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EFFECTS OF ANAEROBIC TRAINING AND PLYOMETRIC TRAINING ON YOUNG FOOTBALL PLAYERS´ PERFORMANCE IN ROBIT KENEMA, SOUTH GONDER, AMHARA REGIONAL STATE

SISAY, BELETE

BAHIRDAR UNIVERSITY

SPORT ACADEMY

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By:-

SISAY BELETE

AUGUST, 2019

BAHIR DAR

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By:

SISAY BELETE

ADVISOR:

Dr. Zelalem Melkamu

A THESIS SUBMITTED TO BAHIR DAR UNIVERSITY SPORT ACADEMY IN PARTIAL FULFILLMENT FOR THE REQUIREMENTS OF MASTER OF SCIENCE IN FOOTBALLCOACHING SPECIALIZATION

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BAHIR DAR

APPROVAL PAGE

BAHIR DAR UNIVERSITY

SPORT ACADEMY

MASTER OF SCIENCE

As member of the examining board of final Master of football coaching specialization open defense we certify that we have read and evaluated this thesis prepared by **Sisay Belete.** Entitled with **"effects of anaerobic training and plyometric training on young football player performance in robit kenema**" and recommended that it is accepted as fulfilling the thesis requirement for the Master of Science in football coaching specialization.

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Name of internal examiner signature Date

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Final approval and acceptance of thesis is contingent upon the submission of the final copy of the thesis to the postgraduate coordinator through the academic counsel of the candidate academy. I her by certify that I have read the thesis prepared under my direction and recommended that it has accepted as fulfilling master of football coaching specialization Thesis requirements.

……. ……. ……..

Name of adviser signature Date

DEDICATION

This thesis is dedicated to:

My father and mother for their endless patience and unwavering support that they

Have shown to me during this long, arduous process. My brothers and sister, who have been supporting and encouraging me so that we may have a better future, My wife, who stayed up the nights so that I could sleep comfortably; who suffered a lot to give me the chance to prove and improve myself; who nurtured in me the love for learning, and

All those whose names I forget to mention.

I dedicate this research.

DECLARATION OF AUTHORSHIP

I her by this thesis for the partial fulfillment of the requirement for the degree of master science in football coaching specialization on the title of "**effects of anaerobic training and plyometric training on football player performance in robit kenema**" is my real original work and all sources materials used in this thesis have been acknowledged. It has not previously formed on the basis for the award of any degree, diploma of any university, other institution of higher learning publication except where due acknowledgement is made in acknowledgments.

Mr. Sisay Belete

Place: Bahir Dar University

Signature ……..

Date ……

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First thanks are given to God; nothing can see light without His command. His grace and His mercy on us are countless.

I would like to express my indebtedness and gratitude to my advisor Dr. Zelalem Melkamu who patiently revised each chapter of this dissertation and provide invaluable direction and support throughout my dissertation writing process. I have been blessed to have such a brilliant supervisor to help me

The successful completion of this study would not have been possible without the support and encouragement of many people in my life who offered their assistance along the way.

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Finally, I am deeply grateful to my wife, my families, who have been my sources of strength and counsel. Many thanks are due to them for providing me with their care, attention as never ending support.

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Abbreviations

PG Plyometric Group.

CG Control Group.

CMJ Countermovement jump

MB5 Multiple 5 Bounds

PT Plyometric training

PHV Peak height velocity

ST Strength training

SSC Stretch shorting cycle

COD Change of Direction

BMI Body max index

COT circumference of thigh

BW Bodyweight

ANG Anaerobic group

N number

SD standard deviation

SPSS statistical package for social science

Abstract

Developing effective anaerobic, plyometric training program for students is a strategy for improving speed, agility, power and skill performance. The purpose of this study was to investigate the effect of anaerobic and plyometric training on 8-weeks intervention program in order to provide a recommendation of the most suitable training program for young soccer players for improving speed performance, agility and jumping parameters (strength and power), passing and shooting. The study employed Experimental research design. 32 male players of Robitkenema football club with the age of (ANG=16.8±0.8, PT=17±1.2, CG=18±1.1) had divided randomly into 3 groups. In the exercise group (ANG, n=12, PT, n=12) and control group (EG, n=8) in total took part in the study. Both EG participated in 3 sessions per week lasting 30-45 minutes per session of exercise training, which comprised as walking, jogging, sprinting, jumping, passing and shooting. All groups had taken pre and post testing and all subjects participated in physical fitness and technical tests: Countermovement jump (CMJ), the Multiple 5 Bounds (MB5) Test and 30meter sprint with 10m acceleration phase were measured on a running track and skill variables measured using measured using on soccer pitch. The data collected from the study subject was analyzed by using SPSS version 21software by ANOVA with level of significant 0.05.The results showed anaerobic and plyometric training significantly improved speed, agility, power, passing and shooting performance in EG at($p<0.05$) and the control group significantly improved their performance in the CMJ ($p<0.05$), however they were the only group to get significantly slower in the 30m Sprint ($p>0.05$) post measurements. Based on this finding, it can be concluded that 8 week anaerobic and plyometric training had positive effect on improvement of player of performance.

CHAPTER ONE

INTRODUCTION

1.1. Background of the study

An effort, to improve high achievement in every sport that occupied by an athlete, is important. One element or factor which is important to reach an achievement in sport is the physical condition. In some studies also said that to achieve is determined by four factors of the exercise of physical preparation, technical preparation, preparation tactics and mental preparation. The explosive strength, agility, jump height and sport specific performance. The main reason is because PT activates the stretch-shorting cycle (SSC) mechanism. The SSC can be main purpose of physical preparation in training is to improve the functional potential of athletes and develop the bio motoric ability to the highest standards.

Professional soccer players on average perform 700 turns, 30-40 sprints which occur every 90 seconds lasting 2-3 seconds, 30-40 tackles and jumps during a 90 minute game (Bloomfield et. al., 2007 & Mohr et. al., 2003). These types of results are not known for young soccer players however, explosive actions are an important feature for all soccer players. Anaerobic means without oxygen. Anaerobic exercise consists of brief intense bursts of physical activity, such as weightlifting and sprints, where oxygen demand surpasses oxygen supply.

In addition to helping your body handle lactic acid effectively, anaerobic exercise has great benefits for overall health. Anaerobic exercise builds and maintains lean mass, protects your joints, increased muscle strength and muscle mass helps protect your joints, which can protect you from injury.

Anaerobic training is an intense physical activity that lasts only a few seconds to a few minutes. Or an activity in which the intensity is so great, that the demand for oxygen is greater than the body's ability to deliver oxygen.
https://study.com: definition, benefits and examples of anaerobic exercise by Donna Rickets.

Anaerobic training usually improves movements, strength and speed. Most anaerobic exercises are designed to develop specific skills such as agility, flexibility, or strength, passing and shooting performance. Weight lifting, sprinting and some forms of gymnastic, for example, usually are considered as anaerobic exercise.

Plyometric training refers to those activities that enable a muscle to reach maximal force in the shortest possible time. A practical definition of plyometric exercise is a quick, powerful

movements using prestretch or countermovement, which involves the stretch shortening cycle (SSC). plyometric is a form of isotonic exercise that is especially useful for athletes training for power development.

The word "plyometric" has roots in the Greek word "pleytheyein" which means to increase or augment. Though certain countries used plyometric techniques in the 60s, the term plyometric was the first used in 1975 by an American track and field coach named Fred wilt after he performed at extensive study of Dr. Verkoshansky training methods. Fred derived the word from this Latin words "pilo"and "metrics". Pilo means more and metrics mean to measure. Fred chose these two root words because plyometric function to better an athlete's quickness and power. Simply put the goal of plyometric is to make athletic movements becomes more expensive. Even though its roots are in track and field, athletes' in every type of sport can benefit from the training. **Https://www.freelapusa.com, the history of plyometric.**

Plyometric are training techniques used by athletes in all types of sports to increase strength and explosiveness (Chu, 1998). Plyometric consists of a rapid stretching of a muscle (eccentric action) immediately followed by a concentric or shortening action of the same muscle and connective tissue (Baechle and Earle, 2000).

Plyometric training (PT) has been proven to improve best described as the lengthening of a muscle (eccentric phase) prior to an immediate shortening of a muscle (concentric phase). PT is mostly used when training athletes from pre puberty to late puberty due to the fact that testosterone levels in this age group are low. The low testosterone levels affect the ability of young soccer players to building muscle mass and thus neural adaptations are easier to focus on (Sohnlein et. al., 2014). There is very little information available for young adults for improving sprint performance. This means that strength and conditioning coaches have to refer to the only general recommendation of a program and duration which was derived from a meta-analysis that included adults, adolescent and pre-puberty athletes. The recommendation is a program lasting 10 weeks with 18 high intensity sessions consisting of 80 jumps per session (Saez de Villarreal et. al., 2012).

Researchers have shown that plyometric training, when used with a periodized strength-training program, can contribute to improvements in vertical jump performance, acceleration, leg strength, muscular power, increased joint awareness, and overall proprioception (Adams, et al., 1992; Anderst et al., 1994; Bebi et al., 1987; Bobbert, 1990; Brown et al., 1986; Clutch et al., 1983; Harrison and Gaffney, 2001; Hennessy and Kilty, 2001; Hewett et al., 1996; Holcomb et al., 1996; Miller et al., 2002; Paasuke et al., 2001; Potteiger et al., 1999; Wilson et al., 1993).

In this modern era, few scientific studies have been conducted to investigate effective methods of developing speed and agility conditioning among school soccer players.

A major component of success in competition is the adoption and implementation of specific training procedures prior to the competitive event. Athletes will utilize a variety of training methods in order to improve in the areas of power, speed, agility and quickness. Depending on the demands of the individual sport, athletes require different skills and physiological tools for optimal performance. Plyometric training, including speed, agility, and quickness training, has received considerable attention as a training methodology. This form of training is of particular interest because in addition to improvements in performance, the athlete may also decrease injury risk.

Plyometric is a form of training used to increase power output and explosiveness. Plyometrics has been defined as explosive calisthenics like exercises involving the conditioning of the neuromuscular system to permit faster and more powerful changes of direction, such as moving from up and down in jumping or switching leg positions as in running. Plyometric consist of rapidly stretching a muscle (eccentric contraction) before shortening it (concentric contraction) to gain maximum movement and power. This action is known as the stretch shortening cycle. The force generated by the concentric action increases because the eccentric action releases stored elastic energy in the muscle being activated. This research was conducts on the effects of anaerobic and plyometric training on young football player performance in robit kenema football club.

1.2. Statement of the problem

As this topic are "effects of 8 weeks anaerobic training and plyometric training on young football player performance in Robit kenema". This research was conducted to show that scheduled anaerobic and plyometric training program for Robit kenema young football player may lead to improve in speed, agility, power, passing and shooting performance

There are 32 players in robit kenema football club for last 3 years. Based on my observation they are not effective in physical fitness problems like speed, quickness and power and they have skill performance like passing and shooting. Anaerobic exercise helps boost metabolism because it helps build and maintain lean muscle. Lean muscle mass is metabolically active, so the more lean muscle mass you have, the more calories you will burn. Anaerobic activity will increase the strength and density of your bones more than any other type of activity, therefore decreasing your risk of osteoporosis. Regular Anaerobic exercise increase strength, speed, and power, which will ultimately help improve sports performance.

Anaerobic conditioning in the form of sprint or interval training is essential to developing the stride patterns required in proper plyometric bounding. The explosive reactions of sprinting or of movement drills that require changes of direction can be performed as part of interval training (repeated efforts with measured recovery periods).
Done together, resistance training and anaerobic training help prepare the athletes body for plyometrics. In turn, plyometric training enhances the athlete's ability to perform in resistance exercise and anaerobic activity –a true partnership in athletic training.

Jump training and upper body plyometrics are relevant to many sports. Gymnastics, diving, volleyball, and jumping events in track and field are all arenas where success depends on the athlete's ability to explode from the standing surface and generate vertical velocity, linear velocity, or both in order to achieve the desired result. But plyometric is not a panacea in athletic condition. It does not exist in a vacuum, nor should it be thought of as a singular form of training. Instead, plyometrics is the icing of the cake –to be used by athletes who have prepared their tendons and muscles (through resistance training) for the tremendous impact forces imposed in high intensity plyometrics.

