in the 1992 Olympics Game increased participation in this sport. Badminton is for two or four people with a temporal structure characterized by repetitive actions of short duration with high speed and technical skill within an 80 m2 court but great intensity like other sports (squash, tennis, and volleyball) (Lees, 2003; Manrique and Gonzalez-Badillo, 2003) Badminton requires a combination of aerobic and anaerobic fitness, speed, power, agility, flexibility, strength and technical skill (Lees, 2003; Lieshout, 2003). Aerobic fitness is defined as The American College of Sports Medicine (ACSM, 2000) the ability to perform dynamic exercise involving large muscle groups at moderate to high intensity for prolonged periods of time. The small dimensions of playing field can limit the maximal sprint length. The short high-intensity type activities during competition depend on mainly anaerobic breakdown of creatine phosphate for energy production in the working muscles (Glaister, 2005). A high level of aerobic fitness is primer factor to compete at the elite level (ie, fast recovery between points) in all racquet sports (Girard and Millet, 2008; Lees, 2003). Maximal oxygen consumption (VO_2 max) reflects the aerobic fitness of the individual (ACSM (2000). Carlson et al. (1985) reported that elite badminton players had a high VO_2 max: 60.5 ml/kg/min on treadmill test. Also, heart rates were reached approximately 100% of maximum heart rate during badminton competition (Faccini and Dal Monte, 1996). Faude et al. (2007) measured oxygen consumption as 73% of VO_2 max in 12 internationally ranked badminton players during a simulated singles badminton match. Furthermore, elite badminton athletes' vastus lateralis muscle had high percentage of slow twitch fibers and a tendency towards the muscle fibre distribution of endurance athletes (Mikkelsen, 1979). Badminton players need to high levels of aerobic power to maintain physical performance during a total time of about 30 minutes (Manrique and Gonzalez-Badillo, 2003; Faude, 2007). Improvement in aerobic power may contribute to recovery from anaerobic performance both by supplementing anaerobic energy during the competition and by providing aerobically produced energy at a faster rate during the recovery period (Tomlin & Wenger, 2001).

Based on above studies, aerobic capacity is considered one of the most important components of

successful performance of a badminton player. Training programs for badminton players should be designed to induce the development of a sufficient aerobic capacity. The aim of this study, therefore, was compared to effect of a badminton-specific training and badminton match on aerobic fitness.

Material and Method

Participants

Thirty adolescents badminton players (age = 11,83 ± 0,69 years; height = 140,13 ± 5,15 cm, weight = 32,36 ± 4,82 kg) consented and volunteered to participate in the study. Descriptive data are presented in Table 1. All participants had prior badminton experience of at least 2 years. None of the participants had been injured 6 months before the initial testing or during the training program. All subjects completed the 20 m shuttle run test (20-MST) to measure aerobic fitness. Before testing, subjects were given practice trials to become familiar with the testing procedures. The 20-MST is a field test to determine aerobic fitness (VO_2max) and has been shown to be a reliable and valid indicator of aerobic power (Leger et al. 1988). The test consisted of shuttle running at increasing speeds between two markers placed 20 m apart according to the pace of the recorded beeps. Participants were required to be at one end of the 20 m course at the beep signal. A start speed of 8.5 km/hour was maintained for one minute, and was increased by 0.5 km/hour every minute. The test score achieved was the number of 20m laps completed before the participant either withdrew voluntarily from the test or failed to arrive within 3m of the end line on two consecutive tones. All participants were randomly divided into two groups after pre-test. One of groups (8 males, 7 females) played only badminton six times per week for 12 weeks. Other group (8 males, 7 females) exposed to badminton-specific training six times per week for 12 weeks.

