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**EFFECTS OF 12 WEEK STRENGTH
TRAINING ON SELECTED PHYSICAL
FITNESS TRAITS AND SPIKING
ABILITY OF JUNIOR VOLLEYBALL
PLAYERS: IN DESSIE TOWN,
AMHARA REGIONAL STATE OF ETHIOPIA.**

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VOLLEYBALL PLAYERS: IN DESSIE TOWN, AMHARA REGIONAL
STATE OF ETHIOPIA.**

By

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JUNE, 2021

BAHIR DAR, ETHIOPIA

BAHIR DAR UNIVERSITY
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DEPARTMENT OF SPORT SCIENCE

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SELECTED PHYSICAL FITNESS TRAITS AND
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PLAYERS:**

IN DESSIE TOWN, AMHARA REGIONAL STATE OF ETHIOPIA

**A THESIS SUBMITTED TO DEPARTMENT OF SPORT SCIENCE, BAHIR
DAR UNIVERSITY IN THE PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE (MSC) IN
COACHING VOLLEYBALL REGULAR PROGRAMME**

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APPROVAL OF THESIS FOR DEFENSE

I hereby certify that I have supervised read and evaluate this thesis entitled on “EFFECTS OF 12 WEEKSTRENGTH TRAINING ON SELECTED PHYSICAL FITNESS TRAITS ANDSPIKINGABILITY OF JUNIOR VOLLEYBALL PLAYERS: IN DESSIE TOWN” by Tesfaye Tadesse prepared under my guidance. Irecommended the thesis by submitted for oral defense.

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BAHIR DAR UNIVERSITY
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APPROVAL OF THESIS FOR DEFENSE RESULT

We hereby certify that we have examined this thesis entitled“EFFECTS OF12 WEEKSTRENGTH TRAINING ON SELECTED PHYSICAL FITNESS TRAITS ANDSPIKING ABILITY OF JUNIOR VOLLEYBALL PLAYERS: IN DESSIE TOWN”. We recommend that it is accepted as fulfilling the thesis requirementfor the DEGREE OF MASTER OF SCIENCE IN COACHING VOLLEYBALL.

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DECLARATION

I declare that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma, or publication. I declare that this thesis is my work and all sources of materials used in this thesis have been duly acknowledged.

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This thesis has been submitted for examination with my approval as a university advisor.

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Date _____

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LIST OF ABBREVIATIONS AND ACRONYMS

AAHPERD: American Alliance for Health, Physical Education, Recreation and Dance

ACSM: American collage of sport medicine

CG:Control group

EG: Experimental group

FITT: frequency, intensity, time, type

FIVB: International volleyball de federation

IAAF: International association of athletics federation

IOC: International Olympic Committee

MD: Mean difference

N: Number of players

POT: Post of test

PT: Pre-test

SPSS: Statistical package for social science

SD: Standard deviation

USA: United States of America

USDHHS: United States Department of Health and Human service

YMCA: Young men's Christian association

ABSTRACT

The main purpose of this study was to determine effects of 12 week strength training on selected physical fitness traits and spiking ability of junior volleyball players. The study employed true experimental research design. 24 male volleyball players of Dessie with the age of (Experimental group = 15.50 ± 0.674 , Control group = 15.50 ± 0.674) were participated by using comprehensive sampling technique and randomly assigned in to two equal groups. Both the experimental group Experimental group (N=12) and control group (N=12) participated in the regular volleyball training, but only Experimental group performed additional strength training for 12 weeks, with 3 sessions per week, each lasting 30-50 minutes. Subjects were measured on tests of 30m sprint run for speed, vertical jump for explosive power, T-shuttle run test for agility, and AAHPERD wall spiking test for spiking ability on two occurrences first before administration of strength training as pre-test and after 12 weeks of the training as post-test. The data collected from the study subjects by using primary data sources were analyzed using SPSS version 16 software by paired t-test to within the level of significant 0.05. The results showed that strength training significantly improved speed, explosive power, agility and spiking ability in Experimental group at ($P < 0.05$). But no significant improvements were found in all the variables in Control group ($P > 0.05$). Based on this finding, it can be concluded that strength training has significant effect on improvement of physical fitness traits and spiking ability of volleyball players. Therefore, this type of training method is suggested to volleyball players and coaches to include in their training sessions for improvement of physical fitness traits and spiking ability.

Key words: Strength training, Physical fitness, spiking ability

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Sports are an organized competitive activities governed by a set of rule and through which the participation improves fitness, mental well-being, social relationships and refreshment (ASC, 2017; UNITS DP, 2017). Today, there are about 28 Olympic sports and most of them are developed in the nineteenth and twentieth century.

Volleyball is the second most popular sport in advanced nations, including China, Brazil and USA and it's the fifth most popular sports in the world, next to soccer, crickets, hockey and tennis (Redding, 2011; Wood, 2017). It has been a part of the Olympic Games since 1964 Tokyo Olympiad (IOC, 2016; FIVB, 2016). Its well-practiced sport in 220 associated countries worldwide and played by 500 million players in addition to a vast number of players playing it for enjoyment without being registered to any clubs. The total number of people playing volleyball as a free time activity may approach to one billion (Vuorinen & Mero, 2018; Yadav, 2015; Kinda, Lenberg & Laskey, 2011).

The volleyball promotes peace and unity throughout the world and played an excellent role within the formation of socialization, shaping personality and providing friendship among the participants (Ahlm & Lindgren, 2013). It also contributes a lot for development of a country (Singh & Behera, 2013). Moreover, Volleyball alone added 202 million dollars for growth, create job opportunity for 6.8 million people and provide 493 million dollars in the form of turnover tax in United Kingdom within 2014 (UK sport, 2017).

Volleyball sport is brief, intense, power and wonderful ball game activities characterized by two teams on a playing court divided by a net and every team play the shock the net to ground it on the opponent's court, and to prevent the ball from being globed on its own court (Yadav, 2015; Singh & Behera, 2013). To attack, the players try their best to make the ball fall down onto the opposite side and to defend; they prevent the ball from falling down onto their own court (Kinda Lenberg & Laskey, 2011). Volleyball game requires a well-developed fitness quality and technical skills (Povovas et al., 2012).

Strength training is that the stimulus imposed by external resistance, which has the aim to develop strength and related aspects, usually using weight, machines or own weight (Mosby's Medical

Dictionary, 2009). Strength training may be a means of preparing or helping volleyball players so on develop performance in volleyball sports (Gordon, 2009). players who perform regular strength training, allow them to be effective in activities such as jumping, lifting, running, pushing or throwing and so on (Lacono, Karcher & Michalsic,2018). To improve players' physical fitness qualities and technical skills level of volleyball players' coaches or players should arrange physical fitness training (Het land & Tveit, 1997). Adding overall strength to the development of specific techniques through the use of strength training enables volleyball players to reach their full potential. Volleyball players can mimic the exact movements needed during a game while performing strength training to build quick and strong muscles fibers that contract quickly and explosively for greater flexibility, mobility and power within the execution of these targeted techniques.

According to Uppal (2013), the sport of volleyball places very high demands on athletic ability of players. Small size of volleyball court requires different running pattern than in football, hockey & other games. There are 100 to 200 jumps with optimum height from relative short approach.

Without jumping power, an efficient smash isn't possible, without adequate speed and agility the player cannot accomplish good performance on defense, without specific playing endurance it'll not be possible to last long in tough competitions. Dale (2017) reported that to be effective in volleyball, a player needs to demonstrate better Physical fitness traits. Particularly, Speed, agility, power, flexibility and muscular strength is very critical. Successful volleyball player possesses greater speed, upper and abdominal strength and flexibility of lower back and hamstring muscles (Stamm, Veldre & Stamm, 2003). Jumping skills, speed and upper and middle body muscle strength are necessary for successful blocking and spiking (Ana, Costa, Santosd, Figueiredo, & Joabd, 2015; Dale, 2017; Gantois, de Castro, Dantas, Cabral, Pinto & Joao, 2017; Pristine, 2014). Agility, speed and explosive power are qualifying components of fitness and desirable athletic performance, and play a key role in most sports. Plyometric and strength training can be a prerequisite for coaches and athletes success (Alam, 2012, Bandyopadhyay & Zearei, 2013). So, the researcher goes through on specific physical fitness qualities such as speed, explosive power and agility.

Upper, middle and lower body muscle strength training is required to perform serve, pass and spike and to demonstrate aggressive blocking in volleyball. Arm and pectoral arch strength is vital in offensive, defensive and in minimizing mistakes in basic skills of volleyball (Zhang, 2010). Abdominal and hip muscle strength training also played a crucial role for explosive jumping and

powerful hitting in volleyball. It provides the muscular link between the upper and lower body and by this suggests assists force summation (Hughes, 2014). Strength of hands and other body parts are important elements you ought to concede to spike accurately and efficiently. Based on the above explanation, the aim of this study was to determine effects of strength training on selected fitness traits and spiking skill ability of junior volleyball players just in case of Dessie male volleyball team.

1.2 Statement of the problem

The effect of strength training on some physical fitness qualities and technical skills of players were studied by different researcher. But there are controversial results existed by those researchers regarding with the effect of strength training on selected physical fitness qualities and technical skills of players. Among those researchers, (Ramin, Zahra & Alireza, 2014), (Kumar & Navnit, 2016) Afyon et al. (2017) (Abebaw, 2019); (Jozsi, Campbell & Evans, 1999); Lacono, Karcher & Michalsik (2018), (Nurten & Esin, 2019) revealed that “strength training has significant effect on speed, explosive power and agility of players”.

On the opposite, the study conducted by Cetin, Ozdol, Baro & Sonowal (2012) investigated that “strength training has no significant effect on vertical jump and speed of players”. (Kraemer, Fleck & Evans, 1996; Baker & Nance, 1999) strength training had a negative effect on speed. In addition Joseph, (1983), also states that “agility and flexibility is not correlated significantly with volleyball playing ability”. Thus, the intentions of the researcher were to compromise and fill this gap between those controversies.

In addition to the pre described facts to the best knowledge of the researcher, even though there are oversea researches conducted on effects of strength training there is no research conducted on effects of strength training on selected physical fitness traits and spiking skill ability in relation to Dessie junior volleyball player’s context locally. Hence, this is also the source of inspiration for the researcher which initiates him to conduct a research on the pre described issue to fill the gap. Because a study like this would have benefit to players’, coaches, physical educators, sport scientists, researchers and so on. Therefore, the purpose of this study was to determine effects of 12 week strength training on selected physical fitness traits and spiking ability of junior volleyball players in case of Dessie town in Amhara regional state of Ethiopia.

1.3 Objectives of the study

1.3.1 General objective

The general objective of the study was to determine effects of 12 week strength training on selected physical fitness traits and spiking ability of junior volleyball players in case of Dessie male volleyball team.

1.3.2 Specific objectives

The study has specific objectives. Specifically this study was conducted to:

1. Examine effects of strength training on speed of junior volleyball players.
2. Identify effects of strength training on explosive power of junior volleyball players.
3. Find out effects of strength training on agility of junior volleyball players.
4. Determine effects of strength training on spiking technical skill ability of junior volleyball players.

1.4 Hypotheses

The study has attempted to test the following hypothesis.

1. **H_{0.1}**: Strength training has no significant effect on speed of junior volleyball players.

H_{1.1}: Strength training has significant effect on speed of junior volleyball players.

2. **H_{0.2}**: Strength training has no significant effect on explosive power of junior volleyball players.

H_{1.2}: Strength training has significant effect on explosive power of junior volleyball players.

3. **H_{0.3}**: Strength training has no significant effect on agility of junior volleyball players.

H_{1.3}: Strength training has significant effect on agility of junior volleyball players.

4. **H_{0.4}**: Strength training has no significant effect on spiking technical skill ability of junior volleyball players.

H_{1.4}: Strength training has significant effect on spiking technical skill ability of junior volleyball players.

1.5. Significance of the study

The study give idea related with effects of strength training up on selected physical fitness traits and volleyball spiking ability. More specifically, the study intends to the following importance: firstly, the study may increase the awareness of volleyball players to engage in strength training to boost their physical fitness and volleyball spiking skill level. Secondly, the study may motivate and encourage volleyball players to engage in strength training. Third, the study may provide meaningful information for those who involve on strength training program for the improvement of physical fitness traits and overall skills ability. Fourth, it may provide a suitable ground for volleyball coaches to have strength training program for their players. Fifth, it helps physical education teachers, coaches and sport science experts to know further about the effect of strength training on physical fitness and spiking skills. Sixth, the study may give an insight for curriculum developers and policy makers and those who are working on the professional development of sport science, who have a role to improve athlete's physical fitness status and sport technical skills performance so as to develop norms and appreciate more strength training to be found in sport science program. Seventh, it could serve as an important resource for those who want to pursue similar studies. Eighth, the study may also help other researchers as a spring board to conduct further researches. Finally, the study may give additional knowledge to area of research and the researcher himself to improve his experience in conducting additional researches.

1.6 Delimitation of the study

The study is designed to determine effects of strength training on selected physical fitness traits and spiking ability of junior volleyball players in case of Dessie male volleyball team of Dessie town in Amhara regional state of Ethiopia.

Even though there are so many physical fitness variables, the scope of this study is selected physical fitness traits as a dependent variable including speed, explosive power and agility. Likewise, since the term volleyball technical skills are broad, the scope of the study is delimit to selected technical skills as a dependent variable including spiking; whereas independent variable is delimit to intensive strength training. Selected volleyball physical fitness traits and technical skills ability tests are delimit to 30 meter sprint run for speed; vertical jump for explosive power; T- shuttle run for agility; AAHPERD wall spike test for spiking.

Participants are select from Dessie male volleyball players, aged between 15 to 17 years.

Types of strength training are confining to upper, medium and lower body strength exercises using body weight and free weight. The duration of the training period is restricted to three days per week and 30 up to 50 minutes per sessions for three months. The study is conducted in the academic year of 2013 E.C/ 2020-2021 G.C.

1.7 Limitations of the study

The influence of certain extraneous variables like life style, daily routine work, diet (only orientation was given to the subjects), metrological variations such as air temperature, atmospheric pressure during testing were not controlled well or fully since it is difficult to control extraneous variables all in all.

