



**THE EFFECT OF CORE STRENGTH TRAINING ON SPEED,
BALANCE AND CORE STRENGTH IN CASE OF
DEBRE TSEGA TOWN U-20 BASKETBALL PROJECT**

MSc THESIS

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TOWN U- 20 BASKETBALL PROJECT

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A THESIS SUBMITTED TO DEPARTEMENT OF SPORT SCIENCES,
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HAWASSA UNIVERSITY
SCHOOL OF GRADUATE STUDIES
ADVISORS APPROVAL SHEET

This is to certify that the thesis entitled ‘**The effect of core strength training on speed, balance and core strength physical fitness performance in case of Debre Tsige town under 20 male basketball project**’ submitted in partial fulfilment of the requirements for the degree of masters in sport science (specialization: in basketball coaching), the graduate program of the department of sport science, and has been carried out by **Mr Bana Yohannes** under our supervision. Therefore, I recommend that the student has fulfilled the requirements and hence hereby can submit the thesis to the department.

Name of major advisor

signature

date

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EXAMINERS APPROVAL SHEET

We, the undersigned, members of the board of examiners of the final open defence by **Mr Bana Yohannes** have read and evaluated his thesis entitled **‘The effect of core strength training on speed, balance and core strength in case of Debre Tsige town under 20 male basketball project** and examined the candidate. This is, therefore, to certify that the thesis has been accepted in partial fulfilment of the requirements for the degree of masters in sport science (specialization: in basketball coaching).

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SGS Approval	Signature	Date

Final approval and acceptance of the thesis is contingent upon the submission of the final copy of the thesis to the school of Graduate Studies (SGS) through the Department/school Graduate Committee (DGS/SGC) of the candidates department.

DEDICATION

I would like to dedicate this thesis to my family, friends and work colleagues who supported for the accomplishment of my dream of receiving my master's degree. Without their support, understanding and tolerance this thesis work would have never been accomplished.

Name: Bana Yohannes

Signature: _____

Date: _____

DECLARATIONS

I hereby declare that the research entitled, “**“The effect of core strength training on speed, balance and core strength in case of Debre Tsige town under 20 male basketball projects”**” is my original work and has not been presented fully or partially by any other person for a Degree/Diploma in any other university, and all sources of material used for this research have been properly acknowledged as in text citation and reference list.

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Name of the Designate

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BIOGRAPHICAL SKETCH

The author was born In Former Burji special Woreda, SNNP region and current Burji zone, South Ethiopia regional state at place called Soyama, in 1988 E.C. he completed his primary and elementary school in Soyama Ayija primary and secondary school in 2005, high school education in 2007 in Arbaminch high and preparatory school and preparatory school in 2009 in Yabelo Shaalaka Jataani Ali preparatory school. He joined the then Metu University in 2009 and graduated with a B.Sc. degree in sport science in 2011 E.C.

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I am short of words and full of emotions as I think of the journey so far, my emotions turn to tears as I think of how to express the Grace of God. Many have watched my journey; very few have been part of the journey. I would not have made it through my MSc. If it wasn't for the Grace of God. With God's grace, I have reached this milestone. Thanks to God for giving me the health, strength, wisdom and patience to walk down this path with courage and self-belief. A man's heart plans his way, but the LORD directs his step.

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List of Abbreviations and Acronym

CG.....Control Group

CST.....Core Strength Training

EG.....Experimental Group

MD.....Mean Difference

N.....Number

POT.....Post Test

PT.....Pre Test

SD.....Standard Deviations

SPSS.....Statistical package for social
science

SNNP.....South Nation Nationalities Peoples
Region

Hi.....Alternative Hypothesis

U-..... Under

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ABSTRACT

The purpose of this study was to investigate the effect of ten week core strength training on speed, balance and core strength in case of Debre Tsige Town U-20 male basketball project. The study employed a true experimental design and census sampling technique was used in this study. 24 U-20 male basketball players was randomly divided equally in to Experimental group (N=12) and control group (N=12). The Experimental group passed through ten week of training intervention. It was conducted, 3 days per week for a total of 45-70 minutes. Both groups participated in pre and post-test. Speed was measured by using 30m sprint test, balance using standing stork test and core strength by using plank test. Data collected from participants were analysed by paired and independent sample t-test using SPSS version 25 with a significance level of < 0.05 . According to paired sample t-test result the experimental group showed significant improvement of 30m sprint test, standing stork test and plank test ($P < 0.05$). But, no significant improvement were found in control group ($p > 0.05$). In addition, as it was analysed by the independent t-test the experimental group show significant improvement on post-test of 30m sprint test, standing stork test and plank test than control group ($p < 0.05$). Based on this finding, it can be concluded that ten week core strength training had a positive effect on speed, balance and core strength of basketball players. Therefore, it is recommended that basketball players and coaches should include the core strength training programs in their training sessions to development speed, balance and core strength of players.

Key words: speed, static balance, core strength and physical performance

CHAPTER ONE

INTRODUCTION

1.1 Background of Study

For optimal physical fitness in practically all sports and activities, core strength is essential. This is because many sporting movements are three-dimensional, requiring players to have strong hip and trunk muscles in order to effectively provide core stability. All sports demand strong core muscles in all three planes of action, although some demand better balance, others force generation, and still others body symmetry(Hibbs et al., 2008).

The term "core" refers to the entire set of muscles that stabilise the body in relation to the soft tissues (cartilage and connective tissues), skeletal system of the trunk region (rib cage, spine, pelvis, and shoulder belt), and/or active motions of the body(Behm et al., 2010).

The transverse abdominal muscles, multifidus, diaphragm, and pelvic floor muscles are some of the muscular groups that make up the "core." Together, these muscles create the greatest amount of stability in the lower back and abdominal area, and they also help to coordinate the movement of the arms, legs, and spine (Prasanna & Tp, 2020).

Several muscle groups in the core area perform a variety of duties, including transferring forces between the lower and upper limbs, maintaining body balance during static and dynamic tasks, and protecting the spine and important organs during posture maintenance and body motions (La Scala Teixeira et al., 2019).

At the start of the 21st century, core strength training—an exercise regimen done with one's own body weight—was incorporated into competitive sports in China with the goal of strengthening the lumbopelvic and deep muscles that maintain the spine's balance (Li et al., 2019).

High-level fitness, peak performance, and injury avoidance all depend on a well-trained core. For the body's balancing system will be stabilised and a proportionate force development will be provided as a result of the growth of the muscles in the core region(McGill, 2010).

In basketball sports, core strength training is a crucial and significant training task that is related to both technical action levels and physical fitness components. In order to help basketball players maintain good body posture, perform well in their upper and lower limb coordination, and achieve the highest level of physical fitness, it is necessary to specifically and effectively train their core strength. This will help to promote the efficient combination and coordinated development of each link in the body, significantly raising the players' overall performance in basketball. Basketball players might also benefit from having strong cores since they can better regulate their bodies and maintain balance during intense practice or competition (Xie, 2014).

Furthermore, from a biomechanical standpoint, core strength training will be contingent upon the human body moving as a "chain". Exercises that target the core can strengthen the connections between the body's various sections, increasing the effectiveness of muscle contraction. Moreover, a variety of sports teams use core strength training. A popular focus in physical training these days is core strength training. The development of core muscle strength and stability of the body's central balance is highly effective(Wang & Wu, 2014).

The primary goals of core strength training for athletes are to stabilise the athlete's spine and pelvis, maintain proper body posture, enhance body control and balance, and improve energy output from the core to the limbs and other muscle groups during exercise. All of these goals contribute to the improvement of athletic performance(Li et al., 2019).

Moreover,it is considered that a lack of core strength leads to poor physical fitness and ineffective technique, which puts the player at risk for declining upper body strength, quickness, and stop(Jeffreys, 2002),in this regard, it is widely believed nowadays that performing core strength exercises is an essential way to enhance overall physical fitness performance..

With the above point of view the researcher wasfind the direct effectof core strength training on speed, balance and Core strength physical fitness performance of under-20 male basketball project team. Therefore, this study wasaimed to investigate the effect of core strength training on speed, balance and core strength performance in the case of Debre TsigeTownU- 20 male basketball projects.

1.2 Statement of Problem

While core strength training is a part of many sports, it is especially important for basketball players as it relates to their physical fitness, performance, and technical skill levels. As a result, core strength training in basketball sports needs to be done specifically and efficiently (Xie, 2014). In addition, for basketball player having poor physical fitness performance is believed to interrupt the transfer of energy and resulting in reduces performance.

Debre Tsige Town under 20 male basketball project athletes is a concern, because as the researcher has a chance to observe the practical session of the project, training like core strength training has not been well emphasized by coach and players. According to the researcher's observations based on physical performance analysis of players during practical and game situations, most players demonstrated poor execution of physical fitness performances such as speed, balance, and core strength during their practical session as well as in the game situations. So, lack of attention for core strength training may have an impact on the quickness, fast break, stopping rebound, maintain balance and core body part strength performance of player. This is one of the sources of inspiration to the researcher to conduct a research on the effect of core strength training on speed, balance, and core strength performance of Debre Tsige Town U- 20 male basketball projects. Secondly, Even though there are scientific studies concerning to core strength training, which may impact on speed, balance, and core strength, the scholars were report controversial finding.

