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EFFECTS OF CORE STRENGTH TRAINING ON SPRINTING ERFORMACE IN THE CASE OF ATHLETE TIRUNESH DIBABAATHLETICS TRAINING CENTER

TARIKU TEMECHE, TEMECHE

BAHIR DAR UNIVERSITY

SPORT ACADEMY

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TARIKU TEMECHE MARE

ADVISOR: ZERIHUN BIRHANU (PhD)

CO-ADVISOR: TEKETEL ABRHAM (PhD)

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THESIS APPROVAL SHEET

BAHIR DAR UNIVERSITY

SPORT ACADEMY

DEPARTMENT OF SPORT SCIENCE

I conducted this Thesis for the impartial fulfillment of the requirement for the Degree of Masters of Science in sport Science Specialization of ATHLETICS COACHING on the title of **"**EFFECTS OF CORE STRENGTH TRAINING ON SPRINTING PERFORMACE IN THE CASE OF ATHLETE TIRUNESH DIBABA ATHLETICS TRAINING CENTER".

Name of chairperson	Signature	Date
Name of Advisor	Signature	Date
Name of Co-Advisor	Signature	Date
Name of Internal Examiner	Signature	Date
Name of External Examiner	Signature	Date

DEDICATION

I would like to dedicate this thesis to my family, friends, work colleagues who supported for the accomplishment of my dream of receiving my master's degree. Without their tolerance, understanding, support, this thesis work would have never been accomplished. Furthermore, I could not have done this thesis without the support of coaches at Tirunesh Dibaba Athletics Training center and short distance trainees in the center.

NAME: TARIKU TEMECHE

Signature: ----------

Date: ----------

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ACRONYMS AND ABBREVIATIONS

DF – Degree of Freedom

F- Frequency

M - Mean

N – Number of Athletes

P– P-Value

SD- Standard Deviation

SE-Speed Endurance

T - Time

SPSS - Statistical Package for Social Sciences

Abstract

The purpose of the study was trying to investigate the effects of eight week core strength training to develop the performance of men athletes of short distance of Tirunesh Dibaba Athletics Training center in Asella. The study followed a true-experimental design. 30 male athletes divided randomly in to experimental and control groups (n=30; 18.30 ± 0.98 years, 1.772 ± .056cm). *The treatment group passed through 8 week of intervention. It was conducted 3x30"seconds – 1:30" minutes for each different core strength exercises [1' & 2' recovery time between each exercise]; intensity 75- 90% and frequency 3 days per week. The Statistical Package for Social Sciences (SPSS) used to interpret the data and analyzed the collected data in quantitative methods. During week 0 and 8 each subject complete two assessment tests for both groups. According to independent t-test result the intervention group show significant performance improvement of 150m speed endurance, at post-test (M = 16.52, SD = 0.51) with t (28) = -4.97, p = 0.000; 400m sprinting (M = 50.50, SD = 1.50) conditions; t (28) = -4.17, p = .000, and core strength plank test (M= 5.40, SD = 0.71) condition, t (28) = 6.29, p = .000 demonstrated significant difference and better peak flow scores than the control groups in 8th weeks. The main finding of this study was that core body strength training can significantly improve speed endurance, sprinting, core strength ability and consistency of developed performance of short distance runners of Athlete Tirunesh Dibaba Athletics Training Center. The overall improvements of mentioned variables of the sprinters were significantly changed with the eight-week core strength training program.*

Key words: Core strength, Sprinting and performance

CHAPTER ONE

1. INTRODUCTION

Core exercises are take priority over assistance to maintenance phase generally comprises that body building focuses on the development of the "six-pack" effect of the abdomen muscles. Sprinting is a type of competitive sport that has to muscle action requires immediate high velocity, high-power movement fast-twitch fibers may be recruited first. This research showed that the way to investigate scarcity of core exercises to develop the performance of sprinters of Tirunesh Dibaba Athletics training center and with this point of view the researcher tried to find the direct effects of Core strength training for sprint runners for enhancing their performance in the aspects of speed endurance. Therefore, this study aimed to investigate the effect of 8 weeks core strength training on sprinting performance in the case of Athlete Tirunesh Dibaba Athletics Training Center.

1.1. Background of the Study

Core is a word of English origin, meaning the core and the center of the body. The core is the midpoint of the body, including the center of gravity of the human body (Mcgill, 2010). Candron (2006) expressed the core definition as the most effective state of the spine being supported by the abdominal and spine muscles during a movement and protect this.

