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EFFECTS OF PLYOMETRIC TRAINING ON THE SELECTED PHYSICAL FITNESS VARIABLES AMONG MALE U-13 ANALEMO VOLLEYBALL PROJECT PLAYERS, THE CASE OF ANA LEMOWEREDA, HADIYA ZONE, ETHIOPIA

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The aim of this study was to investigate the effects of twelve weeks of plyometric training on selected physical fitness among u-13 male Analemo volleyball project players. This study was also creates the awareness for volleyball coaches to incorporate plyometric training when they design training program to develop volleyball player's physical fitness. The study was designed census experimental and used 25 total size of project players, The participants of this study were classified into two groups by purposive sampling system; the experimental group (n=15) who performed plyometric training three days per week for 3 month and 60 mint per session and the control group (n=10) have undergone normal training programs. And both the control and experimental group had taken pretests and posttests. So, all subjects participated in 4 selected physical fitness performance tests: 35meter sprinting test, vertical jump test, V sit and reach test and Pro-agility test the data collected from the study subject were analyzed using SPSS version 21 software by paired sample test and independent sample test of significant at 0.05 level of confidence The polymetric training exercises was conducted Cone Jump, Multiple hops with a Sprint, jumps from different position and direction with cone, frog jump, lateral speed drill, Tuck jumps, sit and reach the foot and Squat jumps. The selected subjects were measured of their physical fitness components, speed, power, agility and flexibility. Descriptive statistics was calculation for statistical treatment. Plyometric training shows more improvement than from pre training session to post training session. The study of plyometric training exercises significantly to increase speed, power, flexibility and agility. The study has significantly improved speed, power, flexibility and agility.

Keywords: Polymetric training, agility, speed, power and flexibility

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Introduction

Volleyball is a popular sport which has thousands of supporters and practitioners at the international area and a competitive sport played on different surfaces such as indoors or outdoors courts. Indoor volleyball is played upon a hard flat surface that is mostly made out of wood or synthetic materials (Gortsila et al., 2013). Jumping ability is very important ability for success in volleyball and it very connected with surface.

Modern volleyball requires for player a good physical endurance, parallel it is very important to develop speed and explosive power and force endurance. Volleyball is also a social game, where next to the good coordination and cleverness comes up to the important place team players good rapprochement and cooperation (Jarvekulg, 2002). Vertical jump ability is critical for success in volleyball. Jumping is utilized during the jump set, jump serve, blocking and spiking. A successful player must not only be able to jump high but must also be able to reach that height quickly. This requires an ability to generate power in a very short time (Powers, 1996).

Volleyball is an intermittent sport that requires players to compete in frequent short bouts of high-intensity exercise, followed by periods of low intensity activity (Gabbett, and Georgieff, 2007). Elite male players have been reported to perform 250 to 300 high-power activities during a 5-game match, and the jumps constitute most of the power events (Hasegawa, *et al.,* 2002).The countermovement jump is performed from different starting positions in different sports with ball. In volleyball, a countermovement jump is usually performed in a fast spike and in a static block jump. Volleyball players use two different Block jump techniques, starting from an upright position or starting from a squat position, with a countermovement being performed in both cases (Amasay, 2008). A number of studies have investigated the effects of different training methods at off-season (Gabbett, and Georgieff, 2007), preseason (Sheppard, *et al.,* 2008).

Volleyball places high requirements on a player's speed, agility, upper-body and lower-body muscular power, and maximal aerobic power (Gabbett, 2008. Sattler *et al.,* 2015). Therefore, coaches and professionals involved in volleyball are interested

In the potential effectiveness of different training regimes and improvement of those conditioning capacities are known to be important determinants of success (Pereira *et al.,* 2015). One of such training regimes is plyometric training. Plyometric training uses the physiological phenomenon of a stretch-shortening cycle in order to enhance the ability of the neuromuscular system to produce maximal force in the shortest possible time (Markovic and Mikulic, 2010). Due to the characteristics of the game, which involve repeated jumping, frequent sprinting and changes in directions, this training regime is a particularly popular method for fitness development in volleyball players (Kim and Park, 2016).