Psychological variables and related factors of the players were not controlled. Lack of suitable facilities and scientific tools of measurements were limitations encountered in this study.

1.8 Operational definitions of key terms

- **junior volleyball players:** Volleyball players aged between 15 to 17 years.
- **Physical fitness traits:** The ability of the players to jump vertically high (explosive power) or the ability of the players to cover a certain distance within a short period of time (moving speed). The capacity of the players to change in direction with maximum speed is also referred as agility.
- **Strength training:** The stimulus imposed by external resistance, which has the aim to develop strength and related aspects, usually using free weight, or individual's own body weight.
- **Technical skills:** The excellence of unavoidable fundamentals/basic elements to play volleyball game such as spiking. It is a skill which is necessary to perform sport that is conditioned by physical abilities of players.

1.9 Organization of the study

The study has six chapters. The first chapter deals with an introductory part of the paper which highlights background of the study, statement of the problem, research objectives, hypothesis, significance, delimitation of the study, limitation of the study, definition of operational terms and organization of the study. The second chapter deals with the review of related literature in which basic terms, related ideas to the study was conceptualized. The concern of chapter three was on the methods of the study, particularly, description of the study area, research approach, research design, population,

sampling and sampling technique, inclusion and exclusion criteria, source of data, study variables, training protocol, instruments of data collection, procedures for administration of tests, validity and reliability, methods of data analysis and ethical issues were discussed. Chapter four presented results of the study, which presented the study data analysis, chapter five presented discussions, all findings of the study and the final chapter presented summary, conclusion and recommendation part of the study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Historical development of volleyball sport

Volleyball is one among the foremost popular ball games within the world which is played by hitting an inflated ball with hands, forearms, head, or any a part of the body. Volleyball was invented in 1895 by William G. Morgan who was the education director of the Holyoke Massachusetts of YMCA in USA (FIVB, 2012). Morgan named the sport as mintonette but in 1895 after seeing an indication at the YMCA nearby Spring Field Massachusetts, a business man named Dr. Hallstead suggested the name to be changed to volleyball because the essential idea of the sport was to volley the ball back and forth over internet. The sport developed rapidly under the supervision of the YMCA education director.

Many changes in rules are made. Today volleyball is listed among Olympic sports (Sahlemichail & Araya, 2005).

Volleyball was introduced first to Africa in 1923 (Egypt and Tunisia). South of the Sahara volleyball started in 1932 with the Military sports monitors at schools. In 1960 with the independence of several countries, National federations were born and grouped along side regions of an equivalent language. First volleyball tournaments were organized with about 20 countries. Volleyball was introduced in our country Ethiopia in 1943 by foreign teachers.

Volleyball was started before Italian occupation and was being played by the first schools of Ethiopia, like Teferi Mekonnen, Minilk and G. Winget. Ethiopia was registered for IOC member in 1946. Ethiopia established a volleyball federation in 1957. Volleyball is now a well-liked game because it requires a couple of equipment, little space, it is often learned quickly and simply, and it's also a highly competitive and fast paced game (Sahlemichail & Araya, 2005).

2.2. Theoretical framework of Strength training

Strength training may be a process of preparing athletes to develop strength or other aspects in sport (Gorden, 2009). Strength training is any physical activity that causes the muscles to figure against a further force or weight (this concept is named resistance). That's why strength training sometimes called resistance training or weight training (Hongu, Michael & Patrick, 2015).

Strength training are often defined because the stimulus imposed by external resistance, which has the aim to develop strength and related aspects, usually using weight, machines or own weight (Mosby's Medical Dictionary, 2009). There are various factors besides the training itself, that affect the result of maximal power as morphological features including fiber type contribution to whole muscle areas, muscle architectural features and tendon properties also as neural factors including motor unit recruitment, firing frequency synchronization and inter muscular coordination (Cormie, Guigan & Newton, 2011). The definitions given by Mosby's Medical Dictionary (2009) is directly associated with this study. Consistent with Mosby, strength training refers to performing exercises by using weight, machines and by using own weight. Strength training has enormous benefit. consistent with (William & Rately, 2014; Hongo, Micheal & Patrick, 2015, strength training have the subsequent advantages to enhance strength and endurance, resistance training are often effective within the development of muscular strength, muscular endurance, power and adaptability and muscular mass in abroad range of individuals , to extend bone mass and density, weight-bearing and resistance exercises can help protect against osteoporosis, to enhance joint stability and balance, reducing the danger of falls, to stop muscle mass by slowing down the loss of muscle mass by continually rebuilding muscles, Adults lose between five and 7 pounds of muscle every decade after age 20, Only strength training prevents muscle loss, to scale back resting vital sign , to scale back low back pain; Improved energy level; Increased confidence; to scale back the pain of osteoarthritis; to scale back symptoms of other chronic disease. Strength training can help to scale back the symptoms of depression, heart condition , type 2 diabetes and sleep disorders, to raised concentration; to sound sleep; Enhances the immune system; Lessons future tear of your body; Increased muscle mass and decreased fat mass; To facilitate metabolism; Improve ability to perform everyday tasks; Increase energy state and reduce the danger of injury.

Strength training has significant benefit for athletes in terms of accelerating muscle mass and decreasing risk of injury. Strength training has been growing in popularity in recent years. Extensive research reveals that not only is resistance training an efficient method for improving muscular strength, endurance and power, but it's also effective for improving the health status of most individuals-not only competitive athletes. Strength or resistance training provides various benefits (Hongo et al, 2015).

Upper, middle and lower body muscle strength is required to perform jump serve, passing, dig and spike and to demonstrate aggressive blocking in volleyball. Arm and pectoral arch strength is

vital in offensive, defensive and minimizing mistakes in basic skills of volleyball (Zhang, 2010). Abdominal and hip muscle strength also played a crucial role for explosive jumping and powerful hitting in volleyball. It provides the muscular link between the upper and lower body and by this suggests assists force summation (Hughes, 2014).

There are essentially three differing types of strength training exercises (Hongo, Michael & Patrick, 2015).

1. Isotonic exercise- involves any movement of your muscle group (legs, arms, stomach, back, etc.) against some type of resistance (example: lifting barbells, dumbbells, exercise using resistance bands, or body weight exercises including pushups and sit-ups).

2. Isometric exercise- exercises do not involve movement of the joint itself, but instead the muscle group is held steady in place against the resistance (example: plank holds, wall sits, holding bags, etc.)

3. Iso kinetic exercises- performed with machines. All forms of resistance training can be used to firm and strengthen muscles. Any muscle group can benefit from resistance training. Strength exercises for upper body strengths are push up, bench press, overhead press, push press, incline bench press, clean and press, bent over row, one arm row, inverted row, chin up, pull up, dead lift, dumbbell curl, hammer curl, cross body curl, dip bar, dip bench, lying triceps extension, lateral raise, bent over lateral raise, face pull, shrug, dumbbell row, barbell upright row, barbell curl and dumbbell lateral raise (Christina, 2020). Strength exercises for lower body strengths are leg extension, leg press, barbell squat, and squat body weight, dumbbell step up, leg raise, tuck jumps, squat single leg, squat jump and marching high knees (Joe, 2017). Strength exercises for middle body strengths are plank; panther shoulder tap, butterfly sit-up, dead bag, half kneeling wood chop, leg raise and hip dip (Amy, 2018).

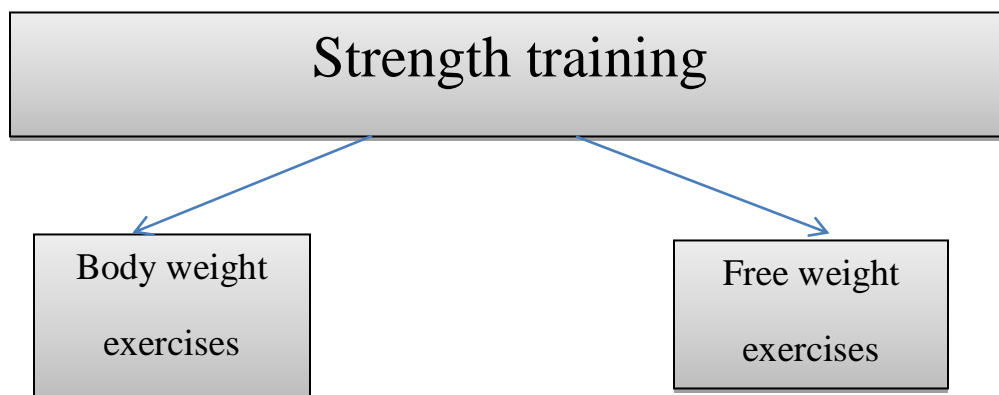


Figure 1: Conceptual framework of strength training

2.3. Theoretical framework of Physical fitness

Physical fitness has been defined by many scholars in several ways albeit there's no universally agreed abreast of the definition of fitness and its' components (Abiyu, 2014).

Baltimore et al., (2017) described fitness because the ability of the body to perform moderate to vigorous levels of physical activity without undue fatigue and capability of maintaining such abilities throughout the life. Haskell & Kiernan (2000) fitness is defined as “the ability of players to hold out games with vigor and application, without undue fatigue and with ample energy”. Garzon (2009) defined that fitness is that the ability of an individual to perform daily activities effectively with vigor and by traits and capacities that are related to a coffee risk for the event of chronic disease and premature death. Wuest & Bucher (1995) described fitness as a group of physical attributes that permits the body to reply or adapt to the stress and stress of physical effort. As cited by Demissie (2019), Tim, Kwong, Russia & Oil (2010) defined fitness because the ability of players in reference to game, like muscular endurance, vertical jumps, flexibility etc.

The definitions given by Tim, Kwong, Russia & Oil (2010); Haskell & Kiernan (2000) are directly associated with this study. Consistent with them, fitness qualities refers to the power of players to play the sport without undue fatigue. The power of the players to leap vertically high (explosive power) or the power of the players to hide a particular distance within a brief period of your time (speed). The capacity of the players to vary in direction with maximum speed is additionally referred as agility.

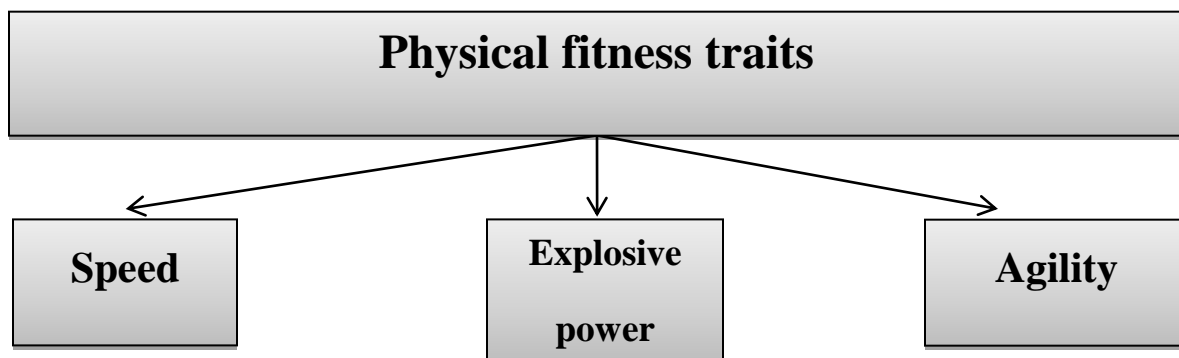


Figure 2: *Conceptual framework of physical fitness traits*

2.4. Physical fitness traits of volleyball players

Physical fitness have health related component and skill related components. Health related fitness components are components which are related to the health of people which include; aerobic fitness, muscular strength, muscular endurance, flexibility and body composition (Olaitan, 2005).

Skill related components are fitness components which are related to the performance of people and includes agility, balance, coordination, speed, power and response time (Wilmore & Costill, 2002).

The greater the fitness, the longer can an individual keep and therefore the more efficient are going to be in performance and his capacity for recovery from fatigue. fitness measurements which play a lively role to enhance the performance of a private in several games and sports, particularly speed, strength, endurance, response time , balance, agility and coordination etc. (Haskell, Lee & Pate 2007) the advantages of fitness are numerous. The one that is physically fit will have greater amount of strength energy and stamina an improved sense of well-being better protection from injury because strong well developed muscle safe guard the bone, internal organs and joints and keep moving parts limber and improve cardio respiratory function. For an honest performance in any sport or athletic event, the high standard of fitness is that the basic requirement. More participation in sports activity isn't enough to enhance fitness. The fitness must be gained through conditioning programed (Gabbett 2008).

As Bucher (1993) Physical development objective help build big muscles and develop the human organic system (organic refers to the digestive, circulatory, excretory, heart regulatory, respiratory and other systems of the human body). The short term and future physiological and psychological benefits of fitness and exercise are well documented. The Governor's council on fitness and nutrition believes that regular physical training is one among the foremost important things humans can do for his or her health. It can help: Control weight, Reduce the danger of disorder , Improve core strength, contribute to productivity within the game and worksite, Reduce the danger for type two diabetes and a few cancers, Improve bone and muscle strength.

Speed

Speed is that the ability to use force rapidly when snatching, cleaning, throwing or sprinting. There are a couple of lifts that qualify as an evaluation for power is that the Olympic style lifts:

the snatch, push jerk and therefore the power clean (Baechle, 1994; O'Shea, 1999). It can be defined as one's ability to perform successive movement of the same pattern at a fast rate (Malina, 2001). Speed is an essential component in almost every sport volleyball (Newton, Kraemer & Hakkinen 1999). In Volleyball, players have to be quick to get to the right position at the right time to return or pass the ball. Speed, both in terms of movement and response time, are often developed by performing sports-specific exercises like multidirectional sprinting and employing a uneven ball called a reaction ball which bounces unpredictably. Therefore, speed is that the rate of movement and sometimes refers to the power to maneuver rapidly and it's a crucial think about all explosive sports and activities that require sudden changes in space. (Markovic et al 2007).

Agility

Agility is recognized as the ability to maintain and control body's position while rapidly moving and changing directions as a response to a stimulus Little, Williams, (2005) & Sheppard, Young (2006). It seems to be associated with athletic abilities like strength, power, speed and balance and it's a determinant of sport performance in field and court sports like volleyball, soccer and rugby Little, Williams (2005), Sekulic, Markovic (2007), Sekulic, Spasic, Mirkov, Cavar, Sattler (2013) & Barnes, Schilling, Falvo, Weiss, Creasy (2007).

