

Compared 2 method of resistance training (traditional and body pump) on the vertical jump and balance in male basketball players 16-18 years

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Abstract. The aim of this study was to compare the bodypump and resistance training on vertical jump and balance on male basketball players 16-18 years. Therefore 36 teenage basketball players voluntarily chosen and randomly divided into three groups including: bodypump group (n=12, age range 17±0.5 year, height 179±0.05cm and a weight range 69.26±12.22kg), resistance group (n=12, age range 17±0.6 years, range height 178±0.09 cm and weight 68.55±14.25 kg) and control group (n=12, age range 17±0.5 years, height range 179±0.06 cm, and the weight range 70.06±8kg), respectively. The field study was a pretest-posttest design. Experimental groups were carried out of 8-weeks of typical training. After 8 weeks, the subjects were then tested by vertical jump measured by Sargent test and balance measured by dynamic balance test. For analysis data one way ANCOVA and Bonferroni test were used. Significant level was $p \leq 0.05$. Between group measurements indicated that the between group the difference was significant. Bonferroni test showed that between experimental and control groups difference was significant, but the difference between the experimental groups was not significant. It can be concluded, for fundamental basketball team with large number of athletes, using a bodypump that has an effect similar to the conventional resistance and perhaps that does not require expensive equipment and as a group performed due, can save money and time and is effective for improving fitness.

Key words: vertical jump, balance, bodypump training, resistance training

Introduction

There has been a significant increasing development in the field of sport science during the recent years and physical fitness, as an important part of this science, has acquired large variety, evolution and development. Safrit has classified the physical fitness into two groups: health-related physical fitness and performance-related physical fitness. Components of health-related physical fitness include body composition, cardiovascular fitness and flexibility, strength and endurance; while components of performance-related fitness include power, speed, muscular strength and endurance, agility, balance, coordination and reaction time (1). In majority of sport fields, there are some skills and movements that rely heavily on physical fitness, strength and power (2). For example, power represents itself in movements such as jump, shot, rebounding in basketball, and quick change of direction in handball, football and speedy spike in volleyball. Reaching the highest vertical level in a jump is an advantage for basketball players, because they can throw the ball into the basket at higher level than

that of the opponent players or receive the rebounding ball from the basket at higher level than other players (3).

Also, maintaining balance during performing many sport movements is a fundamental requirement in all sport fields and considered as one of the factors related to physical fitness which can be improved by specific trainings. In physical fitness, balance is called the ability to maintain the body in an equilibrium state and is composed of two types: static and dynamic (2). In many sport fields, this control over body posture can influence the ultimate performance of a player. As an instance, in order to throw the ball, the basketball player moves his body mass forward in an attempt to improve the shooting range, and then moves his center of mass forward and outside his base of support (3); therefore, for player to be able to prevent himself from falling, he takes a step forward during a shooting and acts vice versa when receiving a ball, i.e. takes a backwards step (4).

Simultaneous performance and maintaining balance either in static state or during a movement requires production of sufficient power by

muscles to be applied to body leverages (bones) which in turns rely on complex balance within musculoskeletal and nervous systems (5). Basketball is a sport field with high level of physical activity containing many quick and sudden movements, and has a periodic nature which requires high level of aerobic and anaerobic fitness. According to Huffman et al. (2000), factors such as agility, power, balance and speed are very important for this sport field to such an extent that these factors are regarded as superiority of one team over its opponent (6). Regular and appropriate exercises related to basketball field are necessary to improve these factors. Sport exercises generally improve human performance, but what should we do if we would like to maximize this skill in a continuous and steady way? In order to show the maximum level of performance, athletes and coaches have utilized many approaches so far. Nowadays, resistance training is used as a part of training routine in many sport fields (7-8). Positive effects of resistance training depend on variation of different factors like intensity, volume and exercise type. During the recent years, exercise volume has been considered as one of the most important factor for resistance training. Especially, single-session exercises with higher level of intensity to save more time have attracted more attention, in contrast to multi-session exercise (9); also, group exercise are preferred over individual exercise due to higher psychological effect of group exercise; aerobic exercises is a case in point in this regard. Since many years ago, various methods have been introduced for resistance exercises such as pyramid, single-set, super set methods and their advantages and disadvantages have been clarified with time by various research studies. This trend is still continuing and many modern methods have been created with new advancement in sport science. One of the new methods with have gained high popularity around the worlds is "body pump" method (10). This method is performed using barbell and dumbbell and playing music. Vaughan et al (2014) and Pfitzinger and Lythe (2003) have introduced this exercise as a low intensity, high repetition resistance workout which is performed in groups. I got its name because intensity in this method is a combination of different rate at which the weights are lifted and it also increases blood flow from

heart to muscles and speeds up the fat-burning process (10-11).