Previous studies have investigated the effects of plyometric training on conditioning capacities in volleyball (Lehnert*et al.,* 2017).

The researcher observed that in Analemo volleyball project, proper plyometric training is not emphasized to include in their training schedule. Therefore, this leads the players towards physically not fit especially, in power, speed, flexibility and agility. If players lack of this training, they cannot perform their volleyball skill properly. The coaches may give more attention for ball contact drill rather than the essential physical fitness development in their training session. Because of this reason players show limitations in physical fitness which affects volleyball skill performance.

Plyometrics is a very popular training method that includes bounding, hopping and depth jumping which seem to be effective for increasing muscle power and vertical jump height (Albert M, 1991). Moreover, plyometric exercises involve starting and changing directions in an explosive way, which seems to be recommended to increase agility performances. Furthermore, it has been shown that plyometric training of 6 to 10 weeks contributes to increased vertical jump height (Alptekin A, *etal.,* 2013) and agility (Miller MG ,*etal.,*2006).

Plyometric exercises have been shown to improve jump performance in many sports. These exercises combine strength with speed of movement to produce power. By using the myotatic stretch reflex of the muscle to produce an explosive reaction, plyometric is believed to be the link between speed and strength (Powers, 1996). The plyometric method is ranked among the most frequently used methods for conditioning in volleyball (Lehnert*et al.,* 2009).

Plyometric training is popular among individuals involve in dynamic sports and plyometric exercises such as jumping, hopping, skipping and bounding are executed with a goal to increase dynamic muscular performance. Plyometric are techniques used by the athletes in all types of sports to increase strength and explosiveness plyometrics consists of rapid stretching of muscle followed by a concentric or stortening action of the same muscle and connective tissue. The stored elastic energy within the muscle is used to produce more force than can be provided by a concentric action alone. Plyometric training when used with a per iodized strength training program can contribute to improvement in vertical jump performance, acceleration, leg strength, muscular power, increased joint awareness and overall proprioception (Tendulkar, *et al.*, 2018).

Plyometric training refers to exercises involving jumping, hopping, and skipping that are characterized by eccentric contractions of the muscle tendon unit immediately followed by concentric contractions which is also referred to as the stretch shortening cycle(Schulte-Edelmann*etal.,* 2005). The mechanism of plyometric training involves elongation of the muscles followed by an immediate strength shortening contraction which utilizes the energy stored during the stretching phase. Soccer requires changing of direction frequently, shuffling, sprinting and jumping, and for any of these movements to occur a player needs strong lower leg power as well as control on balance (Schulte-Edelmann *et al.,* 2005).

Researchers have stated that, plyometric exercise can contribute to developments in vertical jump performance, acceleration, leg strength, and muscular power, increased joint awareness, and easily change the direction of body during game. Plyometric drills usually involve stopping, starting, and changing directions in an explosive manner. These movements are components that can assist in developing agility (Simpson and Miller 2018).

Therefore, the aim of this study is to investigate the effects of 12-week plyometric training program on some selected physical fitness variables among male volleyball players in Analemo U-13 project. The researcher hypothesized that; plyometric training would result in significantly greater improvements in power, speed, flexibility and agility performance in U-13 male volleyball project players.

Objectives of the Study

To investigate the effects of twelve weeks plyometric training on selected physical fitness variables among male U-13 volleyball project players in the case of Analemoworeda, Hadiya zone, Ethiopia.

