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EFFECTS OF PLYOMETRIC TRAINING ON SOME SELECTED SKILL RELATED PHYSICAL FITNESS OF DILLA SELAM HOSPITAL U-17 MALE FOOTBALL PROJECT

BY

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(MAY, 2023)

DILLA, ETHIOPIA

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LIST OF ACRONYMS AND ABBREVIATIONS

PT …..……. Plyometric Training

EG …….. Experimental group

CG …….. Control group

PTG …… Plyometric training group

RT …….. Resistance training

FIFA……Federation of international football associations

PTG…… plyometric training group

CMJ …… counter movement jump

CSA …….Cross sectional area

MKV…….maximal kicking velocity

WHO …….……. World Health Organization

HHQ …….. Health History Questionnaire

SNNPR ……. South Nation Nationality People

SPSS ……. Statistical Package for the Social Science

IRERC……Research Ethics Review Committee.

ABSTRACT

The purpose of this study was to determine the effects plyometric training on physical fitness components of Selam hospital u-17 male football project players at Dilla town. The study design was quasi experimental. The population of the study were selam hospital U-17 male project players whose total number were twenty five (N=25). Because of the little number of study populations, all project players were taken as a sample by using census sampling technique. And by using simple random method trainees were selected as an experimental group (N=13) and a control group (N=12). The experimental group (EG) had eight-week low to moderate plyometric training, twice per week additional to their regular training session(in total five sessions per week) and the control group (CG) were participated only their regular football training three sessions per week. The data was collected by field tests for speed, agility and power (30-m sprint test, T-agility test and Vertical Jump test). The data analysis was done by using Paired sample t-test and independent t-test using SPSS version 20 with significance level of 0.05. Based on the analyzed data, the pre intervention and post intervention test performance of experimetal group were significantly improved their speed 0.26(5.59%)sec *agility,* 2.25(15.83%), *and vertical jump(power)* 8.47cm (19.02%). *So, all alternative hypothesis* ***(H1)*** *are accepted. As aresult, the study shown that eight weeks of plyometric training improved the skill related fitness components (speed, agility and power) Dilla selam hospital of u-17 male football project. Finally the study recommended that coaches, players and football managements should give attention to plyometric training in delivering with other forms of football training to enhance players' skill and performance.*

Key words; Agility, Plyometric training, Power, Speed

CHAPTER-ONE

1. INTRODUCTION

This chapter includes the background of the study, statement of the problem, research hypothesis, objectives of the study, significance of the study, delimitation, the definition of key terms and the organization of the study is mentioned in this part.

1.1 Background of the study

Football is the world's most popular form of sport, being played in every nation without exception. Football/soccer requires athletes to perform short sprints, repeatedly change directions, and complete numerous jumps during a 90 min match (Krustrup et al., 2005); (Stølen et al., 2005). 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). 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 the fitt ness level (reaction time, strength, power, agility, balance, and speed) characteristics of he individual player and should be developed from a young age.

Football is one of the best, oldest and world's most well-liked and entertaining 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 118 years it comprises 209 member associations from every part of world managed by FIFA. Football is an extremely dynamic, competitive, popular sport and played by a very large number of athletes including men and women, young and adults, amateurs and professionals participate. There are currently about 275 million players, around 26 million of whom are women, 5 million referees and officials are actively involved or 4% of the world population (FIFA, 2020; 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, according to FIFA there was above 5.4 billion

cumulative viewership of the World cup 2022 at Qatar and more than 88,966 spectators packed in to Lusail stadium and close to 1.5 billion television viewers watched the FIFA World Cup 2022final in Qatar(FIFA.com).

Football 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 & Malatesta, 2009a)., (Buchheit et al., 2010). Besides football specific technical skills, individual and team tactical knowledge and particularly adequate levels of physical fitness constitute important prerequisites for success in football ((Stølen et al., 2005).

Typical football movements such as tackling, jumping, sprinting, shooting, and rapid change-of-directions require high levels of physical fitness(Meylan & Malatesta, 2009b).These actions are crucial for optimal performance not only in adult (Faude et al., 2013) but also in youth football(Thomas et al., 2009); Marques etal., 2013;(Michailidis et al., 2013); (Söhnlein 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 football players. Currently, it is well-established that plyometric training is safe and appropriate tools for improving physical fitness of young footballers (Michailidis, 2014).

Plyometric training is a form of exercise that utilizes the body's stretch reflex and eccentric muscle power contributes relatively little to aerobic performance, plyometric training helps develop general athletic ability, ballistic skills, kinesthetic awareness, rhythm and coordination. Football players, especially, can benefit from the development of the power and overall athleticism provided by plyometric exercise. Football players need to have the ability to respond quickly and powerfully on both offense and defense(Chapman et al., 2007a).Plyometric training has many advantages for the improvement of athletes overall performance in various sport events including football. Plyometric training exercise improve explosive power, muscular strength, speed and quickness ,agility, neuromuscular coordination, vertical jumppe formance,leg strength, muscular power, increase joint awareness and enhance football skill performances of the athletes.

1.2 Statement of the Problem

As discussed earlier, football 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 national and international level. So, to fulfill this demand, youth(project) football development program is the most important in which players acquire different skills, technical & tactical abilities and knowledge that facilitates the development of player's performance through getting different forms of training like physical (fitness, and technical skills), psychological, theoretical and other aspects of football.

Technique in a football game is exhibited by speed, power, and actions in which explosive power is needed. Actions such as power, running, direction changes, jumps, and short-distance sprint belong to lower extremity. As frequent use of these actions can influence the result of a game and optimal high performance (Stolen, et al.,2005; Chelly et al., 2010a) 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).

