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Do Bosu Ball Exercises Affect Countermovement Jump and Squad Jump Performance in Basketball Players?

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Abstract

This research was conducted to examine the effect of eight-week bosu ball exercises on vertical jump and strength performance in basketball players. The sample group of the research was composed of a total of 40 male basketball players, including 20 players in the experimental group and 20 players in the control group, who have been certified basketball players for at least two years at the at the Provincial Directorate of Youth and Sports Bingol province. Basketball training sessions of 60 minutes were applied to the athletes 3 days a week and continued for 8 weeks. The experimental group underwent an additional 30 minutes of bosu ball exercises. Anthropometric, vertical jump and strength measurements were respectively taken. In addition, comparisons between groups were made with Repeated Measures. According to the results of the evaluation, it was found that there was a statistically significant difference in vertical jump Countermovement Jump (CMJ) values in the comparison between the pre-test and post-test groups of the experimental and control group ($p<0.05$). There was no significant difference in back strength values between the pre-test and post-test groups of the experimental and control group ($p>0.05$). A statistically significant difference was found in the leg strength values between the pre-test and post-test groups of the experimental and control group ($p>0.05$). As a result, we think that bosu ball exercises affect the strength of the muscles in the leg area and thus can significantly affect the vertical jump and strength performance of athletes.
Keywords: Bosu ball, Countermovement jump, Squad jump, Strength

Basketbolcularda Bosu Ball Egzersizlerinin Countermovement Sıçrama ve Squad Sıçrama Performansına Etkisi Var mıdır?

Öz

Bu araştırma, basketbolcularda sekiz haftalık bosu ball egzersizlerinin dikey sıçrama ve kuvvet performansına etkisini incelemek amacıyla yapıldı. Araştırmanın örneklem grubunu Bingöl ili, Gençlik ve Spor İl Müdürlüğünde, en az iki yıl lisanslı olarak basketbol oynayan 20 deney 20 kontrol olmak üzere toplam 40 erkek basketbolcudan oluşturuldu. Sporculara haftanın 3 günü olacak şekilde 60 dakika basketbol antrenmanları uygulandı ve 8 hafta boyunca devam etti. Deney grubuna ek olarak 30 dakika bosu ball egzersizleri uygulandı. Sırasıyla antropometrik, dikey sıçrama ve kuvvet ölçümleri alındı. Test sonuçlarına göre grup içi bağımlı değişkenlerin karşılaştırılmasında bağımlı iki örneklem testi yapıldı. Ayrıca gruplar arası karşılaştırmalar tekrarlı ölçümler ile yapıldı. Yapılan değerlendirme sonucuna göre dikey sıçrama Countermovement Jump (CMJ) değerlerinde deney ve kontrol grubunun ön test ve son test gruplar arası karşılaştırmasında istatistiksel olarak anlamlı fark olduğu tespit edildi ($p<0.05$). Sırt kuvveti değerlerinde deney ve kontrol grubunun ön test ve son test gruplar arası karşılaştırmasında anlamlı farklılık tespit edilmedi ($p>0.05$). Bacak kuvveti değerlerinde deney ve kontrol grubunun ön test ve son test gruplar arası karşılaştırmasında istatistiksel olarak anlamlı farklılık tespit edildi ($p>0.05$). Sonuç olarak, bosu ball egzersizlerinin bacak bölgesinde bulunan kasların gücü etkilediği bu sayade sporcuların dikey sıçrama ve kuvvet performansına önemli oranda etkileyebileceğini düşünmekteyiz.
Anahtar kelimeler: Bosu ball, Countermovement Sıçrama, Squad Sıçrama, Kuvvet

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INTRODUCTION

Improving and peaking performance is the main goal of all coaches and athletes. In order to improve performance, it is important to apply it according to scientific principles in this regard. The effects of various types of muscle-building training, muscle fiber types, muscle biochemistry, and increasing the knowledge gained about nerve-muscle response provide new opportunities for coaches to train the athlete better (Acemoğlu, 2007). In basketball physiological capacity, physical structure, biomotoric characteristics, technical-tactical understanding, team discipline, psycho-mental state, and coach occupy a very important place (Kılınç, 2008).