- To examine the effect of plyometric training on power of volleyball project players,
- To assess the effect of plyometric training on speed of volleyball project players,
- To identify the effect of plyometric training on agility and flexibility of volleyball project players

Materials and Method

A research design is the 'procedures for collecting, analyzing, interpreting and reporting data in research studies (Wong and Cooper 2016). Experimental and control group were incorporated of male volleyball players from Analemo u-13 volleyball project players. The study was designed Census experimental. The study subjects were taken 25 players in the age category of U-13 years of old volleyball players. In this study the researcher was intended to use the materials which are Cones, ball, long wall, sit and reach mat, meter, whistle and stop watch, volleyball court and football field as well. For the experimental group exercise time scheduled per week 3 days for 60 minutes was designed. The pretest was taken and the data was recorded and the testing protocol procedures were kept until the post-test measurement. Before directly engage to the test the participants were requested to warm up for 10- 15 minutes prior to the test program and cool down at the end of activity. The tests were vertical jump for power, 35-meter sprint for speed, agility T-test for agility and V-sit and reach test for flexibility was applied to test player's pre- and post-selected physical fitness variables with field test. Paired sample T test was used to compare the main difference between pre-test and post-field test of power, speed, flexibility and agility. Data were analyzed by using SPSS (version 20). The level of statistical significance for the study was set at $p \leq 0.05$. To examine whether significant difference or not in male volleyball project player's plyometric training, independent sample t-test was used. In addition, to evaluate the pre-post training effect of each training modality, paired sample t-test was employed. The level of statistical significance for the study was set as $p \leq 0.05$ and 95% confidence interval.

Result

The trainers' descriptive study of plyometric training result of pre test and post test mean for experimental groups and control groups.

Figure 1 Descriptive Statistics of pre-test and post-test Mean values for control group

Enclosed as Annexure 01

Enclosed as Annexure 01

Figure 2 Descriptive Statistics of pre-test and post-test mean values for Experimental group

Enclosed as Annexure 02

As shown above this figure 5, Shows the mean difference of pre test to post test on plyometric training were deference from pre- test to post-test. This difference shows the improvement of the fitness performance. The figure showed that the participants 35m sprint runs, V-sit and reach, agility T test and vertical jump performance. The performance for these four variables had been observed in the improvement of agility, flexibility, agility and power due to polymeric training that carried out 3 days per week for 3 months that enabled the participants to perform better from pre to post test. Therefore, polymeric training was recommended for those who want to develop their speed, agility flexibility and power. The result of this study is supported with the study of Shaikh and Mallick (2012) that conducted the study on the effects of plyometrics training among University male students and found that poly metric training was effective in improving explosive power, agility and muscular endurance. Associated physical fitness variables of volleyball players were also improved significantly as a result of selected polymetric training exercises.

Pretest and post test result of experimental group

The baseline assessment results of experimental group (n=15) were assessed using the independent t-test for speed, power, flexibility and agility of physical fitness of the participants in the study was presented in the following.

Table 1: Summary of independent sample t test of experimental group on mean baseline and of speed, agility, flexibility and power

Enclosed as Annexure 03

The above table also displays the pre-test and post test results of the 35m sprint run test for the experimental group. As indicates in the table the pre-test mean value was found to be 5.89sec with SD=0.17 , and Sig =0.000 and the post-test mean value was found to be 5.81sec with SD= 0.19 and Sig =0.001 So, the mean value score of 35m sprint run test indicated that there is relatively difference between both test on the fitness speed performance after the plyometric training program.

The table above also indicates the pre-test and post test results of the Pro-agility (T-test) test for experimental group. As indicated in the table the pre-test means value was found to be 9.39 sec with SD= 0.63 and Sig =0.000 and the post-test mean value was found to be 9.19 sec with SD= 0.64 and Sig =0.000. Therefore, the mean value score of the Pro-agility (T-test) test shows there is the difference in the performance between the two tests on the fitness of agility after the polymetric training program.