Plyometric training (PT) can be used for upper and lower-body exercises. Especially for lower body. It is a method to improve vertical jump ability and leg muscle power which is included in various types of jumps, like the drop jump, and squat jump, hopping, alternate-leg bounding, and stretch-shortening cycle (Markovic & Mikulic, 2010a). Also, PTs are found to increase kicking speed (Sedano et al., 2011). as well as strength, muscle power coordination, agility Thomas et al., 2009; Michailidis etal., 2013;) speed, and acceleration time (Kraemer, et al., 2000; Kraemer et al., 2000; & Siegler et al., 2003) however, there are also reports about neutral impacts(Chimera et al., 2004) or negative impacts (Luebbers et al., 2003).

As explained earlier plenty of studies are conducted across the world on the effects plyometric training (PT) on different skill related variables.

In Ethiopia also there are varies studies are conducted, especially there is a study by Mr. Muluken Awoke conducted on variables like (speed, agility and power) in which this study was conducted based on. The study was concluded that a twelve week plyometric training had a significant effects on agility, speed and power of u-17 female project players (Muluken, 2022). **So, can 8 week PT have a significant effects on male project players with the same age?** This was the sources of inspiration to investigate the effect of plyometric training on male u-17 football project players on skill related fitness components.

1.3. Research Hypothesis

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

H1: Plyometric training has a significant effect on agility of U-17 male selam hospital football project players.

HO: Plyometric training has no significant effect on agility of U-17 male selam hospital football project players

H1: Plyometric training has a significant effect on speed of U-17 selam hospital male football project players'.

HO: Plyometric training has no significant effect on speed of U-17 selam hospital male football project players.

H1: Plyometric training has a significant effect on power of U-17 male selam hospital football project players'.

HO: Plyometric training has no significant effect on power of U-17 male selam hospital football project players'.

1.4. Objectives of the study

1.4.1 General objective

The general objective for this study was investigating the effect of plyometric training on fitness variables(speed, agility &power) of selam hospital U-17 male football project trainees.

1.4.2 Specific objectives

Specifically the objectives of the study were:

- To determine the effect of plyometric training on agility of U-17 male selam hospital football project players'.
- To test the effect of plyometric training on speed of U-17 male selam hospital football project players'.
- To examine the effect of plyometric training on power of U-17 male selam hospital football project players'.

1.5. Significances of the study

This study was highly concerned on the effects of plyometric exercises on the enhancement of football related finesses on selam hospital U-17 male football trainees. Therefore, As the studies on football are oriented more at adult male football players and less

study exists about young male project football players, more studies on this subject are required so, to fill this requirement this may add a great value on youth football area.

The study may help young or project football players by providing a variety of exercise to engage in exercise programs and to evaluate their performance following the training program. Moreover to combine a multiple forms of trainings to enhance the athletic development of young project players in order to be physically fit professionals.

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

It shall 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.

Finally 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 was difficult, challenging and unmanageable. As a result, this study basically, involved the effect of plyometric training packages on some selected football related fitness variables (agility, power and speed) of Dilla U-17 Selam hospital male football project trainees in Gedeo zone Dilla town.

There were different types of tests applied to measure the skill related physical fitness components, but for the purpose of this particular research, it was delimited 30-meter sprint test for speed, The T-Test for agility, and Vertical jump test for power. Moreover, this study delimited during the training season of 2023 G.C

1.7. Limitations of the study

Besides to make the study valid and complete, the following main point was considered as a limitation of the study;

 The study was restricted only three physical fitness components speed, agility and power and left the other components like reaction time, balance and co-ordination due to time,

resource, age and ability of the trainee related with their regular football training and other factors. So, this was the main limitation of the study.

1.8. Operational Definition of Key Terms

Physcial Fitness: 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.

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

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

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.

Concentric contraction: Is when the muscle exerts a force and shortens in length.

Eccentric contraction: Is when the muscle produces a force but increases in its length

1.9. Organization of the Study

This quasi 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 selected physical fitness performances; speed, agility and power, and all of them are 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 were reviewed to support the problem and the findings of the study.

The third chapter of this study explained 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 chapter four the results obtained in the study and analysis were presented, which investigates the nature of the effect of plyometric training on physical fitness perfomances; speed, agility and power of Dilla selam hospital u-17 football project trainees. In addition, this chapter discussed on the results with the existing and past research works.

Finally, in chapter five summaries of the study presented, based on the findings, conclusions, recommendations were drawn.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

This section deals with Background of Plyometric Training**,** Plyometric Training and physiological adaptations, Physical demands of football Game, Studies Related to Plyometric Training on Improving Skill Related Fitness Components were included

2.1. Background 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 movement. He named this discovery the “shock method” (Verkhoshansky, 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 (Verkhoshansky, 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. Football players, especially, can benefit from the development of the power and overall athleticism provided by plyometric exercise. Football 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 football. 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 football skill performances of the athletes. Plyometric training is widely used in conditioning, power training and in prevention and rehabilitation of injuriesinsomesports (Mengesh et al., 2015).

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 (Kayantas & Söyler, 202; TAŞ, 2006).

Training programs made with plyometric exercises make positive contributions to motor features such as speed and power. 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 stretch shortening 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 & Mikulic, 2010b) According to Wang and 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. 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., 2013c; Söhnlein et al., 2014; Loturco etal, 2015; de Villarreal et al., 2012; de Hoyo et al., 2016) has shown plyometric training to be beneficial for the enhancement of performance of young football 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. Plyometric Training and physiological adaptations

PT elicits a variety of physiological adaptations, both structural and neural. Changes in muscle size and/or architecture are common (de Jesus Almeida et al., 2020) whereas reductions in fat mass are not usually seen (Guadalupe-Grau et 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).(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 RT and PT have shown that changes in jump performance relate to changes in the MTC (Tsang et al., 2003).