Therefore, that limitation of previous study and inconsistence of their finding is another source of inspiration for the researcher which motivates the researcher to conduct research and fill the gap. So, the purpose of this study was investigate the effect of core strength training on speed, balance and core strength performance of Debre Tsige Town U- 20 male basketball project player. Based on the above reason the researcher tried to answer the following hypothesis.

1.3. Hypothesis of the Study

The following alternative and null hypothesis was formulated

1. **Hi:** Ten week core strength training has significant effect on speed performance of basketball players.
2. **Hi:** Ten week core strength training has significant effect on balance performance of basketball players.
3. **Hi:** Ten week core strength training has significant effect on core strength performance of basketball players.

1.4. Objective of the Study

1.4.1 General Objective of the Study

The main objective of this study was to investigate the effect of core strength training on speed, balance and core strength in case of the Debre Tsige Town U- 20 male basketball projects.

1.4.2 Specific Objective of the Study

The specific objectives of the study would be

- ✓ To examine the effect of core strength training method on speed of under 20 male basketball players.
- ✓ To measure the effect of core strength training method on balance of under 20 male basketball players.
- ✓ To evaluate the effect of core strength training method on core strength of under 20 male basketball players.

1.5 Significance of the Study

The purpose of this study was to investigate the effect of ten week core strength training on students speed, balance and core strength. Furthermore the result of study was provide piece of evidence regarding to effect of core strength training on physical fitness of under 20 male basketball players. In addition to this:-

- ☞ The finding of this study was provide insights on the effectiveness of core strength training method on speed, balance and core strength among players, This information

will be help physical education teacher, instructor, coaches and trainers in designing more effective training programme to improve physical performance

- ☞ The study was adds to the existing body of scientific literature on the effectiveness of core strength training on physical fitness, contributing to the overall knowledge base in this field.
- ☞ More over this study was bring spring board for other researcher, instructor and coaches to conduct further and detail study concerning the effect of core strength training on different component of physical fitness of player as well as athletes in different aspect of sport.
- ☞ It was provide information and suggest some relevant ideas for coaches and other stakeholders about the implementation of core strength training.

1.6 Delimitation of Study

In order to investigate the effect of core strength training on speed, balance and core strength. The study was delimited by the following. The study was delimited only to Debre Tsige Town basketball projects. The study would be delimited to under 20 male player of the basketball project. The study was delimited by the need for performance based tests. Such as, 30 metre sprint test, standing stork test, Core muscle strength test. In addition to this, the designed training program was delimited to 10 weeks, three days per a week and 45 - 70 minutes duration per sessions.

1.7. Limitation of the Study

The researcher were faced the limiting factors that affect the process of investigation and the result of the study. One of major difficulties was lack of experienced and comprehensive local previous research literature on physical fitness of basketball player was the limitation for this study.

1.7 Operational Definitions of Terms

Athlete: player engages in basketball games or U-20 player in this research

Balance: the preservation of balance when moving or being still(Zolghadr et al., 2019).

Core: is comprised of several groups of muscles including the transverses, abdomens, multifidus, diaphragm and pelvic floor muscles(La Scala Teixeira et al., 2019)..

Core Strength: Strength of abdominal muscles which demonstrate optimal firing patterns and tension-generating capabilities to create movement of the trunk (Dong et al., 2023).

Speed: The capacity to perform a movement in a short period of time(Vretaros, 2016).

Training: is a systematic process to improve an athlete's fitness in a selected activity(Rumpf et al., 2016).

1.8 Organization of the Study

The content of this study was organized into five chapters. The first chapter is consist of introduction part which has different parts under including background of the study; statement of problem; objective of the study; hypothesis of the study; delimitation of the study; significance of the study and organization of the study and operational definition of basic terms used in the study. The second chapter is deals with related points and review of related literature of the study. Third chapter is consist of research methodology, description of study area, research approach, research design, population, sample size and sampling technique, sources of data, data collection instrument, method and procedure of data collection, training protocol, data analysis method and ethical considerations of the study. The fourth chapter was deals with the analysis of data results, interpretations, presentation and discussion of the study. The last chapter is consists the summary, conclusion and recommendation of the study based on the result findings.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1. Concept of Physical Fitness

Physical fitness is the physical ability of individuals to do some activities effectively and efficiently. In line with this, different scholars defined physical fitness in different ways but its meaning resembles to one central idea. For instance, According to (Corbin et al., 2008) Physical fitness is the body's capacity for effective and efficient operation. It is a condition that is made up of six skill-related components of physical fitness which are associated more with performance than with good health and at least five health-related physical fitness components which are directly associated with good health, all of which enhance overall quality of life. A person's capacity to work efficiently, enjoy leisure activities, maintain good health, fend off hypokinetic illnesses, and handle emergency situations is all correlated with their level of physical fitness. (Corbin et al., 2008).

2.2 Factors to Consider during Daily Training or Physical Activity

The warm-up, the workout, and the cool-down are the three parts of the daily activity programme. The daily workout is the most important part of any fitness programme. Nonetheless, experts concur that a warm-up should come before the workout and a cool-down should come after. The body warms up for physical activity during the warm-down, and the body cools down during the cool-down to facilitate proper recovery by helping blood return from working muscles to the heart (Corbin et al., 2008).

2.3. High-Level Performance and Training Characteristics

According to (Corbin et al., 2008) Good genetics, a strong sense of drive, and a dedication to consistent training are necessary for excellent performance. It takes more work and training to succeed in competitive sports, athletics, or high-level jobs than it does to maintain good health and wellness.

2.4. The concept of core

Core strength refers to the torso's core, including the spine, pelvis, and surrounding muscles. It plays a crucial role in stabilizing balance, transmitting power, and reducing force effects. The concept of core power originated from the stability of the spine, with Panjabi being the first to propose it in 1985. Core muscles stabilize the center of gravity, transmit power, and facilitate movement of the upper and lower extremities. They are responsible for power capacity, which is controlled by various factors. Core strength is present in all sports, as it plays a vital role in stability, support, posture, motor skills, and special technology actions (Wang & Wu, 2014).

The lumbar vertebrae, the pelvis, the hip joints, and the active and passive structures that either produce or constrain movement of these segments make up the lumbopelvic-hip complex, or "core." Any system's ability to restrict displacement and preserve structural integrity is what makes it stable (D. Willson et al., 2005).

The core musculature is considered to be all the muscles that have an attachment at the lumbo-pelvic-hip (LPH) complex (Avalta & R, 2007).

2.5. The Meaning of Core Strength

Typically, "core strength" describes the muscles that surround the spine, pelvis, and complete torso. The phrase "core" describes the area of the body below the ribs and pelvis, which comprises the lower extremity muscles staggered in respect to one other, the back muscles, and the transverse pickled muscle. The human body's centre is home to the 29 muscles that make up the lumbar physiological mechanism of the pelvic-hip core. These muscles help transmit power, lessen the consequences of force, and stabilise balance while people move. The concept of core power originated with the idea of core stability, which is based on the stability of the spine (DASTERIDIS et al., 2011).

The sub-abdominal and dorsi muscles make up the core, which is in charge of transmitting force from the upper to the lower body. In addition to everyday activities, core muscles are crucial for maintaining the health of the lower dorsi portion of the spine during force training (Boyacı & Afyon, 2017).

Core strength, which is the back and abdominal muscles' endurance strength, need to be the cornerstone of every physical fitness regimen (Physical Fitness, 2018).

2.6. Developing Core Exercise Program

Essentially, core exercises strengthen the lumbo-pelvic-hip combination by involving tiny joint motions. When it comes to training these muscles, the typical progression is from core stability maintaining posture during an exercise to core strength improving the musculature's functional contractility and finally, core power exercises the ability of the musculature in the core to produce force that is transferred to other parts of the body during explosive movement. Prioritising the improvement of the LPH complex's intrinsic stability over core strength or power exercises in a training programme, core training exercises are low-impact, low-joint movements. It is believed that improved LPH complex stabilisation enhances the execution of several athletic and sport-related abilities(Avalta & R, 2007).

Core exercises are a programme designed to increase a person's physical performance and strength competency in athletes, which in turn improves their ability to withstand resistance. Exercises targeting the core strength are also a common technique for strengthening the muscles that balance the hips and spine. The body's balance and control are enhanced, and both small and major muscular strength increases with this core exercise. Furthermore, self-body weight workout programmes that balance the spine and strengthen the core muscles are referred to as core training. Core workouts are a programme designed to increase athletes' strength competency (AKMAN et al., 2013).

A core fitness program ought to be followed gradually and in phases. To address any underlying muscle imbalances, normal muscle length and mobility should be restored first. Sufficient muscle length and elasticity are essential for optimal joint function and effective movement. Antagonism can lead to muscular imbalances in which antagonist muscles grow weak and inhibited and agonist muscles become dominant and short. A pattern of muscular imbalance can include the iliopsoas, the primary hip flexor, being too tight and active. This inhibits the gluteus Maximus, the primary hip extensor, in return.

2.7. Exercises for Core Strength

According to (Corbin et al., 2008) there are many exercise that help to improve our core part of our body. Some are mentioned below

Crunch (Curl-Up): The upper abdominal muscles are developed with this workout. Stretch your arms out or cross them over your shoulders, place your hands on your ears, or bend

your knees while lying on the floor. Legs can rest on a bench if wanted to add challenge. Put your hands by your sides to reduce resistance (don't put them behind your neck). Raise your hands for greater resistance. Once your shoulder blades are off the ground, curl up and roll back to your starting position. Repeat. Note: The oblique abdominals are developed by twisting the trunk during a curl-up.

