ORIGINAL ARTICLE

Investigation of the effect of acute badminton training on selected biomotoric parameters

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection.

Abstract

Background and Study Aim One of the fastest racquet sports in the world, badminton is defined as a versatile, explosive sprint sport that requires players to perform intense rhythmic movements with its highly competitive and dynamic feature. The aim of this study is to investigate the effectiveness of 4-week badminton training on some selected biomotoric features in young individuals engaged in recreational sports.

Material and Methods Twenty seven students of sports sciences voluntarily participated in the study (age = 18.85 ± 0.98 years). A total of 4 weeks of training was given for 2 hours a day specific to badminton sport. We examined the effects of pre-post training development of biomotoric properties, flexibility, reaction, vertical jump, balance and agility parameters on performance. Statistical analyzes of the data obtained as a result of the research were obtained using the IBM SPSS 23.0 package program.

Results The differences before and after badminton training, a statistically significant difference was found between pretest and posttest measurements of flexibility (5.53%), reaction (24.66%), vertical jump (8.93%), and agility (2.54%) tests ($p<0.05$). In the balance test, although there was a mathematical difference of 17.84%, this difference was not statistically significant ($p>0.05$). Finally, 4-week training improves flexibility, reaction, vertical jump and agility performances in a positive and meaningful way ($p<0.05$).

Conclusions The findings showed that the training method specific to badminton sport improved the flexibility, reaction, vertical jump and agility performances of individuals compared to pre-training. Specifically, these results revealed that the training-performance relationship clearly affects each other positively. In future studies, it can be predicted that more multidisciplinary training methods will be directed to research by making macro plans.

Keywords: badminton, training, biomotoric parameters, blazepod.

Introduction

Besides being an Olympic sport [1], badminton is a popular recreational sport played by 200 million people around the world casually, outdoors, often as a garden or beach game [1, 2].

One of the fastest racquet sports in the world, badminton is highly competitive and dynamic [3, 4] it is also defined as a versatile, explosive sprint sport that requires players to perform intense rhythmic movements [5]. From this point of view, due to the rapid use of the racket and the high frequency of strokes, the player must have good running, acceleration, deceleration, jumping, lunge, change of direction and reflex skills [4, 6]. On the other hand, badminton, a technical sport that requires the development of motor coordination and sophisticated racket movement at elite levels of play, it is important to develop a combination of factors such as muscle strength, muscular endurance, aerobic endurance, agility, power, speed, flexibility, balance, decision making and reflex, which are important for players. The fact that all these factors are very good will bring along the perfect condition, which is important for the players throughout the match. It is known that badminton poses great challenges for players and coaches of all levels, as it is a very complex and multi-talented sport. Therefore, it is a versatile sport that requires a combination of technical and tactical skills, physical and physiological fitness, as well as psychological strength [2, 3, 7-9].

While badminton requires anaerobic energy expenditure for dynamic motor activities such as starting, changing direction, fast and powerful hitting with the shuttlecock, jumping and jumping, it requires aerobic energy expenditure from the duration of the game and to perform repetitive movement sequences [10]. In addition, classification of racquet sports such as table tennis, badminton, tennis and squash as reaction sports highlights excellent eye, hand, foot and ball coordination [6, 11]. This is directly related to visual reaction time and motor response speed. Reaction time is affected by many factors such as age, gender, number of simultaneous stimuli, nutrition, physical activity, training, physical fitness and fatigue [11].

Therefore, the physical and physiological fitness of the players can be a determinant of success in a tournament, so if players want to perform well and achieve success, they must make advanced

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improvements in physical fitness [7, 9]. Therefore, all of the components that make up the conditioning should form part of the training. Because the player must perform various movements such as running, stopping suddenly and moving quickly, jumping, reaching, turning quickly and taking wide steps, which the player does repeatedly and for a long time, without losing his balance [9]. For example, multiplying training modalities to increase leg strength allows the player to move quickly and abruptly in various directions and make high jumps [7]. In this respect, the aim of our study is; to investigate the effectiveness of 4-week badminton training on some selected biomotoric features in young individuals engaged in recreational sports.

Material and Methods

Participants

A total of 27 students (age 18.85±0.98 years) from the faculty of sports sciences who had no health problems and had never played badminton before were included in the study. If they had a history of health problems, a disease or physical condition that could affect physical activity, they were excluded from the study. All of the participants were previously informed about the testing procedures and any known risks, and provided their own written informed consent. Participants were asked not to do any exercise 24 hours before the tests. All of the procedures were in accordance with the Helsinki Declaration of 2021. This study was approved by University of Inonu Ethics Committee for research on human participants.

