

Comparing the Effect of Using Weight Training and Complex Training to Develop Muscular Strength on the Performance Level of High Jump Scoring in Handball

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Abstract: Physical preparation is considered a basic part of the sport training with the aim of improving the level of physical performance of players to the maximum limit allowed by their abilities. Muscular ability is one of the most important special abilities in handball. Using weight training exercises leads to developing the muscular strengths with its different types (maximum – muscular strength – power endurance), developing technical performance and enhancing preparation level for practicing sport activity as well as protecting muscles and achieving balance among different muscular groups in the body.

[Zeinab Ali Muhammad Hathot. **Comparing the Effect of Using Weight Training and Complex Training to Develop Muscular Strength on the Performance Level of High Jump Scoring in Handball.** *J Am Sci* 2013;9(5):338-344]. (ISSN: 1545-1003). <http://www.jofamericanscience.org>. 42

Keywords: plyometric exercises- Complex exercises- ... The skill of scoring in handball

1. Introduction and Research Problem:

Physical preparation is considered a basic part of the sport training with the aim of improving the level of physical performance of players to the maximum limit allowed by their abilities. Muscular ability is one of the most important special abilities in handball.

Using weight training exercises leads to developing the muscular strengths with its different types (maximum – muscular strength – power endurance), developing technical performance and enhancing preparation level for practicing sport activity as well as protecting muscles and achieving balance among different muscular groups in the body.

Howly & Franks (1997) indicate that plyometric exercises are these exercises in which the muscle is able to reach the maximum level of power production in the shortest possible time. These exercises use gravitation to store energy in muscles. This energy is used directly in the reaction in the opposite direction. This kind of exercises is used in lengthening during lengthening and shortening course to produce strong contractive muscular act.

Complex exercises are a mix of weight training and plyometrics used to reach the optimal performance, as they give players the maximum results in the shortest possible time. They are also considered one of the main training patterns used by athletes in developing different physical abilities.

The skill of scoring in handball is one of the important basic skills that coaches give more time in teaching and training, because it is the skill that determines matches result and it has accuracy, strength and suspense for both players and fans.

Through benchmark survey for scientific studies, the researcher noticed that some scientific studies in the field of handball used plyometrics

such as the studies of Tariq (1998): Hamid (2002) Muhammad (2002) Hisham (2003). These studies dealt with comparing weight training with plyometrics. In the study of Hussam (2008), the complex exercises were used while there is no single study (up to the knowledge of the researcher) that dealt with comparing the effect of both weight training and complex training to develop muscular abilities of arms and legs and the performance level of high jump scoring in handball.

Through her work in the field of teaching and coaching handball for female students of the Faculty of Physical Education for Girls, Zagazig University, the researcher noticed severe failure in the performance level (strength – accuracy) of high jump scoring for female students of third year, major of handball. This may be ascribed to their weak muscular ability of arms and legs because some of those in charge of the educational process perform traditional exercises and keep away from performing weight training and complex training. This urged the researcher to perform this study to promote the performance level (strength – accuracy) of high jump scoring of third year female students, major of handball in the faculty through developing the muscular ability of legs and arms by performing suggested programs. The first program is performed by using weight training, and the second one includes complex training with comparing between the two programs to recognize the most suitable training program in developing the muscular ability of legs and arms and the performance level (strength – accuracy) of high jump scoring of third year female students, major of handball in the Faculty of Physical Education for Girls in Zagazig.

Research Objectives:

This research aims at developing suggested training programs (weight training –

complex training) to develop the muscular ability of legs and arms, the performance level (strength – accuracy) of high jump scoring of third year female students, major of handball in the Faculty through learning the following:

1- The effect of weight training and complex training on the muscular ability of arms, and the performance level (strength – accuracy) of high jump scoring in handball.

2- The significance of differences between the first experimental group (weight training) and the second experimental group (complex training) in the post measurement of muscular ability of arms and legs and the performance level (strength – accuracy) of high jump scoring in handball.

Research Hypotheses:

1- There are statistically significant differences between pre and post measurements of the first experimental group (weight training) and the second experimental group (complex training) in the muscular ability of arms and legs and the performance level (strength – accuracy) of high jump scoring in handball in the favor of the post measurement.

2- There are statistically significant differences between post measurements of the first experimental group (weight training) and the second experimental group (complex training) in the muscular ability of the arms and legs and the performance level (strength - accuracy) of the high jump scoring in the favor of the second

experimental group (complex training).

Research Procedures:

Research Approach:

The researcher used the experimental approach because it is suitable for the nature of this research by following the experimental design of the two experimental groups using the pre and post measurements.