T-test may be a well-accepted standard agility test that's easy to administer, since it doesn't require complex equipment and long hours of preparation (Barnes, Schilling, Falvo, Weiss, Creasy (2007).

Pauole (2000) evaluated the reliability and validity of the T-test as a measure of leg power, leg speed and agility in college students. T-test performance was highly related to all three performed skill tests (40-yard dash, counter-movement vertical jump and hexagon test) Pauole, Madole, Garhammer, Lacourse, Rozenek (2000). Thus T-test seemed to be a highly reliable tool in measuring a mixture of physical components including agility, speed and power of lower limbs.

Especially in volleyball Barnes (2007) showed that countermovement jumping ability is correlated with agility and may be used as a predictor of agility test time. More recently Sassi, (2009) tried to determine a modified agility T-test and showed that's still highly correlated to countermovement jump and 10m sprint highlighting the importance of agility on sport performance. Agility movements can be defined as rapid, whole body movements that require single or multiple

changes in velocity (Suchomel et al 2016). There are Researchers reported related with agility and technical skill relation of volleyball players. Endris and Kumar (2018) reported that the mean value of Agility is 10.25 in their study with the title the relationship between physical fitness with skill performance of basketball players.

Explosive power

The ability for a private to rapidly produce force. Often measured with the vertical jump or rate of force development during an isometric mid-thigh clean pull (Shedlarski, Alyssa, (2011).

According to Shorkey (1997) it's the power to transfer energy swiftly in to force. And also it's an explosive strength, is that the ability to effectively integrate strength and speed to supply maximum muscular force at a maximum speed. It is the rate at which energy is expended or work is done. Then Shorkey (1997) define power = work divide by time, or the rate of doing work if one can perform the same work better than the other with in the same interval , then we've got a far better power. It combines strength (force) and velocity or speed (Distance/time). Explosive power is the most essential part of most players' skills and enables players' activities during the games to be not only the required height and with the necessary power but also at the right moment.

The standing long jump is a test for lower body power. This is a non-resistant exercise used to measure jumping ability. This test is very important because the ability to jump is a measure of power. In many sports such as volleyball, football and basketball, power is very important component for players. Power cleans and jerks are exercises which will be wont to measure total body power. Power is important in vigorous performance because it determines how hard a person can hit, jump, and spike (Gordon, 2009).

According to Sheppard, Nolan and Newton, (2012) explosive Power is defined as the ability to release maximum force in the fastest possible time as in jumping and throwing activities. It is also the power to transfer energy swiftly in to force. In addition it is the ability to effectively integrate strength and speed to produce maximum muscular force as fast as possible.

Taware, Bhutkar, &Surdi, (2013).explained that the mean value of vertical jump without approach test for explosive power is 51.45 cm test in their study with the title A Profile of Fitness Parameters and Performance of Volleyball Players. The game of volleyball may be a game of power. For peak performance in volleyball, the muscles which are the source of power must be

strong. It is important for a volleyball player to have explosive power in legs because players have to jump hundreds of times during the match or tournament for executing spiking skill or blocking skill. Thus, a good vertical jump during the spike and block depends on strength, speed and technique. (Palao, Manzanares & Valadés, 2014). You can enhance upper body power with exercises like ball throws and plyometric push-ups, while power within the legs are often improved using leg weights, rope-jumping or a rowing machine in the gymnasium. Power is your ability to get strength at high speeds and is extremely important in volleyball. Volleyball net is 10 feet high, so players need leg power to be ready to jump high enough to dam and smash the ball during play. Hitting the ball with many heats requires upper body power.

Power is commonly developed by performing variations of the Olympic lifts, plyometric or jumping exercises and by training with medicine balls (Singh, & Ram, 2013).

Understanding power capacity and how it can be created is one of the primary keys to optimizing athletic performance. It includes the elements of strength and speed. There are a couple of lifts that qualify as an evaluation for power is that the Olympic style lifts: the snatch, push jerk and therefore the power clean. Furthermore, volleyball may be an intermittent sport that vertical jump is a fundamental a part of the spike, the block, and therefore the topspin and floating serves .The most effective spike in volleyball is probably going hooked in to vertical jump height and therefore the body position adopted before ball contact. Specifically, a high vertical jump in volleyball may be a critical component in hitting and blocking. Indeed, the vertical jump is a common tool used to assess explosive strength in volleyball athletes (Fatouros, Jamurtas & Leontsini 2000).

Power is a combination of speed and strength of players which is important in vigorous performance because it determines how hard a person can hit, jump, and spike (Gordon, 2009). Agility, speed and explosive power are qualifying components of fitness and desirable athletic performance, and play a key role in most sports. Plyometric and resistance training can be a prerequisite for coaches and athlete's success (Alam, 2012, Bandyopadhyay & Zearei, 2013).So, the above explanation is related for this research.

2.5. Theoretical framework of volleyball technical skills

Volleyball skill performance a capacity which is highly dependent upon a combination of physical, technical, tactical skills and psychological aspects of players that plays a vital role during volleyball matches (Chittibabu, 2014).

Technique refers to a way of doing something by using special skills or knowledge. Technique is a skill which is necessary to perform a game which is conditioned by motor abilities of players and the frequency of exercise repetition (Czerwinsk & Taborsky, 1947). In addition to physical fitness traits, volleyball players are expected to develop overall volleyball technical skills ability. Having physical fitness qualities are not enough; rather it also needs technical skills of volleyball sport.

Volleyball is not an easy as it looks, and requires a great deal of technical skill ability along with physical sharpness. All technical skills are important for volleyball players (Chittibabu, 2014).

Hence, volleyball players should develop all technical skill ability. If the players have good technique, they're going to pay more attention to team work and properly performed tactical tasks during the sport. Technical skills are the excellence of unavoidable fundamentals/basic elements to play volleyball game such as serving, passing, setting, spiking, blocking and digging (Czerwinsk and Taborsky, 1947). In volleyball, 80% of the points obtained in international volleyball matches are due to spiking and blocking actions (Marques, Van den Tyler, Vescovi, & GonzalezBadillo, 2008; Lobietti, Michele & Merni, 2006; Voigt & Vetter, 2003). This indicates, the significant importance of the spike and block reach heights of the players. The definition given by Czerwinsk and Taborsky (1947) is directly related to this study. According to them technical skills are basic elements needed to play volleyball such as spiking. There are several offensive skills that all volleyball players must perfect to play at their best. Spiking is that the most crucial component of all actions of Volleyball. Proper timing of the jump and swing of arm are needed to have perfect spike. Spiking is a vital component of skill that used to score more points. Spiking skill ability involves the players jumping to gain as much height as possible and then hitting the ball with the hands, down across the net in to the opponents' court (Blatter, et al., 1979). Hence it's obvious that leg power is required to climb over explosively. Players like to jump up and hit the ball hard in to their opponents' court and quite roughly so. However, the smash or spike is very difficult, and does not always score it is the most exciting part of volleyball game for most players. The spike or smash in three perspectives the dump, the tactile ball, and the off speed attack (Nambaka, 2011).

According to (Rama, 2014), a front zone player hitting the ball forcefully over the net is called spiking. It is also termed as hitting or attacking (Spiking is that the most crucial component of all actions of Volleyball. Proper timing of the jump and swing of arm are needed to have perfect spike.

According to Patsiaouras, et al, (2011). The attack also known as the spike is usually the third contact a team makes with the ball. Cothran, (1992) in his study founded the mean value of 33.55 with standard deviation 13.16 by using AAHPERD Wall Spike test for spiking skill ability of his volleyball players with the title of six volleyball skill tests. The objective of attacking is to handle the ball in order that it lands on the opponent's court and can't be defended. A player makes a series of steps approach jumps, Proper Arm swing, Ball Contact, and landing. Phase of the attack movement According to Kinda , (2006) there are six basic movements inherent in any good attack, including the approach, which encompasses the plant or step close; the jump; the arms wing; ball contact; the follow-through; and landing. How a player executes each movement during the attack leads either to success or failure. If executed properly, the attack terminates a rally, gains some extent, and swings momentum in your team's favor. The object of an honest offensive attack is to place the ball where the defense isn't. It all begins with the approach.

In volleyball, Attacking and blocking performance represent 45% of the total actions in a game and 80% of the points obtained in international volleyball matches are due to spiking and blocking actions (Marques, Van den Tyler, Vescovi, & GonzalezBadillo, 2008; Lobiatti, Michele & Merni, 2006; Voigt & Vetter, 2003). This indicates, the significant importance of the spike and block reach heights of the players.

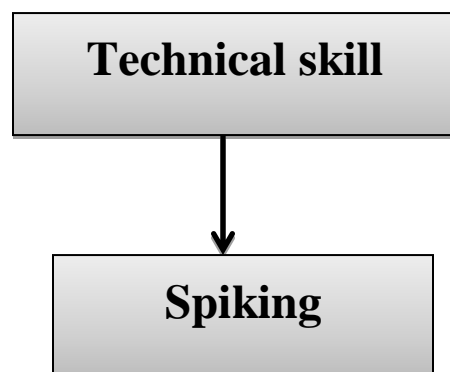


Figure 3: Conceptual framework of technical skills

2.6. Effects of strength training on physical fitness traits and volleyball technical skills

Athletes participating in team sports don't usually have an unprecedented capacity in any particular characteristic of physical performance. Most of the time spent on team sports is essentially supported the technical aspects of the sport itself (Thomson et al., 2008; Stanganelli et al., 2008). Football, for example, requires many different qualities, such as kicking, passing and trapping the ball, throwing in, goalkeeping, tackling, falling behavior, jumping, running, sprinting, starting, stopping and changing direction (Lees & Nolan, 1998).

Today, however, a variety of training methods are used to increase strength and power in sports in order to enhance physical performance and thereby specific team sport performance, such as sprinting and jumping (Gabbett, 2008; Marques et al., 2008; Santos & Janeira, 2008). Studies have shown that maximum strength could determine sprint performance and jumping height in athletes (Wisløff et al., 2004; Nuzzo et al., 2008) and that throwing (ball) velocity correlates with strength performance in the upper extremities (Forthomme et al., 2005; Gorostiaga et al., 2005; Marques et al., 2007; Prokopy et al., 2008). It has also been implied that strength training could improve aerobic endurance performance, in the form of improved running economy, due to improvements in neuromuscular characteristics, including motor unit recruitment and reduced ground contact time (Hoff et al., 1999; Hoff et al., 2002; Jung, 2003).

The key factor to successful strength training at any level of fitness is appropriate programme design.

Speed, agility and explosive power are needed to dive, serve, spike and block. Adding overall strength to the development of these specific skills through the use of strength training enables volleyball players to reach their full potential. Volleyball players can learn the exact movements needed during a game while performing strength training to build quick and strong muscles fibers that contract quickly and explosively for greater flexibility, mobility, agility, speed and power in the execution of those targeted game time skills. Although volleyball is taken into account a non-contact sport, injury often occurs due to the act of continuous jumping, diving, and high volume of movements. Therefore, volleyball players must strength training properly to protect the lower back, shoulders, legs and knees. Strength training helps players protect their joints and reduce the risk of injury as they build explosive power, agility, speed, and flexibility (Widmer, 2020).

The smash or spike is very difficult skill to master, and does not always score and it is the most exciting part of volleyball game for most players (Nambaka, 2011). It takes speed, direction, position, technique, flexibility, endurance, and far more to dominate the competition. Performing volleyball techniques with strength training has advantage to regulate the sport (Widmer, 2020).

The volleyball sport demands repetitive movements of the upper, middle and lower muscle groups. Body muscle strength training is required to perform jump serve, passing and spike and to demonstrate aggressive blocking in volleyball. Strength training is important in offensive, defensive and in minimizing mistakes in basic techniques of volleyball (Zhang, 2010).

Any training has positive or negative, direct or indirect effect on certain variables. So strength training has an effect on physical fitness variables and volleyball spiking skill.

It has an effect on different aspects, for instance, it has an effect on some physical fitness components such as speed, agility and power and volleyball techniques such as spiking.

In overall terms, strength training is frequently used by athletes in order to enhance specific team sport performance (speed, agility and explosive power) and volleyball spiking skill when designing an optimal programme prescription.

Speed and agility are the basic components of volleyball performance. Speed for volleyball players is the capacity to move quickly across the ground to dig or spike the ball (Plisk, 2008; Harman & Garhammer, 2008). It is a complex mixture of psychophysical components volleyball players. These include perception, expectation, decision making, reactions, moving at maximum speed without a ball, actions with a ball and reading the game. All of those components are interrelated and have a big influence on the speed of volleyball players (Kessel, 2019). It's one of the main fitness components and has a critical role for success in many sports, including volleyball (Kessel, 2019). During a volleyball match, every player expected to perform various short sprints and high-intensity court movement (Yadav, 2015; Singh & Behera, 2013). Therefore, players have to be moved rapidly to execute the required activities effectively and efficiently Miller, (2005) & Terrell, (2017).

Very Few studies have been undertaken to examine the speed of junior volleyball players. Gabbett, Georgieff and Domrow (2007) reported the 10m sprint run performance traits of Australian junior volleyball players. The 10 m sprint run test score of players was 1.88 Sec +0.13sec. In the other study, Jaromir, Pavol and Ján (2017) determined the mean score of

Slovakian junior volleyball team players in the 10 m sprint run. The mean sprint runs scored by players of being 1.85 Sec. That is a little bit faster than Australian (1.88 Sec +0.13sec) and Serbian (1.92 + 0.02Sec.) counterparts, as reported by Gabbett, Georgieff and Domrow (2007) and Nebojs, Trajkovic, Milanovic, Sporis, Milic and Stankovic (2012) respectively. Based on the above findings, the average normative score of junior volleyball players in the 10m sprint run is about for 1.88 Sec.

Power is a function of both the strength of the muscle and the rate at which the muscle contracts. Power is a combination of speed and strength which is important in vigorous performance because it determines how hard a person can hit, jump, and spike (Gordon, 2009).