Both anaerobic and 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 of the athletes. Plyometric training is widely used in conditioning, power training and in prevention and rehabilitation of injuries in some sports (Roopch, Martin & Lue-chin, 2010). Plyometric are training techniques used by athletes in all types of sports to increase strength and explosiveness (Chu, 1998). Plyometric consists of a rapid stretching of a muscle (eccentric action) immediately followed by a concentric or shortening action of the same muscle and connective tissue (Baechle and Earle, 2000).Plyometric training (PT) has been proven to improve best described as the lengthening of a muscle (eccentric phase) prior to an immediate shortening of a muscle (concentric phase).

A study on the effects of plyometric (specially on agility) found that most effective plyometric drills have components of stopping, starting and changing directions in an explosive manner, movements that by their very nature should help an athlete in developing agility. When specifically measuring effects on agility, the authors found that their protocol had a positive

effect on increasing agility in their subjects over the control group. Countermovement jump has also been shown to increase from a plyometric program. It was concluded that the gains achieved may have been caused by improved motor improvement or neural adaptations through the plyometric training. Other research found that plyometric training can increase speed in prepubescent boys. The authors concluded that plyometric training had positively affected sprint performance in these subjects, possibly indicating the value of adding a well-designed plyometric program to sports requiring a speed component. Therefore it appears that a plyometric program has positive effects on speed, agility and performance if properly administered. However, as different sports require different parameters of performance, other training modalities should be considered to supplement the plyometric program.

Anaerobic and aerobic exercise use different energy systems of the body. Anaerobic exercises is beneficial for good health because it strengthen bones, burns fat, build muscles and maintains muscle mass, which is important for people as they age.

1.3. Objectives of the study

1.3.1. General objectives

The general objective of this study was to investigate the effect of anaerobic training and plyometric training on young football players´ performance.

1.3.2. Specific objectives

In addition to the general objective above, the research addressed the following specific objectives:

1. To evaluate the effects of 8 week anaerobic and plyometric training on young football players´ speed performance.
2. To measure the effects of 8 week anaerobic and plyometric training on young football players´ agility performance.
3. To determine the effects of 8 week anaerobic and plyometric training on young football players´ jumping Performance.
4. To investigate the significance effects of 8 week anaerobic and plyometric training on young football players´ passing performance.
5. To assess the effect of 8 week anaerobic and plyometric training on young football players´ shooting performance.

1.4. Hypothesis

The study has attempted to test the following hypothesis

1. ***H1***: Eight weeks anaerobic training would have significant main effect on young football player (speed, change of direction speed, power, passing& shooting) performance.
2. ***H0***: Eight weeks Plyometric training there is no main effect on young football player (speed, change of direction speed, power, passing& shooting) performance.

1.5. Significance of the study

Generally this study will have the following significances

- The research finding may help as a guide line for the football players and coach future training design to improve their own performance
- It provides valuable information for Robitkenema young football players who involves on anaerobic and plyometric exercise program for the improvement of speed, agility, power, passing and shooting performance.
- Help coach's to know further about the effects of anaerobic and plyometric exercise and the methods of evaluating player's performance and provide to assess and compare the performance of players on Robitkenema.
- It motivates and encourages player engage in anaerobic and plyometric exercise to boost their performance.
- It will provide the coaches to acquire a deeper insight into their own interactive process.
- The research would enhance researcher ability to conduct further research by providing good experiences.

1.6. Delimitation of the study

Delimitation is defined as bounders put in place by the researcher in effort to narrow the scope of the study (farrow et al, 2002). The study was designed to investigate the effects of eight week anaerobic and plyometric training in Robitkenema football players. This study was delimited in the following areas:

- Subjects were selected at Robitkenema football male players age ranged between 16 to 20 years, and healthy, trained that has not any physical disabilities or medical conditions and volunteers participated in this study.
- Selected physical fitness variables were countermovement jump, multiple 5 bound and 30m sprint measured using a running truck, and skill variables were agility test without a ball, passing and shooting measured using a soccer pitch.
- Anaerobic and plyometric trainings comprised sprinting, jumping agility, passing and shooting exercise.

- ❖ The time of training was limited to three days per week & 45min. per sessions.
- ❖ Among the performance variables, the following independent variables were selected for the study such as plyometric, anaerobic training and the dependent variables were selected for the study such as speed, agility, jumping, passing and shooting performance.

1.7. Limitation of the study

According to (farrow et al 2002) all studies, regardless of their type, have limitations that indicate potential weakness of the study's results. This study is limited by the following factors. In this research,

1. Lack of equipment's, facilities and there is no comfortable training field.
2. Only 16 to 20 age men participants were include in the study, therefore, results cannot be generalized to other populations.
3. The researcher not controlled all outside activities, food habits, physical activities and social habits of the participants.
4. The subjects that were undertaken may not have previously knowledge about exercise training in a regular basis.

1.8. Operational Definition of key terms

- **Anaerobic exercise**: exercising without the presence of oxygen; the work intensity is greater than the rate the body can transport oxygen to be used (Wilmore &Costill, 1994)
- **Plyometric training** is a technique of exercise that involves a rapid eccentric stretch of muscle, followed immediately by rapid concentric of muscle for the purpose of producing a forceful explosive movement over a short period of time.
- **Speed:** is the ability to perform a movement within a short period of time.
- **Power-** the ability to exert force rapidly, based on a combination of strength and speed.
- **Agility:** is the ability to change direction quickly without losing speed and balance.
- **RAE** is defining as the chronological age differences between individuals within annually age grouped cohorts (Barnsley et al., 1985).
- **Anthropometry** –the study of human body measurements especially on a comparative basis.
- **Hypertrophy**-excessive development of an organ or part specially: increase in bulk (as by thickening of muscle fibers) without multiplication of parts.
- **Effect-**a change that results when something is done or happens, an event, condition, or state of affairs that is produced by a cause.
- **Body mass index** is a number calculated from a person's weight and height.

1.9. Organization of the study

This study has consists of five chapters. The first chapter deals with the background of the study, statement of the problem, hypotheses of the study, objectives of the study, significance of the study, delimitation of the study, limitation of the study, definition of terms used in the study. The second chapter deals with the review of related literature, the third chapter deals with the research design and methodology of the study. The fourth chapter deals with presentation, analysis and discussion of the data, and the last chapter deals with the summery of the findings, conclusion and recommendation of the study

CHAPTER TWO

2. REVIEW RELATED LITERATURE

2.1. MATURATION PERIODS OF YOUNG SOCCER PLAYERS

The development process differs for every person and this cannot be rushed. Adolescence usually begins around the age of 13 years old and ends at around the age of 18 years old. This is a time when many changes occur in a person's body. It is important to take note of the cut-off date which differs from sport to sport but for soccer the cut-off date is in the summer. Cut-off date is what is used to determine what age group a player will play under. The cut-off date is a certain time of year, for soccer it is the 1st of January but this changes for sport to sport.

In the older age groups (16–18 years), age and body size differences between high- and low-level players were reduced and not significant (Malina et. al., 2007). Physical strength has been shown to have an effect on kicking, tackling and withstanding a tackle (Reilly et al, 2000). This is a major factor in sports such as rugby were physical strength is one of the biggest parts of the game. A skill such as the hand off when used effectively can make a player stand out from the rest, especially by a physically stronger child between the ages of 11-14 years old. Many coaches believe that physical strength in soccer is not as important because a skilled player is much more valuably to the team compared to a fast, powerful and agile player. However, in underage sport size is a significant factor which can affect the success of a young athlete. Those who stand out due to their size, speed and power have a greater chance to get noticed. Being noticed can enhance the player's chances of being selected for development squads, which inturn leads to better coaching and development of their skill (Malina et al, 2007).

A study by Malina et al. (2000) showed that the skeletal age and chronological age are equivalent in males aged 11-12 years old. Skeletal age is the development of a person bone in years. Chronological age is the number of years a person has lived; it starts from when the person is born. Between 13-14 years chronological age is closely related and at 15-16 years skeletal maturation starts to dominate soccer within Portuguese and young Mexican soccer players.

The different stages of development within adolescent boys needs to be recognized (Malina et al., 2004), and opportunities need to be provided for smaller and later maturing talented boys during adolescence (Malina, 2000).

There is no direct correlation between a person being taller and heavier with an increase in skill level. The size difference plays a small role between the ages of 13-15 but as boys approach maturity in late adolescence, usually aged between 16-18 years the early maturity is no longer apparent and in some cases it has been reversed (Malina et al., 2007 & 2005). The different development stages of an athlete are shown in table 1.

Table 1: Athlete Development (Balyi et al. 2014)

tart	s old
ental Stage	les 6 to 9 & Females 6-8
train	-12 & Females 8-11
train	2 to 16 years old / Females 11 ars old
; to compete	6 to 23 years old/ Females 15 ars old
; to win	9 year + / Females 18 years +
ent & active for life	r at any age

Adapted from Canadian sport police, 2002.

2.2. The development of young soccer player

The development of a good young soccer player involves developing multiple different skills. It is not only important to develop ones technique but there are many different aspects to be taken into consideration.

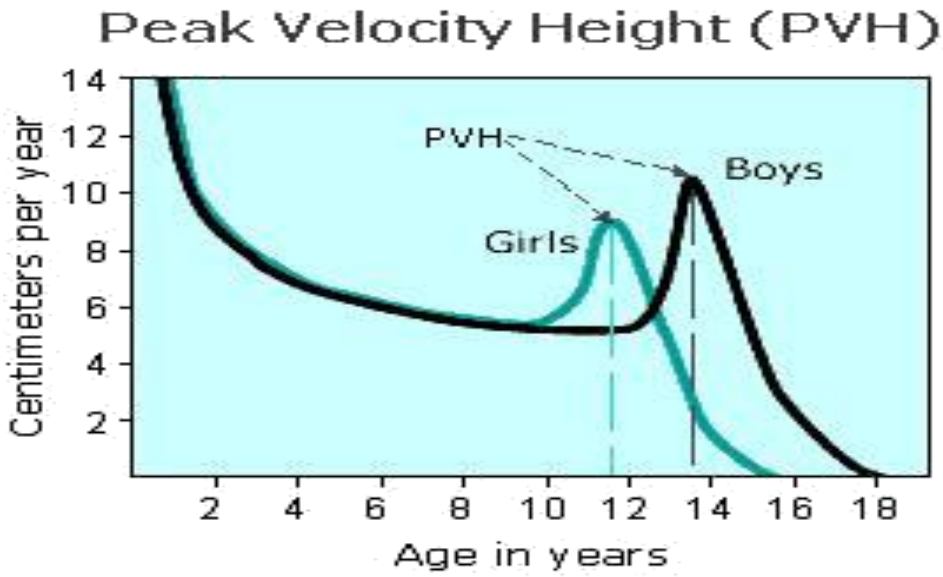
In order for a player to be able to compete at the highest level possible they have to be well rounded at every discipline. The different parameters required from a player who wishes to play at a high professional level are, soccer-specific technical and tactical skills, along with physical

and psychological characteristics (Gonaus et al. 2012, Reilly et al. 2000). Here are a few examples that authors have suggested to be required in order to reach the top playing level; technical skill, (Gonaus et al. 2012, Vestberg et al. 2012) tactical minded, (Gonaus et al. 2012), speed (Gonaus et al. 2012, Vestberg et al. 2012), agility (Jovanovis et al. 2011), endurance capacity (Vestberg et al. 2012) and power (Jovanovis et al. 2011, Dardouri et al. 2013). Certain parameters are harder to develop than others. All the previous physical parameters can be developed with extensive training but the technical and tactical aspects of the game are somewhat more difficult to teach to young populations.

Size is found to have particular importance in the selection process within team sports. Tall players have been found to have a particular advantage in certain positions within soccer (Reilly et al, 2000). Out of 30 players examined it was found that the majority of the tallest players were either goalkeepers or central defenders. The positions where the fittest players resided were the midfielders and fullbacks (Reilly et al, 2000).