Reverse Cur: The lower abdominal muscles are developed with this workout. Assume a prone position. Place your feet flat on the ground, bend your knees, and keep your arms by your sides. Raise the hips off the ground by bringing the knees to the chest. Keep your knees from extending past your shoulders. Go back to where you were before. Again,

Crunch with Twist (on Bench): In addition to strengthening the oblique abdominals, this exercise helps prevent or treat back pain, abdominal ptosis, and lumbar lordosis. With your knees bent 90 degrees and your feet resting on a bench, lie on your back. Hands on ears (the hardest) or arms outstretched and resting on shoulders are also options. Crunch in the same way, but twist your upper body to raise your right shoulder above your left. With your right elbow, reach towards your left knee. Hold on. Go back to the other side and repeat.

Sitting Tucks: This workout enhances lower abdominal strength, endurance, posture, and helps avoid back pain. (People with back pain are not advised to perform this advanced workout.) Place your feet up on the floor and hold out your arms for balance. Legs should be bent and extended in turns, keeping the back and feet off the ground.

Hands and Knees Balance: Start with your hands and knees on the ground. Put your hands exactly below your shoulders and your knees exactly below your hips. Gaze directly down at the ground. Indent the lower abdomen. Raise your opposing arm to a horizontal posture while extending one leg. Maintain a neutral spine posture. Pause. Unwind. With the opposing arm and leg, repeat. Perform ten or more reps on each side.

Marching: With your shoulders back and your lower abdomen drawn in, take a centre position. March still, swaying your arms in opposing directions (forward and backward) while keeping your spine neutral. Go on to running while stationary. Continue for a minimum of one to two minutes.

Side Step: Start by standing on your left side of the floor. Put your left foot in the centre and step up. Step back down to the floor with your right foot first, then your left. Tap your right foot on top. For sixty seconds, repeat. Flip to the other side.

Squatting: Perform the following movements for one to two minutes: stand with your feet apart, your knees slightly angled outward, draw your abdomen in, reach forward with your hands clasped, draw your shoulder blades down and back, squat up and down by bending your knees and moving your hips backward (imagine the movement pattern involved in sitting back on a stool).

According to (Yakut & Talu, 2021) In order to prevent a number of distortion patterns, the core enables maintaining postural alignment and dynamic postural balance during functional activities. Because of this the focus of CST (Core Strength Training) is on the overall and local trunk muscles' strength and conditioning, which cooperate to stabilise the spine. In essence, deep trunk muscle training is a part of CST.

2.8. Beginning of Core Strengthening the Program

You can warm up with a quick aerobic exercise and the "cat" and "camel" stretches. The first step in beginning an exercise programme for core stability is to understand the neutral spine position, which is claimed to be the perfect balance and power posture for maximum athletic performance in many sports. It is situated halfway between the lumbar flexion and extension ranges. Learning to use the abdominal wall muscles with proficiency is the first stage in core stability training. More time and training would be necessary for those who are not adept at volitionally engaging motor pathways, persons with chronic low back pain, and people who show fear-avoidance behaviour in order to learn to engage muscles in isolation or with motor pattern(Akuthota et al., 2008).

2.9. Effect of Core Strength Training on Sport Training

As one of the hottest topics in physical training these days, many sports teams and an individual are use core strength training for the following purpose.

A. Raise Stability of Technical Action

When considering the human body's motion biomechanics, core strength training can be viewed as a chain. Every body part functions as a link in a chain, and for movement technology to be completed, momentum transfer in the chain to the core strength to play a crucial role in the transfer process dynamic chain implementation, upper and lower limb sports coordination, improved power transfer, and improved technical stability are all

necessary. To improve the non-steady state suspension training methods, we incorporate some of its non-steady state strength exercises and balancing exercises in core strength (Wang & Wu, 2014).

B. Improve Muscle Work Efficiency

A good sprinter has less force at their core during the flight phase, which helps the muscles relax and use less energy during the flight. This allows the muscles to prepare for the following contraction and shot motion. The body applies force to the instrument set, and each segment by the trunk fixed support point, each link of bone around a fixed point, fixed point of bone for relative movement, requires participation from the core. The core will be lower extremity and trunk muscle forces of efficient delivery to the upper limbs. Standing triple jump in the three, 100 and 800 metre runs uses the lower limb as the final point of application of force from the upper limb movement. It also requires participation and control of the core muscles to maintain core stability. The transfer of strength between the upper and lower extremities is crucial to the running process. The body's centre of gravity changes along with the movement and a large amplitude change will use excessive energy. Core strength is sufficient to regulate the stability centre and lower energy usage (Wang & Wu, 2014).

C. Prevent Sports Injury

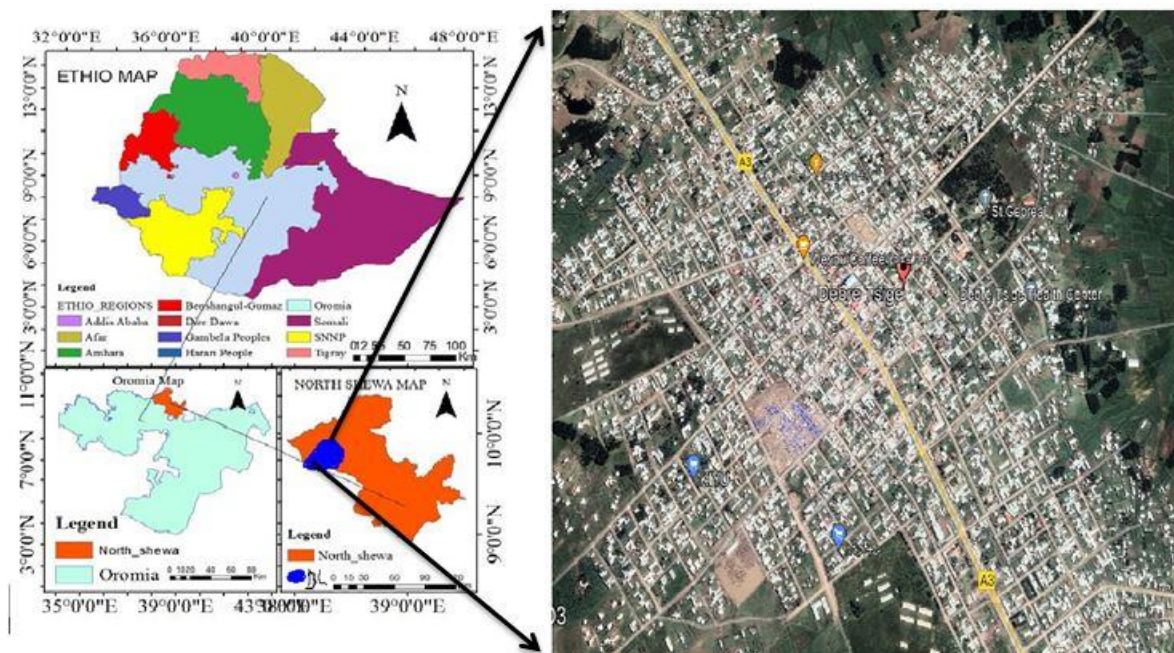
The realm of rehabilitation is where core strength and core stability are first thought to have originated. It is a form of damage and disease treatment in and of itself. A steady state helps to prevent situations like standing triple jumps in three unbalanced lateral lumbar injury landing situations, and it also helps the core to increase stability. Simultaneously, by establishing a stable fulcrum for the strength of the upper and lower limbs, the core area's coordination role can lessen and buffer extremities and joint load, hence preventing sports injuries(Wang & Wu, 2014).In addition to that it Enhance Muscle Work Efficiency, Increase Technical Action Stability, and Reduce Sports Injuries. According to (AKMAN et al., 2013) .

CHAPTER THREE

MATERIAL AND METHODS

3.1. Description of the Study Area

The research was carried out on U- 20 male basketball project players from Debre Tsige Town. Debre Tsige Town is the administrative centre of Debre Libanos Woreda which found in North Showa Zone of Oromiya Regional State, Ethiopia. Debre Libanos Woreda is named after the important monastery of Debre Libanos and North Showa takes its name from the kingdom of Shewa or former province of showa. Debre Tsige is located about 108 km from Addis Ababa. It has a latitude and longitude of 9 48'N 38 44'E and an elevation between 2,738 and 2,782 meters above sea level. It was part of former Yaya Gulelena Debre LibanWoreda. Part of the Semien Shewa Zone, Debre Libanos is bordered on the North West by GerarJarso, on the south west by Yaya Gulele, on the south and south east by Wuchale and on the north east by Amhara Region.



Debretsige town (Sheraro) Kuyu Disttict

Adapted from (Properties & Town, 2016)

3.2 Research Design

Depending on the nature and appropriateness of the pre and post test data and to achieve the intended objective, the research approach designed in the study was true experimental design, since it helps to measure, assess, evaluate, and analyse the effect of core strength training on speed, static balance and core strength. In line with this, participants are randomly assigned to either the experimental or control group. The dependent variables are speed, balance and core strength performance and the independent variable are core strength training. In general, this design involves systematic collection and presentation of the data to give a clear picture of the particular situation. The layout for this study is described as follows:

Table 1: the study design lay out

No	Type of Training	Core Strength Training
1	Frequency	3 day per week
2	Total duration	10 week
3	Duration of training per sessions	45-70 minute
4	Intensity	Low to moderate
5	training day	Monday, Wednesday and Friday
6	Training time	Morning, afternoon, morning

3.3. The Study Population

The target population of this study was 24 U-20 Debre Tsige town male basketball project players who are currently participating..