Explosive power of lower extremes is important part of the physical fitness profile of volleyball players as cited by Demissie (Gantois, de Castro, Paulo, Dantas, Breno, Cabral, Pinto & Joao (2017). Lower limb muscle power, expressed by the numerous jumps performed during volleyball games, which are important for both attacking and blocking actions and complicated part of this game as cited by Demissie (Singh & Behera, 2013).

Players' excellent performances are widely associated with lower extremity explosive power which introduces vertical jump as one of the most important characteristics of physical performance in volleyball players (Zhang, 2010).

Strength can have significant effect on power output because increase the variable strength will increase power. In relation to this, Izquierdo et al. (2000) reports that strength is a key factor in developing high power output. Stanganelli, Dourado, Oncken, Mancan, & DA Costa (2008) suggested that the vertical jump capacity was critical for success in volleyball.

The vertical jump is a basic ability required in many sports including volleyball as cited by Demissie (Scott, Briscoe, Murkowski, Samuel, & Saville, 2003).

Different researchers have been reported that strength training has significant effect on explosive quality of volleyball players, for instance research was conducted by Ramin, Zahra & Alireza (2014) on the effects of resistance and polymeric training on explosive power of young male volleyball players in Guilan province. The participants include 45 volleyball players, 15-22 years old, which were randomly divided in to 3 groups: two training groups and one control group.

Among the two training groups one was engaged in plyometric and the other in strength training. The control group was doing its common volleyball training. They found that after 6 weeks training there were significant difference between average of explosive power in both groups of strength and plyometric in comparison to control group ($p < 0.05$).

The amount of improvement in strength training group was quite plyometric group. Last strength training has significant effect on explosive power.

Additionally, Research was conducted by Abebaw (2019) on effects of strength training on explosive power of players within the case of Demibeche players. The participants include 30 male players, 16-19 years old, which were randomly divided in to 2 groups: one experimental groups and one control group. Experimental group was engaged in strength training. The control group was doing its common training. He found that after 12 weeks strength training there was significant difference between mean many pre (30.73cm) and posttests (71.53) of explosive power in experimental group ($p < 0.05$). The result indicates that strength training has significant effect on explosive power of players from pre to post tests of experimental group ($p = 0.000$) after strength training, but control group hasno significant difference between pre and posttests ($p = 0.089$). He concluded that strength training has significant effect on explosive power of players.

On the opposite hand, Research was conducted by Zemenu (2020) on effects of strength training on explosive power of players within the case of Shendi male volleyball players. The participants include 24 male players, 16-19 years old, which were randomly divided in to 2 groups: one experimental groups and one control group. Experimental group was engaged in strength training. The control group was done its common training. He found that after 12 weeks intensive strength training there was significant difference between mean many pre (39.75cm) and posttests (49.33) of explosive power in experimental group ($p < 0.05$). The result indicates that strength training has significant effect on explosive power of players from pre to post test of experimental group ($p = 0.000$) after strength training, but on top of things group has no significant difference between pre and posttests ($p = 0.054$). He concluded that strength training has significant effect on explosive power of players.

Moreover, consistent with (Jozsi, Campbell & Evans, 1999), strength training features significant effect on power. Strength training improves power, successively allover volleyball performance (Spieszny, 2018). Consistent with Lacono, Karcher & Michalsik (2018) stated that strength training features a direct influence on jumping power, change of direction and defensive actions.

A study done by Spieszny & Zubik (2018) noted that strength training increases power of vertical jump significantly. And also a study stated that strength training improved power in players (Sporis & Fiorentini, 2011).

On the opposite hand, Different researchers are reported that strength training has no significant effect on explosive power quality, as an example Research conducted by Charles (1967) on the effect of selected strength training exercises abreast of leg; free running speed and explosive power. He took experimental group of 20 male players. The experimental group went for a five week strength educational program with four sessions per week. The groups were tested before and after the program. The experimental group made significant greater development in leg strength, but not in running speed and explosive power. He concluded that strength training has no significant effect on explosive power of players.

Similarly, the study was conducted by Cetin & Ozdol (2012) on effects of strength training on jumping power and push up performance in young players. 18 players were participated during this study by dividing in to 2 groups randomly. The training group performed a 12 week strength training and technical training 3 times every week for 60 min. Control group was performed only technical training 3 times every week for 60 min. push up and vertical jump performance were evaluated before and after educational program . There was significant difference between before and after educational program in push up for experimental group. But no significant difference was observed on control group. And also there was no significant difference between before and after educational program in vertical jump for experimental and control group. Researchers concluded that strength training has no significant effect on explosive power of players.

Additionally, Strength training doesn't increase muscle power of players. (Martin Gabler, Olaf, Tibor & Urs (2018).

Agility is that the ability to maneuver your body quickly and efficiently into an edge of our choice (Dale, 2017). Volleyball games is characterized by high speed actions and players should take fast decisions and perform sport-specific tasks occurred during the sport. Moreover, without better traits of speed and agility, it's impossible to be stepping into the proper place at the proper time and perform the specified skill properly in volleyball. , Players often need to move, bend and dive to form successful plays and therefore the better their agility, the higher they're going to be ready to do that.

In reference to agility test many the junior volleyball players, only a few studies are undertaken to work out the agility performance of junior volleyball players. The shuttle runs agility test score of Australian junior volleyball players was 10.49 Sec +0.96sec, as reported by Gabbett, Georgieff and Domrow (2007). This is often better performance with regard to normative standard set by Wood (2008). The agility T-shuttle run sprint test score of junior volleyball players was 11.55 and 11.35 seconds, as reported by Jatinder et al., (2017) and Akilana et al., (2014) respectively.

2.7.Effect of strength training on spiking technical skill

Spiking skill ability involves the players jumping to realize the maximum amount height as possible then hitting the ball with the hands, down across internet in to the opponents' court (Blatter, et al., 1979). Hence it's obvious that leg power is required to climb over explosively. Players wish to jump up and hit the ball hard in to their opponents' court and quite roughly so. However, the smash or spike is extremely difficult, and doesn't always score it's the foremost exciting a part of volleyball for many players. The spike or smash in three perspectives the dump, the tactile ball, and therefore the off speed attack (Nambaka, 2011).

According to (Rama, 2014), a front zone player hitting the ball forcefully over internet is named spiking. It's also termed as hitting or attacking (Spiking is that the most crucial component of all actions of Volleyball. Proper timing of the jump and swing of arm are needed to possess perfect spike.

According to Patsiaouras, et al, (2011). The attack also referred to as the spike is typically the third contact a team makes with the ball. Cothran, (1992) in his study founded the mean of 33.55 with variance 13.16 by using AAHPERD Wall Spike test for spiking skill level of his volleyball players with the title of "six volleyball skill tests".

In volleyball, 80% of the points obtained in international volleyball matches are due to spiking and blocking actions (Marques, Van den Tyler, Vescovi, & GonzalezBadillo, 2008; Lobietti, Michele & Merni, 2006; Voigt & Vetter, 2003). This means, the many importance of the spike and block reach heights of the players. The very best spike reaches height scored by the Canadian junior player. His spike reach height was 382 cm (Keith, 2017). So, the above explanation indicate that to be effective in spiking techniques the lower leg strength, abdominal and upper body strength is significant through systematic design strength educational program . Speed, agility and explosive power are needed to spike and block. Adding overall strength to the event of

those specific skills through the utilization of strength training enables volleyball players to succeed in their full potential. Volleyball players can learn the exact movements needed during a game while performing strength training to create quick and powerful muscles fibers that contract quickly and explosively for greater flexibility, mobility, agility, speed and power within the execution of these targeted game time skills.

CHAPTER THREE

RESEARCH METHODS

In this chapter all attempts are made to describe the study area, the research approach, research design, population, sample and sampling technique of the study, inclusion and exclusion criteria, source of data, study variables, instruments of data collection, training protocol; procedures for administration of tests, validity and reliability, methods of data analysis and ethical issues.

3.1 Description of the study area

The study is conducted in Dessie City Administration located in Amhara region. Dessie City is one of the 3rd Metropolitan City Administration in Amhara region. Astronomically it is located on 11°05' N latitude and 39°40' E longitude, 2470 above sea level and 2250 altitude. Its relative location is bordered by Kalu Woreda and Kombolcha city, in the east Albiko and Dessie around Woreda in the south, Hill Tossa and Dessie around Woreda in the west and Kutaber and Tehuledere Woreda in the north. Dessie city is divided into 5 sub-cities and 26 kebeles, of these 18 are urban kebele and the others 8 are rural kebeles and the total population number is 212,220 and the total area of city is 16,800 hectare.

Dessie is one of the Metropolitan City Administration in Amhara national regional state located at a distance of 401 km from Addis Ababa, 480 km from Bair Dar. The name of the city Dessie was given by 3 hypotheses that our country history writers mentioned elder fathers as follows:

- While Emperor Yohannis came to that location and observed the location he was attracted by natural placement and so they said that I'm happy. So, the name was Dessie.
- While Emperor Tewodros settled around Jemie and they used temporary movable houses (Tents) and that moving house (tent) name was happiest (Destaye). By similarity they called Dessie. Before it had the name of Dessie city it was called Lakomelza.
- Currently the place where is called Monday market (segno gebeya) there was one woman that sold local beer (Tela) her name was Dessie. Merchants came from far for the purpose of trade and if they were not sold their material then put or failed it in Dessie's house. So, when the merchants discussed and appointed with their friends in Ms. Dessie's house. Beginning from that most of the people adapted the name of Dessie.

Source: Dessie City Administration communication office



Source: Dessie City Administration communication office

Figure 4: *Map of the study area (Dessie)*

3.2 Research approach

As the study focuses on the cause and effect phenomenon, the quantitative approach is used for its potential to provide with a lot of information. Quantitative approach is used to describe current conditions, investigate relationships, and cause and effect phenomenon (Mills, 2006).

3.3 Research design

The research design applied for this study is true experimental research design involving quantitative data is employed since the main purpose of this study is to determine effects of strength training on selected physical fitness traits and spiking skillability of junior volleyball players in case of Dessie male volleyball team. Because it helps to analyze the effect of strength training (the independent variable) on selected physical fitness traits and spiking ability of junior volleyball players (the dependent variable).

Inline with this view, Kothari (2004) stated that true experimental research is the means of research that can reliably test hypothesis and show cause and effect relation. Both groups attended their regular volleyball training sessions (three days per week), but in addition, Experimental group underwent a specific strength training program. The layout for this study was as follow.

Table1 the Study design lay out

Treatment	Strength exercise
Frequency	3 days/week
Total duration	12 weeks
Duration/Session	30-50 minutes
Intensity	Moderate to high
Exercise days	Monday, Wednesday, Friday

3.4 Population, sampling and sampling technique

All the 24 male volleyball players of Dessie are selected to serve as population for this study. In this study, the researcher have uses comprehensive sampling techniques, this is because Dessie male volleyball team holds 24 players, and then the researcher have uses these players as a whole. Therefore, the sample of this study includes all of volleyball players at Dessie male volleyball team. The subjects are randomly assign in to two groups of 12 players: the experimental group, EG (n=12) and the control group, CG (n=12). Before applying experimental interventions, a pretest is administered and posttest also conducts at the end of the intervention. It should be noted that the control group underwent only regular volleyball training sessions given by the coach and experimental group is perform additional strength training for 12 weeks, with 3 sessions per week, each lasting 30-50 minutes.

3.5 Inclusion and exclusion criteria

Participants who are healthy, voluntary and accessible are admitted in the study. Whereas individuals with cardiac conditions such as hypertension or uncontrolled diabetes or other conditions that will be contraindicated for exercise testing and training are not admit to the study. Besides, individuals having bone and joint problem, diabetes mellitus, bad habits and those taking medications are not included into the study. However, in this research all populations are included because all players are healthy, voluntary and accessible.

3.6 Source of data

To do this study the researcher has uses primary data sources to get adequate amount of information regarding on effects of strength training on volleyball players' physical fitness traits and spiking skillability. So the primary data is taking from Dessie male volleyball players as pre and posttest measurements in the field.

The data for the study is collect from the results of field tests given from pre to post tests of both experimental and control group. Quantitative data is collecting through the appropriate physical fitness test measures and volleyball spiking skillability tests.

3.7 Study variables

In this study there are three variables: one independent variable (strength training), two dependent variables (physical fitness traits and spiking skill ability). Therefore, the intention of this study is to determine the effects of strength training on two dependent variables (physical fitness traits and spiking skillability).

3.8 Instruments of data collection

So as to collect the necessary data of this study, tests (physical fitness and volleyball spiking skill tests) of data collection tools are using. The aforementioned instruments or tests are uses because the researcher believed that they are effective to collect in depth quantitative data about effects of strength training on selected physical fitness traits and spiking skill ability of junior volleyball players in case of Dessie male volleyball team. That is why (Dornyei, 2007) state that the most common and effective instrument to collect quantitative data in quantitative research approach such as experimental and correlational research studies are tests. Instruments are adopted from scholars. The researcher has collect quantitative data through the appropriate physical fitness test and volleyball spiking skill test measures such as: 30 meter sprint run for speed; vertical jump (using wall and chalk) for explosive power; T-shuttle run for agility; AAHPERD wall spike test for spiking. Before the experimental group going to strength training, the pretests are taking from both control and experimental groups. Posttest is also taking from both groups after 12 weeks strength training programs completed for experimental groups.

3.9 Training protocol

The studied players were divided in to two groups: experimental and control group. Experimental group was subjected to additional strength-oriented training and control group followed standard volleyball training. Experimental group performed three additional units of strength training lasting about 30-50 minutes each for twelve weeks. The training protocol focused on strength was based on such exercises as the barbell squat, the dumbbell and other body weight exercises. The training load increased

progressively throughout the experiment, changing the intensity as well as the number of sets and repetitions in accordance with standard training procedures. The training program had based on recommendations of intensity and volume. Therefore, the researcher had prepared training session plan for experimental players. The following variables were studied in the research: physical fitness traits namely: speed, explosive power and agility and technical skill variable: spiking ability was measured.

The data were collected on two days of a week during pre-test and after three month of strength training again had taken two days and collect the post-test result. On the first day 30 meter sprint run for speed; vertical jump (using wall and chalk) for explosive power; T- shuttle run for agility, was measured whereas AAHPERD wall spike test for spiking skill test was measured on the second day.