Below in figure 1 the Peak height velocity (PHV) is shown. PHV is the period when the growth rate is at its maximum (Balyi et al. 2014 and Lloyd & Oliver 2014). This is the best indication that the focus of training should be on aerobic and strength development. Males should begin strength training 12-18 months after PHV women should begin straight after PHV (Balyi et al. 2001).

As previously mentioned, athlete development should take place as follows Fundamental (age 6/7 until 9/10) Train to Train (age 10/11 until 13/14), Train to Compete (age 14/15 until 17/18) and Train to Win (age 18-19 until 21-22). Girls (12 +/- 1 year old) reach Peak Height Velocity (Balyi et al 2014) at an earlier age compared to boys (14 +/- 1 year old) but similarly it occurs during the stage train to train.



Adapted from PH maximum (Balyi et al. 2014 and Lloyd & Oliver 2014).V is the period when the growth rate is at its

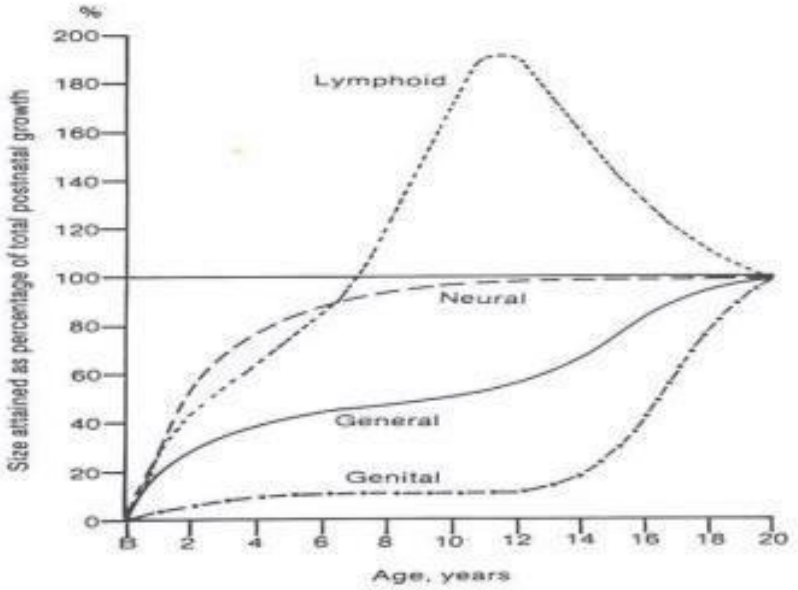
Figure 1 : Peak Height Velocity (Balyi et al 2014) Athlete development differs from girls and boys. Girls (12 +/- 1 year old) reach at an earlier age compared to boys (14 +/-1 year old).

2.2.1. Anthropometrics and body composition

A person's body size can influence, from a very young age, where they are going to play on the pitch. In relation to soccer it has been noticed that usually goalkeepers and defenders are bigger than midfielders (Reilly et al., 2000). Conflicting findings have been produced by Hencken& White (2006) that do not concur with those of previous studies that focused on the anthropometric characteristics of elite soccer teams. For many researches Reilly et al. (2000) was the main source of reference regarding to anthropometrics of soccer players. They found that relative heterogeneity in body size is a characteristic of elite soccer teams, so anthropometric differences were therefore expected between playing positions.

Previous studies (Reilly et al., 2000) have reported significant differences in a variety of anthropometric characteristics, most notably stature and body mass, perhaps suggesting that these variables denote a morphological optimization within soccer. All previous studies apart for the most resent one have suggested that midfielders are preferably lighter in body mass so they can move more freely. It has been suggested that defenders are usually taller and heavier with less body mass. However the only conflicting study by Hencken& White (2006) found that positions were not significantly different from each other in total mass, fat mass, muscle mass, residual mass and lean body mass.

Figure 2 shows the different curves of systematic growth. What follows are the descriptions for each of the curves. The Genital curve indicates hormonal maturation. The General curve shows the growth of the different systems of the body such as the lungs and heart. Neural Curve shows that 95% of the central nervous system is developed by the age of 7. Lymphoid curve shows the immunological tolerance and the level of resistance to infection (Vänttinen et al. 2013 &Balyi et al. 2014).



Adapted from many researches Reilly et al. (2000) was the main source of reference regarding to anthropometrics of soccer players.

Figure 2 Scammon's curves of systematic growth (Scammon 1930)

2.2.2. Critical periods

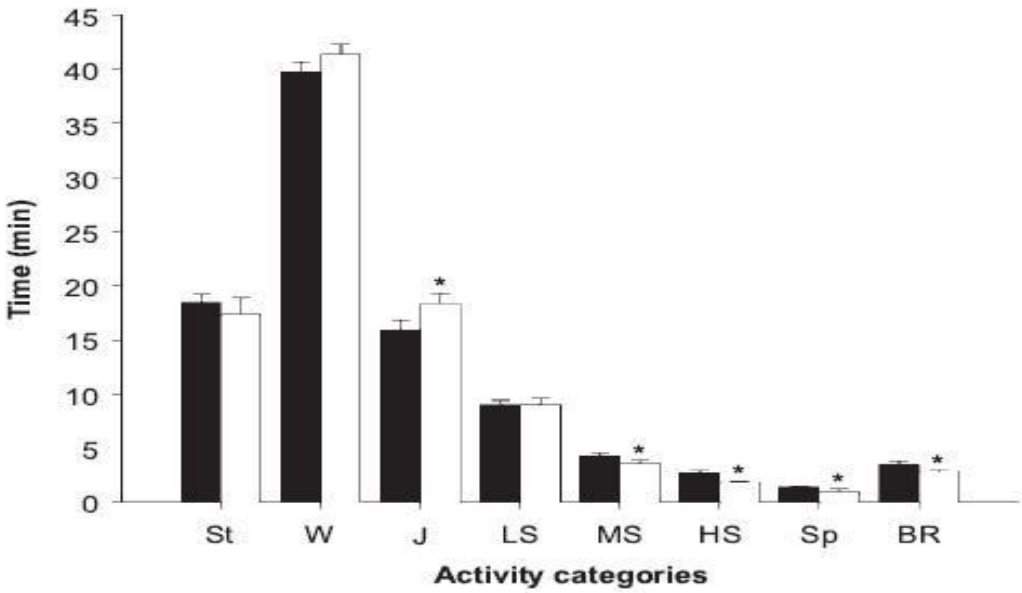
It is important to train specific qualities at specific ages during adolescence. It has been shown that at a certain age, an individual can learn and improve certain qualities to their best standard. The main emphasis should be on speed and speed related strength training at the age of 13. At ages 14-15, the main emphasis should be on speed, strength and aerobic endurance training. At ages 16-17, the focus should be on speed strength and aerobic endurance training. Finally at ages 18-19, the main focus should be on aerobic endurance, speed endurance and maximal strength training. These age ranges give an indication of what the training should be like for adolescents at different age levels. (Balyi, 2001)

2.3. Soccer training for young players

Soccer training has changed dramatically over the years. For the young player nowadays training specificity has progressed hugely over the years. The idea of a young player going out to kick a

ball around a field is long gone. Young academies follow a strict plan for developing young soccer players, which are continuously changing from year to year and also from club to club. The timing of when and how players begin to acquire a new skill is viewed as a very important aspect of how the young of today should be trained. As they say, "timing is everything!"

Figure 3 shows the many intermittent movements during a game. A players training regime should be tailored to improving the most important parameters that distinguish the top-class player from the moderate players. Top-class players were found to perform more high-intensity actions and sprinting, 28% and 58%, respectively, compared to the moderate players (Mohr et al. 2003).



Adapted from Soccer training for young players (Mohr et al. 2003).

Figure 3: Locomotors categories for top-class players (■) and moderate players (□) during a soccer game expressed as total time (mean ±SD). *Significant difference (P <0.05) between groups. St =standing; W=walking; J= jogging; LS, MS and HS= running at a low, moderate and high speed, respectively; Sp= sprinting; BR=backwards running (Mohr et al. 2003).

2.4. Strength training (ST)

A season in soccer is considerably long therefore long lasting periods use a non-linear periodization model. ST for soccer is typically broken up into 4 phases; off-season for building functional strength, early pre-season for building Maximal Strength, late Pre-season for building Muscular power and strength endurance and finally in-season where Maintenance is the main

objective. A combined muscular strength and power training should be put in place to develop a young soccer player's explosive performance, such as vertical jump, shooting power and 30m sprint, and this can also lead to improved aerobic endurance (Wong et al. 2010).

Strength training takes dramatic affect during the initial phase. After 100 days of resistance training the cross-sectional area of muscle increases by 23% and maximal strength can increase up to 91.7%. There is a direct correlation of strength per unit cross-sectional muscle area (Ikai et al. 1970). The timing of when an athlete should begin strength training is very important, players should start strength training when they are 16 years old but before this they should learn the proper techniques and develop motor control.

Strength training is essential in order for an athlete to continue developing into a world class player. Strength training should be accompanied by anaerobic and/or plyometric type training in order to elicit the best results.

Following this type of complex training player will increase their maximal running speed, acceleration, jumping ability, increase the force in kicking, tackles and headers and help prevent injuries (Hickson 1980). At the end of this section table 2 summarize all the different resistance training methods that will be covered in this section.

2.3.1. Hypertrophy training

During strength training the eccentric phase (3 seconds) is slow and the concentric phase (2 seconds) is slightly faster. The muscle tissue brakes down greater during the eccentric phase, therefore when trying to increase body mass many strength and conditioning coaches suggest performing very slow movements eccentrically. Hypertrophy training is not the main cause of concern to a soccer player because the general physique is lean. This is important to achieve a base line training level for the season as it progresses. A good foundation will assist the athlete during the later stages of a training program. The importance of periodization becomes very evident as the season progresses (Kraemer &Hakkinen 2002).

2.3.2. Maximal strength

Maximal strength training is essential when the main goal is to develop an athlete's 1 rep max (1RM). The general protocol is to perform this training with very little reps along with many sets, leaving large rest time in between sets. This type of heavy resistance training leads to the recruitment of type II and type I muscle fibers (Kraemer &Hakkinen 2002).

This is not the most beneficial type of training for soccer players due to the fact that lifts can take a considerable amount of time which is not very soccer specific. This is useful to develop

during the pre-season training. Essentially lifting heavier weights compared to body mass ratio will lead to a faster athlete.

2.3.3. Explosive strength

Explosive power can be developed in many different ways by using heavy, moderate and light weights. During strength training Polymeric training should be used additionally to weight lifting in order to develop explosive power. The goal for an athlete is to produce a great amount of force during a short amount of time. The fast twitch composition of the muscles is the main indication of an athlete's potential (Hakkinen et al. 1985). This is one of the reasons why explosive power is more important than maximal strength for soccer players.

Examples of some exercise are; snatch, clean and jerk and clean. An athlete's ability to perform explosive movements is affected when endurance training is carried out concurrently (Hickson 1980).

2.3.4. Strength Endurance training / anaerobic strength endurance

Strength endurance training is important for adolescent soccer players. Endurance training in early childhood and during the early stages of adolescence is essential for building a strong base on which to plan endurance training later on.

During the early stages of adolescence the soccer player's body has the ability to recover effectively from short exercises lasting less than ten seconds. In short exercises the lactic acid levels do not significantly increase. However, since the body's ability to get rid of lactic acid has not fully developed, the exercises that build high lactic acid levels should be avoided. At the later stages of adolescence, it is important to include endurance exercises that build a good foundation for the future (Balyi et al. 2014).

Resistance training in conjunction with aerobic and anaerobic training can improve performance in endurance sports (Taipale et al. 2014). One of the most popular forms of training muscle endurance is by carrying out a circuit. This type of training helps the athlete to perform repeated high intensity movements. Ideally the trainer should incorporate soccer specific movements into the circuit making it attractive to the players.