3.4. Sample Size and Sampling Techniques

In order to select the samples for this experimental study, censes sampling techniques was used, because populations are small in number. Therefore, the sample population of this study incorporated all of the 24 basketball players at Debre Tsige Town U-20 male basketball project players. Then this research participant was selected to the control and experimental groups. So, 12 participants were assigned as an experimental group (EG) and the other 12 subjects as a control group (CG).

3.5. Sources of Data

Pre- and post-test measurements of the experimental and control groups were collected in the field at the start and end of the training programme in order to get primary data.

.Table 2: dependent variable and their respective test

No	Variable	Test	Unit
1	Speed	30 Metre Sprint Test	Per second
2	Core muscle strength	Core muscle strength by using plank test	Per second
3	Static Balance	Standing Stork Test	Per second

3.6. Variables of the Study

3.6.1. Independent variable

An independent variable is a feature that the researcher modifies in order to pinpoint a certain factor. The effect in the dependent variable is measured using it. So, core strength training was the independent variables in this study.

3.6.2. Dependent Variables

The dependent variable is the variable that is measured by using independent variables. Dependent variables are results of participant actions and are changeable as a result of participant action. So, speed, static balance and core strength was the dependent variable in this investigation.

3.7. Methods of Data Collection

The data was gathered by using 30m speed test, standing stork test and core strength test by using plank through the researcher and help of assistants, then three measurements was made. To minimise measurement bias, the mean of the three assessments was used as the final test for the pre- and post-tests. Participants' information and data was collected, and data collectors have received instruction or training in this regard. While the measurements

taken at the conclusion of the training served as the post-test, the baseline measurements functioned as pre-tests.

3.8. Data Collection Procedures

Test procedures

The detailed descriptions of the performance tests were conducted on the subjects are as follows:

3.8.1. Speed Test

30 Metre Speed Test

The objective of the sprint test is to assess maximum running speed. It involves running a single maximum sprint over a set distance.

Required resources

To undertake this test you will require:

1. Measuring tape or marked track
2. markers
3. Stop watch or timing gates
4. Assistant

How to conduct the test

The test is conducted as follows:

1. The athlete undertakes a warm up
2. A cone/marker is placed at 30m from the start line
3. The athletes sprint the 30m from a sprint start
4. The assistance records the time the athletes takes to complete the 35m
5. The best of 3 * 30m sprint is recorded.

Analysis

Analysis of the result is by comparing it with the results of previous tests. It is expected that, with appropriate training between each test, the analysis would indicate an improvement.

Adopted from(Brian Mackenzie, 2005)

3.8.2 Static Balance Test

Standing Stork Test

The objective of this test is to monitor the development of the athlete's ability to maintain a state of equilibrium (balance) in a static position.

Required resources

To undertake this test you will require:

1. Warm dry location – gym
2. Stop watch
3. Assistant.

How to conduct the test

1. Stand comfortable on both feet
2. Hands on your hip
3. Lift one leg and place the toes of that foot against the knee of the other leg
4. On command from the assistant, raise the heel and stand on your toes
5. Assistant starts the stop watch
6. Balance for as long as possible without letting either the heel touch the ground or the other foot move away from the knee.
7. Coach records the time you were able to maintain the balance.
8. Repeat the test for the other leg.



Figure 1: standing stork test for static balance

Analysis

Analysis of the result was by comparing it with the results of previous tests. It is expected that, with appropriate training between each test, the analysis would indicate an improvement.

Adopted from(Brian Mackenzie, 2005)

3.8.3. Core strength Test

The core muscle strength test using plank

Objective: will be used to monitor the development of the athlete's core strength.

Required resources

- 1.Flat surface,
2. An assistant,
3. A mat or something to support the elbows and arms
4. A watch.

How to conduct the test

The plank test will be conducted as follows:

The assistant will be responsible for instructing the athlete as to the position to assume at the appropriate time sequence. Throughout the test the back, neck and head should be maintained in the posture. If the athlete is unable to hold this position then the test is to be stopped. Using the mat to support your elbows and arms assume the Chinese 22 Press Up position as in Figure below. Once the correct position is assumed the assistant will be starts the watch. Hold this position for 60 seconds.



Figure 2: core strength test by using plank

Analysis

Analysis of the result was done by comparing it with previous test results. It is expected that, with appropriate training between each test, the analysis would indicate an improvement. If the athlete is able to complete the test, up to and expected positions, then it indicates they have good core strength.

Adopted from (Brian Mackenzie, 2005)

3.9. Method of Data Analysis

A quantitative method of data analysis was used for the collected data from performance tests. After administering a field test on selected variables before and immediately after intervention of core strength training, the researcher recorded these quantitative data in the form of pre-test and post test results. The collected data was analysed and interpreted into a meaningful idea by using the statistical software package SPSS version 25 in order to compare physical performance variables and to observe changes among groups. The significance level of the study was set at $p \leq 0.05$. Besides, measures of central tendency like mean, measures of dispersion and standard deviation was used to summarize and describe the findings and the researcher used t-test (paired sample) and independent sample t-test for data entry and analysis.

3.10. Training protocol

The experimental group was perform core strength training program for about 45-70 minute under the supervision of the researcher and the control group was not involve in the training programme

Table 3: ten week core strength training program.

Exercise	week 1	week 2	week 3	week 4	week 5	week 6	week 7	week 8	week 9	week 10
Crunch (Curl-Up)	2×15 sec	3×30 sec	4×30 sec	5×45 sec	6×45 sec	7×60 sec	8×60 sec	9×1:15 sec	10×1:15 sec	10×1:30 sec
Reverse Cur:	2×15 sec	3×30 sec	4×30 sec	5×45 sec	6×45 sec	7×60 sec	8×60 sec	9×1:15 sec	10×1:15 sec	10×1:30 sec
Crunch with Twist (on Bench)	2×15 sec	3×30 sec	4×30 sec	5×45 sec	6×45 sec	7×60 sec	8×60 sec	9×1:15 sec	10×1:15 sec	10×1:30 sec
Sitting Tucks	2×15 sec	3×30 sec	4×30 sec	5×45 sec	6×45 sec	7×60 sec	8×60 sec	9×1:15 sec	10×1:15 sec	10×1:30 sec
Marching	2×15 sec	3×30 sec	4×30 sec	5×45 sec	6×45 sec	7×60 sec	8×60 sec	9×1:15 sec	10×1:15 sec	10×1:30 sec
Plank full support	2×15 sec	3×30 sec	4×30 sec	5×45 sec	6×45 sec	7×60 sec	8×60 sec	9×1:15 sec	10×1:15 sec	10×1:30 sec
Side plank (left & right)	2×15 sec	3×30 sec	4×30 sec	5×45 sec	6×45 sec	7×60 sec	8×60 sec	9×1:15 sec	10×1:15 sec	10×1:30sec

3.11. Methods of Controlling Validity and Reliability of the Data

Data collection instruments, such as watches, was standardised by comparing them to other watches that was similar in order to preserve the validity and dependability of the data. Additionally, three different data collectors were collect the pre- and post-test measures; the final data was determined by averaging the three measurements.

3.12. Ethical Considerations

To guarantee ethical considerations in this study, the following action was taken. Among these, a formal letter was submitted to Debre Tsige Town sport office and Debre Tsige TownU-20 male basketball projects and the study participants have been informed about the objective of the study and adequate explanation was given. Informed consent was taken from each of all participants. Furthermore, the researcher was not force the individuals to take part in the study. Moreover, throughout the study Confidentiality and subject privacy was carefully maintained.

CHAPTER FOUR

RESULT AND DISCUSSIONS

The purpose of this study was to evaluate the effect of core strength training on speed, balance and core strength of under-20 male basketball project player at Debre tsige Town. This chapter deals with description and discussion of data that collected from the two groups. The analysis of pre and post test data collected from randomly selected experimental (N=12) and control (N=12) groups under the study. The collected data were analyzed using paired t-test and independent t-test to analyze pre-test and post-test results of experimental and control groups.

4.1. Results of the study

Table 4: Demographic characteristics of participants

GROUPS				
Measurements		EG	CG	Total
Age (years)	Mean(X)	17.923	18.217	18.07
	N	12	12	24
	Stand. deviation (SD)	1.0175	.8255	0.9215
Weight (kg)	Mean(X)	60.962	60.083	60.5225
	N	12	12	24
	Stand. deviation (SD)	2.2955	5.7122	4.0385
Height (m)	Mean(X)	1.6762	1.6558	1.666
	N	12	12	24
	Stand. deviation (SD)	.08221	.05632	0.69265
Body Mass Index(BMI)	Mean(X)	21.608	21.908	21.758
	N	13	12	25
	Stand. deviation (SD)	2.3171	1.5547	1.9359

Key: N= Number of player in groups, X= Mean value, SD= Standard deviation, BMI= Body mass index EG = Experimental group, CG = Control group,

The above Table 4 indicates the general characteristics of the study participants regarding age, height, and weight and body mass index. The mean of experimental groups' age, height and weight and body mass index were 18.0000 ± 0.85280 year, 57.9167 ± 2.27470 m, and 1.4775 ± 0.06538 kg and 21.608 ± 2.3171 BMI respectively. Table 4 also shows that the mean of control group's age, height and weight were 18.3333 ± 0.65134 year, 57.7500 ± 1.28806 m, 1.5042 ± 0.04166 kg and 21.908 ± 1.5547 BMI respectively; this shows that selected subjects were almost similar age height and weight at the beginning of exercise.