However, Foure et al. observed no change in joint stiffness (Foure et al., 2010) but King & Cipriani, observed increased joint stiffness (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, insufficient studies have compared the two types of training.

A study 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 investigating the effect of PT on the Achilles tendon complex (Foure et al.,2010; (Fouré et al., 2009). After 14 weeks PT, increases in tendon stiffness of 24.1% with no concurrent increase in tendon 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., 2010) by a reduction in energy dissipation (Foure et al., 2010). 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 sub optimal 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).

2.3. Physical demands of football Game

Football 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 football 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 (Arnason et al., 2004). football-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-Rafaee & Al-Hazzaa, 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. Plyometric Training for Football Players

Plyometric training (PT) is widely and frequently used in soccer to improve players’ physical fitness (Sedano Campo et al., 2009; Ozbar et al., 2014; RamirezCampillo et al., 2016c). In general, PT 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 PT 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, kicking distance and velocity, repeated-sprintperformance, aerobic endurance, and body composition (Ozbar et al., 2014; RamrezCampillo 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 Skill Related Fitness Components

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 counter movement 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 groupand 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 showed significant 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 Length of 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.

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 EG: n= 11 CG: n=10 Age: 11.4± 0.6 EG did jumping exercises (one and two leg) and running (skipping) exercises. CG: Regular soccer training only. Tests were linear sprint test, standing long jump. EG showed significant changes in jumping and sprinting where as CG no significant changes.

(Negra et al., 2017) 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. 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. However, the optimal PT 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 PT in female soccer players.These studies adopted different methodological training approaches (Sedano Campo et al., 2009; Ozbar et al., 2014; Gallardo-Fuentes 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 PT 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 above mentioned studies examined the effects of different PJT frequencies on components of physical fitness in young male football players. Considering that the effects of PT 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 examine the effects of different PT in u-17 project male football players.

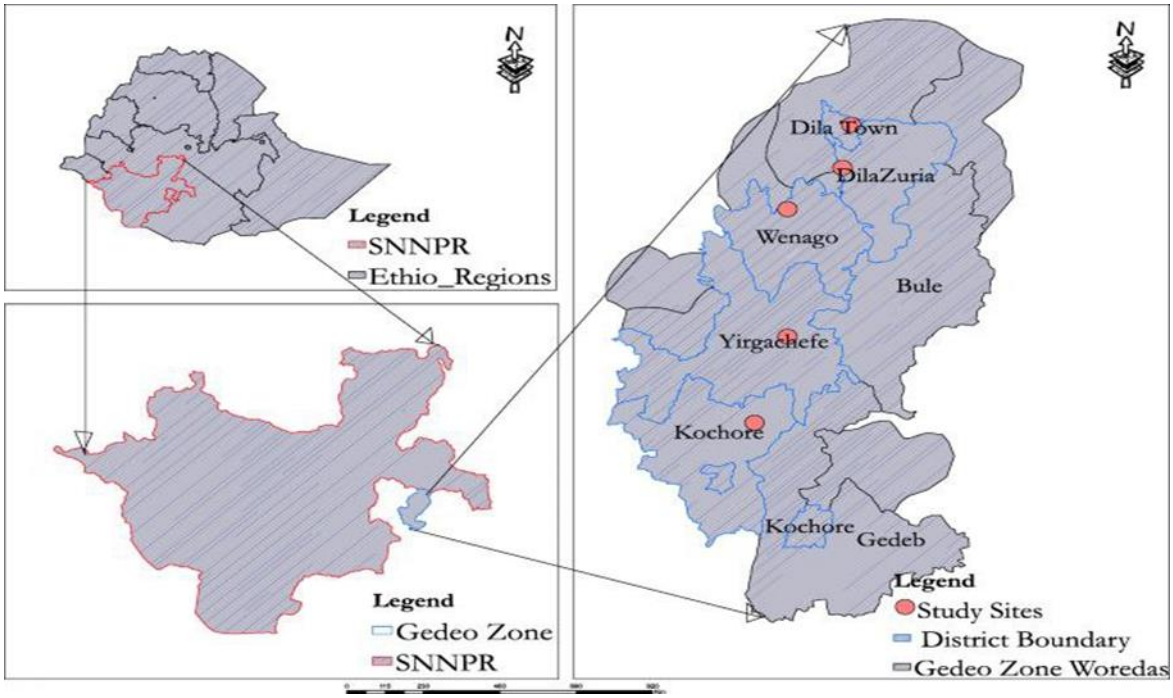
CHAPTER THREE

3. RESEARCH METHODOLOGY

In this section; description of the study area, experimental materials, source of data, 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 were discussed.

3.1. Description of Study Area

The study was conducted in the Southern Nations Nationalities, and Peoples Region (SNNPR) particularly at Dilla town. Dilla is a market town and separate woreda in southern Ethiopia. The administrative center of the Gedeo Zone in the Southern Nations, Nationalities, and Peoples Region (SNNPR), it is located on the main road from Addis Ababa to Nairobi. The town has a longitude and latitude of 6°24′30″N 38°18′30″E, with an elevation of 1570 meters above sea level. Which found in 92 km far from Hawassa, and 359 km far from Addis Ababa, capital city of Ethiopia.



Source: WIKIPEDIA

3.2. Research Approach

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

3.3. Research Design

The aim of this study is to look at the effects of an independent variable on a dependent variable. To use this research design effectively, you need to understand the terms independent and dependent variable. The independent variable affects the dependent variable (Donoghue, n.d.). The study aims to investigate the application of plyometric training (independent variable) and its impact on physical fitness components (dependent variables). According to the objective of the study, the researcher used the quasi experimental research design.

