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Effects of core and dynamic balance training on motor characteristics in Turkish basketball league players

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ABSTRACT

This study aimed to investigate the effects of 8 weeks of core and dynamic balance training on reaction speed and agility in A-team basketball players. A total of 29 male basketball players participated in the study, with athletes divided into two groups: experimental (n=14) and control (n=15). The experimental group received core and dynamic balance training three days a week in addition to technical and tactical basketball training for 8 weeks, while the control group received only technical and tactical training for the same duration. Body fat percentage (measured with Tanita BC 418-ma), the lane agility drill, and reactive shuttle run tests were conducted before and after the training as performance measurements. When analyzing the pre-test and post-test results regarding the effects of core and dynamic balance training on the motoric characteristics of players in the Turkish Basketball League, no significant difference was found in the Reactive Shuttle Run test for the experimental group ($p<0.05$). However, significant differences were observed in both the experimental and control groups for the other tests ($p>0.05$). The findings indicated that core and dynamic balance exercises, when added to basketball training, did not show an additional effect on the athletes in the experimental group, unlike the control group. However, no difference was found in the results of the Reactive Shuttle Run test between the two groups.

KEYWORDS

Basketball; Agility; Reaction Speed; Core; Balance

1. INTRODUCTION

Today, basketball, which holds an important place in international sports organizations, has become one of the most popular sports worldwide, attracting a large audience. This is due to its combination of physical, mental, and basic motoric characteristics, along with its technical-tactical capacity. To achieve high levels of performance in basketball, it is necessary to improve both individual and team fitness, while also enhancing the technical-tactical capacity of athletes (Bloomfield et al., 2007; Helgerud et al., 2001).

Understanding the physiological and physical structures of athletes is crucial for achieving optimal performance levels. Considering the intensive nature of basketball, performing at a high level in a 40-minute competition (approximately 90 minutes with time stops and breaks) can only be achieved with a well-prepared training program that meets the physical and physiological needs of the athlete (Ates et al., 2007). Researchers note that, within the scope of basketball, there is a need for motoric characteristics related to both basic aerobic and anaerobic structures, as well as the technical and tactical skills exhibited during the game (Bloomfield et al., 2007; Sevim, 2010, Yurtseven et al., 2024). In this context, the endurance of these characteristics throughout the competition, along with the perfect execution of movements requiring speed and agility, can only be achieved with basketball-specific training programs. For this reason, modern basketball training programs include specialized training alongside technical and tactical training. Core and dynamic balance training, which are referred to as complementary exercises, are among these specialized training types. The importance of stabilization and mobilization in basketball is well understood today.

Balance is one of the most important coordination parameters in basketball. It is the ability to respond to changes in the body's center of gravity, resulting from neuromuscular stimulation via feedback from visual, vestibular, and somatic sensations (Boccolini et al., 2013). Balance can be divided into two types: static and dynamic. Mastery of balance and maintaining control are essential for excelling in basketball (Kaushik & Sharma, 2013, Duyan et al., 2024).

Core training is an exercise program that targets strengthening the deep muscles that stabilize the spine and the muscles in the lumbopelvic region using the individual’s body weight (Atan et al., 2013). Core balance exercises are used in various fields, including medical rehabilitation, training, and health. This type of exercise improves dynamic balance, functional anatomy, static balance, and flexibility (Sun et al., 2016), as core training leads to both structural changes in muscles and neural adaptation (Iacono et al., 2014). Moreover, core exercises, used for both dynamic and static training, improve core balance and strength by enhancing proprioceptive sensations, aiding muscle recovery, and providing better body control (Hibbs et al., 2011, Gürer et al., 2024).

This study aims to determine the effects of an 8-week core and dynamic balance training program, applied to A-team basketball players, on reaction speed and agility parameters, which are fundamental elements of basketball. It also aims to show that the 8-week core and dynamic balance exercise program, consisting of different combinations, will lead to a positive development in reaction speed and agility in the experimental group of basketball players.

2. METHODS

2.1. Design and Participants

This study aims to investigate the effects of 8 weeks of core and dynamic balance training on reaction speed and agility in A-team basketball players. A total of 29 male basketball players participated in the study, with athletes divided into two groups: Experimental (n=14) and Control (n=15). The Experimental group received core and dynamic balance training three days a week in addition to technical and tactical basketball training for 8 weeks. The Control group received only technical and tactical training for the same duration.