The above table also displayed that the pre-test and post test results of the V sit and reach test for experimental group. From the data, we can see that in the table the pre-test mean value was found to be 4.73 cm with SD= 2.78 and Sig =0.000 the post-test mean value was found to be 6.51cm with SD= 2.27 and Sig =0.000. However, the mean value score of the V sit and reach test indicates that there was difference on the performance between the two test on the fitness of flexibility polymetric training program.

The table above also revealed that the pre-test and post test results of the Vertical jump test for the experimental group. As shown in the table the pre-test mean the value was found to be 30.33cm with SD=3.80 and Sig =0.001 the post test mean value was found to be 32.2cm with SD= 3.9 and Sig =0.001 So, the mean value score of the Vertical jump test indicates that there was a change on the performance between the two tests on the fitness of power after performing the polymetric training program.

Note: from the above explanation of four physical fitness test variables, we can say that there was a significant difference or change between pre test results and post test results after performing 12 week polymetric training on the male volleyball project players between tests. So that polymetric training has great significant effect on the performance of volleyball players.

Pretest and post test result of control group

The baseline assessment results of control group (n=10) were assessed using the independent t-test for Speed, Power, Flexibility and Agility of physical fitness of the participants in the study was presented in the following.

Table 2: Summary of independent sample t-test of control group on mean baseline and of speed, agility, flexibility and power

Enclosed as Annexure 04

The above table also displays the pre-test and post test results of the 35m sprint run test for the experimental group. As indicated in the table, the pre-test mean value was found to be 5.73sec with SD=0.29 and the post-test mean value was found to be 5.745 sec with SD= 0.28 So, the mean value score of 35m sprint run test indicated that there is relatively difference between both test on the fitness speed performance without the plyometric training program. Therefore, polymetric training is essential for volleyball players.

The table above also indicates the pre-test and post test results of the Pro-agility (T-test) test for experimental group. As indicated in the table, the pre-test means value was found to be 9.15 sec with SD= 0.78 and the post-test mean value was found to be 9.14 sec with SD= 0.78. Therefore, the mean value score of the Pro-agility (T-test) test shows there is a little difference in the performance between the two tests on the fitness of agility without the polymetric training program. Therefore, polymetric training is of paramount importance for volleyball trainers.

The above table also displayed that the pre-test and post test results of the V sit and reach test for experimental group. From the data, we can see that in the table the pre-test mean value was found to be 6.9 cm with SD= 4.62 and the post-test mean value was found to be 6.99cm with SD= 4.58. However, the mean value score of the V sit and reach test indicates that there was no change on the performance between the two test on the fitness of flexibility without polymetric training program. Therefore, training without plyometric training is not effective.

The table above also revealed that the pre-test and post test results of the Vertical jump test for the experimental group. As shown in the table

The pre-test mean the value was found to be 32.7cm with SD=5.14 and the post test mean value was found to be 33cm with SD= 5.19 So, the mean value score of the Vertical jump test indicates that there was a little change on the performance between the two tests on the fitness of explosive power without performing the polymetric training program. Therefore, training without polymetric training is not importance.

Note: from the above explanation of four physical fitness test variables, we can say that there was a no significant difference or change between pre test results and post test results without performing 12 week polymetric training on the male volleyball players between tests. So that without polymetric training has no great significant effect on the performance of volleyball players.

Table 3 : The mean difference value and significance level of each test results

Enclosed as Annexure 05

Table showed the overall result of each test Table showed the overall result of each test it includes the mean, mean difference from one test to another and the significance of post tests relative to the pre test. In all the parameters there were progressive significantly improvements in performance changes which were observed in speed, flexibility agility and power physical fitness variables; that means health related and skill related physical fitness in three days per a week for 12 weeks improvement was shown. But their degree is varying from one variable to the other. When we compare pre test and post test result of speed was 0.08 and P value =0.014, flexibility was 1.78 and P value =0.001, agility was 0.2 and P value =0.009, and power was 1.87 and P value =0.014. From this result we conclude that polymetric training shows more improvement than from pre-test training session to post-test training session.