When we look at the basketball branch, it is seen that it has an aerobic energy system (Delextrat and Cohend, 2009; Meckell et al., 2009; Metaxas et al., 2009). Explosive power is highly needed in the game and is often used. Actions such as jumping, sudden turns, sudden acceleration and stopping involve explosive movement and muscle strength is important to be able to perform these actions (Alemdaroğlu, 2012; Erculj et al., 2010; Pliauga et al., 2015). Because in basketball, a player makes a minimum of 50 jumps during the competition, in addition to linear and directional runs of 10-20 m (Drinkwater et al., 2008). It is very important that the movement performed in defensive and offensive organizations during the game happens effectively, for this purpose, the ability to move quickly during the game with a repeated good jump must be combined with other technical actions (Pliauga et al.,2015).

The jumping ability has critical importance for performance in many sports, especially basketball, football, and volleyball (Aragón-Vargas and Gross, 1997). Jumping ability is often tested as an assessment of lower limb strength and power (Carlock et al., 2004). A common method of testing jumping ability is the use of jump and reach tests such as vertical jump tests (Leard et al., 2007). Maximal strength, strength development speed (Carvalho et al., 2014), and muscle stiffness (Driss et al., 2015) are important factors in vertical jump performance.

The bosu ball makes a significant contribution to the acquisition of the general fitness of the body and physical characteristics (Badr, 2013). Aerobic exercise programs are used to increase the strength of the upper and lower limb and central muscles. In addition, the bosu ball can be designed for the development of strength and balance (Şan, 2017). Body composition is the amount of fatty tissue, muscle tissue, and bone in the body (Şahin, 2020). Bosu exercises contribute to growth hormone, and muscle formation as well as burning fat by accelerating blood circulation in the body. Because of having such benefits, it is generally used by people who practice bosu exercises to do cardio exercises, to increase the strength of the lower body and central muscles (Turgut et al., 2018).

The type of exercise and the type of training are among the biggest factors in achieving success. These exercise programs, which contribute to the development of strength and jumping of basketball players, have attracted a lot of attention from coaches, and it has become important to

examine the effects of the bosu ball, which is actively used by basketball clubs today on anaerobic power, balance, jump, and strength in different branches. Based on this information, the aim of this study is to examine the effect of bosu ball exercises on basketball players' jumping and strength ability. According to the research, the hypothesis of the study is that bosu ball exercises have an effect on vertical jump and strength parameters.

METHOD

Research Model

This study was based on the pre-test, post-test, experimental and control group test models. Then, an interview was conducted with each participant who volunteered to participate in the research and written and oral information was provided about the purpose of the research, its duration, the tools used in the research, and the evaluation system (Büyüköztürk et al., 2012).

Research Group

The research group was composed of a total of 40 male basketball players, including 20 players in the experimental group and 20 players in the control group, who have been certified basketball players for at least two years at the Youth and Sports Services sports club in Bingol province. The average age of the experimental group was 14.75±,0.78 (years), the average height was 169±0.09 (cm), the average weight was 53.48±9.62 (kg), and the average BMI was 18.61±2.19 (kg/cm^2) and the average age of the control group was 14.75±0.17 (years), the average height was 164±0.05 (cm), the average weight was 47.94±7.79 (kg), and the average BMI was 17.67±2.05 (kg/cm^2).

Field test protocols along with anthropometric measurements were applied to the volunteers taking part in the research. All measurements were applied to the participants in the morning (between 10.00 and 12.00) as they feel rested. Participants were informed 24 hours before about avoiding strenuous exercise, stimulating types of tea, coffee, alcohol, and carbonated beverages. Before the study, the parental consent form was signed for the athletes and all possible situations that may be encountered during the tests were explained in detail.

Research Protocol

All participants who accepted to participate in the study were told in detail the information about the tests and training content to be applied before the study, and the exercises used in the study were shown and taught in practice one week before the study. Anthropometric, vertical jump, and strength measurements were taken respectively to obtain the pre-test data of the participants.