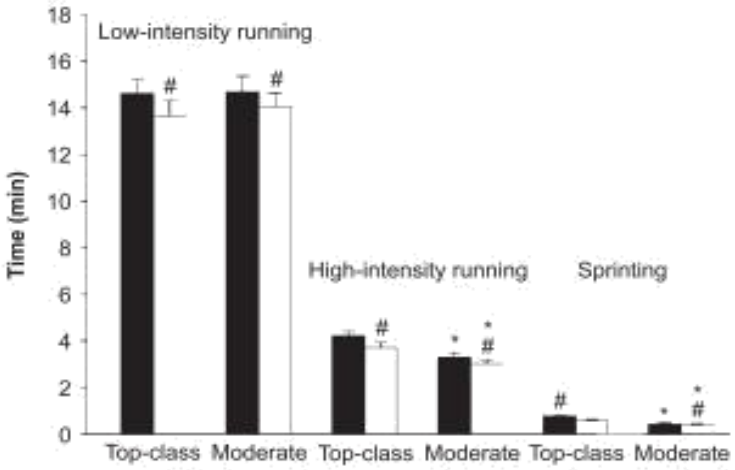
Table 2: Resistance Training protocols (Kraemer &Hakkinen 2002)

Training Methods	Sets x Reps	Load (% of 1RM)	Duration (seconds)	Recovery (minutes)
Maximal strength	4-6 x 1-3	80-100%	0.5-1.5 sec	3-5 min
Hypertrophy	3-5 x 6-12	60-80%	2-3 sec	1-2 min
Explosive Strength	4-6 x 5-10	30-60%	0.2-1 sec	3-5 min
Endurance Strength	4 x 15-30	0-30%	1sec	0.30-1min

Adapted from resistance training protocols (Kraemer &Hakkinen 2002)

2.4.2. Anaerobic Fitness

Professional soccer players on average perform 700 turns, 30-40 sprints which occur every 90 seconds lasting 2-3 seconds, 30-40 tackles and jumps during a 90 minute game (Bloomfield et. al., 2007 & Mohr et. al., 2003). Figure 4 shows the distribution in low-intensity running (jogging, low-speed running and backwards running), high-intensity running (moderate- and high-speed running) and sprinting during the first and second half for top-class and moderate players. These short lasting bouts of high intensity indicate that the anaerobic system needs to be trained in conjunction with the aerobic energy system. For these short bouts of high intensity activities ATP (adenosine triphosphate) is used as the main source of energy (Reilly 2007). The total duration of sprinting is very low meaning that the utilization of this time is extremely important (see figure 4).



Adapted from time spent in 90 minute game (Bloomfield et. al., 2007 & Mohr et. al., 2003)

Figure 4: Time spent in low-intensity running Time spent in low-intensity running (jogging, low-speed running and backwards running), high-intensity running (moderate- and high-speed running) and sprinting during the first (■) and second half (□) for top-class and moderate players (Mohr et al. 2003).

2.5. Plyometric training

There are three types of muscle action; eccentric, isometric and concentric action. An eccentric action or negative work is when the muscle lengthens under tension, such as when a player has to decelerate. Isometric or static hold occurs when the muscle is staying at the same length generating tension and there is little or no movement at the joint. In a dynamic movement this becomes known as the transition phase. When the muscle shortens under tension this is referred to as a concentric action or positive work (McArdle et. al., 2007). The muscle contains muscle fibers made up of two opposing proteins called actin (thin protein filaments) and myosin (thick protein filaments) which work together to form cross-bridges. Cross-bridges work together to perform work and cause motion (Chu et. al., 2013 &McArdle et. al., 2007). There are two types of muscle fibers; type I which are slow and type II which are fast. Explosive training such as plyometric training normally results in the recruitment of fast twitch muscle fibers which are essential to perform actions as fast as possible. Muscle fibers are recruited by activating motor neurons which together are referred to as motor units. The more motor units recruited the greater amount of contractile force can be produced (McArdle et. al., 2007). The aim of plyometric training is to increase performance by increase efficiency of force production.

This type of training involves jumping and bounding type activities accompanied with resistance training, in order to attain the best results. Söhnlein et al (2014) have given recommendations about the duration of a short term PT program in young soccer players. Their recommendations have proved to be controversial in light of other similar studies (Saez de Villarreal et. al., 2015). According to Söhnlein et al (2014) 2 PT sessions per week may be efficient to improve sprint performance. This study indicates that after 4 weeks considerable improvements are noticed. However, the greatest achievements were attained after a 12 week period, but there was no significant change in performance during the final 4 weeks. In some cases you may need to continue for up to 16 weeks of certain parameters such as the 20m sprint performance. This was controversial at the time because prior to this finding it was recommended that plyometric training should take place 3-4 times per week (Saez de Villarreal et. al., 2015).

2.5.2. Stretch shorting cycle (SSC)

To improve a person's jumping ability, SSC exercises have demonstrate considerable enhancement in performance with increased force at a given shortening velocity (see figure 5) (Komi, 2000). Therefore plyometric exercises, such as hopping and bounding, could be brought into a players training regime in the hope of improving their working mechanics. Developing a person's SSC characteristics can improve speed, as muscle fibers are recruited faster and more efficiently, and also endurance capabilities because the onset of fatigue sets in later because movement economy improves becoming more efficient (Harrison, et. al., 2004).

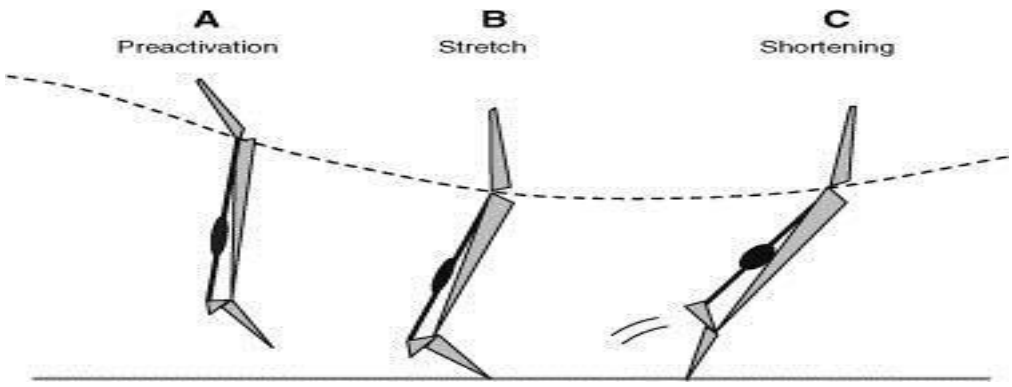


Figure 5: stretch shortening sycle(Kimi, 2000).

Plyometric training (PT) has been proven to improve explosive strength, agility, jump height and sport specific performance (Michailidis et al. 2013). The main reason is because PT activates the stretch-shorting cycle (SSC) mechanism. The SSC is when the muscle is lengthened (eccentric phase) and then immediately after the lengthening the muscle is shortened (concentric phase) (McArdle et al., 2007; Komi 2000).

PT is mostly used when training athletes from pre puberty to late puberty due to the fact that testosterone levels in this age group are low. Due to the low testosterone levels at this age the ability for building muscle mass is limited and thus, neural adaptations should be the main focus of training (Söhnlein et al 2014).

There is no general recommendation available for young adults for improving sprint performance. Strength and conditioning coaches must therefore refer to the only general recommendation of a program and duration which were derived from a meta-analysis that included adults, adolescent and pre-puberty athletes. A pervious article suggests that 6 weeks of plyometric training consisting of one session per week leads to significant improvements in the traditional agility test known as the T-test, Illinois Agility Test and force production (Miller et al. 2006). This was one of the first papers to the author's knowledge that showed improvements in agility tests after a plyometric intervention. The recommendation is a program lasting 10 weeks with 18 high intensity sessions consisting of 80 jumps per session. There is a high trainability in preadolescent soccer players as has been shown by Michailidis et al. (2013) that a 12 week plyometric program leads to better improvements in squat jump (SJ), drop jump (DJ), countermovement jump (CMJ), single leg jump (SLJ), multiple 5-bound hopping (MB5), leg strength and sprint time, compared to normal soccer practice.

2.5.3. Slow and fast SSC

Slow (>0.25s) SSC-type plyometric exercises are used to improve the initial acceleration phase (0-10m) (Delecluse et al. 1995). The ground contact time lasts longer than 0.25s and this type of movement involves large movements at the joints (Söhnlein et al. 2014). Fast (<0.25s) SSC-type plyometric exercises improve the second acceleration phase (10-30m) and maximal velocity phase (30m) (Delecluse et al. 1995). Less than 0.25s ground contact times generally involve smaller movement at the joints (Söhnlein et al. 2014).

Typical sessions consist of 3-5 sets and 6-16 reps of each exercise (starting at 3 sets working up to 5 sets). The numbers of jumps\contacts start at around 90 and increase up to 180 over an eight week period. Number of ground contacts/jumps and jump type will dictate the session intensity. When good technique is mastered then the athlete should slowly and steady progress onto the next progression level. Landing mechanics and technique are factors that should be perfected before progression increase in intensity are considered. A jump mat can be used to determine an athlete's ability to utilize their SSC ability. It has been shown that 30, 60 or 120 seconds rest in

between sets result in similar improvements (Ramírez-Campillo et. al., 2014). From the safety perspective and benefit of the athlete it should be noted that a good strength foundation should precede any plyometric work.

2.5.4. Velocity

An athlete's maximum velocity is achieved after 30 meters of high intensity running. It has been suggested that sprint performance is characterized into 3 phases; (a) initial acceleration phase (0–10 m), (b) secondary acceleration phase (10–30 m), and (c) maximal velocity phase (after 30 m) (Delecluse et al. 1995). The 30m sprint test isn't very soccer specific but it is still necessary to assess all 3 phases of sprinting. After the implementation of a 12 week anaerobic intervention program the participants improved significantly in all the tests (sprint with 180^{o} turns, sprint 4x5m, slalom test with ball,

Slalom test, sprint with 90^{o} turn with ball and sprint with 90^{o} turns) carried out except for sprinting forward and backward (see table 4) (Milanović, et al. 2013).

2.5.5. Agility and/or Change of direction

Change of direction (COD) has sometimes been used as another name for agility but recently they have become acknowledged as different performance abilities. Agility has been defined as a whole body rapid movement with change of velocity or direction in response to a stimulus (Sheppard & Young, 2005).

Agility is performance in a changeable environment such as a match. On the other hand COD takes place in a pre-planned environment, such as the traditional T-test. In the future these traditional agility tests may become known as change of direction speed (CODs) tests.

It has been studied that short term (3 weeks) agility training program can improve agility test results in young players (Jullien et al. 2008). This shows the importance of training specificity. Lateral agility has been found to improve with SAQ training (Milanović, et al. 2013) and linear agility has been found to improve with additional plyometric training (Söhnlein et al. 2014 &Saez de Villarreal et. al., 2012). It has also been shown that a player's agility can be significantly improved when the athlete is 18 years old. Previously it was considered that the majority of development occurs at 16 years old (Milanović, et al. 2013).

2.5.6. Reaction speed

Reaction speed is associated with the term "Quickness" (Brown 2005). Quickness is an essential part of soccer because during a game players have to perform short sprints every 4-5 second. These short sprints can include moving into an advanced position or tracking the movement of an opponent (Bloomfield et. al., 2007 & Mohr et. al., 2003).

Being that millisecond faster than your opponent is the difference from winning and losing possession. When developing an athlete's quickness it is important to avoid using pre-planned agility exercises as this prevent the athlete from developing their reaction speed (Milanović, et al. 2013). A way to incorporate this into a drill is to use different colour cones and the player runs to the colour cone that the coach calls our or the coach can simply show with hand signals which direction the player should run.

Table 3: Agility and/or Change of direction (Milanović, et al. 2013).