3.10 Procedures for administration of tests

The researcher follows standard procedures for testing the selected variables and registering the score in fitness and technical skill record sheet in the direct supervision of subjects. In order to determine effect of strength training on selected variables, all pretest measurements are doing within the first week prior to the commencement of the 12 weeks training program, while posttests was performed within the first week followed the completion of the training program. The participants are performed enough warming up and stretching exercise to all tests at the beginning. The testing sessions was consist of tests intersperse with rest. All tests are explained and demonstrated. Before testing, subjects were given practice trails to become familiar with the testing procedures. Subjects were performing each test as per test procedure. Moreover, each test procedure is discussed below.

3.10.1 Physical fitness performance tests

In order to monitor the effectiveness of strength training, specific fitness tests were implemented to assess each element of volleyball specific fitness variables. If technical ability is equal between players, fitness assessment may prove a valuable instrument for determining team selection and in turn may serve as an important motivation tool. The detail explanation of physical fitness tests are as follows.

Speed (30 meter sprint run test)

Speed is measured by using 30 meter sprint run test.

30 meter sprint run

Objective: to measure an athlete's linear speed or acceleration capabilities.

Equipment's: 40m sports field, 2 test administrators, 2 timing gates, 30m measuring tape, stopwatch, marker cones and performance recording sheet.

Test Procedure: Participants should thoroughly warm-up prior to the commencement of the test. Warm-ups should correspond to the biomechanical and physiological nature of the test. In addition, sufficient recovery (e.g. 3-5 minutes) should be administered following the warm-up and prior to the commencement of the test.

Participant ready's themselves on the start-line (positioned 0.3m behind the first gates – cones A) in a standing split-stance start position. NOTE: it is important for reliability that the participant always uses the same starting stance, Participant should be counted down '3 – 2 – 1 – GO, If the test administrators are using a stopwatch, then the time keeper must stand at the finish line and perform the countdown and time the sprint, On the 'GO' signal the participant must accelerate maximally to the finish line as quickly as possible, Each participant MUST complete a MINIMUM OF THREE SPRINTS, each separated by a 2-3 minute rest if reliable results are desired.

Once the test is over, some subjects may react to the previous exertion. To reduce any problems, the subjects should rest, either sitting or standing, for at least 2-3 minutes. If the subject feels ill or goes quiet or pale, they should lie down with their feet resting on a chair. Note: never leave the participant alone after the test (adopted from Owen Walker 27 Jan 2016).



Figure 5: 30 meter sprint run test

Source: Peter J L Thompson the Official IAAF Guide To Coaching Athletics, 2000

Explosive power (vertical jump test)

Explosive Power was measured using vertical jump tests.

Objective: to measure the explosive power of the leg in vertical jump height jumped.

Equipment: measuring tape or marked wall, chalk for marking wall, score sheet, pencil

Procedure: the player warms up for 10 minutes. The player chucks the end of her or his finger tips. The player stands side on to the wall, keeping both feet remaining on the ground, reaches up as high as possible with one hand and marks the wall with the tip of the fingers (M1). The player from static position jumps as high as possible and marks the wall with the chalk on his fingers (M2).

The assistant measures and records the distance between M1 and M2. The player performed three trials. The assistant calculated and record the highest jump from the three trials. **Scoring:** The jump height is usually recorded as a distance score in centimeter (adopted from Sergeant, 1921).



Figure 6: Vertical jump test

Agility (T- shuttle run test)

Objective: To measure the agility of the athletes.

Equipment's: cones, whistle, measurement tape, stopwatch and non-slip surface.

Procedure: Set out four cones as illustrated in the diagram above (5 yards = 4.57 m, 10 yards = 9.14 m). The subject starts at cone A. On the command of the timer, the subject sprints to cone B and touches the base of the cone with their right hand. They then turn left and shuffle sideways to cone C, and also touch its base, this time with their left hand. Then shuffle sideways to the right to cone D and touching the base with the right hand. Then they shuffle back to cone B touching with the left hand, and run backwards to cone A. The stopwatch is stopped as they pass cone A.

Scoring: when all movement completed the scorer is stopped and total time spent is recorded. Each participant attempts the test twice with an interval of 2-3 minutes and better time from the two trials is used as a result of the test.

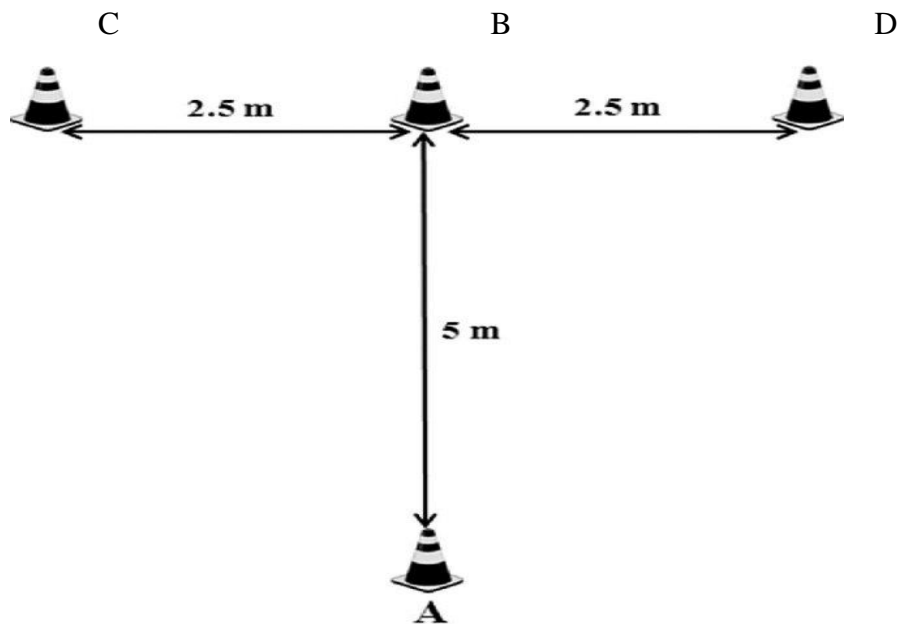


Figure: 7 Agility T-test

Adopted from Mackenzie, (1997) 101 evaluation test.

3.10.2 Volleyball technical skills test

The detailed description of the volleyball skill tests that was conducted on the subjects were as follows.

Spiking (AAHPERD wall spiking test)

Equipment's: volleyballs, stopwatch, a court space with a large wall and restraining line parallel to and 6 feet from the wall.

Procedure: The ball is started with a toss to self. The spiking hand is open and the ball is contacted from a height above the shoulder. As the player spikes it, the ball hits the floor and, after making contact with the wall, rebounds directly to the player. The player repeats the action each time the ball returns.

Rules:

- If control is lost, the ball is restarted and the spikes are added to the Score.
- The ball must be spiked as it returns from the wall; it cannot legally be spiked from a bounce off the floor.
- If a violation occurs, the player is instructed to catch the ball and restart it with a toss to self.

Scoring: This is a 60 second timed test. The total number of times the ball legally hits the wall during each trial was counted for the final score. The balls that are hit off the tosses count. The hits must be legal hits and not "thrown" balls.

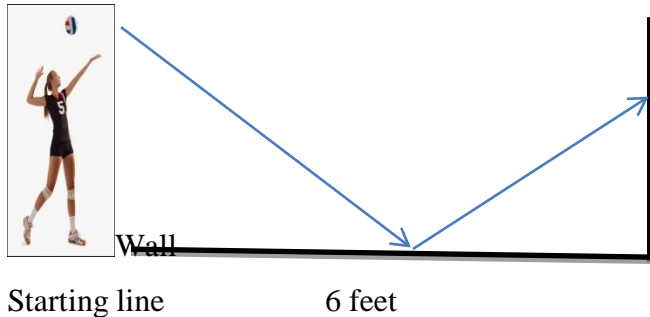


Figure 8: AAHPERD wall spiking test

Adapted from six volleyball skill tests as predictor of game performance (1992)

3.11 Reliability and Validity of instruments

The reliability of a test was assured by establishing efficient and necessary equipment's, and reliability of a test and trainee's reliability. To ensure the uniformity and reliability of the testing technique the investigator had a number of practice sessions in the testing procedures with the guidance of the respective experts. The investigator took all the measurement for the study with the assistance of professional experts.

3.12 Methods of data analysis

The data collected through fitness tests and volleyball skill measures were analyzed and interpreted in to a meaningful idea using computer in order to compare selected physical fitness variable changes observed among groups. Descriptive statistics (mean \pm SD) were presented.

The paired t-test was used to examine whether there is a significant difference between the pre and post test results of experimental & control group. All data analyses were performed with in computer system using statistical package for social science (SPSS), version 16. The significance level for all of the hypotheses was set at 0.05. In addition based on the data results and discussion, brief conclusions and recommendation were written.

3.15. Ethical issues

Ethical issues have become increasingly important in a research involved human beings. In this research, the following crucial points were taken to account. The purpose of the study was explained to the participants and the researcher asks their consent before administrated the training and tests. Ethical standards required that researcher should not put participants in a situation of risk of harm as a result of their participation. The harm would be physical or psychological. Generally, all of the participants have clear information about the purpose of the study and given a sign agreement or consent to participate in this study.

CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter deals with the analysis of pre and post test data collected from experimental (n=12) and control (n=12) groups under the study. The purpose of this study was to determine the effects of 12 week strength training on selected physical fitness traits and spiking skillability of junior volleyball players in Dessie male volleyball team. The physical fitness traits selected for this study were speed, explosive power and agility. In addition, technical skillspiking was used to measure technical skill ability. Pre-tests and post tests were taken from both experimental and control groups before and after 12 weeks of strength training intervention and the scores were recorded. The collected data were analyzed using paired t-test and independent samples t-test to analyze pre and post test results within groups; to analyze pre test results between groups and to analyze post test results between groups with effect sizes of strength training on variables respectively.

4.2 Results of the study

Table 2 *Demographic Characteristic of the Participants*

Group	N	Age	Height	Weight	Playing experience
		Mean \pm S.D	Mean \pm S.D	Mean \pm S.D	Mean \pm S.D
Experimental Group	12	15.50 \pm 0.674	1.61 \pm 0.04	53.43 \pm 1.88	2.00 \pm 0.74
Control Group	12	15.50 \pm 0.674	1.62 \pm 0.05	53.95 \pm 2.50	2.08 \pm 0.79

Key: N= number of players, S.D= standard deviation

As shown in table 1 above, study participants were found in mean \pm SD of age (EG=15.50 \pm 0.674, CG=15.50 \pm 0.674), height (EG=1.61 \pm 0.04, CG=1.62 \pm 0.05), weight (EG= 53.43 \pm 1.88, CG= 53.95 \pm 2.50) and playing experience (EG=2.00 \pm 0.74, CG=2.08 \pm 0.79). This indicated that participants were relatively had the same age, height, weight and playing experience.

Table 3 Analysis of the physical fitness base line data using an independent t-test for two groups

Variables	Group	N	Mean	SD	T	Df	P
Speed result	Experimental	12	5.61	0.63	-1.38	22.00	0.18
	Control	12	5.97	0.64			
Explosive power	Experimental	12	29.08	4.89	0.10	22.00	0.93
	Control	12	28.92	3.60			
Agility	Experimental	12	11.16	0.56	0.36	22.00	0.72
	Control	12	11.08	0.56			

Key: N=number of players, SD =standard deviation, T=t calculate, Df=degree of freedom

The descriptive statistics in the table 2 above shows that the pre test mean and standard deviation scores for experimental group (N=12) were found to be 5.61±0.63 for speed (30m sprint run) 29.08±4.89 for explosive power (vertical jump) and 11.16±0.56 for agility (agility T-shuttle run). In the same way, the average pre test score of speed (30m sprint run), explosive power (vertical jump) and agility (agility T-shuttle run) means and standard deviations of control group (N=12) was found to be 5.97±0.64, 28.92±3.60, and 11.08±0.56 respectively.

According to the data presented in table 2 above, there were no significant differences of speed (30m sprint run) $t=-1.38$, $Df=22$, $p=0.18$, explosive power (vertical jump) $t=0.10$, $Df=22$, $p=0.93$, and agility (agility T-shuttle run) $t=-0.36$, $Df=22$, $p=0.72$ level between the two groups (Experimental and Control group). In all pre tests $p>0.05$ implies that the groups initially were at about the same level. In other words, speed (30m sprint run), explosive power (vertical jump), and agility (agility T-shuttle run) level of the groups did not show any significant difference just at the start of experimentation implying that a comparison of the post test could be possible. Thus, if one asks where the level of speed (30m sprint run), explosive power (vertical jump) and agility (agility T-shuttle run) levels of the volleyball players were, it is revealed in the t-test that they were at the same level.

Table 4 Paired sample t-test results of fitness variables for the two groups of pre and post test

Variables	Subjects	N	MD	SD	T	Df	p
Speed	EG PT-POT	12	-1.07	0.4	-9.42	11	0.00*
	CG PT-POT	12	0.08	0.36	0.72	11	0.49
explosive power	EG PT-POT	12	3.00	1.1	9.21	11	0.00*
	CG PT-POT	12	0.42	1.00	-1.45	11	0.18
Agility	EG PT-POT	12	-1.33	0.86	-5.31	11	0.00*
	CG PT-POT	12	0.01	0.62	0.07	11	0.95

Key: EG=Experimental group, CG= Control group, PT= pre-test, POT= post-test,N=number of players, MD =Mean difference, SD =standard deviation, T=t calculate, Df =degree of freedom

The above table 3 reveals the test of significance differences of the two groups (EG and CG) of pre and post test results. According to the data presented in the table, the pre and post test result of speed showed a statistically significant difference in EG. The result suggests that EG significantly improved 30-meter Sprint performance (MD=-1.07, SD=0.4, p=0.00) when exposed to 12 weeks strength training. But no significant difference was observed in the CG (MD=0.08, SD=0.36, p=0.49).

Table 3 above also displays the test of significance differences of the two groups (EG and CG) pre and post test vertical jump test results. According to the data presented in the table, the pre and post test result of vertical jump showed a statistically significant difference in EG (MD=3.00, SD=1.1, p=0.00) when exposed to 12 weeks strength training than CG (MD =0.42, SD =1.00, p=0.18). The table also shows that EG significantly improved agility T-shuttle run performance (MD=-1.33, SD=0.86, p=0.00) after 12 weeks strength training. But no significant difference was observed in CG (MD=0.01, SD=0.62, p=0.95). There is of course a huge gap between these two figures. This indicated that strength training has large effect on the improvement of speed, explosive power and agility of volleyball players. The implication therefore is the more strength exercise one had better physical fitness traits of the individual would be. The experimental group players with strength training excelled significantly than control group players.