4.1.1. Paired statics of specific physical fitness variables

In this study, both participants EG and CG performed fitness test to measured speed, static balance and core body strength. The mean and standard deviation result of the analysis of the data obtained from the tests are presented in the following table via paired sample t-test by using SPSS software version 25.

Table 5: comparison of paired sample t-test results of dependent variables for experimental group of pre and post-test.

Variables		N	Mean	MD	SD	DF	Sig(2-tailed)
Speed	PT	12	8.9075	2.58500	.51593	11	.000
	POT	12	6.3225		.93188	11	
Balance	PT	12	2.1367	2.01250	.03962	11	.000
	POT	12	4.1492		.12845	11	
Core strength	PT	12	1.9400	2.20917	.48389	11	.000
	POT	12	4.1492		.12845	11	

* The mean difference is significant at the 0.05 level.

Key: PT = pre-test, POT = post-test, N = no of player, DF = degree of freedom, SD = standard deviation, MD = mean difference.

As can be seen from Table 5 the pre and post test result of dependent variable were showed for the experimental group. The mean value of the pre and post test results of speed were 8.9075 and 6.3225 and standard deviation were .51593 and .93188 respectively. And also the data as presented in the above table, the mean value of the pre and post test results of balance were 2.1367 and 4.1492 and standard deviation were .03962 and .12845 respectively. Similarly, the mean and standard deviation results of core strength were 1.9400 and 4.1492 and .48389 and .12845 pre and post-test respectively. Based on the data

indicated in the above table, the p value of speed of the experimental group was .000, for balance was .000, and for core strength was .000. The result indicates that the experimental group is significantly improved speed, balance and core strength ($p < 0.05$).

Table 6: Comparisons of paired sample t-test results of dependent variable for control group of pre and post-test.

Variables		N	Mean	MD	SD	DF	Sig.(2-tailed)
Speed	PT	12	8.5208	.24667	2.29565	11	.952
	POT	12	8.5250		2.31129	11	
Balance	PT	12	2.1442	.03000	.03147	11	.099
	POT	12	2.1142		.06529	11	
Core strength	PT	12	2.0792	.12583	.76970	11	.374
	POT	12	1.9533		.71642	11	

* The mean difference is significant at the 0.05 level.

Key: PT= Pre-test, POT =post-test, N=number of player, DF= degree of freedom, MD= mean difference, SD= standard deviation.

As can be seen in Table 6, the pre and post test result of dependent variables were showed for control group. The mean values of the pre and post test results of speed were 8.5208 and 8.5250 and standard deviation were 2.29565 and 2.31129 respectively. And also the data as presented in the above table, the mean value of the pre and post test results of balance were 2.1442 and 2.1142 and standard deviation were .03147 and .06529 respectively. Similarly, the mean and standard deviation results of core strength were 2.0792 and 1.9533 and .76970 and .71642 pre and post-test respectively. Based on the data indicated in the above table the p- value of speed of the control group was .952, for balance was .099 and for core strength was .374. The result indicates that the CG has no significant improvement observed in speed, balance and core strength ($p > 0.05$).

Table 7:Independent sample t-test result measured between the experimental and control group of pre-test in dependent variable.

Variable	Subject	Mean	SD	DF	Sig. (2 tailed)
Speed	EG	8.9075	.51593	22	.575
	CG	8.5208	2.29565	12.108	
Balance	EG	2.1367	.03962	22	.613
	CG	2.1442	.03147	20.927	
Core strength	EG	1.9400	.48389	22	.601
	CG	2.0792	.76970	18.520	

*. The mean difference is significant at the 0.05 level.

Key: EG= experimental group, CG= control group, DF, degree of freedom, SD, standard deviation

The above Table 7 also displays that the significance difference between the two groups experimental and control group of the pre-test results. The mean and standard deviation value of speed pre-test were 8.9075 + .51593 and 8.5208 + 2.29565 for experimental and control group respectively. In addition as the data showed the mean and standard deviation values of balance test for the experimental and control groups pre-test were 2.1367 + .03962 and 2.1442 + .03147 respectively. Similarly, in the case of core strength, the mean and standard deviation value were 1.9400 + .48389 and 2.0792 + .76970 for experimental and control group respectively. From the data, we can see that the p- value of speed test was .575, for balance test it was .613 and for core strength was .601. The result indicates that the two groups (EG and CG) have no significant difference observed in pre-test result of speed, balance and core strength ($p > 0.05$).

Table 8: Independent sample t-test result measured between the experimental and control group of post-test in dependent variable.

Variable	Subject	Mean	SD	DF	Sig. (2-tailed)
Speed	EG	6.3225	.93188	22	.006
	CG	8.5250	2.31129		
Balance	EG	4.1492	.12845	22	.000
	CG	2.1142	.06529		
Core strength	EG	4.1492	.12845	22	.000
	CG	1.9533	.71642		

*.the mean difference is significant at the 0.05 level.

Key: EG= experimental group, CG= control group, DF= degree of freedom, SD= standard deviation

The above Table 8 is also displays that the significance differences between the two groups (EG and CG) of post-test results. The mean and standard deviation value of speed post test result were 6.3225 + .93188 and 8.5250 + 2.31129 for experimental and control groups respectively. In addition, the data as showed in the above table, the mean and standard deviation value of balance for experimental and control groups post-test were 4.1492 + .12845 and 2.1142 + .06529 respectively. Similarly, in the case of core strength, the mean and standard deviation value were 4.1492 + .12845 and 1.9533 + .71642 for experimental and control group post-test respectively. From the data we can see that, the p value of speed was .006.And for balance was .000 and for core strength was .000. According to the data presented in the above table, the post test result of EG was significantly improved in speed, balance and core strength than post test result of CG ($p < 0.05$).

4.2. Discussions

The present study evaluates on the effect of core strength training on speed, balance and core strength of Debre Tsige TownU-20 basketball projects. Subjects were participated throughout core strength training treatment period and cooperated for the collection of necessary data. Both groups were performing regular basketball training. The experimental or training group participated in ten week core strength training exercise program, while the control group did not participated in ten week core strength training program. As the analysis data indicated that taking part in core strength training regularly had significant effects on speed, static balance and core strength. In this study, the EG had significantly greater improvements than the CG in speed, static balance and core strength after the ten week core strength training program in under 20 male basketball player ($p < 0.05$). In this section, the researcher discussed findings and results that were indicated in the above portion in line with the pre described research hypotheses. Therefore, the finding of this study in each variable was discussed as follows.

Effects of core strength training on speed

The first purpose of this study was to evaluate the effect of core strength training on speed at Debre TsigeTown under 20 male basketball players. Regarding the effect of core strength training for speed in 30m sprint test, there was significant difference in paired t-test score of EG and independent sample t-test score between two groups (EG and CG) post-test. Whereas, the paired t-test score of CG and independent sample t-test score of two groups (EG and CG) pre-test had not seen significance difference. The result suggest that the paired t-test results of EG significantly improved in speed ($p = 0.000$, $p < 0.05$). on the other hand, the CG showed that there was no significant improvement in speed observed in between pre and post testing ($p = .952$, $p > 0.05$). The independent sample t-test result indicates that EG significantly improved than CG as observed in post testing ($p = .006$, $p < 0.05$).

This result is supported and argued by different researchers, for instance,(Temeche, 2021) conducted a study on the effect of core strength training on sprint performance, and the researcher reported that eight week core strength training can significantly improve speed, core strength ability and consistency of developed performance of short distance runners. Conversely, (Dong et al., 2023) conducted a study on Effects of Core strength Training on Sport-Specific Performance of Athletes, and reported that core training had almost no effect

on athletes' power and speed. On the other hand, there was a large effect on general athletic performance, such as core endurance and balance.

Effect of core strength training on static balance

The second objective of this study was to examine the effect of core strength training on balance of U-20 male basketball players. Regarding the effect of core strength training for static balance in standing stork test, there was significant difference in paired t-test score of EG and independent sample t-test score between two groups (EG and CG) post-test. Whereas, the paired t-test score of CG and independent sample t-test score of two groups (EG and CG) pre-test had not seen significance difference. The result suggest that the paired t-test results of EG was significantly improved in balance ($p=0.000$, $p< 0.05$). on the other hand, the CG showed that there was no significant improvement in balance observed in between pre and post testing ($p=.099$, $p>0.05$). The independent sample t-test results indicated that EG significantly improved than CG as observed in post testing ($p=.000$, $p< 0.05$).

This reveals that ten week core strength training for upper extremity resulting in improvement of balance. Thus, the formulated alternative hypothesis was accepted at 0.05 level of confidence. The finding of this study is supported by the finding of(Çakir & Ergin, 2022) conduct a study on The Effect of Core strength Training on Agility, Explosive Strength and static Balance in Young Female Volleyball Players. Report that core strength exercises performed in addition to volleyball training appear to have a positive effect on agility, explosive strength and static balance performances.

