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The effect of a proposed training program using medicine balls on some physical variables and the digital achievement of throwing events in athletics for students of physical education

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Abstract
This study aimed to identify the effect of a proposed training program using medicine balls on some physical variables and the digital achievement of throwing events in athletics for students of physical education at Palestine Technical University "Kadoorie". The study was conducted on an intentional sample of 28 students, who were randomly divided equally into Two groups (experimental and controlling) by 14 students. The results of the study showed that there were statistically significant differences in the effect of the proposed training program among the members of the experimental group and in favor of post-measurement, while the results of the study did not show any change among the control group members between the pre and post measurements. The researcher recommends the need to include medicine balls with educational exercises during teaching throwing activities in athletics, especially the actual shot put, disc-throwing, spear-throwing, discus throw and hammer throw.

Keywords: Medicine balls, Physical abilities, Throwing events, Kadoorie University

Introduction
Sports performance during the past few years has a huge and significant progress with scientific and cognitive progress in various sports sciences and its branches such as psychology, sociology, sports medicine, physiology, chemistry and anatomy, training science, and biomechanics, where trainers and employees in the field of planning and rationing of loads training and academic athletes, make a great efforts to develop training and teaching curricula, methods, techniques, programs, and various tools in order to reach players and students to the best physical, skill, planning, and psychological levels (Khanday *et al*, 2018, p85) [7].
Training using medicine balls is one of the modern, unconventional training methods which appeared as a direct result of the scientific renaissance in the sports field in order to bringing players to the top of sports achievement through the use of medicine balls in pushing, throwing, and passing exercises that can be performed individually, in pairs or collectively, and other different situations and forms, whether it is standing, kneeling, sitting, lying or hanging, as (Savithiri, 2016, p137) [12] indicated that training using medicine balls contributes greatly to developing physical capabilities related to muscle strength, speed, agility and balance (Ameerali & Antony, 2017, p129) [1] showed that the performance of throwing and pushing motions using medicine balls achieves an improvement in the explosive force and the strength characterized by speed and the strength bearing of the upper end of the body as a plyometric exercises. (Pramod & Divya, 2019, p151) [10] states that training using medicine balls is a good way to develop muscle strength, which is an essential component of all movements and technical skills, (Antony & Ameerali, 2017, p129) [1] stated that training using medicine balls is an effective and safe way to increase the training load and the occurrence of adaptation to the functional systems of the player's body.
In this regard, the results of many studies that dealt with the training using medicine balls showed a significant and notable improvement in the physical capabilities related to the

explosive muscle strength, the strength characterized by speed, endurance of strength, and flexibility, in addition to speed, agility and technical skills for various sports, such as studies of (Kobak *et al*, 2019; Beckham *et al*, 2019; Pramod & Divya, 2019; Faigenbaum *et al*, 2018; Khanday *et al*, 2018; Soloman, 2018; Trajkovic *et al*, 2017; Antony & Ameerali, 2017; Savithiri, 2016; Marques *et al*, 2013; Ignjatovic *et al*, 2012; Szymanski *et al*, 2011) [8, 2, 10, 3, 7, 13, 17, 1, 12, 9, 5, 14].

Throwing events in athletics are classified as field activities that require a lot of strength that characterized by speed, where the performance distance of these activities is determined by this element (strength characterized by speed), which is a complex component of strength and speed, and speed is the result of strength, and there is no speed without strength, and thus, the strength increases the speed of the object from the beginning of the movement until the throwing, and the importance of speed also appears during the short kinematic path in which the movement is accomplished and what speed does it need?, thus the player does not reach a good level of throwing except by developing the speed element, Where that speed is transferred to the object during throwing as an co-factor (Assistant Factor), this is what (Young, 2017, p3) [18] indicated by saying that the nature of the performance in the javelin throw activities requires special development of the force characterized by speed, and (Karampatsos *et al*, 2011, p113) [6] stated that excellence in throwing events requires strong muscles of the upper body, and fast white muscle fibers, (Terzis *et al*, 2012) [16] emphasizes the importance of the strength characterized by speed of the top end of the body in discus throw players, as the results of a study (Terzis *et al*, 2012) [16] showed the importance of the muscle strength of the top end of the body at the expense of body mass.

After the baseline survey conducted by the researcher for previous studies to investigate the effect of training using medicine balls on physical variables and athletic achievement, it was found that all studies dealt with the category of women, youth and the elderly, and that these studies aimed at improving the skill, physical and health level of the sample, the researcher didn't find that there studies included the inclusion of the use of medicine balls with educational programs for different sports skills, which constituted a great incentive for the researcher to include training using medicine balls with educational lessons for throwing events in athletics due to the great dynamic similarity between exercises used in the medicine ball and the technical aspects of throwing activities. The lack of muscle strength among students was a major reason for the emergence of the study problem and an incentive to study the effect of training using medicine balls on some physical variables and the digital achievement of throwing events in athletics for students of physical education.