3.4 Population, Sample Size and Sampling Techniques

The target population of the study were male u-17 selam hospital football project trainees who are found at dilla town. The total numbers of players at this team are 25. All are males and the populations are so little in number, all players were taken as a sample by utilizing census sampling technique. These research participants was selected randomly in control group 12 (CG) and experimental group 13 (EG).

3.5. Source of Data

The source of data in the study was primary data from the research participant trainees through field tests. Tests such as agility (Agility T-Agility test), power (vertical jump test), and speed (30 meters speed test).

3.6. Inclusion and Exclusion Criteria

Since the number of trainees are small (25) all the players in the project included in the study as control and experimental group, so there is no exclusion.

3.7. Variables of the Study

The independent variable of the study: The independent variables was 8-week plyometric training intervention.

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

3.8. Data Collection instruments

Since the study needed to investigate the effects of 8 week plyometric training program, the data was collected through field skill test of study participants. So the data collection was through field test of agility, power and speed of football players at Dilla selam hospital football 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 30-meter acceleration test for speed.

3.9. Procedures for administration of fitness tests

3.9.1. General Testing Procedure

Standardized warm-up will be applied for all tests as follows: running(whole body movement), strength and flexibility exercises using their own body weight, dynamic stretching, and sprint-specific warm up for 5-10min. All tests was separated by a 5–10 minutes of break. Each participant will have 2 trials for each test; the best performances of each test will be recorded. All tests will be performed outdoor on the field with participants wearing their regular training kit and football boots. Before the administration of the test the trainees will be 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 will take the test only during the morning session. Three tests will be conducted both pre-training and post-training are used to determine speed, agility, and leg muscle power outcomes. A 30-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.

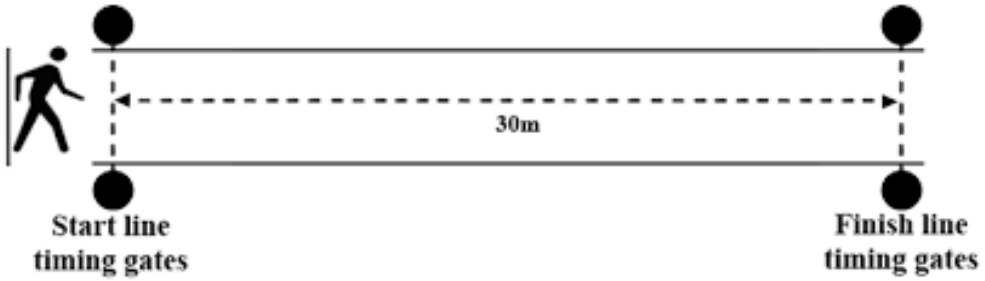
3.9.1.1. 30-Meter Sprint Test

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

Equipments: To undertake this test: a football field with a 30m marked section on the straight and stop watch will be required.

Procedures: The test was performed on an outdoor football field. The subjects will starte to sprint from a standing position behind the start line when they are ready. Sprint times will be recorded using a hand-held stopwatch. On command, the individuals are instructed to run 30 meters as fast as possible over the distance. When they cross the finish line, the time will stop on the hand-held stopwatch (Asadi, 2011; Asadi&Arazi, 2012; Markovic, Jukic, Milanovic, &Metikos, 2007).

Figure 1. 30 meters speed test



Scoring: **The fastest time was recorded.**

3.9.1.2. The Agility T-Test

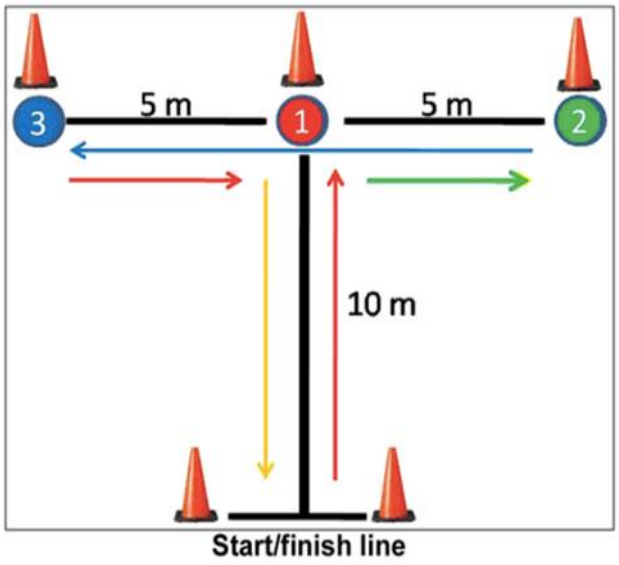
Purpose: The purpose of this test will to measure the player's gility.

Equipment:A marked football field (flat surface that offers good traction), Measuring tape, four cones, Stopwatch will required.

Procedure: The trainee will start at cone starting/finishing line. On the trainer's command, the client sprint to cone 1 and touch the base of the cone with the right hand. He then shuffle left to cone 2 and touch the base of the cone with the left hand. He then shuffle right to cone 3 and touch the base of the cone with the right hand. He then shuffled back to cone 1 and touch the base with the right hand before running backward to the start/finish cone. Stop the stopwatch as the client passes start/finish cone. The T-test will be performed three times with a few minutes of recovery between each test.

Scoring: The fastest time was recorded on a testing form

Figure 2. The T-test



3.9.1.3. Vertical jump test

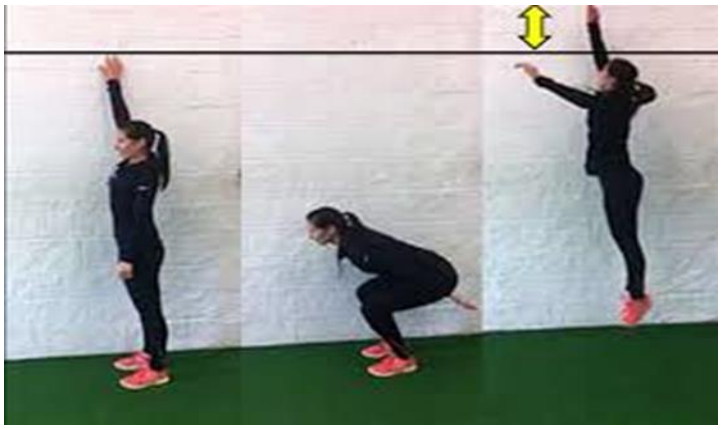
Purpose: This test helps to measure the player's leg power.