Research Sample:

The research sample was selected using intentional method from the third year female students, major of handball in the Faculty of Physical Education for Girls, Zagazig University in academic year 2010/2011, second term. The total size of the sample before performing the main experiment was (36) female students. The researcher removed (12) female students (3 students who failed last year and are remaining to repeat, 1 irregular student and 8 female students participating in the exploratory studies). Thus, the size of the basic sample came to be (24) female students divided into two equal groups as follows:

First experimental group: (containing 12 female students) performing weight training

Second experimental group: (containing 12 female students) performing complex training.

Equality between the first experiment group (weight training) and second experimental group (complex training) was found in terms of the previous variables on which conformity was applied. This is explained in table (1).

Table (1):Significance of Differences between the two Experimental Groups in Physical and Skill-Related Variables under Research

Variables	Measurement Unit	Experimental Group N=12		Control Group N=12		“T” Value
		A	D	A	D	
Age	Years	20.95	0.53	20.80	0.61	0.62
Length	Cm	172.50	3.97	171.25	3.42	0.79
Weight	Kg	69.00	3.80	68.00	3.55	0.64
Muscular ability of the arms	Cm	27.91	3.12	27.50	3.24	0.30
Muscular ability of the scoring arm	M	9.17	1.15	9.00	1.02	0.37
Flexibility of trunk and thigh	Cm	11.50	2.62	11.32	2.50	0.17
Strength of high jump scoring	M	16.45	1.17	16.20	1.10	0.52
Accuracy of high jump scoring	Degree	2.13	0.95	2.00	0.91	0.33

“T” tabular value at the level of 0.05 = 2.074

* Significant at the level of 0.05

From table (1), it is shown that there are no statistically significant differences at the level of 0.05 between the first experimental group (weight training) and the second experimental group (complex training) in the pre measurements of variables under research, which indicates the equality of the two experimental groups in terms of these measurements.

Data Collection Tools:

Physical and Skill-Related Tests:

- 1- Vertical jumping test to measure the muscular ability of the legs
- 2- The test of pushing a weight of (900) grams to measure the muscular ability of the scoring arm.
- 3- The test of folding the trunk to the front from standing position to measure flexibility of trunk and thigh.
- 4- Test of throwing the ball to the farthest distance from high jumping to measure strength of high

jump scoring.

- 5- The test of accuracy of high jump scoring to measure accuracy of high jump scoring.

Suggested Training Programs:

A- Suggested Weight Training Program:

Basics of Developing the Program:

- Considering the characteristics of the research sample.

- Determining weight tools and exercises used.

- The duration of applying the program and weekly training units as follows:

Muhammad (1998)) indicates that a duration of weeks is an enough period to reach the stage of muscular strength and ability. Both **Allaway** (1994) and **Talhah** (1997) points out to scheduling (3) times weekly for weight training to develop muscular ability.

Out of this practical point, the researcher selected a duration of (8) weeks distributed over (3) times weekly, in order to apply the training program.

Load Strength for Weight Training:

Abu El-Ela (1994) (refers to avoiding the use of the highest load varying from 90% to 100% when training on the muscular strength and its components for youth and beginners.

Accordingly, the researcher selected the strength of the maximum load for exercises used in the program to be below 90% of the maximum load that the the (beginner) female student can endure.

Load Size (Repetitions – Groups) for Used Exercises:

Talhah (1997) indicates that repeating the same exercise to develop the muscular ability should be from 8-10 times and the number of groups should be 3-5 groups when training the youth.

Interim Rest Period:

Most scientific references in the field of weight training (10),(14), (20), (21) agreed that the rest period should last till recovery. Therefore, the researcher selected the rest period to vary from (2minutes – 3 minutes) for groups.

B- Complex Training Program:

Basics of Program Development

- Suitability of selected exercises in the training module with the abilities of the research sample individuals.

- Taking care of performing lengthening and flexibility exercises at the beginning of the training module.

- Considering the principle of exercises integrity (legs – arms – trunk) to achieve the maximum possible benefit.

- Using the periodical training method with its two types: high and low strength.

- The daily training module included (4) training

stations where weight training and polymetrics are mixed for high and low limbs inside one complex group. Thus, the female student performs low limb weight training followed by high limb polymetric exercise with considering starting always with weight training to stir the biggest group of muscles directly used in polymetric exercises.

- Giving a positive rest period between each two groups for (2-3) minutes.

- Considering the principle of graduation from easy to hard in performing complex training (weight and polymetric training) inside the training modules and throughout the training program.

Load Strength:

Through the benchmark survey for scientific studies related to developing training programs using complex training, such as (4), (6), (7), (15), (22), the researcher defined the training load strength at the starting point at the level of 60% of the highest load that female student can endure. The load strength in the suggested training program should not exceed 90%.

Load Size (Repetitions – Groups):

Abu El-Ela Abdul Fatah and Ahmad Nasr Ed-Din (2003) (2) indicates that the size of weight and polymetric training for youth should vary from (6-15) repetitions in each group, and groups should vary from (5 – 10) groups.