Discussion

The former table (8) above indicated that the mean score of the 35meter sprint test after giving continuous training with selected exercise was lower than that of before giving exercise. The mean value was 5.89sec before training and it reduced to 5.81sec after training. The mean value difference was .08 sec reductions. This implies that plyometric training is a beneficial modality to enhance the fitness of speed.

The former table (8)indicated that the mean score of the Pro agility test after giving plyometric training with selected exercise was lower than that of before giving exercise. The mean value was 9.39sec before training and it reduced to 9.19sec after training. The mean value difference was =.20sec reductions. Some researchers forward that plyometric training is a beneficial modality to enhance the fitness of agility (Mengesh, Sangeeta et al. 2015). In accordance with these findings, the present study proved that plyometric training significantly improved selected physical fitness variables on male soccer players. The result of this study is supported with the study of Shaikh and Mallick (2012) that conducted the study on the effects of plyometrics training among University male students and found that poly metric training was effective in improving explosive power and agility.

The former table (8)indicated that the mean score of the V-sit and reach test after giving plyometric training with selected exercise was lower than that of before giving exercise. The mean value was 4.73cm before training and it reduced to 6.51cm after training. The mean value difference was=-1.78 reductions. This implies that plyometric training is a beneficial modality to enhance the fitness of agility. The agility performance was increased from pre training test to post training test the result of this study is supported with the study of Shaikh and Mallick (2012) that conducted the study on the effects of plyometrics training among University male students and found that plyometric training was effective in improving explosive power, agility.

The former table (8) indicated that the mean score of the Vertical jump test after giving plyometric training with selected exercise was lower than that of before giving exercise. The mean value was 30.33cm before training and it increased to 32.2cm after training. The mean value difference was -1.87 reductions. This implies that plyometric training is a beneficial modality to enhance the fitness of power. An experimental study conducted on the effects of plyometric and resisted jump-training on speed and power of young athletes showed the greatest amount of change in vertical jump.

The result of this study supported by Lehnert, M. (2009). This systematic review found three studies which observed the effects of plyometric training on the agility/speed of volleyball players.

According to table (8) the study result is supported by Idrizovic, K(2018).The Effects of 3-month Skill-Based and Plyometric conditioning on Fitness Parameters in Junior Female Volleyball Players.

The p value of all four dependent variables (speed, agility, flexibility, and power) test score on the above table 8 was; sig. = 0.014, 0.009, 0.001 and 0.001 respectively those showing that they have statically high significant differences. Depending on the result the researcher concludes that we have enough evidence to reject the null hypothesis of Power, Speed, flexibility and Agility (H01, H02, and H03) and accepted that the Alternative hypothesis of Power, Speed, flexibility and Agility that was ;There is a significant change on Power, Speed, flexibility and Agility due to 12 weeks plyometric exercises training method among Ana lemo volleyball project players. Generally according to this finding the selected type 12 weeks training exercise program brought high significant changes in selected physical fitness components. Therefore, these findings put a remarkable idea for the difference in performance efficiency among Analemo U-13 male volleyball project players.

As the tests result indicated that there was progressive improvement in performance from pre-test to post-test on the performance of the target group due to the plyometric exercise training program of 12 weeks. The test results showed that statistically, significant enhancement was observed in the target group`s fitness level. Plyometric training method provides strenuous work entirely suited to an individual's specific needs, existing capacity, and rate of adjustment to progressive vigorous exercises

Conclusion

This study was shown significant improvement in selected plyometric training variables during training periods in post test.