Research Design

After the demographic and biometric information of the individuals participating in the research were obtained, the performance tests (flexibility, balance, jump, reaction and agility) were measured before the training program. Then, after a 1-week adaptation period, the individuals started badminton-specific training (table 1) for a total of 4 weeks, 60 minutes a day, 2 days a week. After the training program was over, the same tests applied before the training were applied after the training. All tests were administered in the indoor gym of the faculty of sports sciences. All the data obtained were recorded on the form created specifically for the study.

Height and Body Mass

All measurement procedures were performed without minimal clothing and shoes. The height measurements of the participants were measured with a 0.1 cm precision portable stadiometer (Seca Ltd., Bonn, Germany) with the head in the frankfort plane, while the body was upright and the weight was evenly distributed on both legs. Body weight (VA) and body fat ratio measurements were measured with a body analyzer with a capacity of 270 kg and a sensitivity of 100 g (Tanita SC-330S, Amsterdam, Netherlands).

Test Protocols

T Agility Test

The T-Drill is a test of agility and includes forward-backward and left-right running, and measures the ability for defensive movements and speed with directional changes.

Each subject was required to sprint forward 9 m and touch the tip of the cone with the right hand. Then she performed a lateral shuffle to the left 4.5 m, and touched the tip of the cone with the left hand. Subject then changed direction and shuffled 9 m to the right to touch the tip of the cone with her right hand. She then shuffled 4.5 m to the left to touch the tip of the cone in the middle with her right hand. Finally, the subject back-peddled 9 m, passing through the finish point. 3 trial rights were given for each athlete. The subjects were allowed 3 minutes of rest between each run. By writing the measurement results in seconds, the best time obtained in three trials was recorded. Any subject who crossed one foot in front of the other, failed to touch the tip of the cone, and/or failed to face forward throughout had to repeat the test [12-14].

Balance Test

The flamingo balance test measures the ability to balance successfully on a single leg. In the flamingo test, a wooden or metal beam whose body is 50cm long, 4cm high and 3cm wide and the dimensions of the support legs that provide the stability of this beam are applied using a tool that is 15cm long and 2cm wide. Participants should bend their free leg back and grasp their back foot with the same hand and stand for 1 min. Participants are given a trial first to familiarize themselves with the test. The timekeeper helped the participant get into the right position and started timing when the subject released the timekeeper's hand. Then the number of attempts needed to stand on one leg for 1 min is counted for each leg. The result was the maximum number of attempts in 1 min, which was limited to 30. If the subject exceeded this number 15 times in the first 30 s, the subject's result was 31 [15, 16].

Sit and Reach Test

Flexibility was measured using a sit-and-reach test, using a sit-and-reach box (Baselıne/ Fabrication Enterprises, Inc., PO Box 1500, White Plains, NewYork). The subjects sat with their feet approximately hip-wide against the testing box. For the test performance, the subjects was placed seated on the floor with the legs stretched, barefooted, and with the soles of the foot attached to the Seat and Reach case. They kept their knees extended and placed the right hand over the left, and slowly reached forward as far as they could by sliding their

Table 1. Training program

Weeks	Days	Times	Content of the training
1. Week	Tuesday	60 min.	10 min. Badminton game and material presentation 10 min. Warming 20 min. Teaching the basic stance and racket grip [fhd and bkhd] 15 min. Badminton-specific educational game 5 min. Cooling and stretching
	Friday	60 min.	10 min. Warming 10 min. Repeating the basic stance and racquet grip 15 min. Ball bounce exercises [fhd and bkhd] 20 min. Service training and studies 5 min. Cooling and stretching
2. Week	Tuesday	60 min.	10 min. Warming 10 min. Repetition of training and practice of service shots [fhd and bkhd] 25 min. 1, 2 and 3 runway shadow work 10 min. Educational game for stepping development 5 min. Cooling and stretching
	Friday	60 min.	10 min. Warming 10 min. Repeating the running track shadow work 1, 2 and 3 25 min. 4 and 5 runway shadow work 10 min. Educational game for stepping development 5 min. Cooling and stretching
3. Week	Tuesday	60 min.	10 min. Warming 10 min. Repeating the running track shadow work 4 and 5 25 min. 6, 7 and 8 runway shadow work 10 min. Educational game for stepping development 5 min. Cooling and stretching
	Friday	60 min.	10 min. Warming 20 min. Overhead stroke teaching 15 min. Drive stroke training and exercises 10 min. Educational game for developing headshots 5 min. Cooling and stretching
4. Week	Tuesday	60 min.	10 min. Warming 10 min. Repetition of drive stroke training and exercises [fhd and bkhd] 25 min. Clear kick training and exercises 10 min. Educational game to improve clear hit 5 min. Cooling and stretching
	Friday	60 min.	10 min. Warming 10 min. Repetition of clear stroke training and exercises 25 min. Lob-drop stroke training and exercises 10 min. Educational game to improve lop-drop hit 5 min. Cooling and stretching