Badminton-Specific Training Program

package 1: Footwork (Shadow stepping) study, full-field corner for 30 seconds in 8 x 8 again, a total of 5 sets, sets of 2 minute rest breaks. Total time: 28-30 minutes of training methods: common interval

package 2: Station study (rope skipping, jumping work, shuttle, push-ups, front court stepping operation) 70% load at each station, a total of 5 sets of 30 seconds at each station, 1 minute rest between each set. Total time 16-17 min.

package 3: Techniques Strike studies (clear, drop, smash) 30 ball feeding studies, conti-nuous back court spike the ball thrown 30 kinds of work for each shot, 2 minutes rest between each shot. Total time 20 min.

package 4: Drill work, stroke studies as stroke types combined (Front, middle and back strokes made in the courts), 40 seconds loads, a total of 15 sets, 20 seconds rest between each set. Total time 15 min.

Statistical Analysis

Data were analyzed using SPSS Version 16.0 software. Descriptive statistics (Mean ± SD) were calculated for all variables. Data from pre-test and post-test were compared with the Wilcoxon Matched Pairs Signed-Rank test within each group. The Mann-Whitney U test was used to compare the two groups. Statistical significance was set at $p \leq 0.05$.

Results

Mean values and standard deviation (Mean ± SD) of all measurements are presented in Table 2. There were significant differences between pre-test and post-test in both badminton-spesific training ($p = 0.001$) and match group ($p = 0.001$). However, there were no significant differences in 20-MST between badminton-spesific training and match groups ($p>0.05$).

Table 1. Descriptive characteristics and pre and post test results

	Training Group (n = 15)		Match Group (n = 15)	
Variables	Mean	SD	Mean	SD
Age (yrs)	11,5	0,67	11,5	0,74
Height (m)	140,4	5,38	139,86	5,3
Weight (kg)	32,4	4,64	32,33	5,16

Table 2. Pre- and Post-test comparisons for the training (*n* = 15) and match (*n* = 15) groups

	Training Group (*n* = 15)		Match Group (*n* = 15)		
Variables	Mean	SD	Mean	SD	*p* value
Pre-VO_2 max (ml/kg/min)	29,50	14,27	28,80	12,57	0,32
Post-VO_2 max (ml/kg/min)	35,60	14,47	35,30	14,36	0,98

Discussion

The purpose of this study was compared to effects of a badminton-specific training and badminton match on aerobic fitness. Both badminton-specific training (20%) and badminton match (22%) six times per week for 12 weeks improved aerobic fitness. Researchers observed that 60-70% of the energy during badminton competition derived from the aerobic system while 30% obtained from the anaerobic system (Chin et al. 1995; Faccini & Dal Monte, 1996; Lei et al. 1993; Manrique, & Gonzalez-Badillo, 2003). Ooi et al. (2009) found VO_2 max of 56.9-59.5 ml/kg/min using 20-MST for twelve sub-elite and elite badminton players. Faude et al. (2007) measured oxygen consumption as 73% of VO_2 max in 12 internationally ranked badminton players during a simulated singles badminton match. Majumdar et al. (1997) VO_2 max analyzed 55.7 ml/kg/min during 12 training sessions and 35 single matches in six badminton players. Andersen et al. (2007) demonstrated that VO_2 max in 35 elite badminton players participating physical training including resistance exercises for 1-3 h a day, 5-7 times a week for 14 weeks was higher than age-matched untrained individuals (63 ml/kg/min). In the present study, we were observed lower VO_2 max values than elite players because participants had small age and 2 years badminton experience. In accordance with our results, Ghosh et al. (1993) found that a three weeks specific training increased VO_2 max from 43.8 ml/kg/min to 46.4 ml/kg/min in five women badminton players. Walklate et al. (2009) reported that repeated sprint training performed twice per week for a 4 week period in twelve elite badminton players was no show significant difference in 20-MST performance. ACSM (2000) have recommended improving VO_2 max aerobic exercise 3-5 times per week for 20–60 minutes per session, at an intensity that maintains the heart rate between 65-90% of the maximum heart rate. In this study, training duration and frequency were enough to improve aerobic fitness level. Metabolic demands of badminton match are related mainly to aerobic energy metabolism although characterized explosive actions such as lunging, jumping, and powerful strokes. Our results demonstrated that badminton specific training produced a similar increase to badminton match at level of VO_2 max in adolescent players.