Working with youngsters and adolescents has always been both interesting and accompanied with many problems such as injuries caused by sport activity, overtraining, exhaustion, and being costly. Resistance training in this age range has always been followed by risks and challenges. Concerning the novelty of this topic and lack of sufficient studies and also the basic physical needs for basketball players in this age group, the authors aimed to make a comparison between two resistance training routines (conventional and body pump) on vertical hump and balance among male basketball players within age range of 16-18 years old.

Material and Method

Conventional resistance training protocol includes 3 sets of 50, 60, 80 percent of 1RM of each exercises, for two times per week and to conduction of overload principle 1RM test was measured in 2end, 4end and 6end weekends respectively. All the required conditions assumed for conventional resistance training group were also assumed for the body pump group. Body pump training, which has been introduced as a type of low-intensity, high-repetition resistance trainings in the literature, is composed of 9 rhythms in which each muscle group had a separate workout for 5-7 minutes as showed in figure 1. Total duration for each session lasted between 50-60 minutes. Each rhythm contained 100 repetitions for each target muscle group. This type of training could be performed by dumbbell and barbell. In body pump resistance training method, the weight could not be increase due to different rates of exercises. Experimental groups had two sessions of dedicated training per week, and one common session of basketball training with control group. Two experimental groups completed 8 weeks of typical resistance training regime and engaged in regular basketball training class like control group.

In this study short time power (vertical jump) or sergeant test was used for measuring power output. All subjects completed 3 vertical jump, and their best performance was recorded as their mark.

Also, in order to evaluate balance, dynamic balance test was used. According to figure 2, subject places his right foot on the start point and

then jumps, with his left foot, towards the first point where he waits for 5 seconds. Then, he jumps for the next point by his right foot and waits there for another 5 seconds. The process continues like this to end of the points. The landed foot completely covered the point. Each subject could score earn 5 scores for each successful jump, with one extra score being added for each second of maintaining balance at a point (maximum score for balance is 5).

Thus, the total score a player could earn on each point was 10, while the overall score for this exercise was 100.

Statistical analysis. Values were expressed as means±SD. The normal distribution of the data was checked using the Kolmogorov-Smirnov test.

After confirming normal distribution, one-way ANCOVA was used for comparing differences and Bonferroni posthoc test was used for post-hoc comparisons. For all tests, $p < 0.05$ was considered as significant, All statistical tests performed using SPSS software (version 18) and Excel software (office word 2007 version) was used to drawing figures.

Results

Descriptive characteristics of the subjects are shown in table I. It is clear from results of this study (table II and III) that both experimental groups performance (jump and balance) was increased after intervention of 8 week resistance training comparing to control group.

Table I. Mean and standard deviation (SD) of age, height, weight and BMI across groups

Variable	Bodypump Group	Resistance Group	Control Group
Age	17±0.5	17±0.6	17±0.5
Height (cm)	179±0.05	178±0.09	179±0.06
Weight (kg)	69.26±12.22	68.55±14.25	70.06±8
BMI (kg.m ²)	21.5±3.6	21.6±3.3	21.8±1.12

Table II. Results of vertical jump and balance univariate across groups

	Vertical jump					Balance					
	Sum of Squares	Mean Square	F	P	η^2	Sum of Squares	Mean Square	F	P	η^2	df
Group	68.16	34.08	*64.43	0.001	0.81	70.03	38.01	*16.48	0.001	0.53	2
Error	66.89			0.52							29

*Significant differences $p \leq 0.05$

Table III. The findings from the Bonferroni test in comparison to the average vertical jump and balance into three groups

Variable	Group	Mean difference	Extended Error	Sig
Vertical jump	Bodypump	Resistance	0.186	0.305
		Control	3.21	0.309
	Resistance	Bodypump	0.186	0.305
		Control	3.02	0.323
	Control	Bodypump	3.21	0.309
		Resistance	3.02	0.302
Balance	Bodypump	Resistance	0.692	0.637
		Control	3.57	0.645
	Resistance	Bodypump	0.692	0.637
		Control	3.87	0.676
	Control	Bodypump	3.57	0.645
		Resistance	3.87	0.676

