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EFFECTS OF 12 WEEKS PLYOMETRIC TRAINING ON SOME SELECTED FITNESS PERFORMANCES OF ABAYMINCH U/17 FEMALE SOCCER PROJECT TRAINEES IN SEKELA WOREDA

BY

MULUKEN AWOKE

AUGUST, 2022

BAHIR DAR

BAHIR DAR UNIVERSITY

SPORT ACADEMY

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EFFECTS OF 12 WEEKS PLYOMETRIC TRAINING ON SOME SELECTED FITNESS PERFORMANCES

A Thesis Summited to Sport Academy Bahir Dar University in Partial fulfillments of the Requirements for the Degree of Master of Education in Teaching Physical Education

By:

Muluken Awoke

Advisor:

Dagnachew Nigeru (PhD)

AUGUST, 2022

BAHIR DAR

CERTIFICATE

BAHIR DAR UNIVERSITY

SPORT ACADEMY

DEPARTMENT OF SPORT SCIENCE

APPROVAL OF THESIS FOR DEFENSE

I hereby certify that I have supervised, read, and evaluated this thesis titled “Effects of 12 Weeks Plyometric Training on Some Selected Physical Fitness Performances” By Muluken Awoke prepared under my guidance. I recommend the thesis be submitted for oral defense.

Dagnachew Nigeru (PhD)	_____	_____
Advisor‟s name	Signature	Date

APPROVAL SHEET

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DEPARTMENT OF SPORT SCIENCE

APPROVAL OF THESIS FOR DEFENSE RESULT

We hereby certify that we have examined this thesis entitled “Effects of 12 Weeks Plyometric Training on Some Selected Physical Fitness Performances” by Muluken Awoke. We recommend that the thesis is approved for the degree of “Masters of Education inphysical education”.

Board of Examiners

_____ _____

External examiner~~s~~Name Signature Date

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Chair person~~s~~Name Signature Date

DECLARATION

I, Muluken Awoke, hereby declare that the material contained within this research now submitted to the Sport Academy of Bahir Dar University in partial fulfillment for the award of Degree of Master of education in physical education is entirely my own work. I have followed all ethical principles of scholar in the preparation, data collection, data analysis and completion of this thesis. Any materials accessed and utilized and ideas acquired in the process of conducting this research have been cited and acknowledged. All scholarly matter that is included in the thesis has been given recognition through citation. I affirm that I have cited and referenced all sources used in this document. Every serious effort has been made to avoid any plagiarism in the preparation of this thesis.

Students Name: Muluken Awoke

Signature_____

Date_____

DEDICATION

I dedicate this thesis manuscript to my family and beloved friends. As well as I extended my dedication to the man who contribute even a piece of advice throughout my life to reach in this stage.

Mr. Muluken Awoke

Signature:-_____

Date: _____

ACKNOWLEGEMENTS

I am not entirely sure where to begin. The amount of support and the number of people I should acknowledge seems unlimited and overwhelming. First of all I want to thanks to God the Almighty power for enabling me to accomplish my thesis.

Secondly, I would like to express my deepest and heartfelt gratitude to my advisor Dagnachew Nigeru (PhD), for his consistent guidance, follow up, support and providing a constructive and valuable advice, comment, and ideas from the beginning up to the accomplishment of my study work.

Thirdly, I express my appreciation to my friends and colleagues for their kind support during this study. My heartfelt thanks go to my staffs specially my teammates PE department teachers who were a source of immense moral and also technical assistance during the testing sessions in order to make this thesis successful. I would like to address my genuine and deepest gratitude to u-17 female soccer trainees of Gish abay for their willingness to participate in different fitness test relevant for my study.

My deepest gratitude is also goes to my parents and family for their affection. Eventually, to the above mentioned people and to those who have not been mentioned, your sacrifice and encouragement are greatly appreciated and will always be in my memory.

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ABBREVIATION

20-M	Twenty Meters Sprint Time Test
CG	Control Group
EG	Experimental Group
M	Mean Value
PoT	Post-taining Test
PT	Pre-training Test
SD	Standard Deviation
SLJ	Standing Long Jump
SPSS	Stastical Package Software for Social Sciences
T-T	T-Agility Test

ABSTRACT

The purpose of this study was to investigate the effects of 12 weeks plyometric training on selected physical fitness performance of u-17 female soccer project players at Sekela Woreda. The total subject for the study were thirty (n =30) female soccer trainees of Gish Abay Town in Ethiopia 2013 E.C. Since the study populations were little, all were taken as a sample by using comprehensive sampling technique. Through randomization method trainees segregated in to two groups, an experimental group (N=15) and a control group (N=15). The experimental group (EG) performed twelve-week moderate plyometric training, once per week for a total of 45 minutes and the control group (CG) did only their regular soccer training 3 days per week for 60 minutes duration. The data was collected through field tests (20-m sprint test for speed, T-agility test for agility and Vertical Jump test for power). The data were analyzed by using Paired sample t-test using SPSS version 25 with significance level of 0.05.Based on the analyzed data, the pre-posttest performance of EG were significantly improved thir speed in (5.32%) agility in 2.63seconds (17.6%), and vertical jump 8.5cm (19.1%). Generally, the results of this study show that 12 weeks of plyometric training improved speed, agility and power performance of u-17 female soccer project trainees. Therefore the study recommended that coaches should give concentration to plyometric training in coaching soccer and these training methods are recommended to soccer players for improving speedy and skilled performances.

Key words: Agility, plyometric training, power and Speed.

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Football is one of the best, oldest and world's most well-liked form of sport, being played in every nation without omission. According to FIFA (2013) the modern history of the world's preferred game periods more than 100 years it encompasses 206 member association from every part of world managed by FIFA. Football is an extremely dynamic, popular sport and played by massive number of athletes, men and women, young and adults, amateurs and professionals participate (Arifi&Alajand,2015;Jorge et al., 2016). There are currently about 265 million players, 26 million of whom are women, 5 million referees and officials are actively involved or 4% of the world population (FIFA, 2014;Haugen & Seiler,2015). As it is explained by Reilly&Williams (2003) Football is the only sport which attracts almost the entire world population. For example, More than 750 million television viewers watched the FIFA Women's World Cup Canada (FIFA, 2015).

Soccer (also known as football) is the world's most popular form of sport, being played in every nation without exception. Female's soccer is one of today's most popular sports, yet not so long ago, females were forbidden to play it. In fact, until fairly recently, it was still a male-dominated game. The popularity of women's soccer continues to grow as evidenced by the six to eight million female athletes between the ages of 6 and 24 yearsplaying soccer. Soccer requires athletes to perform short sprints, repeatedly change directions, and complete numerous jumps during a 90 min match (Krustrup et al., 2005; Stolen et al., 2005).

The popularity of women's soccer has witnessed rapid growth in the past 10 years as evidenced by 29 million female players worldwide and a 32% increase in participation (FIFA, 2012). Previous research has identified that on an average pitch (105 m 3 68 m),

senior elite female players will cover upward of 10.4 km of field space, and perform over 1,300 different activities, with a change in the type or level of activity every 4 seconds (Gabbett&Mulvey, 2008: Gabbettet al., 2013).

Although low-intensity activities including standing, walking, and jogging have been identified as the predominant movement patterns (upward of 90% of the 90-minute game), the distance covered, and the rate of fatigue during the high-intensity and sprinting activity are the main determinants between higher and lower standards of play (Mohr et al.,2008;Andersson, et al., 2010).Elite female players complete 1.68 6 0.09 km at high intensity and 0.46 6 0.02-km sprinting throughout a game, which is 28 and 24% greater than for the non elite level, respectively.

Furthermore, it is the explosive actions such as sprints, jumps, tackling, duels, kicking, and changing pace, which will determine the outcome of a match and add to the overall demands on the athlete (Reilly et al 2000). These explosive actions are dependent on strength and speed characteristics of the individual player and should be developed from a young age.

Soccer is an intense multidirectional and intermittent field sport that demands technical ability, tactical awareness, and an exceptionally high level of physical conditioning to compete at the international level. The ability to objectively assess the physical performance has become a vital component for player development systems, player monitoring, and youth player identification at the national and international levels (Meylan et al., 2009; Buchheit et al., 2010).

Besides soccer-specific technical skills, individual and team tactical knowledge and particularly adequate levels of physical fitness constitute important prerequisites for success in soccer (Stolen et al., 2005). Typical soccer movements such as tackling, jumping, sprinting, shooting, and rapid change-of-directions require high levels of physical fitness (Meylan&Malatesta, 2009).These actions are crucial for optimal performance not only in adult (Faude et al., 2013) but also in youth soccer (Thomas etal., 2009; Marquesetal., 2013; Michailidisetal., 2013; Sohnlein et al., 2014), even though they

represent only a small but often decisive percentage of total match time. Therefore, identifying effective training methods to optimize performance are vital, especially in young soccer players. Currently, it is well-established that plyometric training is safe and appropriate tools for improving physical fitness of young soccer players (Michailidis et al., 2013; Sohnlein et al., 2014; de Villarreal et al., 2015).