	Experimental group (n = 66)		Control group (n = 66)	
	Initial	Final	Initial	Final
Sprint with 180° turns	7.40 (.33)	7.29 (.35) **	7.46 (.35)	7.49 (.36)
Sprint with backward and forward running	7.84 (.39)	7.74 (.39)	7.76 (.41)	7.80 (.43)
Sprint 4x5 m	5.93 (.38)	5.86 (.39) **	6.04 (.35)	6.07 (.34)
Slalom test with ball	10.93 (1.11)	10.67 (1.06) **	10.95 (1.21)	11.24 (1.23)
Slalom test	7.83 (.74)	7.77 (.76) *	7.85 (1.06)	7.95 (1.13)
Sprint with 90° turns with ball	9.92 (.60)	9.67 (.58) *	9.85 (.64)	9.91 (.65)
Sprint with 90° turns	7.83 (.51)	7.67 (.48) *	7.72 (.63)	7.75 (.65)

CHAPTER THREE

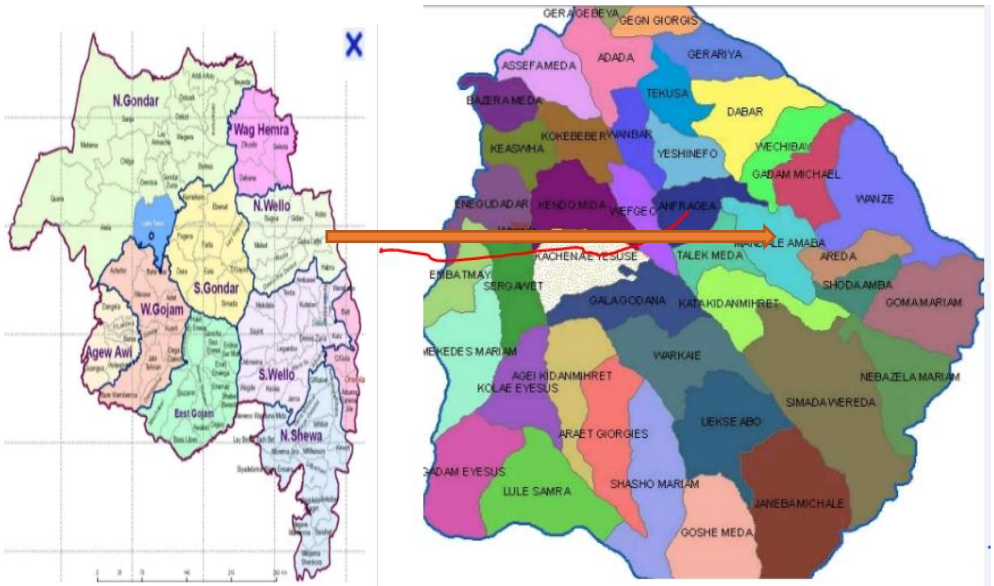
REASERCH METHODS

3.1. INTRODUCTION

This chapter outlines the procedures used in the study. It introduces a complete description of the methodology of the study, the population, the sample, the instrumentation, a description of the anaerobic, plyometric training used in the study and the research design. Eventually, it introduces the statistical treatment of the study findings.

3.2. Research cite

The study was conducted in Robitkenema football club in Sedie-mujja worda of south Gonder Zone, Amhara National regional state (ANRS). The administrative center of South Gonder, Debre tabour, is also the administrative center of Sedie-Muja worda, which lies 267km NE of Bahir dar (the capital city of Amhara). It is bordered by Tache Gayent in the north, simada in the south, Amhara sayinet in the East and Lay Gayinet in the west. The club, which the study was under taken, located in Robit in the city of Muja, established in 2003 E.C and 32 players included in a squad.



Map of Amhara **map of Muja**

Figure 6 Research cite

3.3. Research Design

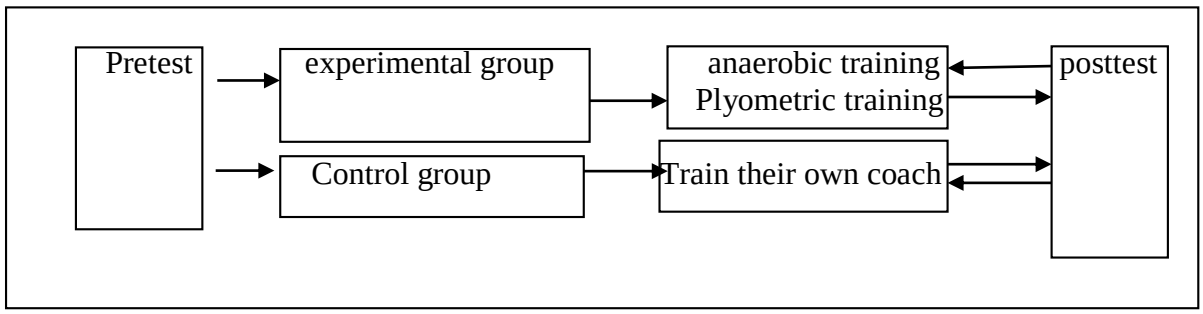
The focus of this study was to investigate the effect of eight weeks anaerobic, plyometric training on football player performance in Robitkenema. Depending on the nature and appropriateness of the pre and post test data the research approach designed in the study was employed experimental design, since it helps to measure, assess, evaluate, analyze the effect of anaerobic, plyometric training in the independent variable on the dependent variable, these are speed, agility, power and skill performance. In general this design involves systematic collection and presentation of the data to give clear picture of the particular situation of the problem. The layout for this study was as follows:

Table 4: The study design layout

Treatment	Anaerobic, plyometric training
Frequency	3 days/week
Total duration	8 weeks
Duration/session	>45 minutes
Intensity	High
Exercise days	Monday, Thursday, Saturday
Time of training	Morning and evening(Saturday)

So, the researcher depended on the following design to test the study hypotheses as shown in Figure (6) below

Figure 7: The experimental design



3.4. Population of the study

The population of the current study consisted of all threety two (32) football players in Robitkenema football team in Sedie Muja worda.

3.5. Sample of the study

Selecting the study sample is one of the most important steps of the study. Ebeedat et al. (2005: 132) define the sample as "A part of the study main population chosen by the researcher using

various techniques and includes members of the main population". The study sample was determined through the simple random method. In Robitkenema, male young football players that have threety two players. The researcher used the lot to select the sample from them. The sample was selected randomly from this club. It consisted of (32) players distributed into three groups; the plyometric group consisted of (12) players, anaerobic group consisted of (12) players and the control group consisted of (8) other players. Table (6) shows the distribution of the sample:

Table 5: Distribution of the sample according to the groups

Group	Plyometric Group	anaerobic Group	Control Group
Male	12	12	8

3.6. Variables of the study

The study included the following variables:

1. The independent variables represented in

1.1. Anaerobic training

1.2. Plyometric training

1.3. Control groups did not perform in any plyometric and anaerobic training.

2. The dependent variable represented in Football player performance includes speed, Agility, Jumping power, passing and Shooting.

3.7. Inclusion and exclusion criteria

Individuals with cardiac condition such as hypertension or uncontrolled diabetes of other conditions that would be contraindicated for exercise testing and training were not admitted to the study. Individuals having bone and joint problem, diabetes mellitus, bad habits and those taking medications were not included into the study.

3.8. Source of data

The data for the study were collected from the result of test given from pre to post test of all anaerobic group, plyometric group and control group. Quantitative data were collected through the appropriate absolute strength, power measures such as countermovement jump test, multiple 5 bound tests and performance measures for 30m sprint test, agility test, passing test and

shooting test. Before the experimental groups were going to anaerobic and plyometric training, the pre and posttest was taken from all anaerobic group, plyometric group and control groups. Posttest was also taken from all groups after 8 week anaerobic, plyometric training programs for experimental groups completed.

3.9. Data collection instruments

In order to collect the data necessary analysis, the researcher was used absolute strength, power and skill tests. The use of appropriate tests helped to collect data from selected absolute strength, power and skill variables. For the success of the study necessary materials and facilities such as cones, balls, stop watch, whistle, record sheets, meter and weight balance were used. The detail of each data collecting tests and procedures are discussed as follows.

3.10. Procedures for administration of absolute strength, power and skill

Tests for Anthropometrics:

Age (years), years of training, height (cm), weight (kg), BMI (kg/m^2) and circumference of thigh (cm) were recorded.

Countermovement Jump (CMJ)

Subjects performed the CMJ on a force plate with hands on their hips and feet shoulder with apart. Participants were then instructed to perform a quick and explosive countermovement jump on verbal command so that knee angle for the jump was no less than 90°. The best performance measured in meters was used for statistical analysis.

Figure 8 picture of countermovement jump

Multiple 5 Bound (MB5)

5 jumps were performed and the total distance covered was measured. From a standing position with both feet on the ground, participants tried to cover as much distance as possible with 5 forward jumps by alternating left and right leg contacts. This test has been recommended for the measurement of lower-limb muscle power instead of the vertical jump test and is considered to

be soccer specific (Sohnlein et. al. 2014). The horizontal distance between the starting line and the heel of the rear foot was recorded to the nearest 1 cm using a meter measure. For all the jumping tests the best of the three trials was chosen for further investigation.

Figure 9 picture of multiple 5 bound tests

Sprint test

Subjects started 0.70m behind the photocells and they were allowed to start whenever they wished and instructed to push off their front leg. There were 3 sets of photocells; one at 0m, second at 10m and the third at 30m. 2 minutes rest between trails was allowed.

Agility tests

When performing the agility test the players preformed the test without the ball. A total of 3 trails were timed and the best was used for the statistics analysis. 3 minutes rest between tests was allowed

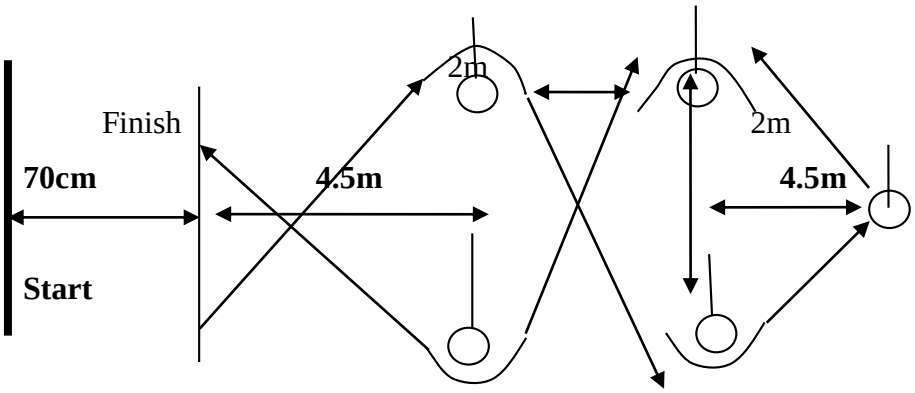
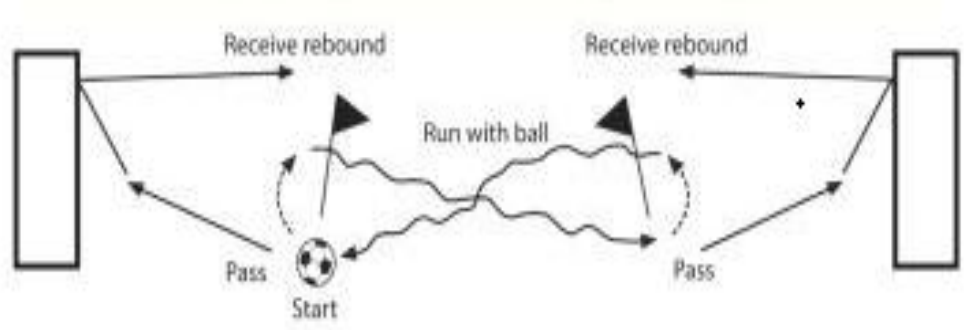


Figure 10: agility test

Passing drill

The passing test layout included two cones 6 m apart from each other and 2 m wide passing walls placed 7 m apart from the cones. Performance time started when a player kicked the soccer towards the wall. Then the player repeated the cycle: pass - receive rebound - dribble between cones - pass to the other wall. The performance ended when the 10th pass hit the passing wall. Five of the passes were given with the right foot and five with the left foot. One successful performance, which was always achieved by the fifth attempt, was required in the test (see figure below). Every player had at least 3 trials each.



Test begins when player makes the first pass.

Test finish when 10th pass hits the wall (5 on each side).

Figure 11: Passing test used in the study

Shooting test

Players performed a maximal velocity instep place kick to a stationary ball. A ball with a standard International Federation of Association Soccer size and inflation was kicked from 15 meters toward a target 1.5 x 1.5 meters. The players were asked to approach the ball at a speed of their choosing and shoot the ball as hard as possible. The first 3 shots that hit the target were recorded; each player had 1 minute rests in between trails. Ball speed was measured using a Second located 4 meters behind the spot kick, held by a person standing on a chair and pointed toward the target according to the instruction manual.

