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Effects of Badminton Training on Physical Parameters of Players

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ABSTRACT The objective of this study was to analyze 8 weeks of a basic technical badminton training program on some fitness parameters of beginner level badminton players. After two months of training it was determined that the vertical jump increased for the experimental group (t = -5.467). It was determined that the standing broad jump performance showed a significant improvement in performance for the experimental group (t = -5.045). Interestingly, the control group's vertical jump (t = -2.091) and standing broad jumping jump (t = -2.214) values were found to increase significantly after 8 weeks. The total balance scores in the experimental group significantly decreased on a firm surface (t = 6.048), foam surface (t = 6.7621), (t = 8.505) after the training. The total BESS (t = -1.437) scores statistically did not show any significant difference after the training. The result of this study could be of help to coaches and athletes to improve performance through selection and adjusting to a suitable training program.

INTRODUCTION

Badminton is considered to be merely a slow and light game for children, a game that can be played outdoors and it is structurally unchallenging. It is appropriate for all ages, women and men and even disabled persons. Beginners can start playing badminton early since the basics are learned rapidly (Zekan 2007).

It was stated that badminton requires jumping, changing directions, rapid arm movements and a broad range of body postures (Cabello et al. 2003), and also requires extremely explosive movements to be carried out over a small court area. Changes in direction are necessary after most shots and all movements must be completed quickly with good technique and control. Vertical and lateral jumps are more usual in all aspects of the game. It was suggested that there are relations between power and movement speeds (Hughes et al. 2005). Therefore, it is vital that programs of fitness assessment should reflect the very exact necessities of the sport.

In badminton, as in other sports, many training programs have been developed to improve fitness parameters of badminton players. Badminton training incorporated strength and endurance activities has been reported to improve endurance and strength of elite and junior level badminton players (Zekan 2007; Babalola 2011). Many studies recommended general muscular endurance, arm muscular strength and flexibility training for physical developments and improving the fitness parameters of badminton players (Fletcher 1994; Babalola 2011; Majamdur 2007). In spite of this, the training load needs to be suitable for monitoring to avoid overtraining particularly for children. Workouts that are too rigorous may interfere with coordination, a factor that is essential in sports requiring much technical skill such as badminton, especially in early ages of sports practice. Also, it is well known that there are characteristic differences amongst elites, adolescents and preadolescents in strength, balance, and other fitness parameters, which also differs from one sport to another.

Muscle strength progress in children has been an issue of discussion for the past few

decades. Yet, scientific confirmation to distinct fact from fiction has been missing. Youth sports have become more popular but young athletes were informed with confusing and, very often, contradictory information concerning the safety and effectiveness of youth strength training. Another important component of badminton sport is balance development. It was reported that balance is a crucial element of movement and is crucial in the ability to take part in physical activity and has the capability to progress balance or postural stability in children (Dwayne and Katz 2003). It was declared that because of the significance of the assessment of balance skills in children by focusing on particular items within the subtests, tests can be used as both discriminative tools to file general postural stability problems and evaluative measures to record movement adjustments connected to the treatment of postural stability (Westcott et al. 1997).

It was suggested that the right amount of exercise is evidently essential for the optimal progress and health status of children and too much or too little exercise may have some unfavorable impact on the physical development of children (McKeag 1991). It was suggested that extra or little exercise might create health risks while there are noticeably more children who could advantage by increasing their physical activity (Healthy Children 2000).

Objectives of the Study

There is lack of information regarding the influence of basic technical training on some physical capacities and balance in children, and this study would help sports facilitators develop skill and competitive fitness and conditioning programs for badminton athletes, and think about special considerations about their skill and fitness training (Fletcher 1994). Thus, this study aims to investigate the effect of the basic technical skills training on the balance of some physical parameters in healthy, beginner level children.

METHODS

Participants and Experimental Design

The experimental group included beginner level badminton players aged between 8-10 years old (female = 9, male = 12), while the control group included Elementary School students from the same age group (female = 10, male = 10).