On the other hand, the finding of this result also argued by the recent researcher(Bilici & Selçuk, 2018) conduct a study on The Effect of 8-Week Core strength Training on static Balance, Agility and Explosive Force Performance. As a result the author reported that the 8-week core strength training intervention showed no effect on athletes' static balance but a positive effect on long jump and agility were observed.

(Yakut & Talu, 2021) The effect of core strength training on flexibility and balance in sedentary Conclusions: 6-week training was effective in increasing dynamic balance and flexibility, but had no effect on static balance.

Effects of core strength training on core strength performance

Furthermore, the third objective of this study was to examine the effect of core strength training on core strength of U-20 male basketball players. In relation to the effect of core strength training for core strength ability in core strength by using plank test, there was significant difference in paired t-test results of EG and independent sample t-test results between two groups (EG and CG) post-test. Whereas, the paired t-test score of CG and independent sample t-test score of two groups (EG and CG) pre-test had not seen significance difference. The result suggest that the paired t-test result of EG significantly improved in core strength ability ($p = .000$, $p < 0.05$). However, the CG showed that there was no significant improvement in core strength observed in between pre and post testing ($p = .374$, $p > 0.05$). The independent sample t-test result indicated that EG significantly improved than CG as observed in post-testing ($.000$, $p < 0.05$).

Result of this study showed that experimental groups who participated in the core strength training program display a great level of improvement in core strength ability than the control group. Therefore, the formulated alternative hypothesis was accepted at 0.05 level of confidence and concluded as core strength training has a significant effect on core strength ability. This result is supported by different scholars. For instance, (Bilici & Selçuk, 2018) conducted a study on effect of core strength training on the vertical jump, core strength and some motor characteristics of 14-16 aged female volleyball players. And as a result, the author reports that 10 week core strength training improved jumping strength and core strength.

(Kuhn et al., 2019) conducted study on Effects of core strength training on throwing velocity and core strength in female handball players. As a result the author Report that core strength training has a great role in improvement of their core strength performance. Generally, it has been widely discussed whether the use of core strength training enhances the speed, static balance and core strength plank test results, greater level of improvement was seen on experimental group players than control group.

So, the use of core strength training as intervention to develop the players speed, static balance and core strength in these conditions is essential and provides physical fitness benefits for basketball players. Accordingly, implementing a part of the training with ten week core strength training program could improve the physical fitness level of basketball players.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This final chapter deals with the summary, research findings, conclusion and recommendation of the study on the effect of core strength training on speed, balance and core strength of U-20 male basketball project.

5.1 Summary

As stated in the topic, the overall purpose of this study was to examine the effect of core strength training on speed, balance and core strength of U-20 male basketball project player at Debre Tsige Town. For the purpose of this research, the researcher try to review the related and available literature in the area of the concept of physical fitness, factor to consider during daily training, concept of core, meaning of core strength, beginning and effect of core strength training on sport and other literature that are incorporated into this area enable to construct the methodologies. In order to achieve the general objective of the study, the following specific research objectives were formulated to:

1. Evaluate the effect of core strength training on speed of U-20 male basketball players.
2. Examine the effect of core strength training on static balance of U-20 male basketball players.
3. Measure the effect of core strength training on core strength of U-20 male basketball players.

Hypotheses were formulated by depending on the above specific objectives. To achieve the purpose of the study, all 24 U-20 male basketball project players found at Debre Tsige Town were taken as a sample by using census sampling technique. Subjects were divided into two groups, an experimental and control group through randomization. The experimental training group performed in ten week additional core strength training program except normal training activities. The research design that was used in this study was true experimental research design and a quantitative research approach was used for this study.

Core strength training was done 3 times per week for 45-70 minutes per session. The selected skill of physical fitness variable were speed (30m sprint test), static balance (standing stork test) and core strength (core strength by using plank test) were taken from participant at pre and post training programs. The data was gathered from the experimental and control groups results in the form of pre-test and post-test method. Pre-test before training was taken for each variable and at the end of the training also post-tests were taken from the two groups. Raw data was statistically analyzed by using SPSS version 25. A paired sample t-test was used to compare within groups and an independent sample t-test was used to compare between groups pre-test and post-test ($p < 0.05$).

The collected data was analyzed through paired t-test and independent sample t-test. Hence, the following findings were investigated.

1. The finding of this study revealed that speed test from 30m sprint run was significantly improved in EG groups in pre to post-tests after ten weeks of core strength training. But, there is no significant difference observed in pre to post-test of CG. Additionally, there was no significant difference in pre-test result of speed performance between the experimental and control groups. However, there was a significant difference in speed in post-test results between EG and CG after ten week of core strength training.
2. The findings of this study indicated that static balance of standing stork test was improved in EG. The experimental group had shown improvement from pre-test to post-test as a result of ten weeks of core strength training. In CG, there was no significant change was found in pre to post-tests. Likewise, there is no significant difference in pretest results of static balance between the experimental and control groups. But there was significant difference in post-test results of static balance between the experimental and control group of U-20 male basketball project players.
3. The findings of this study showed that core strength ability was significantly improved in EG from pre to post-test. But no significant improvement was recorded in CG. Pre-test results of core strength performance between the experimental and control group had no significant difference. Whereas, the post-test result of core strength between the experimental and control group had a significant difference. Core strength training has a significant impact on U-20 male basketball player core strength.

Generally, the results obtained in the study indicated that core strength training has significantly improved the speed, static balance and core strength of U-20 male basketball players.

The main finding of this study demonstrates that ten week core strength training can significantly improve speed qualities, balance and core strength level of basketball players. Consequently, the research alternative hypothesis significant difference in 30meter, standing stork test and core strength using plank test was accepted.

5.2. Conclusions

The purpose of this study was to investigate the effect of ten weeks core strength training on speed, static balance and core strength. According to the data gathered and analysis done the following conclusions are prepared based on the results and findings of the study.

These are:

- Based on the result of the study, it was concluded that the core strength training had a significant effect on the speed of U-20 basketball project player.
- Grounded on the major findings of the study, it was concluded that core strength training had a significant effect on the improvement of static balance of U-20 male basketball players.
- Likewise, implementing core strength training in basketball sessions had a significant effect on the improvement in core strength of U-20 male basketball players.
- The main conclusion to be drawn from the results of the t-test statistics is that core strength training was found to be effective in significantly improving speed, static balance and core strength of U-20 male basketball players.
- The use of core body strength training as intervention to develop the athletes speed, static balance and core strength in these condition is essential and supported for the basketball players
- In general, greater improvement was seen on experimental group player than control group. So implementing a part of the standard training with ten week program of core strength training could improve the athletes speed, static balance and core strength of basketball players.

5.3. Recommendations

The researcher suggested the following recommendations in light of the conclusion made:

- ☞ As the result showed core strength training is relevant to improve speed, develop static balance and maximizing the core strength level.
- ☞ As core strength training was found to have a positive impact on developing physical fitness of basketball players, all basketball coaches are highly encouraged to include the scientific method of core strength training in their training sessions.
- ☞ Engaging in core strength training for 3 days per week for 45-70 minutes each day is important to develop speed, static balance and core strength performance. So, Basketball coaches recommended emphasizing core strength exercise to improve basketball player's physical fitness performance.
- ☞ Coaches also recommended raising trainers' awareness about the importance of core strength exercise in order to improve selected physical fitness of basketball players.
- ☞ Based on the core finding of this study, the researcher recommend that basketball coaches, players, different basketball clubs and training centers to implement core strength training to enhance the speed, static balance and core strength of their athletes.
- ☞ The researcher would also encourage further investigation on the comparison of the effect of core strength training with other training methods on the physical fitness of basketball players.

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APPENDIX A: Informed Consent

The Researcher

My name is Bana yohannes I am an MSc student at Hawasa University Department of sport science. I am conducting an experimental design research study on the effect of core strength training on speed, balance and core strength performance.

The Research

The purpose of this study is to gain insight into the effect of core strength training on speed, balance and core strength in case of Debre Tsige town U-20 male basketball project. The study's findings will be present Hawasa University to department of sport science.

The Process

Your participation in the study will include taking part in intervention of core strength training and pre and post-test measurement of dependent variable in the thesis like speed test, static balance test and core strength test by using plank test with an estimated length of ten week and three days per week.

Risk

This study poses little to no risk to its participants. I will do my best to ensure that confidentiality is maintained by not citing your actual name within the actual study. You may choose to leave the study at any time, and may also request that any data collected from you not be used in the study.

By signing below you agree that you have read and understood the above information, and would be interested in participating in this study.