Plyometric training is a form of exercise that utilizes the body's stretch reflex and eccentric muscle power con-tributes relatively little to aerobic performance, plyometric training helps develop general athletic ability, ballistic skills, kinesthetic awareness, rhythm and coordination. Soccer players, especially, can benefit from the develop-ment of the power and overall athleticism provided by plyometric exercise. Soccer players need to have the ability to respond quickly and powerfully on both offense and defense (Chapman et al., 2007).

Plyometric training has many advantages for the im-provement of athletes overall performance in various sport events including soccer. Plyometric training exercise im-prove explosive power, muscular strength, speed and quickness, agility, neuromuscular coordination, vertical jump performance, leg strength, muscular power, increase joint awareness and enhance soccer skill performances of the athletes. Plyometric training is widely used in condi-tioning, power training and in prevention and rehabilita-tion of injuries in some sports (Roopchand-Martin & Lue-Chin, 2010).

Given existing information on the efficacy of plyometric training that will be designed a 12-week training program consisting of a variety of plyometric exercises added to the normal in-season regimen, performed by the experimental group.

1.2 Statement of the Problem

Nowadays, female soccer shows a great deal of similarity to male soccer in terms of struggle, and properties based on technique-tactic and conditions. Actions such as power, running, direction changes, jumps, and short-distance sprint belong to lower extremity.

During a soccer match, short duration actions such as jumps, direction changes, and accelerations, all of which occur once in 4–6 seconds, are repeated 1,000– 1,400 times (Stolen, 2005).

Technique in a soccer game is exhibited by speed, power of lower extremity, and actions in which explosive power comes to the fore. As frequent use of these actions can influence the result of a game and optimal high performance (Stolen, et al.,2005;Chelly, et al., 2010) the need to develop these properties by different training occurs. One of the training methods that include these actions and that is used for power development is plyometric exercises. These kinds of exercises are characterized by stretch-shortening cycle (Malisoux et al., 2006; De Villarreal et al., 2010).

It can be used for upper and lower-body exercises. Especially for lower body, plyometric training (PT) is a method to improve vertical jump ability and leg muscle power (Markovic, et al., 2010) which is included in various types of jumps, like countermovement jumps (CMJ), the drop jump, and squat jump, hopping, alternate-leg bounding, and stretch-shortening cycle (De Villarreal et al., 2010). Also, PTs are found to increase kicking speed (Sedano et al., 2011) as well as strength, muscle power(Michailidis et al., 2013) coordination, agility (Thomaset al., 2009; Michailidis et al., 2013;) speed, and acceleration time (Kraemer, et al., 2000; Rimmer&Sleivert, 2000; &Siegler, et al., 2003) however, there are also reports about neutral impacts (Chimera, et al., 2004)) or negative impacts (Luebbers, et al., 2003). The controversial and scarce impacts of PT on female soccer players must also be pointed out. Chimera, et al., (2004) reported that 2 times per week for 6 weeks of PT increased small (5.8%) but in significant improvement in vertical jump in collegiate female soccer.

So, this is the sources of inspiration to the researcher to conduct a research on the effect of plyometric training on some selected physical fitness performances of female football project players. Moreover, as the studies on soccer are oriented at male soccer players and less study exists about female soccer players, more studies on this subject are required.

In spite of the opinion that PT is sufficient twice per week (Miller, et al., 2006) the researcher hypothesizes that 12-weeks low- high volume and low-intensity (non deep jump) PT, 2 days per week, will significantly increase power, speed, and agility performance in female U-17 soccer project trainees.

1.3. Research Hypothesis

Based on the above reasons the researcher tried to test the following hypothesis:

H1:1. Twelve weeks Plyometric training has a significant effect on agility performance of female soccer players.

H1:2. Twelve weeks Plyometric training has a significant effect on power performance of female soccer players'.

H1:3. Twelve weeks Plyometric training has a significant effect on speed performance of female soccer players'.

1.4. Objectives of the study

1.4.1. Generalobjective

The general objective for this study was to investigate the effect of twelve-week plyometric training on selected soccer specific fitness variables of U-17 female soccer project trainees.

1.4.2 Specific objectives

Specifically the objectives of this study were:

1. To determine the effect of twelve-week plyometric training on agility performance of female soccer players'.
2. To test the effect of twelve-week plyometric training on power performance of female soccer players'

3. To examine the effect of twelve-week plyometric training on speed performance of female soccer players'

1.5. Significances of the study

This study will be highly concerned on the effects of 12 weeks plyometric exercises on the enhancement of soccer related finesses on U-17 female soccer trainees. Therefore, this study would helpwomen soccer players provide a variety of exercise to engage in exercise program and to evaluate their performance following the training program.

The study will help to provide information about the relevance of plyometric training to improve player's performance through a designed program for those who want to improve soccer related fitness.

It will draw attentions of coaches, sport experts and players on the effects of plyometric training on power, agility and speed fitness tests of soccer projects trainees and The study will serve as important resource for those who want to pursue similar studies.

1.6. Delimitation of the study

Conducting the study in all fitness components will be difficult, challenging andunmanageable. As a result, this study basically, involves about the effect of twelve weeks lower extremity plyometric training packages on some selected soccer related fitness variables (agility, power and speed) of Abayminch U-17 female soccer project traineesin Sekela woreda. There are different types of tests to measure the skill related physical fitness components, but for the purpose of this particular research, it was delimited Twenty-meter sprint test for speed, The T-Test for agility, and Vertical jump test for power. Moreover, this study was delimited during the training season of 2021-2022 G.C.

1.7. Limitations of the study

Despite the attempts made to ensure reliability and validity of data to make this research complete, the following points might be considered as limitations of the study.

- The study focused on 12 weeks of plyometric training; hence, the findings may not be generalized and applicable to the other factors forspeed, agility andpower. Because other different factors or skills possess distinctive features, they require respective investigations.On the other hand, the sample players were taken regardless of players' position, so that the difference responsibilities of the players may have an impact on the results of this study.
- As the subjects participating in this study belong to various schools, therefore the factors such as nutrition, training, regular life activity, psychological and emotional strength etc, may be different and may not be controlled.
- The skill training given to the selected subjects by their coaches were not taken into consideration for this study. This may have considered as the limitation of the current study, though, important steps were taken to systematically handle this possible limitation.

1.8. Operational Definition of KeyTerms

Agility: The ability to explosively accelerate, decelerate, and change direction.

Perfromance: the ability to perform specific skill in efficient manner.

PhyscialFitness: An attained set of attributes that relates to the ability to perform physical activity.

Plyometric training; is a form of exercise that utilizes the body's stretch reflex and eccentric muscle contractions to enhance speed and power.

Power: a measurement of the ability to exert force at higher speeds. More precisely, power is the product of the force exerted on an object and the velocity of the object in the direction in which the force is exerted.

Speed: Displacement per unit time; usually quantified as the time taken to cover a fixed distance.

1.9. Organization of the Study

This experimental research was organized in five chapters. The first chapter presents the background of the study, incorporating the discussions about the effect of plyometric training on some selected physical fitness performances; speed, agility and power, and all of them are succinctly described in this section. This chapter also comprises the statement of the problem, research hypotheses, general objective of the study, specific objectives, and significance of the study, delimitation of the study, limitation of the study, operational definitions of key terms and organization of the study in detail.

Chapter two concentrates on a review of related literature. In this section, relevant research works of both conceptual and empirical analysis was thorough and deeply reviewed so as to support and substantiate the problem and the findings of the study utmost and the missing part that needs to be fulfilled.

The third chapter of this study explains the research methods that include the description of the study area, the research approach, research design, study population, sample and sampling techniques, source of data, data collection instrumentation, method and procedure of data collection, exercise training protocol, method of data analysis, ethical consideration were discussed in detail.

In chapter four the results obtained in the study and analysis were presented, which investigates the nature of the effect of plyometric training on some selected physical fitness perfomances; speed, agility and power at Sekela u-17 football project trainees. In addition, this chapter portraits discussion of the results with the existing and past research works scrutinized in line with the present findings.

Finally, in chapter five summaries of the study presented, based on the findings, conclusions, recommendations, and directions for intervention avowed to possible improvement for future research.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1. An overview of Plyometric Training

The word “plyometrics” has roots in the Greek word “pleythyein” which means to increase or augment. Though eastern countries used plyometric techniques in the 60s, but it came to the attention of the west during the 1970s. The leading researcher of plyometric training was a Russian scientist named Yuri Verkhoshansky. Dr. Verkhoshansky developed a system of exercises called “Jump Training” that used repetitive jumping in order to increase the speed and explosiveness of Russian track and field athletes. He published the results of his studies on this new form of training in 1964. Two years later he entered into scientific research. In his research, the use falling weight’s kinetic energy to increase the strength effort was adapted further for upper body explosive movements. He named this discovery the “shock method” (Natalia v erkhoshansky, 2012).

The term plyometric was first used in 1975 by an American track and field coach named Fred Wilt after he performed an extensive study of Dr. Verkoshansky’s training methods. Fred derived the word from the Latin words “pilo” and “metrics”. Pilo means more and metrics means to measure. By about 1980 had become a valuable tool in major athletic programs. In the early 1990s, George Davies and Kevin Wilk introduced plyometrics into rehabilitation (Natalia v erkhoshansky, 2012).