Interim Rest Period:

Most scientific references specialized in the field of weight and polymetric training agreed that the rest period should last till recovery. Out of this point, the researcher defined the rest period among groups as (2-3) minutes.

Pre Measurements:

The researcher carried out pre measurements for the two experimental groups in the period from 13/3/2011 to 17/3/2011 in the physical and skill-related variables under research.

Applying Suggested Training Programs:

The researcher applied the suggested training programs on the members of the two experimental groups. The weight training program was applied on the first experimental group, while the complex training program was applied on the second experimental group in the period from 20/3/2011 to 14/5/2011 for a period of (8) weeks, in the amount of (3) training modules every week after the end of the academic day in the faculty.

Post Measurements:

Post measurements for the members of the two experimental groups were carried in the period from 15/5/2011 to 17/5/2011 in the same order and conditions of pre measurements.

Results Presentation and Discussion:

First, Results Presentation:

Table 2:Significance of Differences between the Pre and Post Measurements of the First Experimental Group (Weight Training) in the Physical and Skill-Related Variables under Research N = 12

Variables	Measurement Unit	Pre-Measurement		Post Measurement		“T” Value
		A	D	A	D	
<i>Muscular ability of legs</i>	<i>Centimeter</i>	27.91	3.12	30.69	2.41	*3.02
<i>Mucular ability of scoring arm</i>	<i>Meter</i>	9.17	1.15	11.55	0.73	*3.91
Strength of high jump scoring	<i>Meter</i>	16.45	1.17	18.36	0.90	*2.75
Accuracy of high jump scoring	<i>Degree</i>	2.13	0.95	2.81	0.55	*2.52

“T” tabular value at the level of 0.05 = 2.201

* Significant at the level of 0.05

From table (2), it is shown that there are statistically significant differences at the level of 0.05 between the pre and post measurements for the first experimental group (weight training) in

terms of muscular ability of legs and arms as well as the performance level (strength – accuracy) of high jump scoring in handball in the favor of the post measurement.

Table 3:Significance of Differences between pre and post Measurements for Second Experimental Group (Complex Training) in the Physical and Skill-Related Variables under Research N=12

Variables	Measurement Unit	Pre-Measurement		Post Measurement		“T” Value
		A	D	A	D	
<i>Muscular ability of legs</i>	<i>Centimeter</i>	27.50	3.24	34.82	3.03	*6.97
<i>Mucular ability of scoring arm</i>	<i>Meter</i>	9.00	1.02	12.90	0.91	*5.55
Strength of high jump scoring	<i>Meter</i>	16.20	1.10	19.25	0.78	*6.13
Accuracy of high jump scoring	<i>Degree</i>	2.00	0.91	3.50	0.50	*7.19

“T” tabular value at the level of 0.05 = 2.201

* Significant at the level of 0.05

From table (3), it is shown that there are statistically significant differences at the level of 0.05 between the pre and post measurements for

the second experimental group (complex training) in the physical and skill-related variables under research in the favor of the post measurement.

Table 4:Significance of Differences between pre and post Measurements for First Experimental Group (Weight Training) and the Second Experimental Group (Complex training) in the Physical and Skill-Related Variables under Research

Variables	Measurement Unit	First Experimental N=12		Second Experimental N=12		“T” Value
		A	D	A	D	
<i>Muscular ability of legs</i>	<i>Centimeter</i>	30.69	2.41	34.82	3.03	*3.53
<i>Mucular ability of scoring arm</i>	<i>Meter</i>	11.55	0.73	12.90	0.91	*3.84
Strength of high jump scoring	<i>Meter</i>	18.36	0.90	19.25	0.78	*2.47
Accuracy of high jump scoring	<i>Degree</i>	2.81	0.55	3.50	0.50	*3.08

“T” tabular value at the level of 0.05 = 2.074

* Significant at the level of 0.05

From table (4), it is shown that there are statistically significant differences at the level of 0.05 between the two post measurements of the first experimental group (weight training) and the second experimental group (complex training) in the physical and skill-related variables under research in the favor of the second experimental group (complex training).

4. Discussion:**Discussion of the First Research Hypothesis:**

Results of table (2) have shown that there

are statistically significant differences at the level of 0.05 between the pre and post measurements for the first experimental group (weight training) in muscular ability of the legs and arms as well as the performance level (strength – accuracy) of high jump scoring in handball in the favor of the post measurement.

The researcher ascribes this improvement in the muscular strength of legs and arms to the weight training program which is planned and scientifically regulated for the first experimental

group, and to the fact that this program contains regulated exercises with gradual strength varying from (60% to 90%) and various weights for different muscular groups, either arms muscles, chest muscles, abdomen muscles and arms muscles. This had an effective positive impact on the improvement of muscular ability of arms and legs.