Methodology

The researcher applied the proposed training program to a sample (S) of 28 students, at a rate of (58.33%) from the study population. They were randomly assigned to two groups (experimental and controlling) by 14 students for each group, whose ages ranged between 18-22 years, it was chosen using the intentional method and Table 1 clarifies the characteristics of the study sample, before and after applying the training program.

The physical tests were represented (the sprint 30 meters from the first start to measure the maximum speed, straight leg sit-ups test 10 seconds, Schnaw test 10 seconds to measure the strength characterized by the speed of the abdominal muscles, and the medicine ball push test from sitting to measure the explosive strength of the arms muscles, long jump from stability test to measure the explosive strength of the feet muscles, the softball throw to the far distance to measure strength characterized by the speed of the arm muscles and measuring the digital achievement distance for effective Shot Put, discus throw and spear throw.

For data processing, the researcher used the SPSS program through the use of the following statistical treatments:

1. **(Independent samples t-test)** to determine the differences in the pre-measurement between the experimental group and the control and for the equivalence of the two groups.
2. **(Paired samples t-test)** to determine the differences between the pre and post measurement and the ratio.

Table 1: Characteristics and homogeneity of the study sample (S =28).

Variables	Measurement unit	Mean	Standard Deviation	Skewness
Age	Year	19.60	0.73	0.796
Body Mass	Kg	73.53	5.42	-0.914
Tallness	M	1.77	4.98	-0.908

It is clear from Table 1 that the values of the skewness are located between (± 3) and this indicates that the study sample is subjected to the normal distribution, and for equivalence between the members of the experimental and controlling groups in age, body mass, tallness, and in addition to the initial (pre) measurements of the under consideration variables the (T) test was used to indicate the differences between two independent samples, and the results of Table 2 show that.

Table 2: (T) Test results for the significant differences for two independent groups in the pre measurement of the experimental and controlling group (S = 28).

Variables	Measurement Unit	Experimental Group (S=14)		Controlling Group (S= 14)		(T)Value	Significant Differences*
		Mean	SD	Mean	SD		
Age	Year	19.57	0.75	19.64	0.74	-0.252	0.936
Body mass	Kg	71.50	5.81	75.57	4.29	-2.108	0.247
Tallness	M	1.77	6.26	1.78	3.42	-0.561	0.155
Body mass index (BMI)	Kg / m²	20.72	1.23	20.79	1.21	-0.146	0.838
Sprint (30) meters	Second	3.75	0.31	3.74	0.29	0.106	0.840
Straight leg sit-ups test (10) seconds	Once	10.14	1.83	10.35	1.54	-0.334	0.715
Schnaw test (10) seconds	Once	10.14	2.17	10.00	1.79	0.189	0.374
Medicine ball push test	M	3.80	0.75	3.76	0.78	0.147	0.881
The long jump of stability	M	2.02	0.12	2.03	0.14	-0.334	0.344

Softball	M	21.07	1.82	20.66	1.97	0.581	0.943
Shot put	M	9.04	0.10	9.01	0.06	1.148	0.120
Discus throw	M	23.42	2.99	23.37	3.19	0.037	0.552
Spear throw	M	30.03	1.73	29.92	3.12	0.166	0.942

* Statistically significant at the significance level ($\alpha \leq 0.05$). ** SD: Standard Deviation. *** M: Meter.

It is clear from Table 2 that there are no statistically significant differences at the level of significance ($\alpha \leq 0.05$) in all variables between members of the experimental and controlling groups, which in turn means that there is equivalence between members of the experimental and control groups before starting the implementation of the proposed program.

Medicine Ball Training

After referring to previous studies, rules and special scientific references for building and designing training programs as reported on (Pramod & Divya 2019) [10], the researcher designed a training program that depends entirely on the use of medicine balls of different weights 2-5Kg for a period of 8 weeks, at the rate of 3 training units per week, and a period of 60 minutes per training unit, including the warm-up time, And in proportion to the phosphine anaerobic energy production system (Pc + ATP) because the nature of performance in throwing competitions requires this system, and the number of repetitions of one exercise ranged between 8-12, while the number of groups ranged between 2-4 groups, where the training program included exercises for pushing and throwing performed by the student from different situations (standing, kneeling, sitting, lying), where this program was applied to the members of the experimental group, while the controlling group was subjected to the regular educational program, and Table 3 clarifies the content of the training program.