2.2. Instruments and Procedures

- Height Measurement: A height scale with a precision of 0.01 cm was used to measure the height of the athletes participating in the measurements. The athletes stepped onto the height scale with their bare feet. The measurement was taken when the athletes stood in an upright position, and the height was recorded at the top of the head in centimeters.
- Body Fat Percentage Measurement: Body weight and body fat percentage measurements for the athletes were taken twice, at the beginning and the end of the study, using a Body Analyzer (Tanita BC 418 MA).
- Lane Agility Drill Test: This test is designed to measure the level of agility in basketball players. It is also part of the agility tests in the National Basketball Association (NBA) Draft in the USA. It is a test of speed and assesses body control and the ability to change direction. The test setup involves placing cones as shown in the diagram. The test consists of lines around a painted area. The measurement area for the test is 19 feet (5.79 meters) long by 16 feet (4.88 meters) wide. At the start of the test, the athlete positions one foot on the start line and the other foot behind it, ensuring no swinging movements before the test begins. Once the athlete feels ready, he/she can start the test. The sequence involves the athlete making a

forward run, followed by a lateral slide run, then a backward-paddle run, a second backward-paddle run, and a left slide run back to the starting point of the test. The athlete then reverses direction to complete the course in the same manner, and the test ends when the athlete passes through the photocell at the starting point. The athlete's time is recorded, and the better of the two attempts is noted (Sabin & Marcel, 2016).

- Reactive Shuttle Run Test: This test is designed to assess agility in basketball players. It is also part of the agility tests used in the NBA Draft. It measures speed, body control, change of direction, and reaction time. The test layout uses standard NBA basketball court markings, with the measurement area being 16 feet (4.88 meters) wide. The center of the 3-second zone (the painted area) is marked, and a sensor is placed at the center of the zone. The athlete waits in a basketball stance at the center line start area and begins the test when ready. The athlete runs to the right or left, then returns to the opposite line, and finally returns to the starting position after stepping on the line. The test ends when the athlete completes this sequence. The athlete’s times are recorded, and the best of the three attempts is used (Web-1).

2.3. Statistical Analyses

The statistical analysis of the data was conducted using the SPSS 22.0 software package (IBM Corp., Armonk, NY, USA). Descriptive statistics (mean, standard deviation, minimum and maximum values) were calculated for all variables. Prior to the analysis, the assumptions of normality and homogeneity of variances were tested using the Shapiro–Wilk test and Levene’s test, respectively. Since the data met the parametric test assumptions, a Paired Samples t-test was employed to compare pre-test and post-test scores within the groups. The level of statistical significance was set at $p < 0.05$. In addition, effect sizes (Cohen’s d) were calculated to determine the magnitude of the observed differences.

3. RESULTS

In this section, the findings obtained from the analysis of the relevant data are presented and interpreted in table format. Table 1 shows whether there is a significant difference between the body fat status of the experimental group participants before and after exercise.

Table 1. Comparison of body fat pre-test and post-test mean scores of the experimental group participants

Measurement	n	$\bar{X}$	Sd	t	p
Body Fat Pre-Test	14	11.83	4.45	8.17	0.000
Body Fat Post-Test	14	10.91	4.37		

The results showed that when the pre-test and post-test results of the experimental group were compared, a significant difference was found in body fat percentage ($p < 0.05$). In the following, Table 2 shows whether there is a significant difference between the body fat status of the control group participants before and after exercise.

Table 2. Comparison of body fat pre-test and post-test mean scores of control group participants

Measurement	n	$\bar{X}$	Sd	t	p
Body Fat Pre-Test	15	12.93	3.57	9.22	0.000
Body Fat Post-test	15	11.33	3.29		

A comparison of the control group's pre-test and post-test results revealed a statistically significant change in body fat percentage ($p < 0.05$). Table 3 presents the comparison of the experimental group's lane agility drill results before and after the exercise intervention. A statistically significant difference was observed ($p < 0.05$)

Table 3. Comparison of lane agility drill pre-test and post-test mean scores of the experimental group participants

Measurement	n	$\bar{X}$	Sd	t	p
Lane Agility Drill Pre-Test	14	12.36	0.675	6.64	0.000
Lane Agility Drill Post-Test	14	11.86	0.602		

Table 4 shows the comparison of the pre-test and post-test mean scores in the lane agility drill for the control group participants.

Table 4. Comparison of lane agility drill pre-test and post-test mean scores of control group participants

Measurement	n	$\bar{X}$	Sd	t	p
Lane Agility Drill Pre-Test	15	12.93	0.918	3.56	0.003
Lane Agility Drill Post-Test	15	12.67	0.752		

Based on the results of Table 4, a statistically significant difference was found in the lane agility drill results between the pre-test and post-test measurements ($p < 0.05$). Table 5 shows whether there is a significant difference between the reactive shuttle run results of the experimental group participants before and after the exercise. No significant difference was found ($p > 0.05$).