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 is to measure the player's standing height. The player stand side on with the dominant shoulder facing the wall. The player then reache up with the dominant arm and the standing height is measured at the point of their fingertips. The athlete is ready to attempt the first jump attempt. The player is allowed to bend (flex) the knees and swing the arms prior to the jump. The player is not allowed a run up or do shuffles step prior to the jump. The player should be 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 will be 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) will be recorded.

Figure 3. The vertical jump test



3.10. Training Protocols

The plyometric training group participated in 8-week training program performing a variety of plyometric exercises additional to their regular football training, while the control group do not participate in any plyometric exercises rather than their regular football training. The players had two additional plyometric training sessions per week since they are amateur footballers and participating in their regular football training So, they have to do fewer training sessions per week than professional footballers. The intensity of training was adjusted to their fitness level, so that fatigue is not be a factor during post-testing. The plyometric training group took trainining at the same time of day, two additional days per week, throughout the study. The duration of the plyometric exercises' session was gradual, ranging from a minimum of 40 minutes of the first session up to a maximum of 70 minutes. During the training, all subjects was supervised and instructed on how to perform each exercise.

Table 1: 8-Weeks intervention program

8-Weeks intervention program		
Warming up		10 -15 minute
Main exercises	Type / mode of exercise	plyometric training
	Frequency	Two additional PL session per week
	Intensity	Low-moderate intensity exercise (50%-65%)
	Exercise duration	40-70 minute/day
	Exercise days	Wednesday and Saturday
Cooling down		5-10 minute

3.11. Methods of data analysis

A quantitative method of data analysis was used for the collecting data from the performance tests**.** After administering a field test on selected fitness skill variables before and immediately after intervention of plyometric training, the researcher record these quantitative data in the form of pre test and post test results. The collected data analyzed and interpreted into a meaningful idea using different data analyzing techniques in order to compare football 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 were used to summarize and describe the findings and the researcher used paired sample t-test and independent t-test for data entry and analysis.The statistical software package SPSS version 20 was used.

3.12. Data Quality Control

To reduce the mistake that happen during data collection process, assistants get training how to collect and organize the data. In addition to that practical test, measurements was recorded 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 was preceded after receiving permission to conduct this research from affiliated institution and consent from participants and the organizations

CHAPTER FOUR

4. RESULT AND DISCUSSION

The purpose of this study was to investigate the effect of 8 weeks plyometric training on selected skill related fitness performance of u-17 male soccer project players. The selected variables for this study were power, agility and speed. The selected performance tests for this study were 30 meters speed test, Agility T-test, and vertical jump test. Pre-test and post-tests were taken from both experimental and control groups before and after 8 weeks of plyometric training and the scores were recorded. The collected data were analyzed using paired sample t-test and independent t-test to analyzed pre-test and post-test results for both groups.

4.1. Results of the study

4.1.1. Pretest characteristics of the trainees

Table 4.1. Pre-test Characteristics of study participants

Category	Control group(N=12)	Intervention group(N=13)
	M ± SD	M ± SD
30-M Sprint Test(sec)	4.63 ±0.156	4.65 ±0.16
Agility T-test(sec)	14.25 ±0.42	14.21 ±0.31
Vertical jump test(cm)	44.67 ±1.32	44.53 ±1.26

Table 4.1 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 25 male selam hospital football project players. From them 12 are CG and the rest 13 are EG.

As the a table indicated that mean and standard deviation of 30m speed pretest with regard to CGl and EG were 4.63 sec and 4.65sec and the standard deviation was ±0.156 and ±0.16 respectively.

In case of agility, the mean values of the CG and EG were 14.25sec and 14.21sec and the standard deviation values were ±0.42 and ±0.31 respectively.

And finally the mean values of CG and EG in power were 44.67cm and 44.53cm and standard deviation values of were ±1.32 and ±1.26 respectively.

The findings of the study show that CG and EG 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 the variables

Table 4.2. Descriptive Statistics of DV

Variables		Test	Control group CG (N=12)		Experimental group EG (N=13)	
			Mean	St. deviation	Mean	St. deviation
Speed	30m sprint	Pre test	4.63	±0.156	4.65	±0.16
		Post test	4.52	±0.15	4.39	±0.13
Agility	T-test	Pre test	14.25	±0.42	14.21	±0.31
		Post test	14.06	±0.31	11.96	±1.15
Powe	VJ test	Pre test	44.67	±1.32	44.53	±1.26
		Post test	45.17	±1.94	53	±1.58

As described in table 4.2 above the pre test result of 30m speed test of CG and EG was (M =4.63, SD =0.156) and (M =4.65 SD = 0.16) respectively.

After the 8 weeks of plyometric intervention, the post test result of CG and EG become (M =4.52. SD = 0.15) and (M =4.39, SD = 0.13) respectively. Thus the result of EG was statistically significant decrease in speed performance time from pre-test (M =4.65, SD = 0.16) to post-test (M = 4.39, SD = 0.13) The mean decrease in speed performance time was 0.26(5.59%)sec. Whereas no significant difference is observed in control groups.

As described in table 4.2 above the pre test result of agility T-test of CG and EG was (M =14.25, SD = 0.42) and (M=14.21, SD = 0.31) respectively.