The researcher also ascribes the improvement of the first experimental group members in performance level (strength – accuracy) of high jump scoring in handball to the efficiency of the weight training programs in developing the muscular ability of arms and legs. This had a positive impact on the performance level (strength – accuracy) of high jump scoring for third year students, major of handball in the faculty. This result agrees with what **Fornscjesca et al** (2002) indicated that weight training is one of the best techniques used to develop muscular groups working in the activity being practiced as well as improving the muscular ability of legs and arms muscles and developing the technical performance level of athletes.

This result also goes with the results of the studies of: **Tariq** (1998), **Jamal & Munir** (2004) and **Haitham** (2006) which agreed on using weight training programs in developing the muscular ability for arms and legs and the level of motor performance for athletes.

The results of table (3) have shown that there are statistically significant differences at the level of 0.05 between the pre and post measurements for the second experimental group (complex training) in the muscular ability of legs and arms as well as the performance level (strength – accuracy) of high jump scoring in handball in the favor of the post measurement.

The researcher ascribes that improvement in the muscular ability of legs and arms and the performance level (strength – accuracy) of high jump scoring in handball of second experimental group members to the efficiency of the complex training program which contained weight and polymetric exercises for legs and arms. In this program, it was considered to regulate training loads in the way that fits the second experimental group, and to graduate in exercises from easy to hard, which positively affected the muscular ability of legs and arms and the performance level (strength – accuracy) of high jump scoring in handball. This result matches what **Fleck & Kramer** (1997) indicated that complex training increases the ability of muscles in explosive performance, because the strength of muscles are originally developed by weight training, but motor strength are developed by using polymetric training represented by deep jumping, jumping and hopping on hurdles and repeating hopping and rebounding. Consequently, the skill-related level of athletes is

improved.

This result agrees with the results of the studies of: **Radcliffe & Radcliffe** (200), **Ebben & Jensen** (2003), **Jihan** (2004), **Mahmoud** (2006) **Hussam** (2008) **Hassan** (2008)), and **Muhammad As-Sayed Mustafa** on the efficiency of complex training technique in developing muscular ability of the arms and legs and the skill-related performance level for individual and group games players.

Discussion of the Second Research Hypothesis:

Observing the results of table (4), it is shown that there are statistically significant differences at the level of 0.05 between the two post measurements for the first experimental group (weight training) and the second experimental group (complex training) in the muscular ability of legs and arms as well as the performance level (strength – accuracy) of high jump scoring in handball in the favor of the second experimental group (complex training).

The researcher ascribes such improvement to the efficiency of the suggested complex training program which was used with the second experimental group members in developing the muscular ability of the legs and arms. Mixing between the weight training and polymetric training brings together the benefits of resistance training and polymetric training, in addition to the suitability of forming training loads, good selection of exercises and training methods used (boxes – hurdles), performing different jumps, hopping over and among boxes and hurdles. This resulted in developing the muscular energy of legs represented by vertical leaping, as well as using medical balls and dumbbells in polymetric training, which led to developing the muscular energy of the scoring arm represented by throwing a 900 grams load to the farthest distance. This led to improving the performance level (strength – accuracy) of high jump scoring in handball.

This result agrees with the results of the study of: **Factors** (2001) (30) that the mixed (complex) technique containing polymetric and weight training positively affects the strength of legs muscles and carrying out vertical leaping when compared to the weight training and polymetric training.

In this regard, **Ebben et al.** (2002) indicates that the mixed training is one of the best training techniques currently used in developing the physical and skill-related aspects, because this technique brings together the benefits of resistance training and polymetric training.

Conclusions:

- 1- Weight training has a positive effect on the muscular ability of legs and arms and on the performance level (strength – accuracy) of high jump scoring for third year female students, major of handball in the faculty.

- 2- Complex training has a positive effect on the muscular ability of legs and arms and on the performance level (strength – accuracy) of high jump scoring for third year female students, major of handball in the faculty.
- 3- The second experimental group (complex training) surpasses the first experimental group (weight training) in terms of the measurements of muscular ability of the legs and arms and the performance level (strength – accuracy) of high jump scoring for third year female students, major of handball in the faculty.

Recommendations:

- 1- Attention should be paid to applying complex training during special preparation period, because it has a positive effect in developing the muscular ability of the legs and arms and the performance level (strength – accuracy) of high jump scoring in handball.
- 2- It is necessary to draw the attention of those in charge of teaching handball to include weight training programs in the female students' preparation programs, because they have positive effect on improving the physical and technical abilities of female students, major of handball in the Faculty of Physical Education for Girls in Zagazig.
- 3- It is required to conduct some studies that deal with complex training and adopt the physiological tendency to recognize physiological changes resulted from using complex training programs.

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3/27/2013