Plyometric training is a form of exercise that utilizes the body’s stretch reflex and eccentric muscle contractions to enhance speed and power. Though explosive power contributes relatively little to aerobic performance, plyometric training helps develop general athletic ability, ballistic skills, kinesthetic awareness, rhythm and coordination. Soccer players, especially, can benefit from the development of the power and overall athleticism provided by plyometric exercise. Soccer players need to have the ability to respond quickly and powerfully on both offense and defense (Chapman et al., 2007).

Plyometric training has many advantages for the improvement of athletes overall performance in various sport events including soccer. Plyometric training exercise improve explosive power, muscular strength, speed and quickness, agility, neuromuscular coordination, vertical jump performance, leg strength, muscular power, increase joint awareness and enhance soccer skill performances of the athletes. Plyometric training is widely used in conditioning, power training and in prevention and rehabilitation of injuries in some sports (Roopchand-Martin &LueChin, 2010).

Generally, plyometric training is seen as one of the most successful techniques to provide speed and strength in order to increase the muscle strength of the legs and to improve the development of the leg muscles by increasing the bounce feature, to make the athlete higher jumps during the game and to react instantly when needed in the game. If the space between speed and strength can be filled with plyometric studies, weight training performed in plyometric training is seen as one of the most useful techniques for the development of this feature (Rannou et al., 2001; Göllü, 2006). Training programs made with plyometric exercises make positive contributions to motor features such as speed and power. Strength training with plyometric training causes hypertrophy in muscles. This increase in muscle strength is directly proportional to the increase in performance improvement (Paul et al., 2003).

Plyometric training is a form of conditioning with increasing popularity that involves the performance of body weight jumping type exercises with the use of the stretchshortening cycle muscle action (Meylan and Malatesta, 2009). The stretch and shortening cycle improves the capacity of the neural and musculotendinous systems to produce the maximal amount of force in the shortest possible time, a fact that makes plyometric training a combination of power and speed (Markovic and Mikulic, 2010) According to Wang and Chang, 2016 plyometric training consists of dynamic and rapid stretching of muscles (eccentric action) that is instantly followed by a concentric of shortening action of the same muscles and connective tissues. The purpose of plyometric training is to increase the power of subsequent movements using both natural elastic components of muscle and tendon and the stretch reflex (Bedoya et al, 2015). The great advantage of plyometric training is that it uses the stored elastic energy of the muscles, something that

cannot be produced by a concentric contraction alone (Wang and Chang, 2016). Plyometric training programmes typically include explosive exercises such as bounding, hopping and drop jumping and the shortest time of ground touch as it is followed by a rapid movement on the opposite vertical side (Wang and Chang, 2016). This kind of plyometric exercises is shown that can be beneficial for a variety of sports that require explosive actions like sprinting, jumping and change of direction speed. More specifically, a variety of studies (Michailidis et al 2013; Söhnlein, et al 2014; Loturco et al, 2015; Saez et al, 2015; De Hoyo et al, 2016) has shown plyometric training to be beneficial for the enhancement of performance of young soccer players on aspects like jumping, sprinting, kicking and agility. According to the studies of Behm et al, 2008 and Faigenbaum et al, 2009 the plyometric training can be beneficial for youth populations, when is applied according to particular guidelines in order to decrease the risk of injury. The benefits of plyometric training in young athletes consist of increase in neuromuscular function and enhanced bone density.

2.2. Physiological Adaptations to Plyometric Training

PT elicits a variety of physiological adaptations, both structural and neural. Changes in muscle size and/or architecture are common (Ramirez-Campilloet al., 2013) whereas reductions in fat mass are not usually seen Guadalupe-Grauet al., 2009.Traditional resistance training (RT) elicits similar training adaptations. Typically RT uses higher training volumes and allows for more concentrated eccentric loading. It therefore makes sense to combine RT and PT when programming for performance enhancement to maximize these training adaptations. Vissing et al. compared RT and PT programs over a 12-week period. They observed increased quadriceps, hamstring, and adductor whole-muscle cross-sectional area (CSA) by 7 and 10%, respectively, whereas total muscle size increased both with PT and RT (Struminger et al., 2013). A study by Chelly et al. (2010) found increases in thigh muscle volume were not accompanied by change in leg muscle volume and mean thigh CSA with PT.

More common structural changes relate to changes in the mechanical characteristics of the muscle-tendon complex and single-fiber mechanics (Ramirez-Campillo et al., 2013).

Increases in single muscle fiber diameters of 10% in type IIa, 11% in type I, and 15% in hybrid type IIa/x fibers have been reported (Malisoux et al., 2006).The most commonly examined area of structural change from PT involves analysis of the plantar flexor tendon responses such as stiffness (Markovic G and Mikulic P. 2010;Wilkerson et al., 2004)transmission of force Markovic G and Mikulic P. 2010), and CSA (Markovic &Mikulic 2010; Myer et al., 2006). Comparisons of these factors between traditional RT and PT have shown that changes in jump performance relate to changes in the MTC (Tsang&DiPasquale, 2003).

However, Foure et al. observed no change in joint stiffness (Foure et al., 2010) whereas King et al. observed increased joint stiffness (King&Cipriani, 2010). This presents conflicting outcomes as a result of PT. Interestingly; Kuboet al., (2007) attributed increased tendon stiffness to traditional RT but did not investigate the effects of PT. To date, no studies have compared the two types of training.

A study by Carter et al. found PT and isometric contraction interventions showed increased tendon stiffness in both groups where the difference in the extent of tendon stiffness changes accounted for 21% of the variance in performance improvement in jump height (Carter et al., 2007). These results are supported by a series of studies by Foure et al. investigating the effect of PT on the Achilles tendon complex (Foure et al., 2010; Foure et al., 2012) After 14 weeks PT, increases in tendon stiffness of 24.1% with no concurrent increase in tendon CSA indicated that these mechanical changes in the tendon were a qualitative rather than quantitative change.

Any performance enhancement resulting from PT training may be due to improved force transmission (Myer et al., 2006) by a reduction in energy dissipation (Foure et al., 2010). The studies also suggested that the changes were limited to the Achilles tendon complex with no resultant changes in stiffness observed in the gastrocnemius tendon complex or ankle joint itself (Foure et al., 2012). The gastrocnemius muscle did however exhibit changes in stiffness of 133% after 14 weeks PT training compared with the control group. The PT group demonstrated an improvement in squat jump (SJ) and reactive jumps of 117 and 119%, respectively (Foure et al., 2009). The physiological adaptations of

neuromuscular function to PT include increased neural drive to agonist muscles and changes in muscle activation strategies related to the SSC (Markovic&Mikulic, 2010).

Specifically, changes have been observed in hip abduction/adduction and knee flexion angles Wilkerson et al., 2004). Both PT and balance training improved measures of lower extremity valgus during drop-jump landing where PT showed greater benefits for 2-foot landing tasks (Myer et al., 2006). In the acute phase, PT demonstrates similar training-induced muscle damage responses as traditional RT (Tofas et al., 2008). Excessive training volumes can induce neuromuscular impairments that can result in suboptimal training (Drinkwater et al., 2009). Evidence suggests that PT causes damage to predominantly type II muscle fibers. Clearly distinguishable moderate and severe sarcomere damage in type II muscle fibers of both glycolytic and oxidative subtypes (86% and 84%, respectively, have been identified) compared with 27% in slow-twitch fibers (Macaluso et al., 2012).

Elevated creatine kinase and lactate dehydrogenase levels (other measures of acute muscle damage) were reported 72 hours after PT with a concurrent increase in delayed onset muscle soreness over the first 48 hours after training (Tofas et al., 2008). Immunological measures of muscle damage in the acute phase response have been mirrored along a similar timeline, by reduction in jumping performance (Chatzinikolaou et al., 2010; Cadore, et al., 2013) and rate of force development; thus providing evidence that acute responses are primarily a consequence of peripheral fatigue. Hence, adequate recovery between bouts of PT is imperative (Drinkwater et al., 2009). By contrast, no differences in acute hormonal, metabolic, or neuromuscular responses to PT, regardless of repetition number, have been reported (Bishop et al., 2009).

2.3. Physical and physiological demands of soccer Game

Soccer is a game which requires very fast body movement which is determined by situations within the competition such as opposing team‘s player with and without the ball, ball movement and teammate movement. Because of these reasons, modern soccer game is characterized by fast movements, which become prominent in short and long

sprints, explosive reactions (jump) and quick changes of direction (Kapidzicet al.,2011). Soccer is a complex sport and performance depends on a number of factors, such as physical fitness, psychological factors, player technique and team tactics (Arnasonet al., 2004).

Soccer-specific activities such as tackling, heading, passing, shooting, controlling the ball, maintaining balance and holding body position when under defensive pressure, jointly comprise the physical demands of the sport (Stolen et al., 2005). It appears that the physical match demands have become more challenging in recent years (Strudwick and Reilly, 2001) and this has implication for preparation, training and nutritional program of players (Reilly and Gilbourne, 2003).