Table 5. Comparison of reactive shuttle run pre-test and post-test mean scores of the experimental group participants

Measurement	n	$\bar{X}$	Sd	t	p
Reactive Shuttle Run Pre-Test	14	2.83	0.192	1.12	0.146
Reactive Shuttle Run Post-Test	14	2.77	0.128		

In the following, Table 6 presents the comparison of the reactive shuttle run results for the control group participants before and after the exercise.

Table 6. Comparison of reactive shuttle run pre-test and post-test mean scores of the control group participants

Measurement	n	$\bar{X}$	Sd	t	p
Reactive Shuttle Run Pre-Test	15	3.04	0.194	4.83	0.000
Reactive Shuttle Run Post-Test	15	2.96	0.178		

A statistically significant difference was observed between the pre-test and post-test results, indicating a notable change in performance ($p < 0.05$).

4. DISCUSSION

This study aimed to determine whether there were changes in reaction speed and agility performances in athletes from two different basketball teams competing in the Turkish Basketball League when core and dynamic balance training were added to their technical and tactical training.

Within the scope of this study, analysis of the pre-test and post-test measurement values of the experimental group revealed a statistically significant difference in body fat percentage. When comparing the mean values, the post-test measurements were found to be better. Similarly, for the control group, analysis of pre-test and post-test values indicated a statistically significant difference in body fat percentage, with post-test measurements showing improvement.

However, when comparing the post-test results of both the experimental and control groups, no statistically significant difference in body fat percentage was observed. Both groups showed changes between pre-test and post-test measurements.

A study conducted in Brazil found that the average body fat percentage for 35 male basketball players with an average age of 17.3 years was 16.6% (Jurgensen et al., 2015). Hakkinen (1991) found that the average body fat percentage of elite Finnish league basketball players was 13.8%. Castanga et al. (2009) reported a body fat percentage of 10% in their study on basketball players. Yorukoglu &

Koz (2007) reported a mean body fat percentage of 9.53% in their study of 8-star basketball athletes in the substructure of Ankara University Sports Club.

In this research, analysis of the pre-test and post-test measurements of the experimental group showed a statistically significant difference in agility. The post-test measurements were better when compared to the pre-test. Similarly, the control group showed a statistically significant difference in agility values between the pre-test and post-test, with improved post-test measurements. When comparing the post-test results of both groups, no statistically significant difference was found in agility. Both groups showed improvement in agility from the pre-test to the post-test.

In a study conducted on 14 male basketball players in the National Collegiate Athletic Association (NCAA) league in the USA, the average time for the lane agility test was 10.24 seconds (2005). In another study, 12 basketball players in the NCAA league had an average lane agility drill time of 10.38 seconds (Boccolini et al., 2012). Usgu (2015) found that in a doctoral dissertation on functional training's effect on performance-related physical fitness in professional basketball players, the control group had a mean time of 12.72 seconds, and the experimental group had 12.07 seconds for the lane agility drill test. Dawes et al. (2016) found an average of 11.24 seconds in a study of 10 male basketball players in the NCAA Division II.

In sports, high performance is often influenced by speed, mobility (flexibility), and coordination (Stolen et al., 2005). Within the scope of this study, when analyzing the pre-test and post-test results for reaction speed, no statistically significant difference was found in the experimental group. However, the post-test measurements were better than the pre-test values.

In the control group, reaction speed values showed a statistically significant difference, with post-test measurements being better than the pre-test results. When comparing the post-test results of the experimental and control groups, the reaction time measurement values showed a statistically significant difference. The control group exhibited better results in both the pre-test and post-test. Kiratli (2020) found the mean value for the reactive shuttle run test to be 2.86 seconds in his master's thesis, titled “The Turkish Normative Values of Modified NBA Draft Tests among Young Basketball Players”.

5. CONCLUSIONS

While core and dynamic balance exercises did not show a significant difference in the reactive shuttle run post-test for the experimental group, significant improvements were observed in the other tests (body fat percentage, lane agility drill, and reaction speed) following the pre-test and post-test measurements.

Recommendations: Core and dynamic balance training should be incorporated into basketball training programs on different days, either before or after each workout. Core training programs should focus on both stabilization and mobilization. Additionally, balance training should include auditory and visual balance exercises alongside stabilization and mobilization techniques.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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