Table 3: Proposed training program

Week	Exercise with Medicine Ball	Set	Repetition	Rest
1-2-3 Week	Push the medicine ball (2 kg) from the chest with the arms from the standing position. Push the medicine ball (2 kg) from the chest with the arms from the kneeling position. Push the medicine ball (2 kg) from the chest with the arms from the sitting position. Push the medicine ball (2 kg) from the chest with the arms from the lying position and reaching the sitting position. Throw the medicine ball (2 kg) from the side. Push the medicine ball (2 kg) from the standing position with jumping over a barrier with a height of (30 cm). Throw the medicine ball (2 kg) the farthest distance by the arm from above the head.	2 Set	8 Nos	2Min
4-5 Week	Throw the medicine ball (3 kg) over the head with the arms and from the standing position. Throw the medicine ball (2 kg) from over the head with the arm and from the standing position. Throw the medicine ball (2 kg) from over the head with the arm and from the kneeling position. Throw the medicine ball (2 kg) from over the head with the arm and from the sitting position. Push the medicine ball (2 kg) from the chest with the arms from the lying position and reaching the sitting position. Push the medicine ball (2 kg) from the standing position with jumping over a barrier with a height of (30 cm). Throw the medicine ball (2 kg) from the side.	2 Set	10 Nos	2Min
6-7 Week	Push the medicine ball (4 kg) from the chest with the arms from the standing position. Push the medicine ball (4 kg) from the chest with the arms out of the kneeling position. Push the medicine ball (4 kg) from the chest with the arms out of the sitting position. Push the medicine ball (4 kg) from the chest with the arms from the lying position and reaching the sitting position. Throw the medicine ball (4 kg) over the head by the arms and from a sitting position. Throw the medicine ball (5 kg) from the side. Push the medicine ball (3 kg) from the standing position with jumping over a barrier above a height of (30 cm).	3 Set	10 Nos	2Min
8 Week	Push the medicine ball (4 kg) from the standing position with jumping over a barrier with a height of (40 cm). Throw the medicine ball (5 kg) from the side. Throw the medicine ball (4 kg) from over the head with the arm and from the kneeling. Throw the medicine ball (4 kg) over the head with the arm and from the sitting position. Push the medicine ball (4 kg) from the chest with the arms from the lying position and reaching the sitting position. Throw the medicine ball (3 kg) the farthest distance in the arm from above the head.	3 Set	12 Nos	2Min

Results and Discussion

1. The results of the first questions

Are there statistically significant differences at the level of significance ($\alpha \leq 0.05$) between the pre and post measurements averages of the proposed training program using the medicine balls of the experimental group on some physical variables and the digital achievement of throwing events in athletics for students of physical education?.

To answer the first question, the researcher used the means, standard deviations, and paired samples t-test to determine the differences between the pre and post averages measurements of the proposed training program using the medicine balls of the experimental group on some physical variables and the digital achievement of throwing events in athletics at Physical education students, and the results of Table 5 show that.

Table 5: The results of (T) test for the significant of differences between the pre and post measurements averages for the proposed training program using the medicine balls of the experimental group on some physical variables and the digital achievement of shooting events in athletics among students of physical education (S = 14).

Variables	Measurement Unit	Pre Measurement		Post Measurement		(T) Value	Significant Differences*	Change%
		Mean	SD	Mean	SD			
Body mass	Kg	71.50	5.81	70.50	4.76	2.314	*0.038	-1.42
Body mass index (BMI)	Kg / m²	20.72	1.23	18.41	1.28	18.784	*0.000	-12.55
Sprint(30) meters	Second	3.75	0.31	3.66	0.30	7.632	*0.000	-2.46
Straightleg sit-upstest (10) seconds	Once	10.14	1.83	12.64	1.39	-12.315	*0.000	19.78
Schnaw test (10) seconds	Once	10.14	2.17	12.50	1.78	-9.496	*0.000	18.88
Medicine ball push test	M	3.80	0.75	5.51	0.84	-8.304	*0.000	31.03
The long jump of stability	M	2.02	0.12	2.21	0.13	-11.122	*0.000	8.60
Softball	M	21.07	1.82	23.64	3.12	-3.421	*0.005	10.87
Shot put	M	9.04	0.10	11.32	0.85	-9.764	*0.000	25.22
Discus throw	M	23.42	2.99	27.18	4.34	-3.536	*0.004	16.05
Spear throw	M	30.03	1.73	36.78	1.67	***-9.742***	*0.000	22.47

* Statistically significant at the significance level (α ≤ 0.05). ** SD: Standard Deviation. *** M: Meter.