Afterward, basketball training sessions of 60 minutes were applied to both groups 3 days a week and continued for 8 weeks. However, in addition to basketball training, the experimental group was given bosu ball exercises for 30 minutes before starting their training. At the end of the eighth

week, anthropometric, vertical jump, and strength measurements were taken again respectively to obtain the post-test data of both groups.

Data Collection Tools

Height, Weight, and Body Mass Index: The weight measurements of the participants were measured with the Inbody brand Tanita body analyzer with an accuracy of ±1 mm and were registered in kg. Heights were measured as volunteers were asked to hold their breath, be in the anatomical posture position, bare feet, heels together, the head in the frontal plane, and the overhead table touching the vertex point and the values were recorded in cm. The body mass index of the athletes was calculated by dividing the body weight (kg) by the square of the height (m) value (kg/m^2) (Sever, 2018).

Vertical Jump Measurements: Microgate Witty jumping mat was used to determine the vertical jump measurements of the participants. Vertical jump performance was measured with this instrument, which measures the hang time. Two different jumping test protocols were applied.

Countermovement Jump (CMJ) Test: The hands are placed on the hips and remain there throughout the test. When the subject is ready, the subject squats until his knees are bent 90 degrees, then immediately jumps vertically as high as possible and falls back on the mat on both feet at the same time (Sharma et al., 2020).

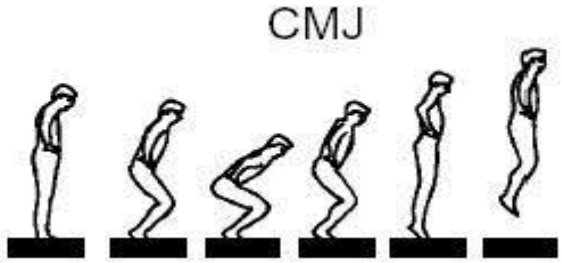

Figure 1. Countermovement Jump

Squad Jump (SJ) Test: It starts in a fixed position by bending the knee joint until 90 degrees. When the subject is ready after the bent, it is performed by opening the knee joint with the feet pushing the ground and getting strength from the ground. It is a test protocol in which the jump strength is measured vertically. In the test, 2 attempts were given, and the highest score was considered valid.

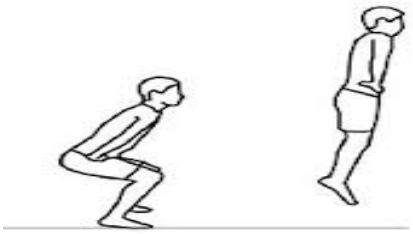

Figure 2. Squad Jump

Measurement of Leg Strength*:* Measurements were made using Takei TKK 5402 Japan brand back and leg dynamometer for the leg strength measurements of the volunteers. After placing their feet on the dynamometer bench with their knees straighten, the volunteers grasped the dynamometer bar firmly with their hands and pulled it vertically upwards as much as possible in the position of the arms stretched, the back straight and the body slightly bent forward (Zorba, 2017). The volunteers were given two attempts, and the best rating was calculated.

Back Strength: Takei TKK 5402 Japan brand back muscle dynamometer was used. Volunteers were asked to pull the bar toward themselves with all their strength, with the chest bent forward 90 degrees on the hips, and knees in the full extension position (Zorba, 2017). Two attempts were given, and the best score was recorded in kg.