*min. = minute; fhd = forehand; bkhd = backhand hands along the measuring board. A tape measure on top of the measuring board indicated in centimeters how far beyond the toes each individual reached. The score [in centimeters] is the greatest distance contacted by the fingertips past the toes. After 2 standard 10-second warm-up stretches, 3 attempts were made and the best score was used [17-19].

Reaction Test

This test was used to determine participants' hand-eye reaction times. The BlazePod™ (Play Coyotta Ltd., Tel Aviv, Israel) instrument developed specifically for this test was used for performance measurement. BlazePod light discs are placed 20 cm apart and 45 cm off center on a hard plate/floor. Participants performed the test with their dominant hand for 30 seconds. During the test, the hand was returned to the starting position after each contact with the light sensors. Before starting the test, participants were allowed to do a pre-test consisting of 5 responses to light stimuli [20, 21].

Vertical Jump

The vertical jump test is a standardized test for measuring explosive power, vertical jump and athletic performance. The vertical jump height indicator (Vertec/by Jump USA) was used for the measurement of this test. At the moment preceding the jump, the participants could freely flex the hip, knee, and ankle joints and prepare the upper limbs for a sudden upward thrust, in an effort to promote the highest vertical jump possible. The participants stands with feet apart below the height indicator. The feet are at shoulder-width. The participants swings his arms forward and up, jumps upward and tries to make contact with the rod of the indicator with his right hand at the position which indicates the highest possible value, lands in the starting position and repeats the jump, only now trying to make contact with the rod of the indicator using his left hand. The rest time between jumps was 20 s. The participant's vertical jump height was calculated as the difference between their maximum jump height and standing reach height. "Peak Power" was calculated from the maximal jump height of three trials [22, 23].

Statistical Analysis

Statistical analyzes of the data obtained as a result of the research were obtained using the "IBM SPSS 23.0 (IBM Corp., Armonk, NY, USA)" package program. After descriptive statistics of the data were made, normality analysis was performed for the data set.

For the homogeneity of the research data, the normal distribution of the data was tested with the "Skewness-Kurtosis" and "Shapiro Wilks" tests. As a result of this test, it was determined that the distributions were normal. Therefore, "Paired Simple T Test", which is one of the parametric tests, was used to analyze the difference between the pre-test and post-test. All tests taken were expressed as median (min-max), mean and standard deviation (SD) values. The degree of significance was determined as "p <0.05" in the study.

Results

Table 2 shows that the average age of the athletes participating in the study was 18.85 ± 0.98 years, an average height of 172.85 ± 7.29 cm, and body weight 62.04 ± 8.83 kg.

Table 2. Descriptive data of all participants

Demographic features	N	$\bar{X}$	SS
Age [years]	27	18.85	0.98
Height [cm]	27	172.85	7.29
Body weight [kg]	27	62.04	8.83

Table 3. Findings of the difference before and after badminton training

		Pre-Test	Post-Test	T Test			
Biomotoric abilities	**N**	**$\bar{X}$±SS**	**$\bar{X}$±SS**	**t**	**p**	**ES**	**%Δ**
Flexibility	27	37.59±7.04	39.67±6.33	-2.721	.011*	0.031	5.53
Reaction	27	1050.78±89.40	791.59±125.30	10.498	.000**	0.238	24.66
Balance	27	6.22±3.74	5.11±2.77	1.955	.061	0.033	17.84
Vertical Jump	27	45.56±8.12	49.63±9.51	-3.631	.001*	0.046	8.93
Agility	27	9.0352±.89420	8.8070±.8076	2.087	.047*	0.026	2.54

ES: Effect Size; * The difference is statistically significant at the p<0.05 level; ** The difference is statistically significant at the p<0.01 level; %Δ: percentage of difference between measurements

The findings of the Paired Simple T-Test results regarding the analysis of the data in this study are as follows.