From the Table 5, it is clear that there are statistically significant differences at the level of significance (α ≤ 0.05) between the pre and post average measurements of the proposed training program using the medicine balls of the experimental group on some physical variables and the digital achievement of throwing events in athletics for students of physical education in the use of the training program for the medicine balls of the experimental group on some physiological and physical variables among students of physical education at the Technical University of Palestine-Khadoury and for the benefit of dimensional measurement. The researcher attributes this to the effectiveness of the proposed training program designed by the researcher according to the scientific rules and principles, and codified by a group of experts and specialists in the field of sports training, as the program included physical exercises based in nature on the performance of 8-12 repetition during a specific period, and this was an incentive to stimulate a large number of motor units, which contributed to major physical adaptations on the muscular and nervous systems to employ the largest number of motor units, and in general the results of the current study came in line with the studies of each of (Kobak *et al*, 2019; Beckham *et al*, 2019; Pramod & Divya 2019; Falgenbaum *et al*, 2018; Soloman, 2018; Trajkovic *et al*, 2017; Marques *et al*, 2013; Szymanski *et al*, 2007; Ignjatovic *et al*, 2012; Szymanski *et al*, 2011) [8, 2, 10, 3, 13, 17, 19, 14, 5, 15] which showed that there is a positive effect of physical training programs on the muscle strength (explosive force, and the force characterized by speed), speed, and endurance of strength, and from here the researchers stated that programming the training by using traditional methods without working with modern methods cannot reach the player to the highest level of achievement.

2. The results of the second questions:

Are there statistically significant differences at the level of significance (α ≤ 0.05) between the pre and post measurements averages of the proposed training program by using the medicine balls of the group controlling some physical variables and the digital achievement of throwing events in athletics for students of physical education?.

To answer the second question, the researcher used the means, standard deviations, and paired samples t-test to determine the differences between the pre and post averages measurements of the proposed training program using the medicine balls of the controlling group on some physical variables and the digital achievement of throwing events in athletics at Physical education students, and the results of Table 6 show that.

Table 6: The results of (T) test for the significant of differences between the pre and post measurements averages for the proposed training program using the medicine balls of the controlling group on some physical variables and the digital achievement of shooting events in athletics among students of physical education (S = 14).

Variables	Measurement Unit	Pre Measurement		Post Measurement		(T) Value	Significant Differences*	Change%
		Mean	SD	Mean	SD			
Body mass	Kg	75.57	4.29	75.14	4.11	2.121	0.054	-0.57
Body mass index (BMI)	Kg / m²	20.79	1.21	20.71	0.80	0.308	0.763	-0.39
Sprint (30) meters	Second	3.74	0.29	*3.66*	0.30	1.174	0.262	-2.19
Straight leg sit-ups test (10) seconds	Once	10.35	1.54	10.50	1.40	-1.472	0.165	1.44
Schnaw test (10) seconds	Once	10.00	1.79	10.07	1.68	-0.563	0.583	0.7
Medicine ball push test	M	3.76	0.78	3.79	0.73	-1.141	0.274	0.79
The long jump of stability	M	2.03	0.14	2.04	0.13	-1.835	0.089	0.49
Softball	M	20.66	1.97	20.61	1.52	0.230	0.821	-0.24
Shot put	M	9.01	0.06	9.13	0.28	-1.776	0.099	1.33
Discus throw	M	23.37	3.19	24.49	3.12	-0.806	0.435	4.79
Spear throw	M	29.92	1.67	*30.07*	1.52	-1.699	0.113	0.50

* Statistically significant at the significance level (α ≤ 0.05). ** SD: Standard Deviation. *** M: Meter.

It is clear from the Table 6 that there are no statistically significant differences between the pre and post average measurements of the proposed training program using the medicine balls of the group controlling some physical variables and the digital achievement of throwing activities in athletics among students of physical education.

The researcher attributes this to the practice of the members of the controlling group, the regular educational program that is limited only to the educational exercises necessary to learn each effectiveness of the throwing activities, compared with the members of the experimental group that committed to a training program using medicine balls, and this would increase the training load among the members of the sample, this contributed to developing and raising the level of muscle strength in its various forms, as well as the speed and level of achievement (performance distance) in throwing activities, and these results are consistent with these studies: (Pramod, 2019; Kobak *et al*, 2019; Karampatsos *et al*, 2011; Ignjatovic *et al*, 2012; Terzis *et al*, 2012; Szymanski *et al*, 2007) [10, 8, 6, 5, 16, 14].

Recommendations

In light of the study's goals and results, the researcher recommends the need to use medicine balls with educational exercises when teaching motor skills that require throwing movements, whether these games are individual or group, as this increases the level of the training load gradually and thus improving the level of muscle strength of the top end muscles of the students, this reflects positively on the degree and speed of students' mastery of these skills and improves their level of achievement.

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