Table 1. Bosu ball exercises and training schedule

1st Move: Squat with arms in front and two feet on the bosu ball placed upside down				
2nd Move: Squat with arms in front and one foot on the bosu ball placed upside down				
3rd Move: Respectively opening the legs to the right and left in 5 repetitions with both feet on the bosu ball placed upside down.				
4th Move: Bending forward while lifting one leg backward 90 degrees with both feet on the bosu ball placed upside down.				
5th Move: Push-ups with both arms on the bosu ball				
6th Move: Sit-ups with the back on the bosu ball				
7th Move: Lunge towards front and back by changing feet on the bosu ball				
8th Move: Pulling the knees up respectively with both feet on the bosu ball				
Week	**Days**	**Moves**	**Reps and Sets**	**Rest**
8 Weeks	Monday	1-2-3rd moves	12 x 3 sets	30 sec rest
	Wednesday	4-5-6th moves	12 x 3 sets	30 sec rest
	Friday	7-8th moves	12 x 3 sets	30 sec rest

Ethical Approval

Before starting the research, approval was obtained from Bingöl University Health Sciences Scientific Research and Publication Ethics Committee on 07.04.2023, with Resolution 11 with a meeting numbered 23/08.

Data Analysis

The obtained data were evaluated with SPSS 25 statistical package software. The pre-test and post-test distribution of the variables of the research data according to the groups were examined, and the normality of the distributions and the homogeneity of the variances were determined via Mauchly Sphericity Test and Levene Test. According to the test results, Paired-Sample T-test was performed to compare the dependent variables in the group. In addition, comparisons between groups were made with Repeated Measure. All tests taken were expressed as arithmetic mean ± standard deviation ($\bar{X}$±sd) and the significance level was accepted as $p<0.05$.

FINDINGS

Table 2. Arithmetic averages of age, height, weight, and BMI values of the participants

Variables	Experimental x̄±sd	Control x̄±sd
Age (years)	14.75±0.78	14.75±0.17
Height (cm)	1.69±0.09	1.64±0.05
Weight (kg)	53.48±9.62	47.94±7.79
BMI (kg/cm^2)	18.61±2.19	17.67±2.05

In Table 2, the average age of the experimental group was 14.75±0.78 (years), height was 1.69±0.09 (cm), weight was 53.48±9.62 (kg), the BMI average was 18.61±2.19 (kg/cm^2), and the average age of the control group was 14.75±0.17 (years), height was 1.64±0.05 (cm), weight was 47.94±7.79 (kg), and the BMI average was 17.67±2.05 (kg/cm^2).

Table 3. Comparisons of CMJ and SJ pre-test and post-test of the participants

Variables	Group	Pre-Test x̄±sd	Post-Test x̄±sd	Within-group variance (%)	t	p	Between-Groups F	Between-Groups p
CMJ	Experimental	36.31±7.30	38.29±7.04	-1.98 (-5.45)	**-5.174**	**0.000**	**5.737**	**0.022***
	Control	29.74±5.45	30.54±4.98	-0.8(-2.68)	**-2.553**	**0.019**		
SJ	Experimental	30.27±6.29	32.02±5.83	-1.75 (-5.78)	**-3.266**	**0.004**	0.65	0.801
	Control	26.02±4.91	27.58±3.92	-1.56(-5.99)	**-3.163**	**0.005**		

x̄: Arithmetic Mean, SD: Standard Deviation, *p<0.05

When the vertical jump (CMJ) values of basketball players were examined in Table 3, it was found that there was a statistically significant difference in the comparison between the pre-test and post-test groups of the experimental and control group ($p<0.05$). In the within-group comparison of the

experimental group, an improvement of -5.45% was found and a statistically significant difference was identified (p<0.000). In the within-group comparison of the control group, an improvement of -2.68% was found and a statistically significant difference was identified (p<0.01). When the vertical jump (SJ) values of basketball players were examined, no statistically significant difference was found in the comparison between the pre-test and post-test groups of the experimental and control group (p<0.05). In the within-group comparison of the experimental group, an improvement of -5.78% was found and a statistically significant difference was identified (p<0.004). In the within-group comparison of the control group, an improvement of -5.99% was found and a statistically significant difference was identified (p<0.005).