Table 5 Analysis of the fitness differences between two groups in the post test

Variables	Groups	N	Mean	SD	T	df	P
Speed	experimental	12	4.54	0.55	-5.79	22.00	0.00*
	control	12	6.04	0.71			
Explosive Power	experimental	12	32.08	5.32	1.90	22.00	0.04*
	control	12	28.50	3.83			
Agility	experimental	12	9.84	0.86	-3.91	22	0.00
	control	12	11.09	0.71			

Key: N=number of players, SD =standard deviation, T=t calculate, Df =degree of freedom

According to the data presented in table 4 above shows that the posttest mean and standard deviation scores for experimental group (N=12) were found to be 4.54±0.55 for speed (30m sprint run) 32.08±5.32 for explosive power (vertical jump) and 9.84±0.86 for agility (agility T-shuttle run). In the same way, the average post test score of speed (30m sprint run), explosive power (vertical jump) and

agility (agility T-shuttle run) means and standard deviations of control group (N=12) was found to be 6.04 ± 0.71 , 28.50 ± 3.83 , and 11.09 ± 0.71 respectively.

According to the data presented in table 4 above, there were significant differences of speed (30m sprint run) $t = -5.79$, $Df = 22$, $p = 0.00$, explosive power (vertical jump) $t = 1.90$, $Df = 22$, $p = 0.04$, and agility (agility T-shuttle run) $t = -3.91$, $Df = 22$, $p = 0.00$ level between the two groups (Experimental and Control group). In all post tests $p < 0.05$ implies that the groups finally were at about the different level. In other words, speed (30m sprint run), explosive power (vertical jump), and agility (agility T-shuttle run) level of the groups show significant difference just at the last of experimentation.

Table 6 Analysis of the technical skill base line data using an independent t-test for two groups

Technical variable	Group	N	Mean	SD	T	Df	P
	Experimental	12	25.75	3.36	-0.33	22.00	0.75
Spiking skill	Control	12	26.17	2.86			

Key: N=number of players, SD =standard deviation, T=t calculate, Df =degree of freedom

The descriptive statistics in the table 4 above shows that the pre test mean and standard deviation scores for experimental group (N=12) were found to be 25.75 ± 3.36 for spiking. In the same vein, the average pre test score of spiking (AAHPERD wall spike) mean and standard deviations of control group (N=12) were found to be 26.17 ± 2.86 .

The above table 4 shows the test of significance difference between the two groups (Experimental and Control group) at the start of experimentation. It was understood that the initial spiking (AAHPERD wall spike) ability of players had to be known so that comparison of the groups in the end experiment could be possible.

According to the data presented in table 4 above, there were no significant differences of spiking (AAHPERD wall spike) $t = -0.33$, $df = 22$, $p = 0.75$ levels between the two groups (Experimental and Control group). In all pre tests $p > 0.05$ implies that the groups initially were at about the same level. In other words, spiking (AAHPERD wall spike) ability of the groups did not show any significant difference just at the start of experimentation implying that a comparison of the post test could be possible. Thus, if one asks where the ability of spiking (AAHPERD wall spike) ability of the volleyball players was, it is revealed in the t-test that they were at the same level.

Table 7 Paired sample t-test results of spiking ability variable for the two groups of pre and post test

Variables	Subjects	N	MD	SD	T	Df	p
Spiking	EG PT-POT	12	4.17	1.70	8.51	11	0.00*
	CG PT-POT	12	-0.17	1.59	-0.36	11	0.72

Key: EG=Experimental group, CG= Control group, PT= pre-test, POT= post-test, N=number of players, MD =Mean difference, SD =standard deviation, T=t calculate, Df =degree of freedom

The above table shows the test of significance differences of the two groups (EG and CG) of pre and post test results. According to the data presented in the table 5, the pre and post test result of spiking showed a statistically significant difference in EG. The result suggests that EG significantly improved spiking ability when measured in AAHPERD wall spike (MD= 4.17, SD= 1.70, p=0.000) when exposed to 12 weeks strength training than CG (MD=-0.17, SD= 1.59, p=0.72). Hence, (P <0.05) Post-training spiking scores was significantly improved than pre-test scores for the EG. But no significant improvement was observed in CG (p>0.05). The results indicated that the applied training protocol caused a significant improvement in spiking skill in EG.

Table 8 Analysis of the spiking ability differences between two groups in the post test

Variables	Groups	N	Mean	SD	T	df	P
Spiking	experimental	12	29.92	4.32	2.51	22.00	0.02*
	control	12	26.00	3.25			

Key: N=number of players, SD =standard deviation, T=t calculate, Df =degree of freedom

According to the data presented in table 7 above shows that the posttest mean and standard deviation scores for experimental group (N=12) were found to be 29.92±4.32 for spiking (AAHPERD wall spike). In the same way, the average post test score of spiking (AAHPERD wall spike) mean and standard deviations of control group (N=12) was found to be 26.00±3.25.

According to the data presented in table 7 above, there was significant difference of spiking (AAHPERD wall spike). $t=2.51$, $Df =22$, $p=0.02$ level between the two groups (Experimental and Control group). In all post tests $p<0.05$ implies that the groups finally were at about the different level. In other words, spiking (AAHPERD wall spike) level of the groups show significant difference just at the last of experimentation.

CHAPTER FIVE

5.1. DISCUSSIONS

The purpose of this study was to investigate the effects of 12 week strength training on selected physical fitness traits and spiking ability of junior volleyball players in Dessie male volleyball team. The subjects participated throughout the testing period and cooperated for the success of collection of necessary data. The experimental group was participated in a 12 week strength training program while the control group did not participate in this strength training program. Experimental group was instructed not to start any new additional program during 12 week period and only perform activities of normal daily livings. Prior to the study, procedures and guidelines had presented and subjects were agreed to participate in the consent form. The findings of this study in each variable were discussed as follows.

5.1.1. Effects of strength training on speed of junior volleyball players

The finding of the study showed that strength training has an effect on the 30-meter sprint run and reduce its time. The result suggests that a significant improvement in sprint performance was shown by EG (MD=-1.07, SD=0.4, $p=0.00$) than CG (MD=0.08, SD=0.36, $p=0.49$).

The lower time spent in covering 30m distance were indicating improvement of sprinting performance in EG. It was observed that after 12 week strength training volleyball players reduced 30m sprint time by -1.07 second lower than the pre test time. So, this finding was found to be significant ($p<0.05$). But in CG the pre and post test result did not undergo any statistically significant reduction ($p>0.05$). Hence the researcher accepted hypothesis $H_{1.1}$ and rejected $H_{0.1}$ at 0.05 level of confidence.

This result is in accordance with the findings of Granados et al., (2007) who studied on effects of different strength training on physical fitness variables. The result indicated that, strength training showed significant effect on sprint performance of elite and amateur women's handball players. The result is also supported by the finding of Sherif Ali and Ahmed Mohamed, (2010); results indicate that strength training program had a positive effect on developing sprint performance of the sample.

Running speed is an important prerequisite factor in competitive volleyball (Fleck et al., 1992). More over results of previous research also indicate that strength training is suitable for developing muscle speed (Amin, 2007, Labib, 2008).

5.1.2. Effects of strength training on explosive power of junior volleyball players

The findings of the study revealed that strength training had an effect on the vertical jump of male volleyball players and had increased the players' jump. The result suggests that a significant increase in a vertical jump performance was reflected by EG (MD=3.00, SD=1.1, $p=0.00$) than CG (MD =0.42, SD=1.00, $p=0.18$). In the strength training performed three days a week in addition to players' volleyball technical trainings, vertical jump was in the pre-training and post-training, it was observed that after the training volleyball players jumped 3.00cm higher than the pre-test score. This finding was found to be significant ($p<0.05$). But in CG the pre and post test result did not undergo any statistically significant changes. This result indicated the effective change was observed on player's power as a result of strength training. Hence the researcher accepted hypothesis H_{1.2} and rejected H_{0.2} at 0.05 level of confidence. Thus, strength training seems to be an essential tool in developing vertical jump performances (Luebbers et al., 2003).

This result is supported by different scholars, for instance, Ramin, Zahra & Alireza (2014) and Abebaw (2019) confirmed that strength training has significant effect on explosive power of players.

Lacono, Karcher & Michalsik (2018) stated that strength training has a direct influence on jumping power, change of direction and defensive actions. The result is also supported by Michal Spieszny and Mateusz Zubik (2018) conducted on effects of strength training programs in Handball Players and its influence on power during the competitive period. Analysis of the results showed that strength training programs induced a statistically significant increase in jumping height and power generation. The result was also in accordance with Emel Cetin and Yeliz Ozdol (2012) the result on pre and post tests of jumping performance showed significant change in EG ($p<0.05$) after strength training. The result is also supported by Nikolaos xozoglou, (2007) who studied on the effect of strength training program on jumping performance for preadolescent children. This study proved that strength training has been proven to be an effective way of improving jumping performance. Further, this result was also in accordance with finding of Alberto et al., (2014) who studied on effects of strength training on vertical jump height and lower limb strength development in elite male handball players. This study also proved that strength training has been proven to be an effective modality for improving jumping performance of volleyball players.

Most researchers agree that higher maximal power may be associated with an advantage in blocking, hitting, pushing and ball throwing accuracy (Marques & González-Badillo, 2006). Strength training improves the muscle contractile mechanisms, maximal force capacity and the

rate of force development (Rimmer and Sleivert, 2000). Additionally, strength training is known to potentiate stretch shortening cycles (Komi, 2000) which are crucial when performing some volleyball specific motor offensive and defensive actions such as jump attacks and blocks. Strength training is an effective modality in the increase of peak torque of leg muscles (Fatouros et al., 2000; Harris et al., 2000). Subsequently, strength exercises are more effective in developing strength, jumping capacity and specific volleyball motor actions.

5.1.3. Effects of strength training on agility of junior volleyball players

The finding of the current research showed that strength training has had a significant effect on the agility performance of male volleyball players. The result suggests that a significant improvement in agility performance was shown by EG (MD=-1.33, SD=-5.33, p=0.00) than CG (MD=0.01, SD=0.62, p=0.95). In the strength training performed three days a week in addition to players' volleyball technical trainings, agility performance was in the pre-training and post-training, it was observed that after the training volleyball players reduced agility T-shuttle running time by -1.33 second lower than the pre test time. This finding was found to be significant (p<0.05). The lower time spent in covering distance, direction change and acceleration were indicating improvement of agility. The above table 3 illustrates the improvement of agility, because there was decline in time resulting from 12 weeks of strength training. But in CG the pre and post test result did not undergo any statistically significant reduction (p>0.05). Hence the researcher accepted hypothesis H_{1.3} and rejected H_{0.3} at 0.05 level of confidence.

This finding of the study is in accordance with the findings of Frank et al., (2017) who studied on effects of a six-week strength training programme on change of direction performance in youth team sport athletes. The result showed that strength training significantly improved agility performance of players. Another study conducted by Anil R. Waghmare, (2012) on study of flexibility, agility and reaction time in handball Players also supports this finding. The result indicated that, strength training showed significant effect on agility performance of handball players. Moreover, this result was also in accordance with the finding of Acsinte, Alexandru and Milon, (2012) who studied on effects of power and strength training on agility performance of handball players. The result proved that strength training is an effective method for improving agility performance of volleyball players.

5.1.4. Effects of strength training on spiking ability of junior volleyball players

The findings of the study revealed that strength training had an effect on the spiking ability of junior volleyball players and had increased the players' spiking ability. The result suggests that a significant increase in a spiking skill ability was reflected by EG (MD=4.17, SD=1.70, p=0.00) than CG (MD = -0.17, SD=1.59, p=0.72). In the strength training performed three days a week in addition to players' volleyball technical trainings, spiking skill was in the pre-training and post-training, it was observed that after the training volleyball player's wall spike 4.17 higher than the pre test score. This finding was found to be significant (p<0.05). But in CG the pre and post test result did not undergo any statistically significant changes. This result indicated the effective change was observed on players' spike as a result of strength training. Hence the researcher accepted hypothesis H_{1.4} and rejected H_{0.4} at 0.05 level of confidence. Thus, strength training seems to be an essential tool in developing spiking ability.

This result is supported by different researchers, for instance, Zhang (2010) Strength training is required to perform spike and to demonstrate aggressive blocking in volleyball. Arm and pectoral arch strength is vital in offensive, defensive and in minimizing mistakes in basic skills of volleyball. Abdominal and hip muscle strength training also played a crucial role for explosive jumping and powerful hitting in volleyball. Another study conducted by Motriz (2020) stated that eight weeks of strength and power training positively affect volleyball kill probability. And also Hughes, (2014) Strength of hands and other body parts are important elements you ought to concede to spike accurately and efficiently.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary

The purpose of this study was to determine effects of 12 week strength training on selected physical fitness traits and spiking ability of junior volleyball players in Dessie male volleyball team. For this purpose, the researcher reviewed the available literatures in order to decide the focus of the study and methods.

In order to attain the general objectives of the study, the following specific research objectives were formulated to:

1. Examine effects of strength training on speed of junior volleyball players.
2. Identify effects of strength training on explosive power of junior volleyball players.
3. Find out effects of strength training on agility of junior volleyball players.
4. Determine effects of strength training on spiking technical skill ability of junior volleyball players.

Based on the above specific objectives, the hypotheses were formulated. Subjects for the study were 24 males who were participating in Dessie male volleyball team. Subjects divided in to two groups, an experimental and control group. The experimental group performed in a three- month of additional strength training program. However, the control group did not perform strength training program. But, they did perform as equal as normal training activities with the experimental players for the regular volleyball training program.

All subjects participated in all physical fitness traits tests: speed, explosive power, agility and technical ability tests: spiking. Both had taken pre and post testing. True experimental method was employed to collect a data used to analyze the change mean scores to experimental and control groups.