Name Date

APPENDIX B: Weekly core strength training plan

Week 1 training program

Day	Time	Duration	Phase	Content	Set	Rep	Rest b/n exercise (sec)	Rest b/n set(sec)	Intensity
Monday	11:00-12:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	2	20	60	Moderate
				Reverse Cur:	3	2			
				Crunch with Twist (on Bench)	3	2			
				Sitting Tucks	3	2			
				Marching	3	2			
				Plank full support	3	2			
				Side plank (left & right)	3	2			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Wednesday	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	2	20	60	Moderate
				Reverse Cur:	3	2			
				Crunch with Twist (on Bench)	3	2			
				Sitting Tucks	3	2			
				Marching	3	2			
				Plank full support	3	2			
				Side plank (left & right)	3	2			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Friday	11:00-12:00		Warming up	Jogging, running, different movement of arm and leg, stretching.					moderate

		45	Main part	Crunch (Curl-Up)	3	2	20		Moderate
				Reverse Cur:	3	2	60		
				Crunch with Twist (on Bench)	3	2			
				Sitting Tucks	3	2			
				Marching	3	2			
				Plank full support	3	2			
				Side plank (left & right)	3	2			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low

Week 2 training program

Day	time	Duration	Phase	Content	set	rep	Rest b/n exercise	Rest b/n set	Intensity
Mon	1:00 2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	3	20	60	Moderate
				Reverse Cur:	3	3			
				Crunch with Twist (on Bench)	3	3			
				Sitting Tucks	3	3			
				Marching	3	3			
				Plank full support	3	3			
				Side plank (left & right)	3	3			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Wed	1:00 2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	3	20	60	Moderate
				Reverse Cur:	3	3			
				Crunch with Twist (on Bench)	3	3			
				Sitting Tucks	3	3			
				Marching	3	3			
				Plank full support	3	3			

				Side plank (left & right)	3	3			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Fri			Warming up						moderate
		45	Main part	Crunch (Curl-Up)	3	3	20	60	Moderate
				Reverse Cur:	3	3			
				Crunch with Twist (on Bench)	3	3			
				Sitting Tucks	3	3			
				Marching	3	3			
				Plank full support	3	3			
				Side plank (left & right)	3	3			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low

Week 3 training program

Day	time	Duration	Phase	Content	set	rep	Rest b/n exercise	Rest b/n set	Intensity
Mon day	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	4	20	60	Moderate
				Reverse Cur:	3	4			
				Crunch with Twist (on Bench)	3	4			
				Sitting Tucks	3	4			
				Marching	3	4			
				Plank full support	3	4			
				Side plank (left & right)	3	4			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Wed nesd	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate

ay									
		45	Main part	Crunch (Curl-Up)	3	4	20	60	Moderate
				Reverse Cur:	3	4			
				Crunch with Twist (on Bench)	3	4			
				Sitting Tucks	3	4			
				Marching	3	4			
				Plank full support	3	4			
				Side plank (left & right)	3	4			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Friday			Warming up						moderate
		45	Main part	Crunch (Curl-Up)	3	4	20		Moderate
				Reverse Cur:	3	4	60		
				Crunch with Twist (on Bench)	3	4			
				Sitting Tucks	3	4			
				Marching	3	4			
				Plank full support	3	4			
				Side plank (left & right)	3	4			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low

Week 4 training program

Day	time	Duration	Phase	Content	set	rep	Rest b/n exercise	Rest b/n set	Intensity
Mon day	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	5	20	60	Moderate
				Reverse Cur:	3	5			
				Crunch with Twist (on Bench)	3	5			
				Sitting Tucks	3	5			

				Marching	3	5			
				Plank full support	3	5			
				Side plank (left & right)	3	5			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Wed	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	5	20	60	Moderate
				Reverse Cur:	3	5			
				Crunch with Twist (on Bench)	3	5			
				Sitting Tucks	3	5			
				Marching	3	5			
				Plank full support	3	5			
				Side plank (left & right)	3	5			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Fri			Warming up						moderate
		45	Main part	Crunch (Curl-Up)	3	5	20	60	Moderate
				Reverse Cur:	3	5			
				Crunch with Twist (on Bench)	3	5			
				Sitting Tucks	3	5			
				Marching	3	5			
				Plank full support	3	5			
				Side plank (left & right)	3	5			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low

Week 5 training program

Day	time	Duration	Phase	Content	set	rep	Rest b/n exercise	Rest b/n set	Intensity
Mon day	1:00- 2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	6	20	60	Moderate
				Reverse Cur:	3	6			
				Crunch with Twist (on Bench)	3	6			
				Sitting Tucks	3	6			
				Marching	3	6			
				Plank full support	3	6			
				Side plank (left & right)	3	6			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Wed	1:00- 2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	6	20	60	Moderate
				Reverse Cur:	3	6			
				Crunch with Twist (on Bench)	3	6			
				Sitting Tucks	3	6			
				Marching	3	6			
				Plank full support	3	6			
				Side plank (left & right)	3	6			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Frida			Warming up						moderate

		45	Main part	Crunch (Curl-Up)	3	6	20		Moderate
				Reverse Cur:	3	6	60		
				Crunch with Twist (on Bench)	3	6			
				Sitting Tucks	3	6			
				Marching	3	6			
				Plank full support	3	6			
				Side plank (left & right)	3	6			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low

Week 6 training program

Day	time	Duration	Phase	Content	set	rep	Rest b/n exercise	Rest b/n set	Intensity
Mon day	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	7	20	60	Moderate
				Reverse Cur:	3	7			
				Crunch with Twist (on Bench)	3	7			
				Sitting Tucks	3	7			
				Marching	3	7			
				Plank full support	3	7			
				Side plank (left & right)	3	7			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Wed	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	7	20	60	Moderate
				Reverse Cur:	3	7			
				Crunch with Twist (on Bench)	3	7			

				Sitting Tucks	3	7			
				Marching	3	7			
				Plank full support	3	7			
				Side plank (left & right)	3	7			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Frída			Warming up						moderate
		45	Main part	Crunch (Curl-Up)	3	7	20 60		Moderate
				Reverse Cur:	3	7			
				Crunch with Twist (on Bench)	3	7			
				Sitting Tucks	3	7			
				Marching	3	7			
				Plank full support	3	7			
				Side plank (left & right)	3	7			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low

Week 7 training program

Day	time	Duration	Phase	Content	set	rep	Rest b/n exercise	Rest b/n set	Intensity
Mon day	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	8	20	60	Moderate
				Reverse Cur:	3	8			
				Crunch with Twist (on Bench)	3	8			
				Sitting Tucks	3	8			
				Marching	3	8			
				Plank full support	3	8			
				Side plank (left & right)	3	8			
		5	Cooling	Jogging, walking, upper and lower body					Low

			down	stretching					
Wed	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	8	20	60	Moderate
				Reverse Cur:	3	8			
				Crunch with Twist (on Bench)	3	8			
				Sitting Tucks	3	8			
				Marching	3	8			
				Plank full support	3	8			
				Side plank (left & right)	3	8			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Fri			Warming up						moderate
		45	Main part	Crunch (Curl-Up)	3	8	20	60	Moderate
				Reverse Cur:	3	8			
				Crunch with Twist (on Bench)	3	8			
				Sitting Tucks	3	8			
				Marching	3	8			
				Plank full support	3	8			
				Side plank (left & right)	3	8			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low

Week 8 training program

Day	time	Duration	Phase	Content	set	rep	Rest b/n exercise	Rest b/n set	Intensity
Mon day	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	9	20	60	Moderate
				Reverse Cur:	3	9			

				Crunch with Twist (on Bench)	3	9			
				Sitting Tucks	3	9			
				Marching	3	9			
				Plank full support	3	9			
				Side plank (left & right)	3	9			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Wed	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	9	20	60	Moderate
				Reverse Cur:	3	9			
				Crunch with Twist (on Bench)	3	9			
				Sitting Tucks	3	9			
				Marching	3	9			
				Plank full support	3	9			
				Side plank (left & right)	3	9			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Fri			Warming up						moderate
		45	Main part	Crunch (Curl-Up)	3	9	20 60		Moderate
				Reverse Cur:	3	9			
				Crunch with Twist (on Bench)	3	9			
				Sitting Tucks	3	9			
				Marching	3	9			
				Plank full support	3	9			
				Side plank (left & right)	3	9			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low

Week 9 training program

Day	time	Duration	Phase	Content	set	rep	Rest b/n exercise	Rest b/n set	Intensity
Monday	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	10	20	60	Moderate
				Reverse Cur:	3	10			
				Crunch with Twist (on Bench)	3	10			
				Sitting Tucks	3	10			
				Marching	3	10			
				Plank full support	3	10			
				Side plank (left & right)	3	10			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Wed	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	10	20	60	Moderate
				Reverse Cur:	3	10			
				Crunch with Twist (on Bench)	3	10			
				Sitting Tucks	3	10			
				Marching	3	10			
				Plank full support	3	10			
				Side plank (left & right)	3	10			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Friday			Warming up						moderate

		45	Main part	Crunch (Curl-Up)	3	10	20	60	Moderate
				Reverse Cur:	3	10			
				Crunch with Twist (on Bench)	3	10			
				Sitting Tucks	3	10			
				Marching	3	10			
				Plank full support	3	10			
				Side plank (left & right)	3	10			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low

Week 10 training program

Day	time	Duration	Phase	Content	set	rep	Rest b/n exercise	Rest b/n set	Intensity
Mon day	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	10	20	60	Moderate
				Reverse Cur:	3	10			
				Crunch with Twist (on Bench)	3	10			
				Sitting Tucks	3	10			
				Marching	3	10			
				Plank full support	3	10			
				Side plank (left & right)	3	10			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Wed	1:00-2:00	10	Warming up	Jogging, running, different movement of arm and leg, stretching.					Moderate
		45	Main part	Crunch (Curl-Up)	3	10	20	60	Moderate
				Reverse Cur:	3	10			
				Crunch with Twist (on Bench)	3	10			
				Sitting Tucks	3	10			
				Marching	3	10			
				Plank full support	3	10			
				Side plank (left & right)	3	10			

		5	Cooling down	Jogging, walking, upper and lower body stretching					Low
Friday			Warming up	Jogging, running, different movement of arm and leg, stretching.					moderate
		45	Main part	Crunch (Curl-Up)	3	10	20	60	Moderate
				Reverse Cur:	3	10			
				Crunch with Twist (on Bench)	3	10			
				Sitting Tucks	3	10			
				Marching	3	10			
				Plank full support	3	10			
				Side plank (left & right)	3	10			
		5	Cooling down	Jogging, walking, upper and lower body stretching					Low

Adapted from: Bahri et al.(2017).