The number of changes in modern football has postulated to be greater than previously report, because it is generally, accepted that the game is continuously becoming faster and more athletically challenging than before (Al-Hazzaaet al., 2001). Most high-level players share some physiological characteristics (Mohr et al., 2003). Analysis of football matches has determined that football consists of many different physiological variables; these are aerobic power, anaerobic power, musculature strength, agility, repeated sprint ability and flexibility (Bloomfield et al., 2007; Randers et al., 2010). As supposed by various physiological parameters have been shown to have strong correlations with football performance (Turner et al., 2011).

2.4. The Effect of PT for Soccer Players

Plyometric jump training (PJT) is widely and frequently used in soccer to improve players' physical fitness (Sedano Campo et al., 2009; Ozbar et al., 2014; Ramirez-Campillo et al., 2016c). In general, PJT involves quick and powerful multi-joint movements like jumping, hopping, and skipping. These movements are characterized by rapid eccentric phases, immediately followed by high-velocity concentric muscular actions that are potentiated through the stretch reflex (Taube et al., 2012).

More specifically, there is ample evidence that PJT is beneficial to improve components of physical fitness in female soccer players (Ozbar et al., 2014; Ramrez-Campillo et al., 2016). These benefits range from increases in lower muscle power, speed (i.e., linear sprint), change of direction ability (CoDA), kicking distance and velocity, repeated-sprint performance, aerobic endurance, and body composition (Ozbar et al., 2014; Ramrez-Campillo et al., 2016). Of note, these adaptive processes constitute key physical fitness characteristics that, in addition to technical and tactical qualities, contribute to performance in female soccer (Arnason et al., 2004; Spencer et al., 2005; Datson et al., 2014). PJT-related physiological adaptations primarily involve the central and peripheral nervous systems (Markovicand&Mikulic, 2010; Taube et al., 2012). In addition, there is evidence for somatic and musculoskeletal adaptations (Sedano Campo et al., 2009; Markovic&Mikulic, 2010; Alvarez et al., 2012).

2.5. Studies Related To Plyometric Training on Improving Speed, Agility and Power

Meylan and Malatesta (2009) studied the effect of plyometric training on agility and speed with experimental and control group. Length: 8 weeks Soccer players. Total: 25 TG: n= 14 CG: n=11 Age: 13.2 ± 0.6 years. TG performed various plyometric drills for 20 to 25 minutes as a substitute for some soccer drills within the usual 90- minute practice twice per week. Plyometric drills included multiple jumps (ankle hop, vertical and lateral hurdle jump), horizontal and lateral bounding, skipping, and footwork (speed ladder). CG did regular soccer training only. Tests were linear sprint test, agility test and countermovement jump. The TG has showed beneficial impact on linear sprint training (-2.1%, $p = 0.004$), agility (-9.6%, $p < 0.004$) where as CG: No significant changes.

Rubley et al, (2011) studied the effect of plyometric training on vertical jump performance (power) with mixed-model experimental design with one intervention group and one control group. The training had 14 weeks Length and subjects were Soccer players. Total: n=16 PTG: n=10 CG: n=6 Age: 13.4 ± 0.5 years. PTG did various types of jumps, hops, skips, footwork, and sprint drills. First 6 weeks: single-leg forward hops

over 6-inch cones, double-leg hops over 10- inch hurdles, lateral hops over 10-inch hurdles, and lateral shuffles over a 12-inch box. Final 6 weeks: 10-inch box jumpups, 10-inch depth jumps, and cutting drills. CG did regular soccer training only. Tests were Vertical jump test. PTG showedsignificant increases of performance in vertical jump distance after 14 weeks significant increase in vertical jump after 14 weeks but CG showed no significant changes.

RamírezCampillo et al, (2014) studied the effect of plyometric training on agility, speed and power with experimental and control group. The Lengthof intervention was7 weeks and subjects were Soccer players. Total: n=76 TG: n=38 CG: n=38 Age: 13.2 ± 1.8 years TG did Plyometric drills including 2 sets of 10 repetitions of drop jumps from 20, 40, and 60 cm (i.e., 60 contacts) performed on a grass soccer field. CG did regular soccer training only. Tests used to measure their performance were linear sprint test, agility test, countermovement jump test, drop jump, maximal kicking test for distance 2.4-km time trial test. TG: Plyometric training induced significant improvements in countermovement jump (4.3%), drop jump (16%) and agility (-3.5%) maximal kicking distance (14%) and had nonsignificant effect on sprinting. CG showed no significant changes.

Söhnlein, Q, Müller, E, & Stöggl, T (2014), studied the effect of plyometric training on agility, speed and power with experimental and control group. The study used experimental study design with one intervention and one control group. The study had 16 weeks Length and participants were Soccer players. Total: n=22 PTG: n=12 Age: 12.3 0.8 years CG: n=10 Age: 13.0 ± 0.9. By PTG did the following jumps were performed during every vertical horizontal PT session: 2-footed ankle hop forward, hurdle jumps (with height increasing during the 16 weeks), single leg hop forward, and squat jump. During every lateral PT session, the following jumps were performed: lateral bound stabilization, lateral hurdle jumps, double leg zigzag, and single leg hop lateral. CG did regular soccer training only. Tests were linear sprint test, shuttle run test and standing long jump test PTG showed Significant improvements ($p<0.05$)in sprinting (-3.2%, agility (- 6.1%) and long jump performance (+7.3%) where as CG no significant changes

RamírezCampillo et al, (2015) studied the effect of 6 weeks plyometric training on agility, speed and power with experimental and control group. Total: n=54 CG: n=14 BG: n=12 UG: n=16 B + UG: n=12 Age: 11.4 ± 2.2 years BG did Bilateral horizontal and vertical jumping exercises UG did Vertical and horizontal jumping exercises on both right and left leg B + UG did Bilateral and unilateral vertical and horizontal jumping exercises on both legs. CG did only regular soccer training only. Tests were counter movement jump test and drop jump test, maximal kicking velocity, linear sprint test, agility test, endurance test and balance performance test BG, UG, B+UG showed significant changes, in maximal kicking velocity, sprinting and agility in all groups. CG showed no significant changes

Campillo et al, (2015) studied the effect of 6 weeks plyometric training on agility, speed and power with experimental and control group. Total: n=40 VG: n=10 HG: n=10 VHG: n=10 CG: n=10 VG did vertical unilateral and bilateral plyometric exercises. HG did horizontal unilateral and bilateral plyometric exercises. VHG did vertical and horizontal unilateral and bilateral plyometric exercises CG did regular soccer training only. Countermovement jump tests, drop jump test, reactive strength index, maximal kicking velocity, linear sprint test were used. VHG showed siignificant changes in jumping, sprinting, agility whereas VG, HG and CG showed no significant changes.

Michailidis (2015) studied the effect of 10 weeks plyometric training on agility, speed and power of soccer players with experimental and control group. The total n=21 JG: n= 11 CG: n=10 Age: 11.4± 0.6 JG did jumping exercises (one and two leg) and running (skipping) exercises. CG: Regular soccer training only. Tests were linear sprint test, standing long jump. JG showed significant changes in jumping and sprinting where as CG no significant changes.

Negra et al, (2016) studied the effect of 8 weeks plyometric training on agility, speed and power of soccer players with experimental and control group. The study used experimental study design with one intervention and one control group. Total: n=28 EG: n=15 CG: n=13 Age: 15.7 ± 0.2 years. E: Plyometric training program consisting of hurdle and drop jumps. CG did regular soccer training only. Tests: - agility tests - linear

sprint tests. Significant gains in jumping, sprinting and agility tests were seen in EG whereas no significant changes were seen in CG.

Chaabène and Negra (2017) studied the effect of 8 weeks plyometric training on agility, speed and power of soccer players with experimental and control group. Total: n=25 LPT: n=13 years HPT: n=12 Age = 12.70± 0.25 years The two experimental groups participated in an 8-weeks in-seasonPT program with 2 training sessions per-week. Both groups conducted five soccer training sessions per-week and two plyometric training sessions were integrated into the regular soccer training routine every first PT session in each week was focused on improving the vertical leap (i.e., CMJs), whereas every second PT session was focused on improving the horizontal jumping ability (i.e., two-footed ankle hop forward). Players were instructed to perform at maximal intensity. Tests were linear sprint test, agility, vertical jump test, counter-movement jump test, horizontal standinglong-jump test LPT, HPT. Significant effects on sprinting (p=0.05), agility (p=0.02), horizontal (p=0.07) and vertical jump ability (p=0.08) were observed on both groups.

However, the optimal PJT design that improves components of physical fitness in amateur female soccer still needs to be elucidated (Ramirez-Campillo et al., 2018). In a recent scoping review (Ramirez-Campillo et al., 2018) identified four randomized controlled trials only that examined the effects of PJT in female soccer players. These studies adopted different methodological training approaches (Sedano Campo et al., 2009; Ozbar et al., 2014; Ramirez-Campillo et al., 2016; RamrezCampillo et al., 2016), which do not allow to elucidate optimal PJT program parameters for female soccer players. Thus, further comparative studies are needed to elucidate optimal PJT modalities (i.e., intensity, volume, frequency, etc.) for this group of athletes. An important PJT modality is training frequency (Ramirez et al., 2018), usually reported as the number of training sessions performed during a given period of time (i.e., 1 week).