Procedures

Before the collection of data, the objectives of the study and methodology of each test were explained to the subjects. An informed consent form was taken from the subjects signed by their parents or guardians. All of the subjects participated in the study were absent of any health problems or disability. The experimental group underwent the summer badminton training program for eight weeks, and five days per week. Each session was held for 60 minutes, while the control group was not exposed to any type of training. The fundamentals and practice of badminton skills such as passing, throwing, and hitting were implemented during the 8 weeks of the training. No special strength training was scheduled so that the subjects would not be exposed to harmful effects of strength training for this age group. The measurements were completed before and after 8 weeks of the training program. They included the assessments of length measurement, weight measurement, vertical jump, horizontal jump test, and balance tests

Vertical Jump Test Protocol

A New Test 2000 contact mat system was used to evaluate the jump height (cm) of the subjects. Participants were required to start in a standing position and the jump technique was demonstrated before they started jumping. A modified counter movement jump, with hands kept on the hips was used to assess the vertical jump height in order to stop the inertial effects of arm actions. The greatest value of the vertical jump height was written following three trials for each subject. The subjects were required to jump vertically using a countermovement with arm swing. During the jump, an approach step was not allowed. A 0.5 to 1-minute rest period was given between trials.

Horizontal Jump Test Protocol

The subjects stayed behind a line marked on the ground in feet to some extent apart. A two-foot takeoff and landing was used, with swinging of the arms and bending of the knees to provide forward drive. The players tried to jump as far as possible, landing on both feet without falling backwards. The measurement was taken from takeoff line to the nearest point of contact on the landing. The participants had to land with the feet together and stay upright. The distance was calculated from the initial line to the end where the heel struck the ground upon finishing the test. The subjects tried it three times, and their best score was recorded.

BESS (Balance Error Scoring System) Balance Test Protocol

Balance performance of the subjects was measured using the Balance Error Scoring System (BESS). The test subjects was assessed in six different circumstances with closed eyes and without any support for 20 seconds on two different surfaces (flat and foam) and three standing positions (double leg, single leg and tandem). The gym floor is used for flat surfaces. The foam surface consisted of a 50x41x6 cm, medium size density foam (Airex Balance Pad, Alcan Airex AG, CH- 5643 Sins / Switzerland). The testing of the subjects was completed in the following order: double leg flat surface, one leg flat surface, tandem stance flat surface, a pair of legs, foam pad, foam pad, one leg, and tandem stance foam surface. A 20-second trial time was performed for each experimental condition. The same order of testing was used before and after the training period. A stopwatch was used to measure time at 20-second trials. The maximum error for each of the 6 test conditions were calculated and summed to obtain the best total BESS score. Two familiarization sessions were provided to the subjects after instruction of the testing before the actual testing. "One BESS error was scored if the subject engaged in any of the following:

(1) lifting the hands off the iliac crests; (2) opening the eyes; (3) stepping, stumbling, or falling; (4) moving the hip into more than 30° of flexion or abduction; (5) lifting the forefoot or heel; or (6) remaining out of the test position for longer than 5 seconds. Error scores were calculated for each of the 6 conditions and summed to obtain the total BESS score" (Erkmen et al. 2009). The double leg stance situation included the subject standing with feet together. The single leg stance was completed on the non-dominant leg. In tandem stance, the non-dominant foot was located at the back of the dominant foot, and the subject was required to keep the stance with the great toe of the non-dominant foot touching the heel of the dominant foot. For all circumstances, the player was to stay still with eyes closed and hands on the hips (Riemann and Guskiewicz 2000). After the demonstrations, two adaptation trials were given to the subjects before the real data collection. A superior score on the BESS shows a weaker postural control.

Statistical Analysis

Results were analyzed using the SPSS version 22.00 (SPSS Inc., Chicago, USA). The Shaphiro-Wilk test was used to check the normality. The average and standard deviation of all parameters were calculated. It was determined that the data is normally distributed. The groups' differences were determined with paired and independent t-tests. Statistical significance was accepted at an alpha level of 0.05.

RESULTS

There were no significant differences between the training and control groups' age, height, and the mean body weight ($p > 0.05$) after 2 months of training.

There were significant differences in the vertical jump performance between training and control groups in both the pre-test ($t = -2.563$, $p < 0.05$) as well as the post test ($t = -2.337$, $p < 0.05$). Similar scores in standing broad jump performance in the pretest ($t = 6.476$, $p < 0.05$) and posttest ($t = 7.448$, $p < 0.05$) were determined between the groups (Table 1).

After two months of training it was determined that the vertical jump increased for the experiment group ($t = -5.467$, $p < 0.05$). It was determined that the standing broad jump performance showed a significant improvement in performance for the exercise group ($t = -5{,}045$, $p < 0.05$). Interestingly, the control groups' vertical jump ($t = -2.091$, $p < 0.05$) and standing broad jump ($t = -2.214$, $p < 0.05$) values were found to increase significantly after 8 weeks.