*Significant differences $p \leq 0.05$



Figure 1. Bodypump exercises

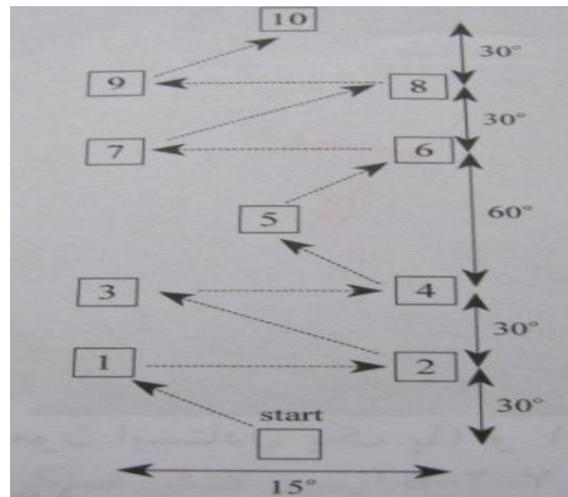


Figure 2. Dynamic balance test

Discussion and Conclusion

In this study, it was observed that both resistance training (conventional and body pump) had significant effect on balance and vertical jump, which means that body pump training and resistance training both improved record related to the balance and vertical jump. Furthermore, examining the intergroup changes revealed that there was a significant difference between experimental group and control group; however, no significant difference was observed between the two training groups. Balance is defined as the ability to maintain the projection of the body's centre of mass (CoM) within manageable limits of the base of support, as in standing or sitting, or in transit to a new base of support, as in walking (Winter 1995) or doing exercise or playing a sport (3). Body pump and resistance training have been reported to improve balance performance. Few studies have closely examined whether the dose of resistance exercise relationship between decline in strength and poorer determines a positive balance outcome. This study illustrated that weight training may best deliver to power and balance. Perhaps body pump and resistance training could stimulate several types of neuromuscular benefits and so increased motor unit recruitment and activation to enhance balance (3-5).

Vertical jump in basketball is an example of a power activity. Under best condition during a sport session, power is defined as product of strength and speed (12). In basketball, power represents itself in jump shooting, rebounding and sudden change of direction.

Since many years ago, increased strength has been proven to be a direct result of increase in muscle volume (hypertrophy). Although this is a logical statement, there some evidence that neural control in a trained muscle also increases and thus allowing the muscle to produce more force. Nervous system has a considerable role in increasing strength caused by resistance training. By a convincing discussion, Enoka states that increased although strength can be obtained without change in muscle structure, it is impossible neural adjustment (7-13). Thus, strength is not merely characteristics of a muscle, but is considered among properties of a motor system. Calling the motor system is a significant factor in increasing the strength. This point can explain a part of increased strength in absence of hypertrophy as well as in superhuman strengths. Increased strength can be the result of changes in relation with motor neurons located at vertebral column which causes further coordination of motor units, facilitation and increase in muscles' force-producing capability. Motor units are generally called upon at different times. Motor units are controlled by a group of neurons. These neurons are capable of transmitting stimulating and inhibiting impulses. There are various evidences supporting the simultaneous increase in motor units via resistance training, but there are still contradictory results about whether coordination of activation of motor units can produce higher level of muscle contraction (13-14).

This is obvious that synchronization improves level of force production and capacity of application of sustainable force. Another possibility is that without including simultaneous action of motor units, larger numbers of units are employed for specific tasks. Such an improvement in recruitment models can be caused by increased nervous flow to alpha motor neuron during maximum contraction. This increase in nervous flow can also maximize discharging of motor units. This is also possible that inhibiting impulses decrease and allow for further activation of motor units or continue their activity with higher frequency (12-13). Researches have shown that standard trainings with weights can improve power (12). It has also been proven that dynamic exercises are an effective factor for increasing power (12). Several studies have reported that performing squat exercise with heavy lifts results in improved performance in vertical jump (14-16). Also, variety of speed at which the weights are lifted has also demonstrated different results. Researchers have a unanimous agreement that high and intermediate repetitions are required in order to gain hypertrophy and muscular endurance; while low repetitions with high loads are needed for muscular strength (17). Arazi et al (2011) investigated effect of three resistance training methods (slow, intermediate and fast) on muscle's EMG response among non-athlete males. they showed that there was no significant difference between these three methods (17). Moreover, Kakhak et al. (2014) studied the acute effects of two resistance trainings with intermediate intensity, the same volume as well as slow and fast speeds on some of the anabolic and catabolic hormones and concluded that slow and fast resistance training can significantly increase level of the growth hormone immediately after the training session (18). However, there was no significant difference between the two training methods. Slow resistance training had greater impact on secretion of testosterone growth hormone, compared to fast resistance training. Slow and fast resistance trainings did not have any effect on cortisol, insulin and glucose (19). Body pump training method, which has been introduced as a high repetition, low volume resistance training and its capability to improve strength and power, balance and endurance has been shown by literature, uses both slow and fast resistance training (10-11). Vaughan et al (2014)

investigated effect of body pump method on strength, balance and walking rate among healthy elderly people (11). Results of their study showed that this method increases strength and improves balance and walking rate among the subjects. Results of the present study are in agreement with results of Adams and Faors (2000), Paul et al. (2003) and on effect of resistance training on power. However, due to novelty of body pump method, there are only a limited number of researches in this area available to the author. According to the results of this study, there was no significant difference regarding effect of both training methods, i.e. both methods had the same effect on vertical jump. Therefore, in order for basketball players within 16-18 age group to improve their vertical jump, they can utilize one of the two methods on their own choice. Since body pump method does not require expensive and complex devices, and can be performed with a number of dumbbell and barbell, not only it can produce the advantages provided by conventional resistance methods, it can also be applied to fundamental basketball teams and clubs (and probably other sports similar to basketball) with limited amount of money and time resources, because it is performed in group and in harmony with all the players together.

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