After the 8-weeks of plyometric intervention, the post test result of both CG and EG become (M =14.06, SD = 0.31) and (M =11.96, SD = 1.15) respectively. The result of EG was statistically significant decrease in agility performance time from pre-test (M =14.21, SD = 0.31) to post-test (M = 11.96, SD =1.15). The mean decrease in speed performance time was 2.25(15.83%) sec. whereas no significant difference is observed in CG.

As shown in the table 4.2 above, the pre test result of vertical jump test of CG and EG was (M =44.67, SD = 1.32) and (M=44.53, SD =1.26) respectively.

After the 8 weeks of plyometric intervention, the post test result of CG and EG become (M=45.17, SD = 1.94) and (M =53, SD =1.58) respectively. The result of EG was statistically significant increase in power performance from (M=44.53, SD =1.26) to (M =53, SD =1.58). The mean increase in vertical jump length was 8.47cm (19.02%) whereas no significant difference is observed in control groups.

Table 4.3. Pre and posttest Paired T-test result for EG

Paired Samples Test						
		Paired Differences				
				95% Confidence Interval of the Difference		Sig. (2-tailed)
		Mean	Std. Dev	Lower	Upper	
Speed	Pretest vs posttest	.26154	.11929	.18945	.33363	.000
Agility	Pretest vs posttest	2.25385	1.11551	1.57975	2.92794	.000
VJtest	Pretest vs posttest	8.46154	1.12660	9.14234	7.78074	.000

As shown in table 4.3, there is a significant difference in the effect of plyometric training on speed between pretest and posttest value. The comparison was found to be smaller than the significant level (p = 0.00 < 0 .05). Result showed that the posttest had faster time during the 30m sprint test after plyometric training compared to the pretest. Therefore, there is a significant difference in speed among football project players who performed plyometric training. Then we accept the alternative hypothesis.

There is also a significant difference in the effect of plyometric training on agility between the pretest and posttest of EG as the value for this comparison was found to be smaller than the significant level (p = 0.000 < 0 .05) as shown in the table. Result showed that the EG had faster time during the posttest agility t-test after plyometric training compared to the pretest.

Therefore, there is a significant difference in agility among male football players who performed plyometric training. So, we accept the alternative hypothesis.

There is a significant difference in the effect of plyometric training on power between pretest and posttest of EG as the value for this comparison was found to be smaller than the significant level ($p = 0.000 < 0.05$). Result showed that the EG had better length during the vertical jump posttest after plyometric training compared to pretest. Therefore, there is a significant difference in power among football project players who performed plyometric training. Then the alternative hypothesis was accepted.

Table 4.4. Paired T-test result for CG

Paired Samples Test						
		Paired Differences				
				95% Confidence Interval of the Difference		Sig. (2-tailed)
		Mean	Std. Deviation	Lower	Upper	
Speed	Pretest vs posttest	.10833	.12401	.02954	.18713	.012
Agility	Pretest vs posttest	.18333	.18990	.06268	.30399	.07
VJ test	Pretest vs Posttest	-.50000	1.08711	-1.19072	.19072	.139

As shown in table 4.4, there are no significant difference in the effect of plyometric training on skill related fitness (speed, agility and power) compared between pretest and posttest of CG as the value p=0.012, 0.07 and 0.139 respectively for speed agility and power of CG. Since the comparisons between pretest and posttest of CG were found to be greater than the significant level (p= > 0 .05). Therefore there are no significant difference between pretest and posttest of CG

4.1.3 Independent T-test

The Independent T- test compares the means of two independent groups in order to determine whether there is statistical evidence that the two independent groups are significantly different or not. In this study the two groups are EG and CG.

Table 4.5 Independent t- test between experimental and control group

Independent Samples Test									
	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
VJump post test	.417	.525	11.085	23	.000	7.833	.707	6.372	9.295
			10.991	21.254	.000	7.833	.713	6.352	9.314
Speed post test	.644	.430	-2.365	23	.002	-.133	.056	-.249	-.017
			-2.345	21.261	.002	-.133	.057	-.250	-.015
Agility post test	5.608	.027	-6.103	23	.000	-2.097	.344	-2.807	-1.386
			-6.328	13.817	.000	-2.097	.331	-2.808	-1.385

From above table 4.5 showed that Levine's Test is used to check the assumption of equal variance between the two groups (EG and CG) after intervention. It is tested by using F-test. The results of Levine's Test for Equality of Variances there is unequal variance b/n EG and CG for the variables (speed, agility and power). Therefore, the assumption of equal variance between groups was satisfied, because the p-value of Levine's assumption of equal variance for those variables are less than 0.05. Therefore, alternative hypothesis was accepted for speed, agility and power. This implies; the intervention of plyometric training shown a significant effect on EG.

4.2. Discussion

The aims of this research was to determine whether or not the plyometric training have effect on some skill related fitness componenets speed, agility and power of u-17 male selam hospital football project players. And how its result could be compared with other previously conducted studies.

After the intervention of 8 weeks of plyometric training on EG the performance of u-17 male project players was significantly enhanced speed by 0.26sec (5.59%), agility 2.25 sec (15.83%) and power 8.47cm (19.02%).

Therefore plyometric training had a significant effect on speed, agility and power on u-17 male football players. Furthermore the researcher tried to discuss whether this work agrees or not with other previous carried out works as follows;

Meylan and Malatesta (2009) studied the effect of plyometric training on agility and speed with experimental and control group. Length: 8 weeks football players. Total: N=25 EG: N= 14 CG: N=11 Age: 13.2 ± 0.6 years. EG performed various plyometric drills for 20 to 25 minutes as a substitute for some football 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 football training only. Tests were linear sprint test, agility test and counter movement jump. The EG 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.