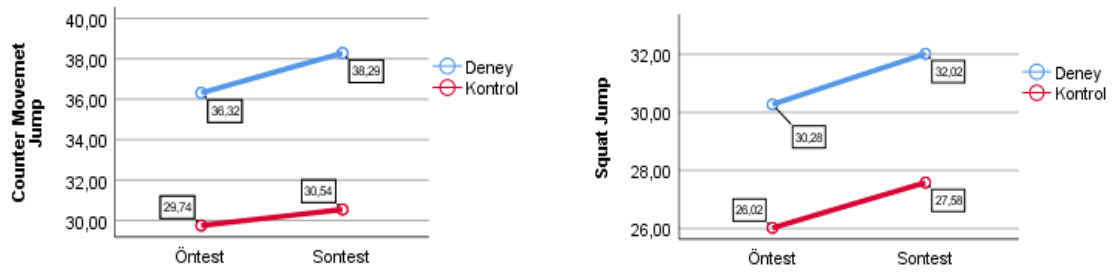

Figure 3. CMJ and SJ chart

Table 3. Comparisons of the strength pre-test and post-test of the participants

Variables	Group	Pre-Test x̄±sd	Post-Test x̄±sd	Within-group variance (%)	t	p	Between-Groups	
							F	p
Back Strength (kg)	Experimental	70.99±19.67	75.28±19.62	-4.29 (-6.04)	-1.967	0.064	1.743	0.195
	Control	69.40±20.53	70.64±19.42	-1.24 (-1.78)	-1.665	0.112		
Leg Strength (kg)	Experimental	58.05±15.38	66.91±16.12	-8.86 (-15.26)	**-3.707**	**0.001**	**5.033**	**0.031***
	Control	62.65±16.47	64.67±14.62	-2.02 (-3.22)	-1.071	0.298		

x̄: Arithmetic Mean, SD: Standard Deviation, *p<0.05

When the back strength values of the basketball players were examined in Table 4, no significant differences were found in the pre-test and post-test within-group comparisons of the experimental and control group (p>0.05). When the leg strength values were examined, a statistically significant difference was found in the comparison between the pre-test and post-test groups of the experimental and control groups (p>0.05). In the within-group comparison of the experimental group, an improvement of -15.26% was found and a statistically significant difference was identified (p<0.001). Although there was -3.22% improvement in the within-group comparison of the control group, no statistically significant difference was found (p>0.05).

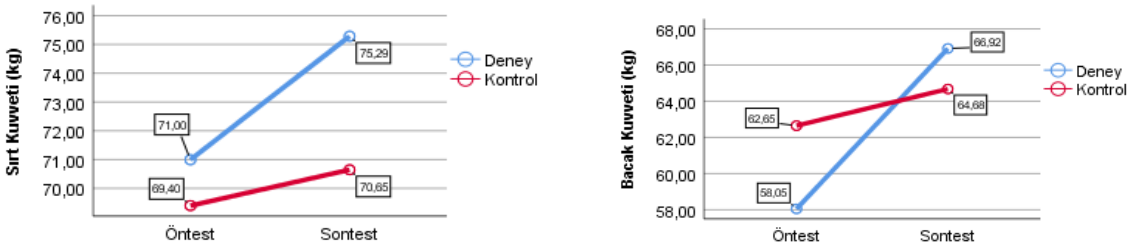

Figure 4. Back and leg strength chart

DISCUSSION AND CONCLUSION

Performance is the score that the athlete has concretely revealed as a result of the combination of physical, physiological, biomotoric, psychological, mental, technical, and tactical factors. Multiple factors affect this score obtained by the athlete. Researchers in many sports branches have worked on performance analysis with a holistic approach. In addition to determining the strengths and weaknesses of athletes, it is important to determine the training plans and programming according to the data obtained (Ostojic et al., 2006).