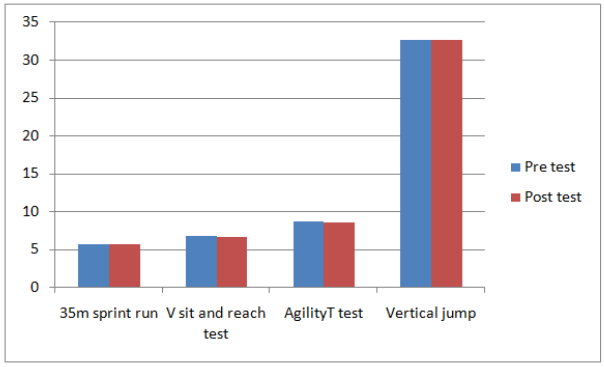
- Plyometric training program have shown significant improvement on speed performance of Analemo volleyball project players.
- Plyometric training program have shown significant improvement on flexibility performance of Analemo volleyball project players.
- Plyometric training program have shown significant improvement on power performance of Analemo volleyball project players.

- Plyometric training program have shown significant improvement on agility performance of Analemo volleyball project players.
- To improve male volleyball player's physical fitness, programmed fundamental training method plays a significant role.
- The test can anticipate the current physical fitness performance level (power, speed, flexibility and agility) of male volleyball players.
- Regarding the result of finding, male volleyball players were fascinated without losing interest for better improvement of performance.
- The program has also shown significant change in improving the selected variables of physical fitness components.

Annexure

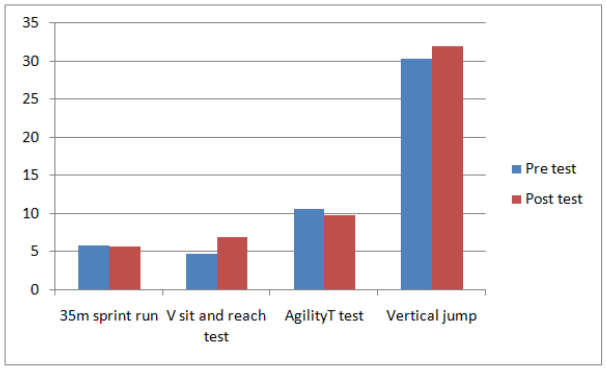
Annexure 01

Figure 1 Descriptive Statistics of pre-test and post-test Mean values for control group



Annexure 02

Figure 2 Descriptive Statistics of pre-test and post-test mean values for Experimental group



Annexure 03

Table 1: Summary of independent

Sample t test of experimental group on mean baseline and of speed, agility, flexibility and power

Pre-test					Post-test			
Dependent variables	Mean	SD	T-value	Sig	Mean	SD	T-value	Sig
Speed	5.89	0.17	121.19	0.000	5.81	0.19	107.65	0.001
Flexibility	4.73	2.78	6.149	0.001	6.51	2.27	8.501	0.001
Agility	9.39	0.63	53.76	0.000	9.19	0.64	51.98	0.000
Power	30.33	3.80	28.9	0.001	32.2	3.9	29.87	0.001

SOURCE; PRIMARY DATA/ 2022

Annexure 04

Table 2: Summary of independent sample t-test of control group on mean baseline and of speed, agility, flexibility and power

Pre-test					Post-test			
Dependent variables	Mean	SD	T-value	Sig	Mean	SD	T-value	Sig
Speed	5.73	0.29	61.33	0.015	5.745	0.28	61.33	0.514
Flexibility	6.9	4.62	4.719	0.001	6.99	4.58	4.655	0.501
Agility	9.15	0.78	35.8	0.007	9.14	0.78	35.87	0.509
Power	32.7	5.14	20.83	0.001	33	5.19	19.931	0.560

SOURCE; PRIMARY DATA/ 2022

Annexure 05

Table 3 : The mean difference value and significance level of each test results

Dependent Variables	Test (I) Mean PT	Test (II) Mean Value PT	MD P(I-II) Respectively	P
Speed	5.89	5.81	0.08	0.014
Flexibility	4.73	6.51	-1.78	0.001
Agility	9.39	9.19	0.2	0.009
Power	30.33	32.2	-1.87	0.001

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