Therefore this study agrees with the previous work of (Meylan and Malatesta (2009)) in terms of speed and agility variables as it explained above, the result has showed beneficial impact on linear sprint training (-2.1%, $p = 0.004$), agility (-9.6%, $p < 0.004$) on EG where as CG: had no significant changes. But restricted on effects of plyometric training on speed and agility whereas nothing explained about other fitness variable (power).

Rubley et al, (2011) studied the effect of plyometric training on vertical jump performance (power) with mixed-model experimental design with EG and CG. The training had 14 weeks Length and subjects were Soccer players. Total: N=16, E G: N=10 CG: n=6 Age: 13.4 ± 0.5 years. EG 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 football training only.

Tests were Vertical jump test. EG showed significant increases of performance in vertical jump distance after 14 weeks significant increase in vertical jump after 14 weeks but CG showed no significant changes.

The study also agrees with the previous work of (Rubley et al, (2011)) as it resulted significant increases of performance in vertical jump distance after 14 weeks significant increase in vertical jump after 14 weeks but CG showed no significant changes. But the effects on other variables are not shown in the previous work of (Rubley et al, (2011).

RamírezCampillo et al, (2014) studied the effect of plyometric training on agility, speed and power with EG and CG. The Length of intervention was 7 weeks and subjects were football players. Total: N=76 EG: N=38 CG: N=38 Age: 13.2 ± 1.8 years EG 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 football field. CG did regular football 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. Plyometric training induced significant improvements in countermovement jump (4.3%), drop jump (16%) and agility (-3.5%) maximal kicking distance (14%) and had non significant effect on sprinting. CG showed no significant changes.

The study again agrees with the previous work (RamírezCampillo et al, (2014)) on the effect of plyometric training on agility, speed and power with EG and CG. As sown above Plyometric training induced significant improvements in agility and power but had non significant effect on sprinting. CG showed no significant changes. So this study disagrees the result that showed as plyometric training had no significant effect on sprinting (speed).

Söhnlein, Q, Müller, E, & Stöggl, T (2014), studied the effect of plyometric training on agility, speed and power with EG and CG. The study used experimental study design. The study had 16 weeks Length and participants were football players. Total: N=22 EG: N=12 Age: 12.3 0.8 years CG: N=10 Age: 13.0 ± 0.9. By EG 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.

EG 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.

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 EG: N= 11 CG: N=10 Age: 11.4± 0.6 EG did jumping exercises (one and two leg) and running (skipping) exercises. CG: Regular soccer training only. Tests were linear sprint test, standing long jump. EG showed significant changes in jumping and sprinting where as CG no significant changes.

(Negra et al., 2017) studied the effect of 8 weeks plyometric training on agility, speed and power of soccer players with EG and CG. The study used experimental study design. Total: N=28 EG: N=15 CG: N=13 Age: 15.7 ± 0.2 years. 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.

(Muluken, 2022) studied the effect of 12 weeks of plyometric training on some selected fitness (speed, agility and power) of u-17 female football project players with EG and CG. The study was experimental research design. Total N=30, EG=15 and CG=15. EG had one plyometric session per week and the CG was performed their regular football training. Tests; 20m sprint test, agility T-test and vertical jump tests. Significant gains in jumping, sprinting and agility tests were seen in EG whereas no significant changes were seen in CG.

This study completely agrees with the previous works of (Söhnlein, Q, Müller, E, & Stöggl, T (2014)), Michailidis (2015), (Negra et al., 2017) (Muluken, 2022)) as listed above plyometric training showed Significant improvements in speed, agility and power on EG where as CG no significant changes.

CHAPTER FIVE

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary

The purpose of this study was to investigate the effect of plyometric training on physical fitness performances of u-17 male football 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:

- To determine the effect of 8-week plyometric training on agility of male football players'.
- To test the effect of 8-week plyometric training on power of male project players'
- To examine the effect of 8- week plyometric training on speed of male football 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 a quasi experimental research design. The numbers of participants were 25 and all are taken as a sample by using census sampling technique. The participants were grouped into EG and CG through randomization. The EG group performed in 8-weeks of additional plyometric training to their regular training program. However, the CG only participated in their regular football training program. All subjects participated in all performance tests. The study used primary sources of data through field tests 30-M sprint test, T- Agility test and Vertical Jump Tests. The data was gathered from the EG and CG. results as in the form of pre-test and post-test method had been organized using appropriate and relevant statistical method of analysis. Data was analyzed through paired t-test and independent t-test .

5. 2. Conclusions

The sources of inspiration to investigate the effect of plyometric training on male u-17 football project players on skill related fitness components was based on the previous work carried out by (Muluken, 2022) studied the effect of 12 weeks of plyometric training on some selected fitness (speed, agility and power) of u-17 female football project players with EG and CG.

Hence, the following major findings were indicated.

- 8-weeks plyometric training program had significant improvement in speed performanc of male u-17 football project trainee. Therefore hypothesis accepted.
- 8-week plyometric training can improve explosive power performance in u-17 male football project players. Hypothesis accepted
- 8-week splyometric training program brought observable improvement in agility performance on male u-17 football project trainee's. Hypothesis accepted.

And the study resulted Significant gains in jumping, sprinting and agility tests on EG whereas no significant changes on CG. Based on this the researcher investigated to answer;

Can 8 weeks of plyometric training have a significant effects on male project players with the same age (U-17)?

Based on the results obtained and the discussion made in the study, the researcher drawn the conclusion to answer <*YES*> for the above question. So the researcher can conclude;

- Yes, 8 weeks of plyometric training can generate a significant effect on skill related fitness components (speed, agility and power) of u-17 male project players as the previous work by (Muluken, 2022) 12 weeks of plyometric training did on u-17 female football project players. So, plyometric training can have a significant effect on both male and female u-17 football project players. But the exact length (duration) of time needed to bring the most effective change on the fitness variables seek further investigation. Moreover the effect of plyometric training on other skill related fitness variables (coordination, reaction time and balance) also needs further study.