APPENDIX C: Profile of study participants

A. experimental group

NO	Name(code) of players	Age	Weight	Height
1	GD	18	58	1.54
2	EF	18	56	1.46
3	BN	19	55	1.42
4	MB	16	60	1.39
5	YZ	18	60	1.37
6	LN	18	57	1.59
7	OP	17	59	1.53
8	RS	18	61	1.45
9	KT	19	60	1.46
10	FS	18	59	1.48
11	BY	19	54	1.51
12	TG	18	56	1.53

B. Control group

No	Name(code) of players	Age	Weight	Height
1	MM	18	58	1.45
2	YM	18	57	1.54
3	FW	19	59	1.56
4	TZ	18	55	1.49
5	PH	19	58	1.52
6	KS	19	59	1.47
7	SM	18	59	1.50
8	DE	18	56	1.52
9	TL	19	57	1.44
10	KB	19	58	1.47
11	RA	17	58	1.52
12	GY	18	59	1.57

APPENDIX D: Dependent variable and their respective test

No	Variable	Test	Unit
1	Speed	30 Metre Sprint Test	Per second
2	Core muscle strength	Core muscle strength by using plank test	Per second
3	Static Balance	Standing Stork Test	Per second

APPENDIX E: Physical fitness test score sheet

Name _____

Fitness test 1: 30m sprint test

	Trial 1	Trial 2	Trial 3	average
Scores in second				

Fitness test 2: standing stork test

	Trial 1	Trial 2	Trial 3	Average
Score in minute				

Fitness test 3: core strength by using plank test

	Trial 1	Trial 2	Trial 3	Average
Scores in minute				

APPENDIX F: Pre-test 30m sprint test, standing stork test and core strength by using plank test

A. Experimental group

No	Name(code) of players	30m sprint test/second	Standing stork test/second	Core strength by using plank/minute
1	GD	8.67	2.13	2.58
2	EF	8.68	2.11	1.48
3	BN	8.93	2.09	2.77
4	MB	8.46	2.16	1.47
5	YZ	9.17	2.07	2.47
6	LN	8.30	2.18	1.99
7	OP	8.11	2.15	2.05
8	RS	8.87	2.12	1.77
9	KT	9.80	2.10	2.03
10	FS	8.95	2.17	1.38
11	BY	9.70	2.16	1.31
12	TG	9.25	2.20	1.98

B. Control group

No	Name(code) of players	30m sprint test/second	Standing stork test	Core strength by using plank/minute
1	MM	6.65	2.16	1.88
2	YM	6.67	2.20	4.16
3	FW	7.91	2.17	1.81
4	TZ	5.48	2.16	1.62
5	PH	12.10	2.12	2.38
6	KS	10.32	2.10	1.49
7	SM	11.01	2.15	1.90
8	DE	5.53	2.12	1.36
9	TL	8.78	2.18	2.79
10	KB	7.92	2.14	1.61
11	RA	11.64	2.13	1.72
12	GY	8.24	2.10	2.23

APPENDIX G: Post-test 30m sprint test, standing stork test and core strength by using plank

A. Experimental group

No	Name(code) of player	30m sprint test/second	Standing stork test/second	Core strength by using plank/minute
1	GD	7.67		4.31
2	EF	6.67		4.07
3	BN	6.83		4.19
4	MB	4.46		4.46
5	YZ	7.17		4.01
6	LN	6.28		4.12
7	OP	5.11		4.05
8	RS	5.53		4.04
9	KT	6.81		4.13
10	FS	6.05		4.21
11	BY	6.12		4.11
127	TG	7.17		4.09

B. control group

No	Name(code) of player	30m sprint test/second	Standing stork test/second	Core strength by using plank
1	MM	6.69	2.01	2.24
2	YM	6.63	2.25	3.15
3	FW	7.46	2.15	1.01
4	TZ	5.91	2.09	2.17
5	PH	12.08	2.14	2.21
6	KS	10.35	2.03	1.40
7	SM	10.98	2.16	1.74
8	DE	5.56	2.05	1.09
9	TL	8.87	2.11	2.97
10	KB	7.76	2.15	1.67
11	RA	12.00	2.10	1.22
12	GY	8.01	2.13	2.57

APPENDIX H: The study design lay out

N.o	Type of Training	Core Strength Training
1	Frequency	3 day per week
2	Total duration	10 week
3	Duration of training per sessions	45-70 minute
4	Intensity	Low to moderate
5	Training day	Monday, Wednesday and Friday
6	Training time	Morning, afternoon, morning

APPENDIX I: Ten week core strength training program

Exercise	week 1	week 2	week 3	week 4	week 5	week 6	week 7	week 8	week 9	week 10
Crunch (Curl-Up)	2x15 sec	3x30 sec	4x30 sec	5x45 sec	6x45 sec	7x60 sec	8x60 sec	9x1:15 sec	10x1:15 sec	10x1:30 sec
Reverse Cur:	2x15 sec	3x30 sec	4x30 sec	5x45 sec	6x45 sec	7x60 sec	8x60 sec	9x1:15 sec	10x1:15 sec	10x1:30 sec
Crunch with Twist (on Bench)	2x15 sec	3x30 sec	4x30 sec	5x45 sec	6x45 sec	7x60 sec	8x60 sec	9x1:15 sec	10x1:15 sec	10x1:30 sec
Sitting Tucks	2x15 sec	3x30 sec	4x30 sec	5x45 sec	6x45 sec	7x60 sec	8x60 sec	9x1:15 sec	10x1:15 sec	10x1:30 sec
Marching	2x15 sec	3x30 sec	4x30 sec	5x45 sec	6x45 sec	7x60 sec	8x60 sec	9x1:15 sec	10x1:15 sec	10x1:30 sec
Plank full support	2x15 sec	3x30 sec	4x30 sec	5x45 sec	6x45 sec	7x60 sec	8x60 sec	9x1:15 sec	10x1:15 sec	10x1:30 sec
Side plank (left & right)	2x15 sec	3x30 sec	4x30 sec	5x45 sec	6x45 sec	7x60 sec	8x60 sec	9x1:15 sec	10x1:15 sec	10x1:30 sec

APPENDIX J: Demographic characteristics of Participants

GROUPS				
Measurements		EG	CG	Total
Age (years)	Mean(X)	17.923	18.217	18.07
	N	13	12	25
	Stand. deviation (SD)	1.0175	.8255	0.9215
Weight (kg)	Mean(X)	60.962	60.083	60.5225
	N	13	12	25
	Stand. deviation (SD)	2.2955	5.7122	4.0385
Height (m)	Mean(X)	1.6762	1.6558	1.666
	N	13	12	25
	Stand. deviation (SD)	.08221	.05632	0.69265
Body Mass Index(BMI)	Mean(X)	21.608	21.908	21.758
	N	13	12	25
	Stand. deviation (SD)	2.3171	1.5547	1.9359

APPENDIX K: Comparison of paired sample t-test results of dependent variables for experimental group of pre and post-test.

Variables		N	Mean	MD	SD	DF	Sig(2-tailed)
Speed	PT	12	8.9075	2.58500	.51593	11	.000
	POT	12	6.3225		.93188	11	
Balance	PT	12	2.1367	-2.01250	.03962	11	.000
	POT	12	4.1492		.12845	11	
Core strength	PT	12	1.9400	-2.20917	.48389	11	.000
	POT	12	4.1492		.12845	11	

APPENDIX L: Comparisons of paired sample t-test results of dependent variable for control group of pre and post-test.

Variables		N	Mean	MD	SD	DF	Sig.(2-tailed)
Speed	PT	12	8.5208	.24667	2.29565	11	.952
	POT	12	8.5250		2.31129	11	
Balance	PT	12	2.1442	.03000	.03147	11	.099
	POT	12	2.1142		.06529	11	
Core strength	PT	12	2.0792	.12583	.76970	11	.374
	POT	12	1.9533		.71642	11	

APPENDIX M: Independent sample t-test result measured between the experimental and control group of pre-test in dependent variable

Variable	Subject	Mean	SD	DF	Sig. (2 tailed)
Speed	EG	8.9075	.51593	22	.575
	CG	8.5208	2.29565	12.108	
Balance	EG	2.1367	.03962	22	.613
	CG	2.1442	.03147	20.927	
Core strength	EG	1.9400	.48389	22	.601
	CG	2.0792	.76970	18.520	

APPENDIX N: Independent sample t-test result measured between the experimental and control group of post-test in dependent variable.

Variable	Subject	Mean	SD	DF	Sig. (2-tailed)
Speed	EG	6.3225	.93188	22	.006
	CG	8.5250	2.31129		
Balance	EG	4.1492	.12845	22	.000
	CG	2.1142	.06529		
Core strength	EG	4.1492	.12845	22	.000
	CG	1.9533	.71642		