A previous study (Sedano Campo et al., 2009) examined the effects of a 12 week PJT with 3 sessions per week in amateur female soccer players aged 23 years and observed significant improvements in countermovement jump (CMJ; 114.5%), drop-jump (DJ;

116.1%), and maximal kicking velocity (MKV) performance in the dominant (111.9%) and non-dominant leg (113.2%). In another study (Ozbar et al., 2014), 8 weeks of PJT with a frequency of one session per week significantly improved triple-jump distance of the dominant (112.1%) and non-dominant leg (115.7%), standing broad jump distance (15.2%), CMJ height (117.6%), CMJ peak power (110.8%), and 20-m sprint-time (18.1%) in amateur female soccer players aged 18 years.

Similarly, following 6 weeks of PJT with two sessions per week, a previous work (Ramirez-Campillo et al., 2016c) demonstrated significant improvements in CMJ height (110.7%), CMJ height with arm swing (18.3%), the reactive-strength index (121.5%), the medicine ball throwing test (16.7%), the 30-m sprint-time test (15.2%), a CoDA test (14.0%), and aerobic performance in the 20-m shuttle run test (19.7%) in amateur female soccer players aged 22 years.

Of note, the effects of different PJT frequencies have previously been analyzed in futsal players (Yanci et al., 2017), and in prepuberal male soccer players (Bouguezzi et al., 2018). Yanci et al. (2017) examined the effects of one vs. two PJT sessions on components of physical fitness in male futsal soccer players aged 24 years while controlling for weekly training volume. It was found that two PJT sessions per week significantly improved CoDA performance (14.8%) and vertical as well as horizontal jump performance (13.4 to 115.3%). One PJT session per week improved 15-m linear sprint-time (12.4%) and repeated-sprint performance (12.4 to 15.1%).

Bouguezzi et al. (2018) studied the effects of an 8-week PJT with either one vs. two sessions per week on components of physical fitness in prepuberal soccer players. These authors reported comparable performance improvements irrespective of training frequency in measures of muscle strength and power, CoDA performance, and kicking distance. However, none of the aforementioned studies examined the effects of different PJT frequencies on components of physical fitness in adult female soccer players. Considering that the effects of PJT could partially be moderated by factors such as sex (De Villarreal et al., 2009) and age (i.e., maturation) (Asadi et al., 2017, 2018; Moran et

al., 2017), further research is needed to elucidate the effects of different PJT frequencies in adult female athletes.

2.6. Assessment of Soccer Players Performance

The main reason of testing and measurement are at the heart of athletes progress is that they determine where an individual currently stands regarding his or her training status and, more importantly, where he or she is headed. The final outcome of any training program is to arrive at a peak level of performance or to achieve some predetermined goals. And also due to the following reasons:

Information from performance assessments can help practitioners to determine the type, quantity and rate of training (extremely important during rehabilitation) as well as determining competitive strategies such as the rate or pattern of play (Meyers, 2006). More effective preparation can be achieved through minimizing training errors and providing greater control over coaching interventions. The methods of assessment used depend greatly on the requirements of the individual sport or event, the availability of equipment and facilities, the practicality of assessment and the personal perspectives of the researcher (Maud, 2006).

Similarly, it is recognized that to be effective, assessment procedures should be specific and valid and resulting measures should be reproducible and sensitive to changes in performance (Winter et al., 2007). When testing sports performers, the single most important aim is quality control (Stratton et al., 2004). To accurately evaluate athletes, proper tests must be chosen that allow an in-depth view of an individual‘s performance level. This is best accomplished by choosing specific tests designed to measure only one aspect of human performance. Often many separate tests were required to precisely measure an athlete‘s state of training, and each test should be chosen with risks and outcomes in mind. Sport coaches sometimes make choices based on anecdotal evidence or use insensitive tests that are incapable of discriminating variable human performance. The proper procedure is to first determine what the desired outcome is, then design a test and measurement protocol around that outcome (Brown and Weir, 2001).

Tests chosen should be specific to the sport and to the population being tested. Fitness staff, technical coaches and managers to have an objective understanding of their player‘s physical condition it is necessary to profile players through fitness assessment. There are a laboratory or field based tests can be applied but it depends up on the purpose and objectives of the tests. Field assessment of soccer players often incorporate more functional movement patterns thus increasing the validity of these tests. Field tests have the advantage that all players in a team can be tested frequently, easily and rapidly at low cost (Krustrupet al., 2005).

By considering the above thoughts for this study the researcher designed a field test battery to test the performance of the trainees for the investigation. Various tests have been designed for field sports either to be part of an overall assessment battery or to measure specific components of performance. In this study the researcher designed Illinois agility test, (test Agility of the athletes), 20 metrers sprint (to test the subjects speed), and Vertical jump test (to test the power of lower extremities of the soccer players).

CHAPTER THREE

RESEARCH METHODS

In this section; description of the study area, experimental materials, source of data, treatment and study design; description of population and sampling methods, methods and procedures of data collection, experimental measurements, methods of data analysis, data quality control and ethical considerations are discussed.

3.1. Description of Study Area

The study was conducted at Gish Abay Town in SekelaWoreda. Sekela is one of the fifteen Woredas in West Gojjam Zone of Amhara National Regional State. It is located at 459 Kms in North West of Addis Ababa, the capital of Ethiopia; it is 160 Kms in South East of Bahir Dar, the capital of Amhara National Regional State, and 74 Kms in North East of Finote Selam, the capital town of West Gojjam Zone. The district is bordered on Southwest by Bure Woreda, on the West by Agew Awi Zone, on the North by Mecha Woreda, on the East by Quarit Woreda and on the South East by Jabi Tehnan. The administrative center of Sekela Woreda is Gish Abay town. The district has a total of 27 kebeles of which 26 are rural based kebeles and only 1 is urban kebeles.

According to Sekela woreda Education office 2017, the total population of the district was 162,204 of which male accounts for 79,071 (48.7%) and female accounts 83,133 (51.3%) of the total population. Besides from 48.7% of male population of the district, 92.65% of them are living in rural areas and the remaining 7.35% are urban residents. In addition to that, from the 51.3% female populations of the district, 91.35% of them are living in the rural areas and the other 8.65% are urban dwellers. The estimated total area coverage of the district is 6534.5 hectares. It is located at an elevation of 3062 meter above sea level and 10˚55'0" N latitude and 37˚31'60" E longitude. The average annual rainfall of the area ranges from 1600mm to 1800mm with an average temperature of 18^{o}C. The district is characterized by 70% highland (Dega), 18% midland (Woynadega) and 12 % lowland (Qola) agro-ecological zones.

According to Sekela woreda Education office 2017, almost all the population of the district are Amhara ethnic groups and 99.94% of them are Amharic language speakers and 99.96% of the populations in study area are followers of Orthodox Christianity religion and the remaining 0.04% of them are other religion followers. The longest river in the world, Blue Nile starts its long journey at its base.

3.2. Research Approach

This study used quantitative type of research approachbecause; this approach would be used for testing objective theories by examining the relationship among variables (Creswell, 2012). These variables, in turn, can be measured, typically on instruments, so that numbered data can be collected and analyzed using statistical procedures.

3.3. Research Design

To achieve the objective of studytrue experimental design in a pre and posttest approach was employed. Before the exercise program both experimental and control groups were tested then, with the same measuring tests all subjects were tested again after the consecutive 12 weeks of plyometric training program.

3.4 Population, Sample Size and Sampling Techniques

The target population of this study was Female u-17 soccer project trainees who were found at Sekela town. The total numbers of players at this team were 30. All were females and the populations were so little in number, all players were taken as a sample by utilizing comprehensive sampling technique. These research participants were randomly assigned in to control (CG) and experimental group (EG).

3.5. Source of Data

The source of data in the study wasprimary data from these research participant trainees through field tests. Tests such as agility (Agility T-Agility test), power (vertical jump test), and speed (20 meters sped test).

3.6. Inclusion and Exclusion Criteria

The health status of the subject were assessed by physical activity readiness questionnaire and the subjects who were free from any injury, impairment or disability and chronic disease were included for the study and subjects who could not fulfill these criteria were excluded.

3.7. Variables of the Study

The independent variableof the study: The independent variables were the treatment effect of the 12-week plyometric training program.

The dependent variables: The dependent variableswere power, speed and agility of soccer players.

3.8. Data Collection instruments

Since the research design is true experimental research design, the data were collected through field skill test of study participants. So the data was collected through field test of agility, power and speed of soccer players at Sekela soccer Project players. The tests were measured by using standardized test items included: vertical jump height test for power test, T-agility test for agility, and 20-meter acceleration test for speed.

3.9. Procedures for administration of fitness tests

3.9.1. General Testing Procedure

Warm-up was standardized for all tests as follows: 5-minute running, 10-minute strength and flexibility exercises using their own body weight, 2-minute dynamic stretching, and 5-minute sprint-specific warm up. All tests will be separated by a 5–10 minutes of break. Each participant had 2 trials for each test; the best performances of each test were recorded. All tests were performed outdoors on the pitch with participants wearing their regular training kit and soccer boots. Before the administration of the test the trainees were given chance to practice the prescribed test so that they become familiar with the test and know exactly what to be done and how to use the equipments. To make the testing condition uniform, all the subjects took the test only during the morning session.