3.11. Methods Data analysis

The data collected through strength and performance tests like 30m sprint, countermovement jump test, multiple 5 bounds test, agility test, passing test and shooting test and the collected data were analyzed and interpreted into a meaningful idea using computer in order to compare strength, power and skill variable changes observed among groups. Data was analyzed using computerized statistical package software SPSS version 21 and manually. The paired T-test) test was used to compare the pre and post training data.

The level of significance was set at 0.05

Velocity= $^{distance}/_{time\ or}\ V = d/t$

CHAPTER FOUR
RESULTS AND DISCUSSION

4.1. Introduction

This chapter deals with the analysis of pre and post test data collected from randomly selected anaerobic (n=12), plyometric (n=12), and control (n=8) groups under the study. The study aimed at investigating the effect of anaerobic and plyometric training on football player performance in Robitkenema. To achieve this purpose, the anaerobic and plyometric training was designed, and the study instruments, which included pretest and posttest results. The researcher adopted the experimental approach in his study. The pre-test was conducted on the groups, and then the program was implemented on the experimental group and the other one on the control group. After that, the test was conducted on both groups after eight weeks on both groups. Finally, collected data were analyzed using ANOVA test to analyze pre-test and post test results of anaerobic, plyometric and control groups to test the hypotheses. This chapter tackles the results and data analysis using as follows:

4.2. Results of the study

Table 6: characteristics of the study participants (Mean± SD)

	AN Group (n=12)		PT Group (n=12)		Control Group (n=8)	
	Pre	Post	Pre	Post	Per	Post
Age (years)	16.8±0.8	-	17±1.2	-	18±1.1	-
Years of Training	3.8±0.8	-	4.2±0.8	-	4±0.7	-
Weight (kg)	51.2±2.3#	54±1.4#	52.2±3.4#*	54.8±2.5#*	51.2±1.9*	51.2±1.9*
Height (m)	1.67±0.06	1.74±0.07	1.68±0.04	1.76±0.065	1.69±0.5	1.65±0.03
BMI	17.55±1.2#	18.84±2.6#	17.9±1.3#	17.8±1.9#	19.1±1.2	19.58±0.7*
CoT (cm)	39.8±2.3#	41.2±2.95#**	39.5±1.8#	41.5±1.6#**	39.6±1.9	40±2.3**

* p<0.05, ** p<0.01 & *** p<0.001, refers to significant differences between Pre and Post.# p<0.05, significant difference with the control group.

As shown from above table 7 descriptive characteristics of 32 study participants from Robitkenema football club mean of age(AN=16.8, PT=17,& CG=18), weight(AN=51.2, PT=52.2,&CG=51.2), height(AN=1.67, PT=1.68, CG=1.69), BMI(AN=17.55, PT=17.9, CG=19.1), COT(AN=39.8, PT=39.5, CG=39.6). Subjects were relatively had the same age, weight, height, BMI and COT at the beginning of the groups.

Table 7: Analysis of variance of circumference of thigh (COT) result

Source of variation	Sum of Square	df	Mean square(ms)	F
Between group	12.15	12	6.075	
Within group	47.6	2	3.97	1.53
Total	59.75	14	10.045	

* Mean difference is significant at 0.05 levels.

"F" table value at (12&2) d f. at (0.05) sig. level equal 3.89.

Table (8) shows that "F" obtained value (1.53) is less than "F" critical value (3.89) in all domains ($\rho > \alpha$). Null hypothesis (H0) is accepted. That means there is no difference between mean.

4.2.1. Countermovement jump (CMJ)

The Control group were the only group to significantly (p<0.05) improve from pre to post measurements in the CMJ (table 9)

Table 8: Analysis of variance Counter movement Jump result

Source of variation	Sum of Square	df	Mean square(ms)	F
Between group	83.3335	12	41.67	
Within group	22	2	1.83	22.8
Total	105.3335	14	43.5	

* Mean difference is significant at 0.05 levels.

" F" table value at (12and 2) d f. at (0.05) sig. level equal 3.89.

Table (9) shows that "F" obtained value (6.89) is greater than "F" critical value (3.89) in all domains ($\rho < \alpha$). Alternative hypothesis (H1) is accepted. That means at least one is different between mean.

4.2.2. 30meter sprint

No main effect was found for measurement (F (4.24), p=0.637) or for group (F(2.30), p=172) regarding to the 30 meter sprint. However, the only noticeable change was that the control group became significantly slower (p=0.02) from pre to post in the 30meter sprint the other two groups got a little bit faster (fig. 10).

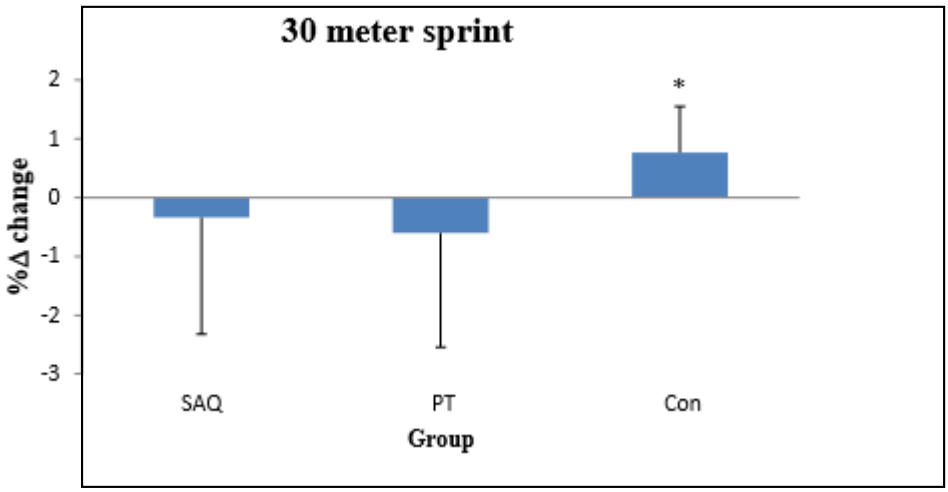


Figure 12: Relative changes in 30meter sprint time performance. *p≤0.05,(mean ±SD).

Table 9: Analysis of variance 30 m Sprint result

Source of variation	Sum of Square	df	Mean square(ms)	F
Between group	8.1335	12	4.06675	
Within group	11.6	2	0.96	4.24
Total	17.7335	14	5.02675	

* Mean difference is significant at 0.05 levels.

"F" table value at (12and 2) d f. at (0.05) sig. level equal 3.89.

Table (10) shows that "F" obtained value (4.24) is greater than "F" critical value (3.89) in all domains ($\rho < \alpha$) Alternative hypothesis (H1) is accepted. That means at least one is different in mean.

4.2.3. Multiple 5 Bounds (MB5) Test

A significant main effect was found for measurement (F(0.73), p<0.012). The plyometric group were the only group to significantly improve their MB5 (p<0.05) (fig 11).

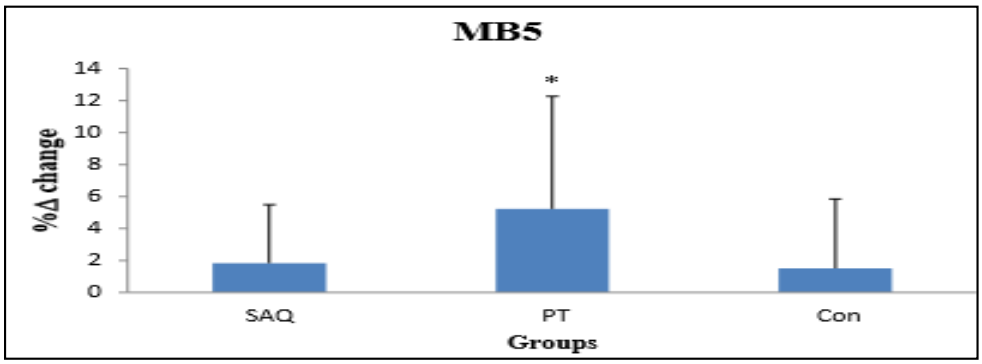


Figure 13: Relative Changes in MB5 performance.*p≤0.05, (mean ±SD).

Table 10: Analysis of variance Multiple 5 Bounds (MB5) result

Source of variation	Sum of Square	df	Mean square(ms)	F
Between group	56.95	12	28.475	
Within group	470	2	39.2	0.73
Total	526.95	14	67.675	

* Mean difference is significant at 0.05 levels.

"F" table value at (12and 2) df.at (0.05) sig. level equal 3.89.

Table (11) shows that "F" obtained value (0.73) is less than "F" critical value (3.89) in all domain ($\rho > \alpha$) Null hypothesis (H0) is accepted. That means there is no difference between means.

Table 11: Absolute strength, power and performance values at pre and post measurements within the Groups (Mean±SD).

	AN Group (n=12)		Plyometric Group (n=12)		Control Group (n=10)	
	Pre	Post	Pre	Post	Per	Post
CMJ (cm)	63±10.37	73±9.75	84±9.62	93.6±3.57	76±11.94	**86±17.8***
30m Sprint (s)	6.8±2.2	4.8±1.3	5.8±1.5	4±0.7	5.6±1.14	**5.8±0.8***
MB5 (cm)	47±8.4	52.4±5.9	47±5.7	**55.8±7.1***	50±7.9	57±5.7
Agility (s)	9±1.6	7.8±1.5	8.2±0.8	6±0.7	9.6±1.8	7.2±1.6
Passing (s)	44.2±4.3	40.8±3.3	48.4±2.1	44.2±3.2	45.4±3.8	43.2±3.7
Shooting (m/s)	75.4±7.73	80.6±6.2	73±6.7	**77.6±6.4****	68.6±2.2	71.4±1.95

* p<0.05, ** p<0.01 & *** p<0.001, refers to significant differences between Pre and Post measurements.# p<0.05, ## p<0.01 significant difference with the control group.

4.2.4. Agility tests

There was no significant main effect change in measurement (F(2.625), p=0.170) or group (F(2.29), p=0.642) from pre to post in any group in the agility test.

Table 12: Analysis of variance agility result

Source of variation	Sum of Square	df	Mean square(ms)	F
Between group	8.4	12	4.2	
Within group	21.6	2	1.6	2.625
Total	30	14	5.8	

* Mean difference is significant at 0.05 levels.

"F" table value at (12and 2) d f. at (0.05) sig. level equal 3.89.

Table (13) shows that "F" obtained value (2.625) is less than "F" critical value (3.89) in all domains ($\rho > \alpha$). Null hypothesis (H0) is accepted. That means there is no difference between mean.

4.2.5. Passing test

No significant improvements were observed in the passing test. Main effect for measurement (F (1.33), p=0.648) and for group (F (2.29), p=0.803).

Table 13: Analysis of variance passing result

Source of variation	Sum of Square	df	Mean square(ms)	F
Between group	30.5335	12	15.3	
Within group	138.4	2	11.55	1.33
Total	168.9335	14	26.83	

* Mean difference is significant at 0.05 levels.

"F" table value at (12and 2) d f. at (0.05) sig. level equal 3.89.

Table (14) shows that "F" obtained value (1.33) is less than "F" critical value (3.89) in all domains ($\rho > \alpha$). Null hypothesis (H0) is accepted. That means there is no difference between mean.

4.2.6. Shooting velocity

There was no a significant main effect present in measurement (F(3.85), p=0.001) but not between groups (F(2.29), p=0.069). The Plyometric group shooting speed got significantly slower (p<0.001) from pre to post measurements while both the other groups decreased their performance but was not found to be significant.

Table 14: Analysis of variance shooting result

Source of variation	Sum of Square	df	Mean square(ms)	F
Between group	220.1335	12	110.06675	
Within group	343.6	2	28.63	3.85
Total	563.7335	14	138.69675	

* Mean difference is significant at 0.05 levels.

"F" table value at (12and 2) d f. at (0.05) sig. level equal 3.89.

Table (15) shows that "F" obtained value (3.85) is less than "F" critical value (3.89) in all domains ($\rho > \alpha$). Null hypothesis (H0) is accepted. There is no difference between mean.

4.3. Discussion

Anaerobic training

Previous studies have indicated that additional anaerobic training can improve performance in agility tests (Milanović, et al. 2013) and straight line speed (Milanović et al 2014). However, from this study the anaerobic group's agility performance and sprint speed did not improve to the amount expected.