In this study, the vertical jump and strength improvements of bosu ball exercises performed for eight weeks on basketball players were examined. According to the results of the statistical analysis, statistically significant differences were found in the within-group comparison of the basketball players' experimental and control groups' vertical jump CMJ and SJ pre-test, and post-test. In the between-group comparison, a statistically significant difference in CMJ values was found between the experimental and control groups. And there was no statistically significant difference in SJ values between the experimental and control groups. According to the literature review, Gidu et al., (2018) reported in their study titled "The Effects of Proprioceptive Training on Balance, Strength, Agility and Dribbling in Adolescent Male Soccer Players" that there was a significant difference in CMJ values between the experimental and control group after 8 weeks of bosu exercise. Son et al., (2018) compared the effect of lower body strength training on vertical jump capacity with proprioceptive exercises in their study and they applied 4 supervised proprioceptive exercises including the Bosu ball stance, Rocket board, Bodyblade, and 4-minute single-leg stance exercises per workout station 3 days a week to the participants, and they reported that although there was an improvement in vertical jump SJ values, there was no significant difference. Aysan (2019) applied bosu ball strength exercises for 8 weeks in his study titled "Investigation of the Effect of Bosu Ball Strength Training on Some Parameters of 14-Year-Old Children" and obtained a statistically significant difference in vertical jump data $P<0.05$. Safci (2018) used bosu ball in resistance training in his study titled "The Effect of 8-week Resistance Training on Some Strength Parameters in Male Basketball Players Aged 14-16" and according to

the study result, he reported a significant difference in vertical jump values between experimental and control group. Salot et al., (2020) reported in another study that the bosu exercise program applied for 6 weeks was effective in improving the vertical jump height of male soccer players. In the literature research conducted, it is seen that the bosu exercise program has a positive effect on vertical jump performance. In this study, it was found that it has a positive effect on the vertical jump performance of basketball players. While there was a significant difference in CMJ values in the experimental and control groups, no significant difference was found in SJ values although there was an increase. Despite the fact that the Bosu exercises have a positive effect on jumping performance, the reason for this difference may be that the rest period between two jumps is not well adjusted. As a result, it was observed that the bosu exercise program had a positive effect on vertical jump performance.

According to the statistical analysis results, when the back strength values of the basketball players were examined, there was no significant difference in the pre-test and post-test within-group and between-group comparison of the experimental and control groups ($p>0.05$). When the leg strength values were examined, a statistically significant difference was found in the comparison between the pre-test and post-test groups of the experimental and control groups ($p>0.05$). According to the result of the literature review, Safçi (2018) in his study reported that there was no significant difference in the back strength pre-test comparison between the experimental and control groups, and there was a significant difference in the leg strength post-test comparison between the experimental and control groups. Özdoğru (2018) stated in his study that there was no statistically significant difference in the back strength performances of the pre-test and post-test measurements of the swimmers in the experimental and control groups participating in the study. Sarıkaya (2022) in his study stated that there was no statistically significant difference in the back strength values of Taekwondo in (Taekwondo practitioners) after eight weeks of bosu ball exercise in the pre-test and post-test between-groups comparison of the experimental and control groups. Bayrakdar (2020) stated in his study on child swimmers that there was a statistically significant difference in the back and leg strength parameters between the stable ground group, the unstable ground group and the control group of calisthenic exercises. Cosio-Lima et al., (2023) reported an increase in back strength values as a result of 5 weeks of core training programs.

It is said that sports branches with high anaerobic intensity, leg volume, muscle mass, muscle fiber length, and muscles that take an active role in the power generated by the muscle are important. As a result of the studies, it is stated that athletes with greater muscle mass, leg volume, and leg mass exhibit better anaerobic performance (Özkan, 2010).

As a result, the development of strength and jumping in children differs according to age groups. In addition, there is a significant relationship between the content of strength training applied to children and strength improvement. It is an important matter to adjust the strength training to be

applied to children according to individual differences between children and the psychomotor development period. We can say that strength training consciously applied to children increases strength development. We believe that the bosu ball exercises we have done can significantly affect the vertical jump and strength performance of athletes since the muscles in the leg area affect strength. It is thought that bosu ball exercises performed in addition to eliminating mediocrity in the planning of training and in line with the principle of versatility will provide an increase in performance criteria, as well as being an alternative study for athletes.

Conflict of Interest: There is no personal or financial conflict of interest between the authors of the paper.

Researchers' Statement of Contribution: Research Design-MS, Data Collection-MS; GK, statistical analysis- AA; Preparation of the article, MS; PA, GK.

Ethical Approval
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Number: 23/08

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