In Table 3, according to the results we analyzed for the dependent sample groups, the differences before and after badminton training a statistically significant difference was found between pretest and posttest measurements of flexibility (ES=0.031; p=0.011; 5.53%), reaction (ES=0.238; p=0.000; 24.66%), vertical jump (ES=0.046; p=0.001; 8.93%), and agility (ES=0.026; p=0.047; 2.54%) tests ($p<0.05$).

In the balance test, although there was a mathematical difference of 17.84%, this difference was not statistically significant (ES=0.033; p=0.061) ($p>0.05$).

Discussion

This study aimed to investigate the effect of 4-week badminton training on some biomotoric properties in young individuals who have not played badminton before but play sports recreationally. Although there was little improvement in parameters such as flexibility (5.53%), reaction (24.66%), vertical jump (8.93%) and agility (2.54%) before and after training, this improvement was significant ($p<0.05$). However, although a percentage improvement was observed in the balance (17.84%) parameter, this improvement was not significant ($p>0.05$).

Chong [24], according to the results of the study in which they conducted a pre-post test on the agility of badminton players two days a week for a total of 4 weeks with two different groups, stated that although there was no significant difference between the training group and the control group, the training group made a significant improvement with a few training sessions. Churi and Varadharajulu [8], in their study in which they performed core exercises on badminton players for four weeks, revealed that these exercises showed improvement in strengthening the core region. Sighamoney et al. [25] in their four-week study to investigate the effect of strengthening the core region on dynamic balance and agility, they showed that strengthening the core region has a significant effect on dynamic balance and agility. Wee et al. [2] investigated the effects of multiple shuttle training on aerobic and anaerobic capacity, leg strength and agility. The study lasted for a total of four weeks, divided into two groups as control and training groups. Accordingly, when the pre-test and post-test mean scores were compared, it was determined that there was an improvement in VO2max, average power, leg reactive power and agility parameters in the training group. Dass et al. [5] aimed to evaluate the effectiveness of strengthening and plyometric resistance training on anaerobic power and muscle strength in badminton players. According to the data obtained after 5 weeks of training, they concluded that there was a significant improvement in the post-training values in the comparison made for the training group. Guo et al. [4] designed a 6-week study in which they examined the effect of combined balance and plyometric training on the diversion performance of badminton players. Accordingly, they revealed that combined training can improve the changing performance of badminton players more than plyometric training alone. This study also showed that short-term training models have effects on agility and anaerobic capacity in parallel with the literature. However, the balance parameter did not show any improvement in our study, contrary to the literature. For balance development, training should be arranged in a way that includes longer-term and parameter-specific studies. Based on this, Preeti et al. [6], in their study to evaluate the effectiveness of pilates on lower extremity strength, dynamic balance, agility and coordination skills in badminton players, they made the training and control groups exercise for 60 minutes for 5 weeks, two days a week. Accordingly, they explained that pilates exercises showed a significant improvement in both groups at the end of the 5th week and also showed a significant difference in the training group players. These results showed us that balance studies require longer-term studies. When we examined the reaction studies, Patel and Rathi [11] stated that there was an improvement in the training group compared to the control group, but this was not a statistically significant improvement, according to the results of the exercise they had done twice a day for four weeks for visual reaction time. Our study showed similar improvements in visual and tactile reaction parameters with the literature, but unlike the literature, this improvement was significant. Bhosale et al. [26], in their study in which they looked at the effects of 6-week plyometric training on agility and vertical jump parameters, shows that plyometric training improves jumping and agility performance in badminton players. In this sense, our research has revealed that short-term training provides improvements in vertical jump performance in parallel with the studies carried out. Jan and Yaday [27], in their study to investigate the effect of some training on flexibility and coordination in tennis and badminton players, stated that badminton players developed more flexibility and coordination. In our research, we have shown similar results with the literature and we can say that regular training or exercises improve flexibility.

Conclusions

The study showed that the training method, which is specific to badminton sports and with mixed training planning, improves the flexibility, reaction, vertical jump and agility performances of individuals who do recreational sports, by improving them compared to pre-training. Specifically, these results revealed that the training-performance relationship clearly affects each other positively. In future studies, it can be predicted that more multidisciplinary training methods will be directed to research by making macro plans.

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Conflicts of interest

The authors declare no conflicts of interest.

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