It is important to note that the strength improved very significantly from Pre to Post measurements. Although this is not a popular test to be performed when researching performance level of soccer players, this test is a very reliable and the improvement in the players in the countermovement jump strength can only be look at as a positive outcome for the 8 weeks of training. It could be suggested that diagonal sprint training is effective to develop strength levels in soccer player's age 16-20years old. A positive training effect can be produced without the use of expensive additional equipment, which is an advantage for soccer clubs and Strength and conditioning coaches. For this age group it might be enough to practice sprint training in preseason to develop lower body strength. However, if one wants to develop other performance parameters additional strength exercises and plyometric training are required. Also, without performing efficient strength training to stabiles the joints the likely hood of injury is increased (Faigenbaum et al. 2010). Therefore, it is highly recommend the perform proprioception exercises and strength exercises should also be performed the help prevent injury (Lauersen et al. 2014).

Plyometric training

It has been previously shown that plyometric training improved jump height and jump distance (Michailidis et al. 2013). As predicted jump height and length did improve but oddly enough the result was not significant in the CMJ whereas it was significant for the MB5. It has been suggested that the MB5 is a soccer specific test and more applicable to determine the performance level of a soccer player (Michailidis et al. 2013). Horizontal jumps maybe more soccer specific because players have to constantly jump over tackles, jump to make tackles, etc. These types of jumping tests are not as popularly used in research but they are becoming more commonly used. The reason may be that in order to have data that is comparable to previous research the tests must remain the same. Two relative new studies have used the MB5, LJ and single leg jump to examine power production (Michailidis et al. 2013&Söhnlein et al. 2014). These tests are becoming more popular to use when working with soccer players. They are more

closely related to movements that occur during a soccer game. Jumping off one leg is more often the way a player jumps for the ball.

Furthermore, this result may be due to the type of training program the players completed. The start of the program did include exercise for improving jump height at the start but as the program progressed the exercises focused more on repeated jump ability in the sagittal plane. The exercise where preformed mover forward and it was difficult to emphasis jump height when suitable equipment was not available to the trainers. Soccer is a running sport and in order to increase running speed you have to improve horizontal propulsion forces and minimize horizontal breaking forces. This program was aim towards training specificity. The focus was towards plyometric in the horizontal force production to train in a specific manor to improve speed.

There is previous evidence to suggest that performance in speed and agility can be improved by plyometric training (Söhnlein et al. 2014 &Saez de Villarreal et al. 2012).

Some studies have suggested that 8 week is not long enough to find improvement in the 30 meter sprint time (Söhnlein et al. 2104). However, in this study the 30 meter sprint time did improve in the plyometric group and the anaerobic group. Straight line speed improved but agility for did not change from pre- to post measurements. Although agility did not improve, the passing test involves reactive agility, when the ball rebounds from the wall. This acts as the stimulus the player has to react to, whereas the agility test used in this study was more pre-planned change of direction which has been shown to be difficult to improve (Sporis et al. 2010). This positive correlation suggests that this type of training may be suitable for developing reactive/unpredictable agility, which is game specific.

Control Group

Previous research shows that traditional soccer training does not lead to any significant improvements in measurements of agility, jumping and speed. A complex training method may be the most favorable training strategy for improving jumping performance, sprint and agility performance. A combined resistance training program combined with plyometric training or anaerobic training should be more beneficial to the athlete traditional training methods (Seitz et al. 2014).

However, the Control Group in this study mainly preformed small sided games with increasing intensity from weeks one to six. Interestingly, the Control group did improve their jump height and absolute countermovement jump significantly. This may be due to the high intensity small games and the fact that they had to jump to compete for the ball in the air. However, they were the only group to get significantly worse in the 30 meter sprint. Therefore it can be suggested that additional anaerobic training and/or Plyometric training is required to maintain or improve

maximum speed. Straight line acceleration is a key performance measure when it comes to determining who can make it to the top level in soccer. From figure11, we can see that if a player is already fast to begin with it is difficult to become faster. Once again a variation in training to develop and/or maintain a player's speed is necessary when players have surpassed their PHV.

Interestingly, there was a positive correlation between the decrease in sprint speed and the increase in the countermovement jump. The CG were bigger in size (Table 7), providing a possibly reason why they were overall stronger compared to their smaller counterpart when looking at the absolute value but unable to transform this strength into efficient power production. They may have reached their maximum maturity development already whereas the other groups still have to.

Skill development

The time to complete the passing slightly decreased in the anaerobic group where it slightly improved in both the Plyometric Group and the Control Group. It is important to note that these changes were not significant which means the skill level of all the players remained at the same level over the 8 weeks of training. Therefore, performing an additional 1 hour of Plyometric training or anaerobic training does not affect the skill level of boys aged 16-20 years old. During a 6 hour training week it is recommended to perform 1 hour of anaerobic and plyometric training sessions.

There are many different physical attributes that have a role in soccer but this study concentrated on the importance of jumping performance, sprinting ability and agility. All of these affect a player's ability while playing the game. It is important for players to be able to out-jump/out-run opponents when competing for aerial duels, retrieving a loose ball, closing down an opposing player with the ball, passing a player when in position of the ball, etc. All these aspects of the game involve being able to perform well in all these physical performance tests. A coach can visually see the performance trade off on the pitch once the players are put to the real test, which is playing a game. Young players sprinting ability is an early indication if they have potential to play at the top level. Researchers have suggested that this is one factor that is extremely difficult to improve (Gonaus et al. 2012, Vestberg et al. 2012).

The most commonly used sprinting tests are the 15m and the 30m speed test. This seems to vary from country to country. Researchers may carry out the same test that clubs use in their own test battery. Further research is needed to make sure this idea is correct. Agility is another very important aspect of determining how successful a player will eventually be (Jovanovis et al. 2011). There seems to be no longer a standard agility test that all researchers use. It is evident,

from a large amount of the articles, that researchers develop their own agility test or use one derived by their FA (Football association) body in their own country. The greater power performance is also a very important aspect of a soccer players overall performance (Jovanovis et al. 2011, Dardouri et al. 2013).

Generally, the results of the present study in accordance with the result of other findings provide that both anaerobic and plyometric training is the optimal model of exercise for improving speed, agility, power, passing and shooting performance.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1. Summary

The purpose of this study was to evaluate the effect of eight weeks anaerobic and plyometric training on football player performance in Robitkenema. For this purpose, the researcher reviewed the available literature in order to decide the focus of the study and methodologies. In order to obtain the general objective of the study, the following specific research objectives were formulated.

- To evaluate the effects of 8 week anaerobic and plyometric training on young football players´ speed performance.
- To measure the effects of 8 week anaerobic and plyometric training on young football players´ agility performance.
- To determine the effects of 8 week anaerobic and plyometric training on young football players´ jumping Performance.
- To investigate the significance effects of 8 week anaerobic and plyometric training on young football players´ passing performance.
- To assess the effect of 8 week anaerobic and plyometric training on young football players´ shooting performance.

Based on the above specific objective, the hypotheses were formulated. In dealing with the basic objectives, the study conducted on Robitkenema young football players among a population of 32 players using random sampling technique 12 players were anaerobic group, and 12 players were plyometric groups of two experimental group for two month and three days per week, and 8 players serve as control group were attended 3 days per week on previous training method. A pretest and posttest result of absolute strength, power and performance tests were taken to gain the necessary information required. Through ANOVA test the data was analyzed. Hence, the following findings were investigated.

The present study was conducted with Robitkenema young soccer team and it has indicated that plyometric and/or anaerobic training is required for boys aged 16-20 years old to maintain and/or improve maximum sprint speed over the course of an 8 week training period. Only two 30-45minute session was required to improve straight line speed and jumping in the horizontal plane. This frequency of training was also sufficient to maintain agility performance and vertical

jump height. Teams that do not have access to specialized training equipment know that basic plyometric and anaerobic training is beneficial to the young players.

5.2. Conclusion

The present study examined the effects of 3 different training protocols on soccer players aged between 16-20 years old. Based on the main findings of the study, the following points were stated as a conclusion.

1. The anaerobic group significantly improved their absolute and relative strength levels in the countermovement jump from pre to post.
2. The Plyometric Group was the only group to significantly improve their performance in the MB5 from pre to post.
3. The control group significantly improved their performance in the CMJ. However, it was the only group who significantly slowed in the 30m Sprint post measurements.
4. The skill level of all the players remains unchanged over the course of the 8 weeks.

5.3. Recommendations

Based on results, discussions and findings of the study, the following would be recommended.

- For better improvement of absolute strength, power and performance, players should engage in anaerobic and plyometric training more than 3 days per week 60 minute each day.
- Both anaerobic and plyometric training had a positive effect on absolute strength, power and performance. So for the better improvement players should participate in anaerobic and plyometric training.
- Anaerobic and plyometric training had a great effect on the improvement of speed, agility, power, passing and shooting performance.
- Further study should be conducted in different clubs to understand how anaerobic and plyometric training affects absolute strength, power and performance.
- All football coaches as a means to improve strength, power and performance status of players should encourage anaerobic and plyometric training among various football clubs.

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Appendixes 1: Distribution of the sample according to the groups

Group	Plyometric Group	anaerobic Group	Control Group
Male	12	128	

Appendix 2: profile of study participant

A. Anaerobic group

No	Name of player	Age	Height(m)	Weight(kg)	Years of training	COT
1	Habtie	16	1.70	50	3	39
2.	Destaw	17	1.60	54	4	37
3	Amnual	18	1.65	48	3	38
4	Derse	16	1.65	52	4	41
5	Awuye	17	1.75	52	5	45
6	Abush	16	1.65	50	2	39
7	Asnakew	16	1.70	52	5	37
8	Shirtie	17	1.75	53	4	40
9	Derbew	19	1.55	48	3	39
10	Ayichew	18	1.65	49	3	41
11	Asnakew	19	1.75	50	4	40
12	Amide	16	1.65	45	5	42

B. Plyometric group

No	Name of player	Age	Height (m)	Weight(kg)	Years of training	COT(cm)
1	Asmamaw	17	1.65	51	5	39
2	Kindey	17	1.70	48	4	40
3	Wudwud	16	1.65	57	5	37
4	Getasew	16	1.75	51	4	38
5	Shegay	19	1.70	54	3	42
6	Yohannis	16	1.65	53	3	41
7	Habitamu	19	1.70	49	4	38
8	Eyayaw	16	1.60	48	2	39
9	Birhan	19	1.75	47	3	40
10	Eneyew	19	1.60	50	3	41
11	Tsedalu	18	1.65	49	2	37
12	Alehegn	17	1.70	50	4	42

C. Control group

No	Name of player	Age	Height(m)	Weight(kg)	COT	Years of training
1	Mesetet	18	1.60	52	43	4
2	Zeleke	19	1.55	50	40	5
3	Seani	18	1.60	54	38	3
4	Yohannis	17	1.60	49	37	4
5	Tadesse	20	1.58	51	39	4
6	Abedie	17	1.65	50	40	5
7	Amare	18	1.75	52	38	4
8	Akele	19	1.70	54	42	3

Appendix 3: Pre and post test results of strength, power and skills in experimental group