5.3. Recommendations

Based on the result in the research findings, the following recommendations have been forwarded for coaches, football players and for further studies:

The results of this study highlight the potential of using plyometric training techniques to improve the speed, agility and power related components of football is necessary for players in the field.

The researcher recommend that football coaches should implement in-season plyometric training to enhance the performance of their players.

According to the results, it can be concluded that plyometric exercises were effective in increasing speed, agility and explosive power of the players. So these training methods are recommended to football players and coaches for improving those performances.

This study is limited to one particular category of football players, u-17 male traineess. Future studies should extend these observations to other sex, age groups, and other levels of competition.

Plyometric programs are often implemented during the pre-season to bring players to an appropriate initial level of fitness. Such a pre-season regimen may serve better to improve the athletic performance of footballers by enhancing muscular strength, endurance, and power. So, it’s recommended that pre-season implementation is more effective than in-season plyometric training.

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Appendix A

Work sheet

Training weeks	Days/week	Training volume (time in min)	Plyometric drills	Set x rep	Training intensity
Week 1	Wed	40	Side to side ankle hops Standing jump and reach	2 x 10 2 x 8	Low Low
	Sat	40	Front cone hops Side to side ankle hops	4x7 2x12	Low Low
Week 2	Wed	45	Standing jump and reach Standing long jumps	3x10 4x5	Low Low
	Sat	45	Front cone hops Side to side ankle hops	5x8 3x10	Moderate Low
Week 3	Wed	50	Standing long jump Lateral jump over barrier Lateral cone hops	5x5 2x8 2x8	Low Moderate Low
	Sat	50	Side to side ankle hops Double leg hops Standing jump and reach	3x10 2x8 3x12	Moderate Low Low
Week 4	Wed	55	Lateral jump over barrier Lateral cone hops Standing long jump	2x10 2x12 5x6	Moderate Low Moderate
	Sat	55	Side to side ankle hops Lateral jump over barrier Standing jump and reach	4x10 2x10 4x10	Moderate Moderate Low
Week 5	Wed	60	Double leg hops Standing long jumps Front cone hops	2x10 5x8 5x10	Moderate Moderate Low
	Sat	60	Lateral cone hops Cone hops with 180-degree turn Double leg hops	3x10 3x6 3x10	Moderate Low Moderate
Week 6	Wed	65	Single-leg vertical jump Standing jump and reach Lateral cone hops	3x5 4x12 4x10	Low Low Moderate
	Sat	65	Side to side ankle hops Lateral jump over barrier Standing long jumps	5x12 3x10 4x12	Low Low Moderate
Week 7	Wed	65	Lateral jump single leg Double leg hops Cone hops with 180-degree turn	2x5 3x12 3x8	Low Moderate Low
	Sat	70	Lateral jump single leg Lateral cone hops Lateral jump over barriers	2x7 4x12 3x12	Moderate Low Moderate
Week 8	Wed	70	Single-leg vertical jump Side to side ankle hops Cone hops with 180 degree turn	4x5 5x14 4x8	Moderate Low Moderate
	Sat	70	Single-leg vertical jump Standing long jumps Double leg hops	5x6 5x12 4x12	Moderate Moderate Moderate

Appendix B

Pre and post test score sheet

vertical jump test CG(cm)		vertical jump test EG(cm)		30m speed test(sec) CG		30m speed test(sec) t EG		Agility test(sec) t CG		Agility test(sec) t EG	
VJCo Pretest	VJCo Posttest	VJEx Pretest	VJEx posttest	STCo Pretest	STCo posttest	STEx Pretest	STEx posttest	TtCo Pretest	TtCo posttest	TtEx Pretest	TtEx posttest
46	47	44	53	4.6	4.5	4.5	4.3	14	13.8	14.3	12.1
45	45	46	56	4.5	4.3	4.6	4.5	14.7	14.4	13.9	14.4
45	46	43	53	4.7	4.8	4.7	4.4	14.3	14.1	14.9	14.5
44	45	44	51	4.8	4.6	4.6	4.4	14.2	13.9	14.3	11.3
45	44	45	52	4.4	4.3	4.9	4.5	14.8	14.5	14.2	11.2
42	43	46	54	4.6	4.4	4.4	4.3	13.8	13.9	13.8	11.2
45	46	44	52	4.9	4.6	4.8	4.6	14.1	13.8	14	11.3
47	49	43	53	4.8	4.7	4.5	4.2	13.6	13.5	14.2	11.3
44	43	45	54	4.4	4.5	4.6	4.4	14	14.1	13.8	12
46	46	44	51	4.6	4.4	4.9	4.6	14.6	14.2	14.3	11.6
44	46	47	55	4.7	4.6	4.7	4.3	14.9	14.5	14.5	11.2
43	42	43	51	4.6	4.6	4.5	4.3	13.9	14	14.2	12
		45	54			4.8	4.3			14.4	11.4

Appendix C

Descriptions;

- **STCoPretest:** speed pre-test for control group
- **STCoposttest:** Speed posttest for control group
- **STExPretest:** speed pre-test for experimental group
- **STExposttest:** speed posttest for experimental group
- **TtCoPretest:** T-test pretest for control group
- **TtCoposttest :** T-test posttest for control group
- **TtExPretest**: T-test pretest for experimental group
- **TtExposttest:** T-test posttest for experimental group
- **VJCoPretest**: vertical jump pretest for control group
- **VJCoPosttest:** vertical jump posttest for control group
- **VJExPretest:** vertical jump pretest for experimental group
- **TtExposttest:** T-test posttest for experimental group