Three tests conducted both pre-training and post-training were used to determine speed, agility, and leg muscle power outcomes. A 20-meter sprint test will be used to determine speed. T-test agility to determine agility and vertical jump test were used to determine leg muscle power (Asadi&Arazi, 2012).

3.9.1.1. Twenty-meter sprint test

Purpose: The objective of this test was to monitor the development of the soccer player's ability to effectively and efficiently accelerate from a standing start orfrom starting blocks to maximum speed.

Equipments: To undertake this test: 400m field with a 20m marked section on the straight and stop watch were required.

Procedures: The test was performed on an outdoorsoccer pitch. The subjects started to sprint from a standing position behind the start line when they are ready. Sprint times were recorded using a hand-held stopwatch. On command, the individuals were instructed to run 20 meters as fast as possible over the distance. When

they crossed the finish line, the time was stopped on the hand-held stopwatch (Asadi, 2011; Asadi&Arazi, 2012; Markovic, Jukic, Milanovic, &Metikos, 2007).

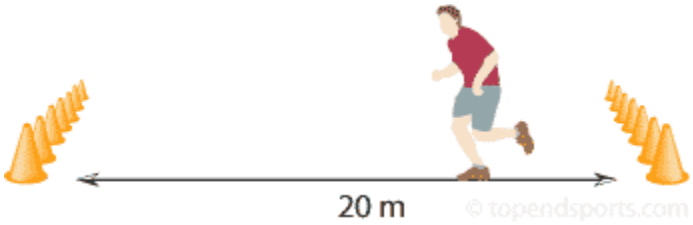

Figure 1. 20 meters speed test

Scoring: The fastest time were recorded.

3.9.1.2. The T-Test

Purpose: The purpose of this test was to measure the player's gility.

Equipment:A marked football field (flat surface that offers good traction), Measuring tape, four cones, Stopwatch and Timing gates (optional)

Procedure: The client started at cone A. On the trainer's command, the client sprinted to cone B and touched the base of the cone with the right hand. He or she then shuffled left to cone C and touches the base of the cone with the left hand. He or she then shuffled right to cone D and touch the base of the cone with the right hand. He or she then shuffled back to cone B and touch the base with the right hand before running backward to the start (cone A). Stop the stopwatch as the client passes cone A. The T-test was performed three times with a few minutes of recovery between each test.

Scoring: Record the fastest time on a testing form

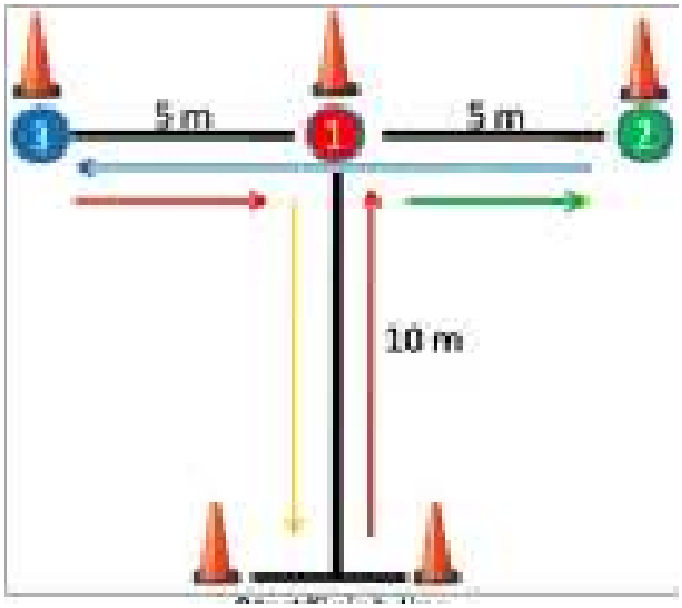

Figure 2. The T-test

3.9.1.3. Vertical jump test

Purpose: This test measured the player's leg power.

Equipment: A smooth wall with a ceiling high enough to measure maximum jump height, Measuring device, e.g. stick, tape measure and Chalk.

Procedure: The first step was to measure the player's standing height. The player stood side on with the dominant shoulder facing the wall. The player then reached up with the dominant arm and the standing height was measured at the point of their fingertips. The athlete was then ready to attempt the first jump attempt. The player was allowed to bend (flex) the knees and swing the arms prior to the jump. The player was not alloweda run up nordo shuffles step prior to the jump. The player was allowed a maximum of two efforts after a thorough warm-up. At the highest point of the jump the player reaches up and touches the wall, making a chalk mark. The player's vertical jump score was measured as the distance between the standing height and the jump height.

Scoring: The standing height is subtracted from the jump height and recorded as the vertical jump score. The highest value (cm) is recorded.

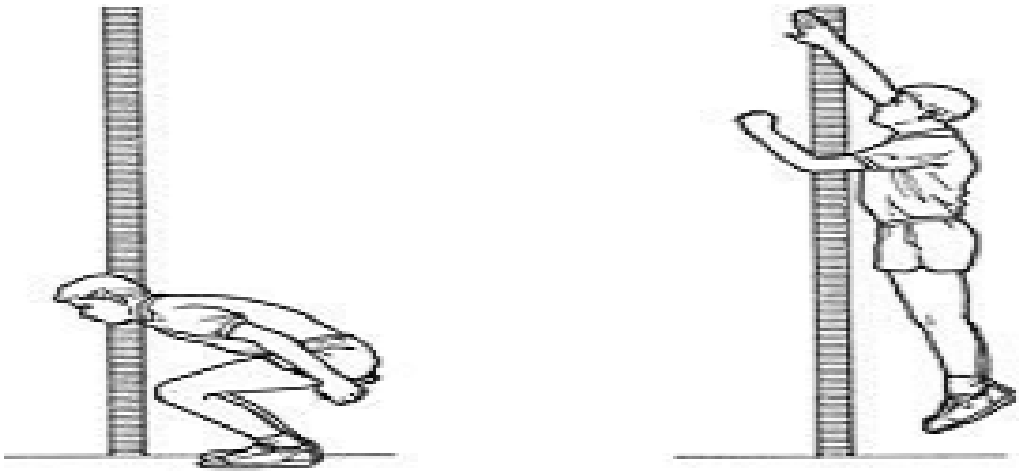

Figure 3. The vertical jump test

3.10. Training Protocols

The plyometric training group participated in a 12-week training program performing a variety of plyometric exercises designed, while the control groupdid not participate in any plyometric exercises. It was performed one plyometric training session per week because amateur footballers have been involved who perform fewer training sessions per week than professional footballers.The intensity of training was tapered so that fatigue would not be a factor during post-testing. The plyometric traininggroup took trainining at the same time of day, one day a week (on Tuesday), throughout the study. The duration of the plyometric exercises' session was gradual, ranging from a minimum of 30 minutes of the first session up to a maximum of 60 minutes. During thetraining, all subjects were supervised and instructed on how to perform each exercise.

3.11. Methods of data analysis

A quantitative method of data analysis was used for the collected data from performance tests**.** After administering a field test on selected soccerfitness skill variables before and immediately after intervention of plyometric training, the researcher recorded these

quantitative data in the form of pre test and post test results. The collected data was analyzed and interpreted into a meaningful idea using a computer in order to compare soccer fitness skill variables and to observe changes among groups. The significance level of the study was set at $p \leq 0.05$. Measures of central tendency like mean and measures of dispersion like standard deviation was used to summarize and describe the findings and the researcher used paired sample t-test for data entry and analysis. The statistical software package SPSS version 25 was used.

3.12. Data Quality Control

To reduce the mistake that was occurred during data collection process, assistant data collectors and trainers had gotten training how to collect and organize the data. In addition to that practical test, measurements wasrecorded with photograph for farther check on test and measurement procedures and protocols.

3.13. Ethical Considerations

The study dealt with the ethical issues and code of conduct related to the investigation. It made participants guarantee and confidential of the information that was given to the study and risk of harm due to participations. Therefore, the study was conducted according to the rules, regulations, policies and code of ethics of Bahirdar University.

CHAPTER FOUR

RESULT AND DISCUSSION

Overview

The purpose of this study was to investigate the effect of 12 weeks plyometric training on selected skill related fitness performance of u-17female soccer project players. The selected variables for this study were power, agility and speed. The selected performance tests for this study were Agility T-test, 20 meters speed test and standing long jump test. Pre-test and post-tests were taken from both experimental and control groups before and after 12 weeks of plyometric training and the scores were recorded. The collected data were analyzed using paired sample t-test to analyzed pre-test and post-test results for both groups.