Conclusion

In the present study, both badminton-specific training and badminton match six times per week for 12 weeks increased aerobic fitness level. Badminton is a sport requiring intermittent high-intensity efforts and loading high demands on both the aerobic and anaerobic systems during play and recovery. Therefore, the badminton training should include aerobic exercises in addition to resistance exercises to improve competition during match. Future research should investigate optimal training protocols to concurrently develop muscular strength and aerobic fitness for badminton players.

References:

American College of Sports Medicine. 2000. *ACSM's Guidelines for Exercise Testing and Prescription* 6.th ed. Baltimore, Maryland: Lippincott Williams and Wilkins.

Andersen, L. L., Larsson, B., Overgaard, H., & Aagaard, P. (2007). Torque-velocity characteristics and contractile rate of force development in elite badminton players. *European Journal of Sport Science, 7*(3), 127-134.

Carlson J, Tyrrell J, Naughton G, et al. (1985). Physiological responses during badminton games by elite Australian players. *Badminton Sitelines, 13,* 17-20.

Chin, M. K., Wong, A. S., So, R. C., Siu, O. T., Steininger, K., & Lo, D. T. (1995). Sport specific fitness testing of elite badminton players. *British Journal of Sports Medicine, 29*(3), 153-157.

Faccini, P. & Dal Monte, A (1996). Physiologic demands of badminton match play. *American Journal of Sports Medicine, 24*(6 Suppl.), S64-S66.

Faude, O., Meyer, T., Rosenberger, F., Fries, M., Huber, G., & Kindermann, W. (2007). Physiological characteristics of badminton match play. *European journal of applied physiology, 100*(4), 479-485.

Ghosh, A. K., Goswami, A., & Ahuja, A. (1993). Evaluation of a sports specific training programme in badminton players. *The Indian journal of medical research, 98*, 232-236.

Girard, O., and Millet, G.P., (2008). Neuromuscular fatigue in racket sports. *Neurol Clin, 26*(1): 181-194.

Glaister, M. (2005). Multiple sprint work. *Sports medicine, 35*(9), 757-777.

Lees, A. (2003). Science and the major racket sports: a review. *Journal of sports sciences, 21*(9), 707-732.

Lei, R.R., Deng, S.X., Lu, L.F. (1993). Study on the physiological function, physical quality and mental characteristics of the Chinese badminton players. *Chin Sports Sci Technol, 29*: 28-38.

Leger, L. A., Mercier, D., Gadoury, C., & Lambert, J. (1988). The multistage 20 metre shuttle run test for aerobic fitness. *Journal of Sports Sciences, 6,* 93–101.

Lieshout, K.A.V., & Lombard, A.J.J. (2003). Fitness profile of elite junior badminton players in South Africa. *Afr Phys Health Educ Recreat Dance, 9* (3): 114–20.

Majumdar, P., Khanna, G. L., Malik, V., Sachdeva, S., Arif, M., & Mandal, M. (1997). Physiological analysis to quantify training load in badminton. *British journal of sports medicine, 31*(4), 342-345.

Manrique, D. C., & Gonzalez-Badillo, J. J. (2003). Analysis of the characteristics of competitive badminton. *British journal of sports medicine, 37*(1), 62-66.

Mikkelsen, F. (1979). Physical demands and muscle adaptation in elite badminton players. In: Terauds J, ed: Science in racquet sports. Del Mar, CA: Academic Publishers.

Ooi, C. H., Tan, A., Ahmad, A., Kwong, K. W., Sompong, R., Mohd Ghazali, K. A., & Thompson, M. W. (2009). Physiological characteristics of elite and sub-elite badminton players. *Journal of sports sciences, 27*(14), 1591-1599.

Tomlin, D. L., & Wenger, H. A. (2001). The relationship between aerobic fitness and recovery from high intensity intermittent exercise. *Sports Medicine, 31*(1), 1-11.