The mean differences for the vertical jump and vertical jump test parameters did not differ between training and control groups (Vertical

Table 1: Subjects' demographic characteristics

Variables	*Groups*	*Pre- test*		*Post-test*	
		Mean	*Std. deviation*	*Mean*	*Std. deviation*
Age (years)	Training	9.54	1.94	10.05	1.82
	Control	10.05	0.686	10.07	1.67
Height (cm)	Training	141.50	7.80	142.65	8.04
	Control	145.00	6.48	146.60	6.73
Body Weight (kg)	Training	37.67	8.29	38.69	8.59
	Control	36.44	8.36	37.39	8.64

jump: t = .413, p <0.05, standing broad jump: t = .901, p <0.05).

Total BESS scores in the training group significantly decreased on a firm surface (t = 6.048, p <0.05), and foam surface (t = 6.7621, p <0.05), (t = 8.505, p <0.05) after the training. The control group's foam surface BESS scores significantly decreased (t = 2.138, p <0.05) while flat ground (t = -2,091, p <0.05) and total BESS (t = -1,437, p <0.05) scores statistically did not show any significant difference after the training.

The mean differences between pre and post-tests for BESS scores are presented on firm surface (t=4.788; p<0.05), foam surface (t=4.072; p<0.05) and total BESS (t=6.060; p<0.05) scores for control was significantly higher.

For before and after training, the subjects' average vertical jump scores are presented in Table 2. There were significant differences in the vertical jump performance between training and control groups in both the pre-test (t = -2.563, p <0.05) as well as in the post test (t = -2.337, p <0.05). Similar scores in standing broad jump performance in the pretest ((t = 6.476, p <0.05) and posttest (t = 7.448, p <0.05) were determined between the groups.

After two months of training, it was determined the vertical jump increased for the experiment group (t = -5.467, p <0.05). It was determined that the standing broad jump performance showed a significant improvement for the exercise group (t = -5.045, p <0.05). Interestingly, the control group's vertical jump (t = -2.091, p <0.05) and standing broad jumping jump (t = -2.214, p <0.05) values increased significantly after 8 weeks (Table 3).

Table 3: Mean differences between pre- and post-test

	Groups	*Mean*	*Std. deviation*
Vertical Jump (cm)	Training	1.46	1.36
	Control	1.20	2.57
Standing Broad Jump	Training	5.35	5.40
	Control	3.65	7.37

Both parameters did not differ between training and control groups (Vertical jump: t = .413, p <0.05, standing broad jump: t = .901, p <0.05) (Table 4).

Total BESS scores in the training group significantly decreased on a firm surface (t = 6.048, p <0.05), and foam surface (t = 6.7621, p <0.05) after the training. The control group's foam surface BESS scores significantly decreased (t =

Table 2: Mean and standard deviations of vertical jump and standing broad jump for pre- and post-test

Variables	*Groups*	*Pre- test*		*Post-test*	
		Mean	*Std. deviation*	*Mean*	*Std. deviation*
Vertical Jump (cm)	Training	23.46 ‡	3.84	24.92 †‡	3.92
	Control	26.20	3.24	27.40 †	3.03
Standing Broad Jump (cm)	Training	128.42 ‡	17.92	133.77 †‡	18.75
	Control	98.70	11.35	102.44 †	9.24

† Statistically significantly different from pretest, at p<0.05.
‡ Statistically significantly different from Training Group, at p<0.05.

Table 4: BESS scores for pre- and post-test

Variables	*Groups*	*Pre- test*		*Post-test*	
		Mean	*Std. deviation*	*Mean*	*Std. deviation*
Firm Surface	Training	9.46 ‡	2.97	7.03 †‡	3.18
	Control	4.10	2.07	4.20	2.33
Foam Surface	Training	17.154 ‡	2.68	13.85 †	3.40
	Control	13.75	2.61	12.95 †	2.84
Total BESS	Training	26.62 ‡	4.83	20.88 †‡	6.27
	Control	17.85	4.07	17.15	4.27

† Statistically significantly different from pretest, at p<0.05.
‡ Statistically significantly different from Training Group, at p<0.05.

2.138, $p < 0.05$), while flat ground ($t = -2.091$, $p < 0.05$) and total BESS ($t = -1.437$, $p < 0.05$) scores statistically did not show any significant difference after the training.

The mean differences between pre- and post-tests for BESS scores are presented in Table 5. Firm surface ($t=4.788$; $p<0.05$), foam surface ($t=4.072$; $p<0.05$) and total BESS ($t=6.060$; $p<0.05$) scores for the control group were significantly higher.