Fitness and technical skill profiling had achieved by means of tests. The data was gathered from tests of experimental and control groups results in the form of pre-test and post-test method had been organized using appropriate and relevant statistical method of analysis. Paired t-test, which assists to come up with findings had used. Finally, as study revealed that strength training has been a significant effect on volleyball to enhance their physical fitness and spiking ability.

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

1. The finding of this study indicated that improvement in speed trait of experimental group was observed. Experimental group had shown improvement as a result of strength training. Speed was improved better and had significant change in EG in pre to post tests. In CG no significant change was found in pre to post tests. There was no significant mean score difference of speed in pre- tests of EG compared with CG before 12 weeks strength training. But, there was significant mean score difference of speed in post tests of EG compared with CG after 12 weeks strength training. Strength training has large effect size on improvement of speed.
2. The finding of this study revealed that explosive power was significantly improved in EG after 12 weeks of strength training. But, in CG there was no significant change as recorded in pre to post tests. EG had no significant pretests mean score difference in explosive power compared with pretests of CG before 12 weeks strength training. But, EG had significant posttests mean score difference in explosive power compared with posttests of CG after 12 weeks strength training. Strength training has large effect size on improvement of explosive power.
3. Finding of this study indicated that there was a significant improvement of agility trait in EG than CG as a result of strength training. EG showed significant increase in agility trait with the consequence of strength training but no significant improvement was found in CG. EG had no significant pretests mean score difference in agility compared with pretests of CG before 12 weeks strength training. But, EG had significant posttests mean score difference in agility compared with posttests of CG after 12 weeks strength training. Strength training has large effect size on improvement of agility.
4. The finding of this study indicated that spiking ability was significantly improved in EG as a result of 12 weeks strength training. But, in CG no significant change was observed in pre to post tests. There was no a significant means score difference of spiking ability in pre-tests of EG compared with CG before 12 weeks strength training. But, there was a significant means score difference of spiking ability in post tests of EG compared with CG after 12 weeks strength training. Strength training has large effect size on improvement of spiking ability. Finally, the study revealed that strength training has been a significant effect to enhance volleyball players' physical fitness traits and spiking ability.

6.2 Conclusions

Based on major finding of this study, the following points were stated as a conclusion.

- Strength training had a significant effect on improvement of speed of junior volleyball players.
- Strength training had a significant increase in explosive power of junior volleyball players.
- Strength training was found effective in a significant improvement of agility of junior volleyball players.
- Strength training had a significant increase on spiking ability of junior volleyball players.

Generally, strength training had significant effect on volleyball players' physical fitness traits and spiking ability.

6.3 Recommendations

Based on findings of the study, the subsequent recommendations are forwarded.

- For better improvement of physical fitness and technical skills, volleyball players are highly recommended to engage in strength training at least 3 days per week 30-50 minutes each day in addition to the regular training program. Thus training program per week would be increased and contents suggested to emphasis on strength exercises.
- Strength training had a positive effect on physical fitness and spiking ability improvements.

Therefore, for better improvement; volleyball players are suggested to participate in strength training exercise rather than devoting most of their time only on games.

- Coaches are recommended to encourage participants, and focus on strength training to improve physical fitness and spiking ability of volleyball players.
- The sport offices are highly suggested to incorporate and encourage strength training programs through different projects.
- Design of Players Training programs are highly recommended to improve physical fitness traits and spiking ability of volleyball players.
- The study was conducted only to determine effects of 12 week strength on selected physical fitness traits (speed, explosive power and agility) and technical skill (spiking). So, it is recommended for other researchers to deal with other physical fitness variables like flexibility, endurance, coordination etc. and other volleyball technical skills such as, blocking, setting and digging in various age categories and sex. Thus, these are other principal areas for further research.

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Appendices

Appendix 1: Researcher's twelve weeks strength training program for experimental group

Month	Week	Day	Phase	Contents	Dose						
					Time	Rep.	Set	Rest	Intensity		
February	1	Tuesday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate	
			Main part	- Pull up - Push up - Incline dumbbell press - Hummer strength bench - Chest dips - Standing French press - Dumbbell lateral raise	50 min	8 10 8 8 10 8 8	3 3 3 3 3 3 3	1 min	85%		
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low	
		Thursday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min						Moderate
			Main part	- Leg press - Tuck jumps - Dumbbell step up - Dead lifts - Pull ups - Single arm dumbbell row - Underhand barbell row	50 min	10 10 10 10 8 8 8	3 3 3 3 3 3 3	1 min	85%		
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low	
		Saturday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min						Moderate
			Main part	- Squats - Walking lunges - Leg press - Butterfly sit up - Standing leg curls - Seated calf raise - Overhead press	50 min	8 8 8 10 8 8 8	3 3 3 3 3 3 3	1 min	85%		
			Cooling down	Players perform light mov't and static stretching at the end of the session	5 min					Low	

Month	Week	Day	Phase	Contents	Dose						
					Time	Rep.	Set	Rest	Intensity		
February	2	Tuesday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate	
			Main part	- Bench press - Bent over row - One arm row - Hummer strength bench - Chest dips - Standing French press - Dumbbell lateral raise	50 min	10 10 10 10 10 10	3 3 3 3 3 3	1 min	85%		
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low	
		Thursday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min						Moderate
			Main part	- Face pulls - Tuck jumps - Dumbbell step up - Dead lifts - Pull ups - Single arm dumbbell row - Underhand barbell row	50 min	10 12 12 12 10 10 10	3 3 3 3 3 3 3	1 min	85%		
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low	
		Saturday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min						Moderate
			Main part	- Squats - Walking lunges - Leg press - Butterfly sit up - Standing leg curls - Seated calf raise - Overhead press	50 min	10 10 10 12 10 10 10	3 3 3 3 3 3 3	1 min	85%		
			Cooling down	Players perform light mov't and static stretching at the end of the session	5 min					Low	

Month	Week	Day	Phase	Contents	Dose						
					Time	Rep.	Set	Rest	Intensity		
February	3	Tuesday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate	
			Main part	- Bench press - Bent over row - One arm row - Hummer strength bench - Chest dips - Standing French press - Dumbbell lateral raise	50 min	10 10 10 12 10 10	4 4 4 4 4 4	1 min	85%		
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low	
		Thursday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min						Moderate
			Main part	- Face pulls - Tuck jumps - Dumbbell step up - Dead lifts - Pull ups - Single arm dumbbell row - Underhand barbell row	50 min	10 12 12 10 10 10	4 4 4 4 4 4	1 min	85%		
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low	
		Saturday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min						Moderate
			Main part	- Squats - Walking lunges - Leg press - Butterfly sit up - Standing leg curls - Seated calf raise - Overhead press	50 min	10 10 10 12 10 10 10	4 4 4 4 4 4 4	1 min	85%		
			Cooling down	Players perform light mov't and static stretching at the end of the session	5 min					Low	

Month	Week	Day	Phase	Contents	Dose						
					Time	Rep.	Set	Rest	Intensity		
February	4	Tuesday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate	
			Main part	- Pull up - Push up - Incline dumbbell press - Hummer strength bench - Chest dips - Standing French press - Dumbbell lateral raise	50 min	12 12 12 12 12 12	4 4 4 4 4 4	1 min	85%		
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low	
		Thursday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min						Moderate
			Main part	- Leg press - Tuck jumps - Dumbbell step up - Dead lifts - Pull ups - Single arm dumbbell row - Underhand barbell row	50 min	12 12 12 12 12 12	4 4 4 4 4 4	1 min	85%		
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low	
		Saturday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min						Moderate
			Main part	- Squats - Walking lunges - Leg press - Butterfly sit up - Standing leg curls - Seated calf raise - Overhead press	50 min	12 12 12 12 12 12	4 4 4 4 4 4	1 min	85%		
			Cooling down	Players perform light mov't and static stretching at the end of the session	5 min					Low	

Month	Week	Day	Phase	Contents	Dose				
					Time	Rep.	Set	Rest	Intensity
March	5	Tuesday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min				Moderate
			Main part	- Bench press - Bent over row - One arm row - Hummer strength bench - Chest dips - Standing French press - Dumbbell lateral raise	40 min	8 8 8 8 8 8	5 5 5 5 5 5	1 min	90%
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min				Low
		Thursday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min				Moderate
			Main part	- Face pulls - Tuck jumps - Dumbbell step up - Dead lifts - Pull ups - Single arm dumbbell row - Underhand barbell row	40 min	8 8 8 8 8 8	5 5 5 5 5 5	1 min	90%
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min				Low
		Saturday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min				Moderate
			Main part	- Squats - Walking lunges - Leg press - Butterfly sit up - Standing leg curls - Seated calf raise - Overhead press	40 min	8 8 8 8 8 8	5 5 5 5 5 5	1 min	90%
			Cooling down	Players perform light mov't and static stretching at the end of the session	5 min				Low

Month	Week	Day	Phase	Contents	Dose					
					Time	Rep.	Set	Rest	Intensity	
March	6	Tuesday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate
			Main part	- Pull up - Push up - Incline dumbbell press - Hummer strength bench - Chest dips - Standing French press - Dumbbell lateral raise	40 min	8 8 8 8 8 8	5 5 5 5 5 5	1 min	90%	
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low
		Thursday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate
			Main part	- Leg press - Tuck jumps - Dumbbell step up - Dead lifts - Pull ups - Single arm dumbbell row - Underhand barbell row	40 min	8 8 8 8 8 8	5 5 5 5 5 5	1 min	90%	
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low
		Saturday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate
			Main part	- Squats - Walking lunges - Leg press - Butterfly sit up - Standing leg curls - Seated calf raise - Overhead press	40 min	8 8 8 8 8 8	5 5 5 5 5 5	1 min	90%	
			Cooling down	Players perform light mov't and static stretching at the end of the session	5 min					Low

Month	Week	Day	Phase	Contents	Dose				
					Time	Rep.	Set	Rest	Intensity
February	7	Tuesday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min				Moderate
			Main part	- Bench press - Bent over row - One arm row - Hummer strength bench - Chest dips - Standing French press - Dumbbell lateral raise	40 min	6 6 6 6 6 6	6 6 6 6 6 6	1 min	90%
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min				Low
		Thursday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min				Moderate
			Main part	- Face pulls - Tuck jumps - Dumbbell step up - Dead lifts - Pull ups - Single arm dumbbell row - Underhand barbell row	40 min	6 6 6 6 6 6	6 6 6 6 6 6	1 min	90%
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min				Low
		Saturday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min				Moderate
			Main part	- Squats - Walking lunges - Leg press - Butterfly sit up - Standing leg curls - Seated calf raise - Overhead press	40 min	6 6 6 6 6 6	6 6 6 6 6 6	1 min	90%
			Cooling down	Players perform light mov't and static stretching at the end of the session	5 min				Low

Month	Week	Day	Phase	Contents	Dose					
					Time	Rep.	Set	Rest	Intensity	
February	8	Tuesday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate
			Main part	- Pull up - Push up - Incline dumbbell press - Hummer strength bench - Chest dips - Standing French press - Dumbbell lateral raise	40 min	6 6 6 6 6 6 6	6 6 6 6 6 6 6	1 min	90%	
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low
		Thursday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate
			Main part	- Leg press - Tuck jumps - Dumbbell step up - Dead lifts - Pull ups - Single arm dumbbell row - Underhand barbell row	40 min	6 6 6 6 6 6 6	6 6 6 6 6 6 6	1 min	90%	
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low
		Saturday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate
			Main part	- Squats - Walking lunges - Leg press - Butterfly sit up - Standing leg curls - Seated calf raise - Overhead press	40 min	6 6 6 6 6 6 6	6 6 6 6 6 6 6	1 min	90%	
			Cooling down	Players perform light mov't and static stretching at the end of the session	5 min					Low

Month	Week	Day	Phase	Contents	Dose				
					Time	Rep.	Set	Rest	Intensity
April	9	Tuesday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min				Moderate
			Main part	- Pull up - Push up - Incline dumbbell press - Hummer strength bench - Chest dips - Standing French press - Dumbbell lateral raise	30 min	6 6 6 6 6 6	5 5 5 5 5 5	1 min	95%
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min				Low
		Thursday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min				Moderate
			Main part	- Leg press - Tuck jumps - Dumbbell step up - Dead lifts - Pull ups - Single arm dumbbell row - Underhand barbell row	30 min	6 6 6 6 6 6	5 5 5 5 5 5	1 min	95%
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min				Low
		Saturday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min				Moderate
			Main part	- Squats - Walking lunges - Leg press - Butterfly sit up - Standing leg curls - Seated calf raise - Overhead press	30 min	6 6 6 6 6 6	5 5 5 5 5 5	1 min	95%
			Cooling down	Players perform light mov't and static stretching at the end of the session	5 min				Low

Month	Week	Day	Phase	Contents	Dose					
					Time	Rep.	Set	Rest	Intensity	
April	10	Tuesday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate
			Main part	- Bench press - Bent over row - One arm row - Hummer strength bench - Chest dips - Standing French press - Dumbbell lateral raise	30 min	6 6 6 6 6 6	5 5 5 5 5 5	1 min	95%	
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low
		Thursday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate
			Main part	- Face pulls - Tuck jumps - Dumbbell step up - Dead lifts - Pull ups - Single arm dumbbell row - Underhand barbell row	30 min	6 6 6 6 6 6	5 5 5 5 5 5	1 min	95%	
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low
		Saturday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate
			Main part	- Squats - Walking lunges - Leg press - Butterfly sit up - Standing leg curls - Seated calf raise - Overhead press	30 min	6 6 6 6 6 6	5 5 5 5 5 5	1 min	95%	
			Cooling down	Players perform light mov't and static stretching at the end of the session	5 min					Low

Month	Week	Day	Phase	Contents	Dose					
					Time	Rep.	Set	Rest	Intensity	
April	11	Tuesday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate
			Main part	- Bench press - Bent over row - One arm row - Hummer strength bench - Chest dips - Standing French press - Dumbbell lateral raise	30 min	6 6 6 6 6 6	5 5 5 5 5 5	1 min	95%	
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low
		Thursday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate
			Main part	- Face pulls - Tuck jumps - Dumbbell step up - Dead lifts - Pull ups - Single arm dumbbell row - Underhand barbell row	30 min	6 6 6 6 6 6	5 5 5 5 5 5	1 min	95%	
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min					Low
		Saturday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min					Moderate
			Main part	- Squats - Walking lunges - Leg press - Butterfly sit up - Standing leg curls - Seated calf raise - Overhead press	30 min	6 6 6 6 6 6	5 5 5 5 5 5	1 min	95%	
			Cooling down	Players perform light mov't and static stretching at the end of the session	5 min					Low

Month	Week	Day	Phase	Contents	Dose				
					Time	Rep.	Set	Rest	Intensity
April	12	Tuesday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min				Moderate
			Main part	- Pull up - Push up - Incline dumbbell press - Hummer strength bench - Chest dips - Standing French press - Dumbbell lateral raise	30min	6 6 6 6 6 6	5 5 5 5 5 5	1 min	95%
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min				Low
		Thursday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min				Moderate
			Main part	- Leg press - Tuck jumps - Dumbbell step up - Dead lifts - Pull ups - Single arm dumbbell row - Underhand barbell row	30 min	6 6 6 6 6 6	5 5 5 5 5 5	1 min	95%
			Cooling down	Players perform light movements and static stretching at the end of the session.	5 min				Low
		Saturday (afternoon)	Warming up	Walking, jogging, running, harmonized movement of hands, legs, arms and dynamic stretching	5 min				Moderate
			Main part	- Squats - Walking lunges - Leg press - Butterfly sit up - Standing leg curls - Seated calf raise - Overhead press	30 min	6 6 6 6 6 6	5 5 5 5 5 5	1 min	95%
			Cooling down	Players perform light mov't and static stretching at the end of the session	5 min				Low

Appendix 2: Participant information sheet and informed consent form

Researcher's name: Tesfaye Tadesse

Advisor name: Dimissie Gashu (PHD)

Research title: Effects of strength training on selected physical fitness traits and spiking skill ability of junior volleyball players in Dessie Town, Amhara Regional State of Ethiopia.