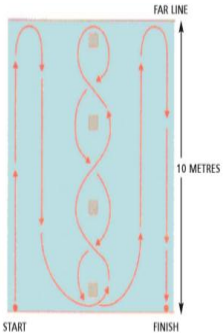
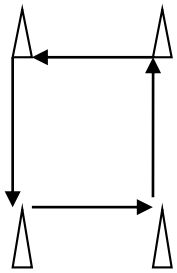
No.	Anaerobic group											
	CMJ(cm)		MBS(cm)		30m sprint(s)		Agility(s)		Passing(s)		Shooting(m/s	
	Pretest	Posttest	pretest	posttest	pretest	posttest	pretest	Post test	pretest	posttest	Pretest	posttest
1	60	70	40	48	5	5	9	6	45	40	74	81
2	55	64	45	49	8	5	8	7	43	40	75	79
3	78	82	40	50	9	4	10	6	48	44	78	81
4	65	80	50	54	4	6	11	7	54	49	75	79
5	55	70	60	62	8	6	9	9	38	34	74	80
6	69	74	48	49	9	4	10	6	45	41	75	79
7	66	71	65	66	6	5	8	7	43	40	78	83
8	72	76	62	65	7	5	9	6	39	35	79	81
9	65	69	47	49	9	6	9	7	52	47	79	81
10	74	79	53	54	9	4	7	6	38	37	75	79
11	58	66	46	49	8	6	9	7	45	43	69	83
12	64	68	42	46	5	4	10	5	42	40	78	80
No.	Plyometric group											
1	80	95	45	59	5	4	8	6	49	45	80	82
2	85	98	45	52	6	5	9	7	45	41	70	76
3	75	89	40	48	6	4	8	6	48	42	65	69
4	90	92	50	57	5	4	7	6	49	46	70	78
5	87	95	52	60	7	5	8	5	50	47	78	80
6	79	88	49	55	5	4	10	7	51	46	68	73
7	95	98	48	56	6	5	7	5	52	47	65	71
8	83	96	52	58	6	4	9	6	46	42	64	70
9	85	97	52	62	5	3	7	6	45	43	78	82
10	82	91	43	48	6	4	8	6	48	44	85	87
11	79	85	45	54	7	3	9	7	52	47	75	78
12	86	93	45	62	5	4	8	5	45	42	80	85

Appendix4: Pre and post test results of strength, power and skills in control group

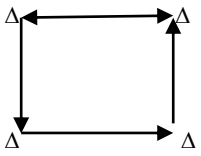
No.	Control group											
	CMJ(cm)		MBS(cm)		30m sprint(s)		Agility(s)		Passing(s)		Shooting(m/s	
	Pretest	Posttest	pretest	posttest	pretest	posttest	pretest	Post test	pretset	posttest	Pretest	posttest
1	85	90	52	54	6	7	10	8	46	43	70	73
2	75	85	44	48	5	4	9	8	51	50	65	64
3	78	87	50	54	6	5	10	9	42	41	70	71
4	69	83	49	52	5	5	11	10	37	36	69	72
5	78	85	55	60	6	5	9	7	38	34	74	75
6	69	79	48	59	5	8	10	7	54	48	57	60
7	75	87	54	66	6	7	8	6	46	46	71	79
8	80	91	49	65	6	6	10	8	50	49	72	77

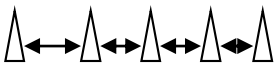
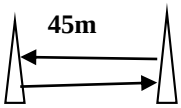
Appendix 5: Eight week anaerobic and plyometric training program for Experimental group

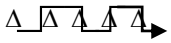
DAy	time	Week1	Sets&reps	intensity	Week2	Sets &reps	intensity
monday	15 min	Warming up activity -general &specific warming up stretching exercises -dynamic&static stretching		low	Warming up activity -general &specific warming up Stretching exercise -dynamic &static stretching		Low
	25 min	Main part -20m sprinting -Jumping 5 cones -small sided game	3×20m 3×5 times	high	30m sprint One to one pass Δ⟷Δ Game like training	3×30m 5×10	high
	10 min	Cooling down activity -walking -jogging -Static stretching		low	Cooling down activity -waking -jogging -static stretching		Low
Thus day &Wednesday			rest				

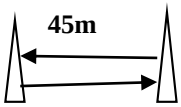
THURSDAY	15min	**Warming up exercise** -general and specific warming up **Stretching exercise** -dynamic &static stretching		low	Warming up activity -warming up with ball		Low	
	30min	**Main part** **Agility activity** **-M pattern**  **-game like training** **9 vs 9**	3 times	High	**Main part** **-passing activity**  -Playing game with small sided area	3times	high	
	10min	**Cooling down** -walking -jogging -static stretching		low	Cooling down exercise -walking -jogging -static stretching		Low	
Friday			recovery time					

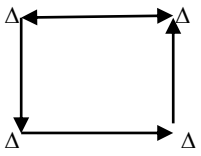
SATURDAy	15min	**Warming up exercise** Warming up withball		low	Warming up activity -general &specific warming up Stretching exercise -walking -jogging -static stretching		Low	
	30min	**Main part** **High jump activity** **-by bending hips then jump each person alternatively.** **-game like training**	3×8	High	**Main part** **Conditioning exercise** **-playing volleyball game, due to improving jumping ability** -Playing game with small sided area		high	
	10min	**Cooling down** -walking -jogging -static stretching		low	Cooling down exercise -walking -jogging -static stretching		Low	
Sunday			recovery time					

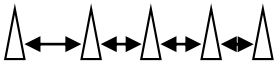
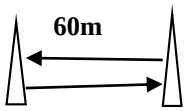
DAy	time	Week3	Sets&reps	intensity	Week4	Sets &reps	intensity
monday	15 min	**Warming up activity** -general &specific warming up stretching exercises -dynamic&static stretching		low	**Warming up activity** -general &specific warming up Stretching exercise -dynamic &static stretching		Low
	25 min	**Main part** -30m sprinting -do one leg hops with a balance step between hops -small sided game	3×10m Do 10with each leg, work up to two sets of 2o.	high	**Main parts** Jump as high as possible from both legs. Rectangular pass  Game like training	10to20explosive two leg jump 5×10	high
	10 min	**Cooling down activity** -walking -jogging -Static stretching		low	**Cooling down activity** -waking -jogging -static stretching		Low
Thus day & Wednesday			rest				

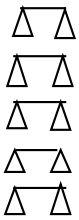
THURSDAY	15min	**Warming up exercise** -general and specific warming up **Stretching exercise** -dynamic &static stretching		low	Warming up activity -warming up with ball		Low	
	25min	**Main part** Agility with out ball  -game like training	3×20m	High	**Main part** shootingactivity 1vs 1 shot  -Playing game with small sided area	5×45m	high	
	10min	**Cooling down** -walking -jogging -static stretching		low	Cooling down exercise -walking -jogging -static stretching		Low	
Friday			recovery time					

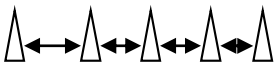
S A T U R D A y	15min	**Warming up exercise** Warming up with ball -training of activity freely in open space		low	**Warming up activity** -general &specific warming up Stretching exercise -walking -jogging -static stretching		Low	
	30min	**Main part** -tire jump Zigzag running with 2 yards between cones and sprinting  -game like training 10 vs 10	3×8	High	**Main part** Conditioning exercise -playing handball game, due to developing agility, speed, power, balance and coordination. -Playing game with small sided area 5 vs 5 ground pass		high	
	10min	**Cooling down** -walking -jogging -static stretching		low	**Cooling down** exercise -walking -jogging -static stretching		Low	
Sunday		recovery time						

THURSDAY	15min	**Warming up exercise** -general and specific warming up **Stretching exercise** -dynamic &static stretching		low	Warming up activity -warming up with ball		Low	
	25min	**Main part** Agility with out ball  -game like training 9 vs 9 (pt vs an)	3×20m	High	**Main part** shootingactivity 1vs 1 shot  -Playing game with small sided area 2 vs 2, 3 vs 3, 4 vs 4 pressure coverage	5×45m	high	
	10min	**Cooling down** -walking -jogging -static stretching		low	Cooling down exercise -walking -jogging -static stretching		Low	
Friday			recovery time					

DAy	time	Week5	Sets&reps	intensity	Week6	Sets &reps	intensity
monday	15 min	**Warming up activity** -general &specific warming up stretching exercises -dynamic &static stretching		low	**Warming up activity** -general &specific warming up Stretching exercise -dynamic &static stretching		Low
	25 min	**Main part** -fitness activity -pushup,situp, Squat trust, running with an elevated area,rolling&jump. - game like traning 11 vs 11 (an vs cot)	3×10 each exercise	high	**Main part** Jump as high as possible from both legs. Rectangular pass  Game like training 11 vs 11 pt vs cot	10to20explosive two leg jump 5×10	high
	10 min	**Cooling down activity** -walking -jogging -Static stretching		low	**Cooling down activity** -waking -jogging -static stretching		Low
Thus day & Wednesday			rest				

THURSDAY	15min	**Warming up exercise** -general and specific warming up **Stretching exercise** -dynamic &static stretching		low	Warming up activity -warming up with ball		Low
	25min	**Main part** **Agility with out ball**  **-two leg jump** **Jump as high as possiblefrom both legs.** **-game like training**	3×20m Do 10to20 explosive two leg jumps.	High	**Main part** **-shooting activity** **1vs 1 shot** **60m**  -Playing game with small sided area	5×45m	high
	10min	**Cooling down** -walking -jogging -static stretching		low	Cooling down exercise -walking -jogging -static stretching		Low
Friday			recovery time				

	15min	**Warming up exercise** Warming up with ball -training of activity freely in open space		low	Warming up activity -general &specific warming up Stretching exercise -walking -jogging -static stretching		Low
S A T U R D A y	30min	**Main part** **-tire jump** **Zigzag running with 2 yards between cones and sprinting**  **-game like training**	3×8	High	**Main part** -shooting as long as possible a free space. -jump in5 straddle  -playing game between anaerobic group vs plyometric group		high
	10min	**Cooling down** -walking -jogging -static stretching		low	**Cooling down** -walking -jogging -static stretching		Low
Sunday			recovery time				

THURSDAY	15min	**Warming up exercise** -general and specific warming up **Stretching exercise** -dynamic &static stretching		low	Warming up activity -warming up with ball		Low
	25min	**Main part** Agility with out ball  -do one leg hops with a balance step between hops -game like training 8 vs 8	3×20m Do10with each leg, work up to two sets of 2o.	High	**Main part** **Posttest** -agilitytest -passing test -shooting	3times	high
	10min	**Cooling down** -walking -jogging -static stretching		low	Cooling down exercise -walking -jogging -static stretching		Low
Friday			recovery time				

	15min	**Warming up exercise** Warming up with ball -training of activity freely in open space		low	Warming up activity -general &specific warming up Stretching exercise -walking -jogging -static stretching		Low
	30min	**Main part** -Tyre jump -passing -m pattern agility -competition between two groups	3×8	High	**Main part** -competion between Experimental groups		high
S A T U R D A y	10min	**Cooling down** -walking -jogging -static stretching		low	**Cooling down** -walking -jogging -static stretching -feedback and acknowledgment time.		Low
Sunday			recovery time				

Appendix 6: methods of calculate ANOVA

In order to calculate the value of "F" you must find the following points. This is

1. Total sum of squares(SSt)

   SSt =∑(χi-Ẍ)2

   Xi: represents' the result of each study participant

   Ẍ: the average of total number of participant.

2. Between groups sum of squares(SSb)

   SSw =∑(χi -Ẍi)2

   Xi: the result of individual participant,

   Ẍi- the result of each group mean

3. Within groups sum of square(SSw)

   SSw = ∑(nj(Ẍi-Ẍ)2)

   Nj- no_ of participants per team

   Ẍi- the result of each group mean,

   Ẍ: the average of total number of participant.

4. Mean square within(MSw):

   MSw= SSw/N-j

   N- Total no_ of study participant, J- no_ of groups

5. Mean square between (MSB):

   MSb= SSb/j-1

6. F=MSb/MSw, f, represents one way analysis of variance – ANOVA.

   And also to calculate Table value, considered the following points.

5. Degree of freedom; nominator=N-j, denominator = j-1
6. Level of significance: 0.5 or 0.01.
7. Types of test: two tailed test
8. By 12 &2 df& two tailed test, find critical value

Appendix 7: Intervention schedule

Week -1 - Familiarization sessions

Week 0 - pre testing

Week 8 - Post testing

Appendix 8: Schedule for the measurements

Each testing period subjects will have 2 days of testing 48 hours before the first training session and 48 hours after their final training session. The testing protocol was usually broken up into two days. Day 1 consisted of sprint and jumps and day 2 consisted of agility tests and any endurance tests.

Day 1

- Jumping performance; Countermovement Jump (CMJ) and Multiple 5 Bounds (MB5) Test.
- Speed tests; 30meter sprint with 10m acceleration phase also measure.

Day 2

- Agility tests (without the ball)
- Passing drill to test skill level.
- Soccer specific testing: shooting velocity.

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Appendix 8: photo of Robitkenema football club