Table 5: Mean differences between pre- and post-tests

Groups		*Mean*	*Std. deviation*
Firm Surface	Training	2.42 †	2.04
	Control	-.10	1.33
Foam Surface	Training	3.31 †	2.49
	Control	.80	1.67
Total BESS	Training	5.73 †	3.44
	† Statistically significantly different from Control Group, at $p<0.05$.	.70	2.18

DISCUSSION

Compared to other sports, not many studies investigate the physical and physiological profiles of badminton players in the literature. Hughes (1995) suggested that the training load needs proper monitoring to stay away from overtraining. Workouts that are too demanding may hinder with coordination especially for growing children, a factor that is essential in sports requiring extremely technical skills, such as badminton (Majamdur 1997). The results of this study showed that the training program does not have any significant effect on the vertical jumping and standing broad jumping in pubertal badminton players while balance performance are affected positively by the program.

This study assessed the vertical jumping and standing broad jumping performances. To the researchers' knowledge, there are no studies similar to this study that assessed jumping performance after 8 weeks of training in pubertal children. It is suggested that competitive badminton consists of very explosive actions completed in a small area. Lateral jumps are becoming more and more frequent in all disciplines of the game. It is essential that programs of fitness measurement reveal the very detailed necessities of the sport (Hughes et al. 2005). The results of this study explored that the vertical jump and standing jump parameters did not differ between training and control groups, standing broad jump. Surprisingly, training and control groups' vertical jump and standing broad jumping jump values were found to increase significantly after 8 weeks. In a similar study evaluating the jumping ability of pubertal children, it was found that, the training group exercised 5 times a week, had also higher jumping and sprinting performances than the controls who trained for twice a week although these differences were accounted for by the increased fat mass of the control boys (Sanchis et al. 2011). A training program, which consists frequency, duration, and intensity of training, is particularly important. As in the studies formerly cited, low-intensity training volume with short-duration study protocols possibly led to innately inconsistent findings. For example, Faigenbaum et al.'s (2000) study demonstrated strength gains in pre-pubertal children with as little as twice a week training sessions. However, in this study, the researchers did not include any major movements to improve physical strength except basic technical skills in badminton. It was suggested that the density or frequency of training that depends on age, gender, modality or purpose, could cause some differences in technical development of some bio motor abilities. In a study that consisted 73 children aged 5-11 years old, the Bosco vertical jump test and standing long jump test were completed before and after 4 months of training (Bilge et al. 2010). It was found that the training group who exercised more frequently in the week had also higher jumping scores than the controls who trained a few times a week. Considering the average age of individuals who participated in the present study, the growth and development of these individuals at this age group is the fastest, (Gökmen et al. 1995). Thus, improvements in both groups may be attributed to the rapid growth of children for this age group.

To the researchers' knowledge, no studies evaluated balance performance of children with BESS error scoring. This study is particularly unique assessing the balance performance of pubertal children BESS error scoring system. In badminton, it was confirmed that changes in direction are required after most shots and all movements must be rapid and performed with good technique and control (Hughes et al. 2005). It was also recommended that racket sports such as table tennis, tennis, badminton and squash require a combination of psychological stability, tactical analysis, motor coordination as well as strong physical and physiological attributes. These demands make the sports particularly challenging for athletes at different levels (Arabaci 2008). According to the results of the study, eight weeks of badminton training improves balance performance of pubertal children. Apart from the close relationship between balance skills and children's motor performance, a dysfunction in postural control may be used as a sign of several types of developmental deficits (Visscher et al. 2007).

CONCLUSION

The result of this study could be helpful for coaches and athletes to improve performance through selection and adjust suitable training program. The main goal of sports facilitators is to develop the players' physical performance and proper growth of children athletes. To develop these abilities, the training circumstances must be transformed continually until positive adaptations in athletes occur and then athletic performance improves and the most significant part of training is amount and concentration. Because of its attractiveness, badminton could be well adopted for children. The game with its basic rules is simple and could be started with it at an early age. Thus, the game would help children progress their balance.

RECOMMENDATIONS

Children continue to grow and demonstrate expected increases in their strength. Therefore, any research to inspect strength gains in a child must combine an acceptable control to account for regular growth. The exercises such as rebounding and long jumping may be an indicator of readiness to participate in formal weight training exercises. A focus on harmless training and individual self-improvement must be of concern to sports facilitators instead of competition.

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