Dear participants,

At present, I am conducting a research study which aims to determine the effects of strength training on physical fitness traits and spiking skill ability of volleyball players. So you are kindly requested to participate in this research as described below.

The research study will be carried out and governed by the regulations for research on human beings.

These regulations require that the researcher should obtain a signed agreement (consent from you to participate in this research.

The researcher will explain to you in detail the purpose of the study, the procedure to be used, the potential benefits and risks, confidentiality and rights in this study. Thus you can ask the researcher and questions that you may have about the study. After discussion, if you agree to participate in this study, please sign this form in the presence of the researcher. You may discontinue at any time from the study if you choose to do so.

Purpose of the study

The purpose of this research project is to determine the effects of strength training on selected physical fitness traits and spiking skill ability of junior volleyball players in Dessie Town, Amhara Regional State of Ethiopia.

Moreover, the aim of this study is to write a thesis as a partial requirement for the fulfillment of master's program in coaching volleyball.

Procedure of the study

You will undertake physical fitness and volleyball technical skills level test. These tests will help the researcher to describe the initial physical fitness and volleyball spiking skill ability of the group. The whole group will be divided in to two groups, either experimental or control group. Both experimental and control group will undertake volleyball technical tactical training. However the control group will continue a normal volleyball technical tactical training while the experimental or intervention group will undertake additional strength training sessions for 12 weeks period and three times a week.

Pretesting for a whole group will be taken approximately for two days. Then, posttest will be run or the test that will be taken before the training will be repeated at the end of the 12 weeks intervention training. The post test for the whole group will be taken approximately for two days, too.

Benefits and risks

Individuals participating in this study will receive a copy of all test results and gain a better understanding of their performance in physical fitness and volleyball spiking skill ability compared with the group average. In addition, you will also receive ongoing education and coaching throughout the training. The risk of being participating in this study is very minimal, but while administering the tests and during training session you may experience localized muscle fatigue in your body. You might feel some muscle soreness and fatigue during and after the cessation of the exercise tests and training but I do not expect any unusual risks as a direct result of this study. If any unexpected physical injury occurs, appropriate first aid will be provided, but no financial compensations will be given. There would not be any direct payment for participating. But the finding from this research may reveal important information for the investigator and you.

Confidentiality

The information you will provide will be remained confidential. There will be no information that will identify you in particular. The finding of the study will be general for the study participants and will not reflect anything particular of individual persons. The test will be coded to exclude showing names. No reference will be made in oral or written reports that could link participants to the research. Generally, the information will be used only for research purposes without identifying you as an individual.

Rights

Participants for this study are fully voluntary. You have the right to declare to participate or not in this study. If you decide not to participate, you have the right to withdraw from the study at any time and this will not label you for any loss of benefits.

Declaration of informed voluntary consent

I have read the participant information sheet. I have clearly understood the purpose of the research, the procedures, the risks and benefits, issues of confidentiality and the rights of participating. I have been given the opportunity to ask questions for things that may have been unclear. I was informed that I have the right to withdraw from the study at any time.

Therefore, I declare my voluntary consent to participate in this study with my initial (signature) as indicated below.

Name of participant: _____

Signature of participant: _____

Date: _____

I certify that I have explained fully to the above participant about the purpose, the procedures, confidentiality, rights, the potential benefits and the possible risks involved in this research study:

Name of investigator: _____

Signature of investigator: _____ Date: _____

Appendix 3: physical activity readiness questionnaire (PAR-Q)

Dear participants,

Physical activity readiness questionnaire is the first step to take in to consideration if one planned to involve in regular exercise. Many health benefits are associated with participating in regular exercise.

The physical activity readiness questionnaires are designed to identify the small number of participants for whom strength training might be inappropriate or those who should seek medical advice concerning the type of activity most suitable for them. The following questions are prepared and distributed to participants regarding to their health status for the participation of the designed strength training.

Direction: please read the following questions carefully and indicate your correct responses to each question by writing on blank space or by putting a tick (x) mark under one of the two boxes (YES or NO options) given below that represents your idea accurately.

Participant’s full name: _____

Participant’s signature: _____

Date: _____

NO.	Questions	Yes	No
1	Do you currently participate in regular exercise at least 2 times per week?		
2	Do you currently smoke?		
3	Do you have coronary heart disease?		
4	Have you currently take medications?		
5	Do you have diabetes mellitus or any other metabolic disorder?		
6	Have you ever suffered from shortness of breath at rest or with physical exercise		
7	Have you ever pain in your chest when you do physical exercise?		
8	Do you have high blood pressure?		
9	Do you have bone or joint problem which has been aggravated by		

	exercise?		
10	Do you have upper or lower back pain which has been aggravated by exercise?		
11	Do you have a work that is physically demanding?		
12	Have you ever feel feint or lost consciousness?		

Thank you!

Appendix 4: profile of participants

A. Experimental group (EG)

No	Name / code of participant	Age (year)	Height (cm)	Weight (k.g)	Training experience
1	EE1	15	1.56	51	2
2	EE2	15	1.58	53	1
3	EE3	16	1.66	52	3
4	EE4	15	1.60	53.6	2
5	EE5	17	1.68	55	3
6	EE6	15	1.57	53	2
7	EE7	15	1.59	52	1
8	EE8	16	1.57	51.6	2
9	EE9	16	1.64	56	2
10	EE10	15	1.60	52	1
11	EE11	15	1.62	54	2
12	EE12	16	1.67	57	3

B. control group (CG)

No	Name / code of participant	Age (year)	Height (cm)	Weight (k.g)	Training experience
1	CC1	15	1.54	50.5	1
2	CC2	15	1.59	54	2
3	CC3	16	1.67	53	3
4	CC4	15	1.61	54	1
5	CC5	17	1.71	58	3

6	CC6	15	1.57	53	2
7	CC7	15	1.58	51	1
8	CC8	16	1.60	52	2
9	CC9	16	1.66	57	3
10	CC10	15	1.62	54	2
11	CC11	15	1.63	53	2
12	CC12	16	1.69	58	3

Appendix 5: Demographic characteristics of the participants

Group	N	Age	Height	Weight	Playing experience
		Mean \pm S.D	Mean \pm S.D	Mean \pm S.D	Mean \pm S.D
Experimental Group	12	15.50 \pm 0.674	1.61 \pm 0.04	53.43 \pm 1.88	2.00 \pm 0.74
Control Group	12	15.50 \pm 0.674	1.62 \pm 0.05	53.95 \pm 2.50	2.08 \pm 0.79

Key: N= number of players, S.D= standard deviation

Appendix 6: selected physical fitness and volleyball spiking skill ability description

NO	Parameters	Types of tests	Unit
1	Speed	30m sprint test	Second
2	Power	Vertical jump test	Centimeter
3	Agility	T- Shuttle run test	Second
4	Spiking	10 wall spike test	Number in oneminute

Appendix 7: pre and post test results of speed (30m sprint test), Explosive power (vertical jump test) and agility (T- Shuttle run test) for experimental group players

Cod of Players	Fitness tests					
	Speed		Explosive power		Agility	
	30m sprint run test		Vertical jump test		T- Shuttle run test	
	PT	POT	PT	POT	PT	POT
EE1	6.98	5	25	28	10.52	9.55

EE2	5.63	5.1	28	31	10.55	9.95
EE3	5.06	4	23	25	11.42	9.85
EE4	5.92	4.5	29	33	10.55	9.75
EE5	4.97	3.5	30	34	11.53	9.62
EE6	4.83	4	34	36	10.58	9.75
EE7	6.07	5.02	34	35	11.50	9.5
EE8	5.92	5	32	35	12.10	10.35
EE9	4.82	4.04	32	36	10.59	9.85
EE10	6.01	5.05	18	22	11.57	10.05
EE11	5.63	4.9	31	34	11.55	9.95
EE12	5.48	4.4	33	36	11.48	9.94

Key: PT= pretest, POT= posttest

Appendix 8: pre and post test results of speed (30m sprint run test), explosive power (vertical jump test) and agility (T- Shuttle run test) for control group players

Cod of players	Fitness tests					
	Speed		Explosive power		Agility	
	30m sprint run test		Vertical jump test		T- Shuttle run test	
	PT	POT	PT	POT	PT	POT
CC1	7.02	7.5	27	28	11.54	11.54
CC2	6.63	6.5	26	25	10.58	10.58
CC3	5.08	6.05	28	27	11.47	11.47
CC4	5.97	6	26	25	10.56	10.56
CC5	5.94	5.7	31	30	10.54	10.54
CC6	6.12	5.98	33	33	10.56	10.56
CC7	4.93	5.01	32	31	11.54	11.54
CC8	6.01	6.04	34	33	11.43	11.43
CC9	5.48	5.03	30	32	11.55	11.55
CC10	5.94	6.01	21	20	10.57	10.57
CC11	5.68	5.7	30	29	10.55	10.55
CC12	6.82	7	29	29	12.05	12.05

Key: PT= pretest, POT= posttest

Appendix 9: pre and post test results of spiking (10 wall spike test) for experimental group players

Code of players	Volleyball spiking skill test	
	10 wall spike test	
	PT	POT
EE1	28	32
EE2	24	27
EE3	21	24
EE4	27	31
EE5	25	29
EE6	22	26
EE7	26	32
EE8	20	25
EE9	29	32
EE10	30	34
EE11	29	35
EE12	28	32

Key: PT= pre test, POT= post test

Appendix 10: pre and post test results of spiking (10wall spike test) and for control group players

Code of players	Volleyball spiking skill test	
	10 wall spike test	
	PT	POT
CC1	27	26
CC2	23	24
CC3	25	25
CC4	22	20
CC5	28	29
CC6	26	27
CC7	24	22
CC8	27	26
CC9	23	24
CC10	30	28
CC11	28	31
CC12	31	30

Key: PT= pre test, POT= post test

Appendix 11: pictures during physical fitness traits and spiking skill tests

30m sprint run test



Vertical jump test



Agility T-test



AAHPERD Wall spike test



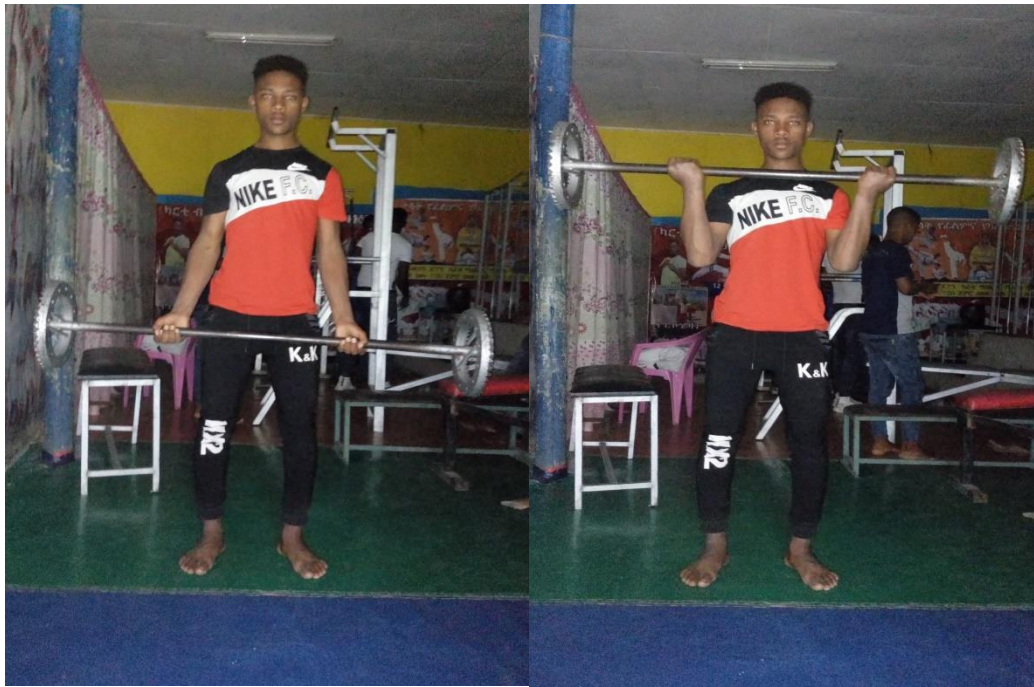
Appendix 12: Pictures during training



Picture 1 Walking Lunges



Picture 2 Dumbbell Kickback



Picture 3 Overhand Curl



Picture 4 Push-up