4.1. Results of the study

4.1.1. Baseline characteristics of the trainees

Table 1. *Baseline Characteristics of study participants*

Category	Control Group (N = 15)	Intervention Group (N = 15)
	M ± SD	M ± SD
20-M	4.3± 0.32sec	4.32 ± 0.29
T-AT	14.7± 0.37sec	14.9 ± 0.34
VJT	44.3±3.58cm	44.5±4.5cm

Table 1 provided detailed statistics on the pre-test results of speed, agility and power for for the control and intervention group. As shown in the table, the participants were 30 female soccer players. Of them 15 are CG and the rest 15 EG. As the a table indicated that mean and standard deviation skill variables pretest with regard to experimental and control group were 4.3 and 4.4 for speed and the standard deviation was ±0.32and ±0.29 respectively. On the other side in case ofagility, the mean values of the experimental and control group were

15.02 and 14.9 and the standard deviation values were ±0.37 and ±0.34respectively. And also the mean values of experimental and control groups in power were 46and 45cm and standard deviation values of were ±3.58cmand ±4.5 cmrespectively. The findings of the study show that experimental group and control group have no significant difference in speed, agility and power observed in pre-testing. Therefore, these randomized groups as experimental and control were most probably equivalent in their pretest results.

4.1.2. Effect of Plyometric Training on Speed, Agility and power of soccer Players

Table 2. *Descriptive Statistics on the PT and PoT results of the dependent variables*

Variable	Test	CG(N=15)		EG(N=15)	
		Mean	Std. Deviation	Mean	Std. Deviation
20-M	Pre test	4.3	0.32	4.32	0.29
	post test	4.28	0.24	4.09	0.31
T-T	Pre test	14.7	0.37	14.9	0.54
	post test	14.71	0.3	12.27	0.32
VJT	Pretest	44.3	3.58	44.5	4.5
	post test	44.8	4.20	53.3	2.3

As described in table 2 above the pre test result of 20-M run test of CG and EG was (M =4.3, SD = 0.32) and (M =4.4, SD = 0.29) respectively. After the 12 weeks of plyometric intervention, this result become (M =4.2, SD = 0.24) for CG and (M =4.1, SD = 0.31) for EG respectively. The comparison was statistically significant decrease in speed performance time from pre-test (M =4.32, SD = 0.29) to post-test (M = 4.09, SD = 0.31) on experimental groups whereas no significant difference is observed in control groups. The mean decrease in speed performance time was 0.23(5.32%). Result showed that the intervention group had scored better time during the 20-M sprint test after plyometric training compared to the control group. Therefore, there is a significant difference in speed among soccer players who performed plyometric training.

As described in table 2 above the pre test result of T-T of CG and EG was (M =14.7, SD = 0.37) and (M=14.9, SD = 0.54) respectively. After the 12 weeks of plyometric intervention, this result become (M =14.71, SD = 0.3) for CG and (M =12.27, SD = 0.32)

foe EG respectively. The comparison was statistically significant decrease in agility performance time from pre-test (M =14.9, SD = 0.54) to post-test (M = 12.27, SD =0.32) on experimental groups whereas no significant difference is observed in control groups. The mean decrease in speed performance time was 2.63(17.6%) seconds. Result showed that the intervention group had scored better time during the T-T after plyometric training compared to the control group. Therefore, there is a significant difference in agility among soccer players who performed plyometric training.

As shown in the table above, the pre test result of VJT of CG and EG was (M =46, SD = 3.58) and (M=44.5, SD =4.5) respectively. After the 12 weeks of plyometric intervention, this result become (M=46, SD = 4.20) for CG and (M =53, SD =2.3) for EG respectively. The comparison was statistically significant increase in power performance on experimental groups whereas no significant difference is observed in control groups. The mean increase in vertical jump length was 8.5cm (19.1%). The result showed that the intervention group had scored bettr length during the vertical jump test after plyometric training compared to the control group. Therefore, there is a significant difference in power among soccer players who performed plyometric training.

Table 3. *Paired T-test for Speed and Agility and power Score in Pre and Post Training*

Variable	Mean	t	p	95% Confidence Interval	
				Lower	Upper
20-m	0.23	3.76	0.001	0.21	0.26
T-T	2.63	2.53	0.01	2.49	2.77
SLJ	8.5	2.53	0.01	6.5	10.5

As shown in table 3, there is a significant difference in the effect of plyometric training on speed between control and intervention group as the value for this comparison was found to be smaller than the significant level (p = 0.001 < 0 .05). Result showed that the intervention group had faster time during the 20m sprint test after plyometric training compared to the control group. Therefore, there is a significant difference in speed among soccer players who performed plyometric training.

There is also a significant difference in the effect of plyometric training on agility between the control and intervention group as the value for this comparison was found to be smaller than the significant level (p = 0.01 < 0 .05) as shown in the table. Result showed that the intervention group had faster time during the agility t-test after plyometric training compared to the control group. Therefore, there is a significant difference in agility among u-17 female soccer trainees who performed plyometric training.

There is a significant difference in the effect of plyometric training on power between control and intervention group as the value for this comparison was found to be smaller than the significant level (p = 0.01 < 0.05). Result showed that the intervention group had better length during the vertical jump test after plyometric training compared to the control group. Therefore, there is a significant difference in speed among soccer players who performed plyometric training.

4.2. Discussion

Plyometric programs are often implemented during the preseason to bring players to an appropriate initial level of fitness. Such a preseason regimen may serve to improve the athletic performance of footballersby enhancing muscular strength, endurance, and power. Furthermore, previous authors (Meylan& Malatesta, 2009; Markovic & Mikulic, 2010; have recommended continuation of a plyometric training program into the soccer season to maintain and increase explosive ability. However, little is known about the possible influence of plyometric training on tasks such as jumping ability and agility in female soccer players and what is known is controversial.

Firstly, one of the aims of this research was to determine whether or not the plyometric training will improve sprinting speed performance. The findings show that the sprint performance of the intervention group has substantially increased after twelve weeks of plyometric training by 0.3 seconds.Similar results were found in previous work carried out by (Chaabène and Negra, 2017;Michailidis, 2015;Rubley et al., 2011), and disagreement with Ramírez Campillo et al, (2015).

During the plyometric training, the stretch-shortening cycles are related to the improvement of the sprint results. This study's results illustrate the importance of achieving high strength rates to boost sprint efficiency in soccer players, with intervention group players showing the highest sprint efficiency and control group players showing the lowest sprint performance. The current research has also consistently demonstrated that plyometric training could substantially reduce the sprinting output over time.

Further gains in sprint performance can be caused by training consistency. The ability to perform full running on short distances is considered an important part of running during soccer matches. Leading to better neuromuscular changes (e.g. intra and inter muscular coordination), and quick movement (based on a short stretch cycle) increases their speed of sprinting The increase in sprint time among U-17 female soccer trainees after twelve weeks of plyometric training is most likely due to improvement of the drive control and stretch-shortening capacity or musculoskeletal rigidity because of improved leg explosive strength (Delloet al., 2016). Plyometric training improves the performance of the sprint, especially from 10 m to 40 m (Asadiet al., 2018). It can also refer to sprint performances, which explain the differences. As a result, plyometric training has significantly improved the performance of soccer players in the current study.

The factor that probably affects the obtained results for the 20-meter sprint test in the present study after training only 12 weeks is the quality of the modified training program which was designed to suit soccer movements. In relation to the transfer of plyometric training to sprinting, it is likely that the greatest improvements in sprinting will occur at the velocity of muscle action that most closely approximates the velocity of muscle action of plyometric exercises employed in training (Rimmer & Sleivert, 2000). It is also possible that a training program that incorporates greater horizontal acceleration such as cone hops with a change of direction sprint would result in the most beneficial effects (De Villarreal et al., 2008).

Secondly, our results substantiate the hypothesis that substitution of one session per week of plyometric training enhanced the agility performance of the lower limbs whether assessed by run times of the T-Agility test. In contrast, the control group who continued with the standard training program showed a worsening of the performance in these variables. In plyometric training group, significant improvements were observed in the T agilitytests. The players who incorporatedthe plyometric exercise were able to significantly increase their time by 2.89 seconds, compared to the control group. Fewer studies examined the effects of plyometric training on specific agility and the result of our study is in agreement with previous studies by (Ramírez Campillo et al, 2015, Negra et al, 2016). Therefore, we found a positive relationship between plyometric training and improvements of agility tests. Therefore, the present research provides novel findings in the field of advanced training methodologies in the amateur footballers' field. Although the experimental group performed plyometric exercises only once a week, it achieved equally good results compared to the control, demonstrating the effectiveness of the intervention protocol used in this study.

Thirdly, the players who incorporatedthe plyometric exercise were able to significantlyincrease their Vertical jump height by 8 cm compared to thecontrol group.These changes were interpreted as a moderate effect size showing the effectiveness of the plyometric training program. Results of the present study are in agreement with previous research by (Rubley et al, 2011; Michailidis, 2015; Söhnlein, et al., 2014) because it was shown that the plyometric training program caused significant difference in vertical jump ability between pre-training and post-training values for PG as compared with a control group.

It is important to point that improvements observed in the vertical jump could have been induced by various neuromuscular adaptations, such as an increased neural drive to the agonist muscles, changes in muscle-tendon mechanical-stiffness characteristics, alterations in muscle size and/or architecture, and changes in single-fiber mechanics (de Villarreal et al., 2009; Thomas et al., 2009). Other possible aspects of neural adaptation to PT include (i) changes in leg muscle activation strategies (or inter-muscular coordination) during vertical jumping, particularly during the preparatory (i.e. pre-

landing) jump phase; and (ii) changes in the stretch reflex excitability (Bishop and Spencer, 2004; De Villarreal et al., 2009).

Generally, our aim in this study was to determine how speed, agility and explosive strength (power) are affected by a 12-week in-season plyometric training program. As we expected, the main findings of the current study indicated that a12-week plyometric training program focusing on the lowerlimbs, in addition to the regular soccer training, increased agility, explosive strength (power) of the lower limbs as well as sprinting speed in U-17 female soccer trainees.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary

The purpose of this study was to investigate the effect of plyometric training on selected physical fitness performances of u-17 female soccer project Players. For this purpose, the researcher reviewed the available literatures in order to decide the focus of the study and methodologies. In order to attain the general objective of the study, the following specific research objectives were formulated:

1. To determine the effect of twelve-week plyometric training on agility performance of female soccer players'.
2. To test the effect of twelve-week plyometric training on power performance of female soccer players'
3. To examine the effect of twelve-week plyometric training on speed performance of female soccer players'

Based on the above specific objectives, the hypotheses were formulated. A quantitative research approach was used for this study and the research design that this study was used an experimental research design. The numbers of participants were 30 and all are taken as a sample by using comprehensive sampling technique. The participants were grouped into experimental and control groups through randomization. The experimental training group performed in a three-month of additional plyometric training program. However, the control group did not perform the selected plyometric training program. Nevertheless, they did perform as equal as normal training activities to the experimental players for the regular soccer training program. All subjects participated in all performance tests. The study used primary sources of data through field tests 20-M sprint test, T- Agility test and Vertical Jump Tests. The data was gathered from the experimental and control groups results as in the form of pre-test and post-test method ahd been organized using appropriate and relevant statistical method of analysis. Through

paired t-test the data was analyzed. Hence, the following major findings were investigated.

The finding of this study indicated that improvement in 20-M sprint score, T- agility test and Vertical jump test were observed in experimental group as a result of the 12 weeks plyometric training whereas no significant change were found in pre to post test results by control groups.

5. 2. Conclusions

Based on the results obtained and the discussion made in this study, the researcher drawn the following conclusions.

- It could be concluded that 12-week plyometric training can improve explosive \power performance in female soccer players.
- Twelve weeks plyometric exercise training program brought observable improvement on female u-17 soccer project trainee's speed performance.
- Twelve weeks plyometric exercise training program brought observable improvement on female u-17 soccer project trainee's agility performance

5.3. Recommendations

Based on the conclusions drawn in light of the research findings, the following recommendations have been forwarded:

Recommendations for coaches: The results of this study highlight the potential of using plyometric training techniques to improve the power-related components of soccer thought to be necessary for success. We strongly recommend that soccer coaches implement in-season plyometric training to enhance the performance of their players.**Recommendations for soccer players:**According to the results, it can be concluded that plyometric exercises were effective in increasing agility and explosive power and reducing sprint time in soccer players. So these training methods are

recommended to soccer players and coaches for improving speedy and skilled performances.

Recommendations for further study: Our findings were limited to one particular category of soccer players, u-17 female soccer traineess. Future studies should extend these observations to women, to other age groups, and other levels of competition. Furthermore, observations are also needed with differing intensities and volumes of plyometric training to determine their optimum dosage for this form of preparation.

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APPENDICES

APPENDIX- A

Sample Consent Form

I _____ hereby consent to participating in the anthropometric test and three months of scientific studies which is conducted on the effect of plyometric raining on the following terms:

I have been informed about the wellness, current status of health assessment and questionnaires, the training procedures and understand what I will be required to do and I understand that I will take the three months of training. I understand that there is always a risk of injury associated with training. And I can withdraw my consent, freely and without prejudice, at any time.

I understand that the information obtained from the test will be treated confidentially, with my right to privacy assured. However, the information obtained may be used for statistical analysis or scientific purpose with my right to privacy retained.

I accept that: this is my personal interest and willingness to participate in any of the necessary procedures which involves in any steps of this study as possible.

Participant signature_____Date_____

Parent/Guardian name (if under the age of 18) _____

Parent/Guardian signature_____Date_____

APPENDIX-B

Twelve Weeks of Plyometric Training plan

Training week	Training Volume(foot contacts)	Plyometric Drill	Set x Reps	Training Intensity
Week 1	90	Side to side ankle hops Standing jump and reach Front cone hops	2 x 12 2 x 12 6 x 7	Low Low Low
Week 2	90	Side to side ankle hops Standing jump and reach Standing long jumps	2 x 12 2 x 12 6 x 7	Low Low Low
Week 3	90	Side to side ankle hops Standing long jump Lateral jump over barrier	2 x 12 6 x 7 2 x 12	Low Low Low/medium
Week 4	120	Side to side ankle hops Double leg hops Lateral cone hops Diagonal cone hops	2 x 12 2 x 12 2 x 12 6 x 8	Low Low Low/Medium Medium
Week 5	120	Side to side ankle hops Lateral jump over barrier Lateral cone hops Standing long jump	2 x 12 2 x 12 2 x 12 6 x 8	Low Low Low/Medium Medium
Week 6	120	Side to side ankle hops Lateral jump over barrier Standing jump and reach Diagonal cone hops Plyo box jump 30 cm	2 x 12 2 x 12 2 x 12 5 x 6 4 x 5	Low Low Medium Medium/High High
Week 7	120	Diagonal cone hops Standing long jump with lateral sprint Lateral cone hops Cone hops with 180-degree turn Plyo box jump 30 cm	5 x 6 4 x 6 4 x 6 4 x 6 5 x 5	Low Medium Medium Medium High
Week 8	140	Side to side ankle hops Standing jump and reach Lateral cone hops Diagonal cone hops Plyo box jump 30 cm	2 x 12 2 x 12 6 x 6 6 x 6 6 x 4	Low Low Medium Medium High
Week 9	140	Side to side ankle hops Lateral jump over barrier Diagonal cone hops Lateral jump single leg Plyo box jump 50 cm	2 x 12 2 x 12 6 x 6 2 x 7 6 x 6	Low Low Medium/High High High
Week 10	120	Side to side ankle hops Hexagon drill Double leg hops Cone hops with change of direction sprint Plyo Box jump 50 cm	2 x 12 5 x 4 4 x 5 4 x 5 6 x 6	Low Low Low Low/Medium High
Week 11	140	Diagonal cone hops Lateral jump over barriers Cone hops with 180 degree turn Cone hops with change of direction sprint Single-leg vertical jump	3 × 8 3 × 8 4 × 8 4 × 8	Low Moderate Moderate Moderate Moderate
Week 12	120	Diagonal cone hops Cone hops with 180 degree turn Cone hops with change of direction sprint Single-leg vertical jump	3 × 10 3 × 10 3 × 12 4 × 6	Low Moderate Moderate High

APPENDIX-C

Descriptive data of the trainee's characteristics of pre and post test

No	Code of Participants	Age	20 meter acceleration (sec.)		Vertical jump (cm)		T-Agility test (sec.)	
			Pre test	Post test	Pre test	Post test	Pre test	Post test
1	CG-1	15	4.4	4.3	44	45	14.6	14.4
2	CG-2	16	4.3	4.2	43	43	15.3	14.9
3	CG-3	16	4.2	4.2	43	44	15.2	15.0
4	CG-4	15	4.1	4.2	46	46	14.8	14.8
5	CG-5	16	4.2	4.2	45	46	15.3	15.2
6	CG-6	15	4.5	4.4	46	46	14.4	14.6
7	CG-7	15	4.4	4.3	45	45	14.8	14.5
8	CG-8	15	4.4	4.3	45	45	14.4	14.3
9	CG-9	16	4.3	4.3	46	47	14.8	14.6
10	CG-10	15	4.2	4.2	44	44	14.4	14.6
11	CG-11	16	4.1	4.2	43	44	15.1	15.5
12	CG-12	16	4.2	4.2	43	43	15.4	15.2
13	CG-13	16	4.5	4.4	44	44	14.3	14.5
14	CG-14	16	4.4	4.4	44	45	14.2	14.4
15	CG-15	16	4.4	4.4	44	45	14.5	14.2
16	EG-1	16	4.3	4.1	43	52	14.5	12.0
17	EG-2	16	4.3	4.1	44	51	14.7	12.1
18	EG-3	16	4.1	4.0	44	53	14.8	12.2
19	EG-4	15	4.2	4.1	44	55	14.6	11.8
20	E5-5	15	4.6	4.2	45	53	14.9	11.8
21	EG-6	15	4.4	4.1	45	52	14.9	12.0
22	EG-7	16	4.4	4.1	45	55	15.1	13.0
23	EG-8	16	4.3	4.1	46	53	15.2	11.9
24	EG-9	15	4.2	4.1	45	53	15.4	13.2
25	EG-10	15	4.2	4.0	44	55	15.5	11.9
26	EG-11	16	4.2	4.0	45	53	15.7	12.8
27	EG-12	16	4.5	4.0	43	53	15.8	12.8
28	EG-13	15	4.5	4.1	45	55	14.2	12.2
29	EG-14	15	4.4	4.2	45	53	14.2	12.3
30	EG-15	16	4.3	4.2	45	54	14.8	12.1

APPENDIX-D