The core defined as whole muscles providing stability of the body in connection with the skeletal system of the trunk region (rib cage, spine, pelvis, and shoulder belt), soft tissues (cartilage and connective tissues) or involving in active movements of the body (Behm et al., 2010). Exercise work is called core training performed with person's body weight, aiming to strengthen deep muscles and lumbopelvic muscles that keep the spine in balance (Atan, 2013). The body muscles are taught to control the spine during dynamic movements thanks to the core training (Takanati, 2012). Core exercises are the exercise of stabilizing muscle groups that keep the body in balance. These muscles are the hips, back and abdominal muscles. They are responsible for supporting the posture, revealing the movement, coordination of muscle action, ensuring soundness, absorption of force, revealing the force and transferring it to the whole body (Atıcı, 2013).

Core strength is the human core body muscles, in order to stabilize the core parts of the body center of gravity control, transmission, movement of upper and lower extremity strength for the main aim of the power capacity, which is mainly influenced by many factors (Li Shengfu, 2015).

Core strength usually refers to the core of the torso, including the spine and pelvis and its surrounding muscles. The core we mean that the body below the ribs and pelvis area, it contains the muscles have abdominal muscles and back muscles, transverse pickled muscle and pelvic floor muscle, staggered pelvic and lower extremity muscles. Lumbar physiological mechanism of the core muscles of the pelvic - hip includes 29 muscles are located in the core position of the human body. These muscles in the human body motion play roles in stabilizing balance, transmitting power and reducing the force effects (Xue Bing 2009).

The concept of core power originated from the core stability based on the stability of the spine. In 1985, Panjabi first proposed the concept of spinal stability. He believed that the stability of the spine includes muscle and neural control unit three system passive, active spinal vertebrae. The core muscles are affected by innervated ability support ability and the matching of breath and movements (Li Shengfu, 2015).

Li Shengfu, 2015 added that the core strength training is used in various sports teams. The core strength training has become a hot spot of physical training. It is very effective to develop the core muscle strength and body central balance stability and is also an effective means to improve the motion ability and injury prevention.

Strength training is an important factor in annual training planning for maximal velocity in modern sprint races. In the last decade an increase in the use of strength training in young athletes' training has been noted, especially at the perfection stage of training in athletes aged 17 to 20 years. The main goal of this training stage is to realize athletes' technical potential in strength training in order to improve speed and avoid injuries. Another study confirmed the beneficial role of strength training for young athletes in their future ultimate performance during adulthood. In the period when motor abilities mature and advanced mastery is achieved, all body part strength training can influence the structural make-up of the young athlete's body, especially in terms of the quantity and quality of muscle tissues leading to muscular hypertrophy (Dasteridis, 2011).

In sprinting Gareth Jones, (2013) mentioned that core stability reduces unwanted secondary movement, such as the unintended side to-side sway of a sprinter's torso. These small movements are a major obstacle to achieving maximum performance for short distance runners since they reduce momentum by diverting energy from its intended purpose, placing uncontrolled strain on their body and potentially causing injury. For athletes who run on uneven surfaces core training improves posture and spinal alignment with positive benefits for balance. Additional benefits mentioned by Gareth Jones, (2013) are:

- Core strength enables the sprinter to achieve an optimal body position when running, taking the strain off their back and hips.
- Core strength improves back and hip alignment and mobility, and strengthen hip placement, minimizing the stress placed on the athlete joints as a result of running.
- Core strength improves the sprinter rotational strength and mobility. This increases the speed at which they can roll their hips, and so improves their running speed.

With the above point of view the researcher tried to find the direct effect of Core strength training for sprint runners for enhancing their performance. Therefore, this study aimed to investigate the effect of 8 weeks core strength training on sprinting performance in the case of Athlete Tirunesh Dibaba Athletics Training Center.

1.2. Statement of the Problem

Core strength exists in all of sports items. At present, all sports action is a movement chain to center muscle group which plays a role in stability and support in motion posture, motor skills. Any athletic project technical movements are not relying on a single muscle group can be completed. It must mobilize many muscles coordination work. It is also the main part of the overall force which plays a pivotal role on the upper and lower limb collaborative work (Beattie, 2008). Previous research was conducted by Sasaki, (2018), and suggested that in sports performances, core strength is very important to improve body balance and postural control in movements such as landing and contact.

Theoretically, a strength-trained athlete will be more economical as sub-maximal forces developed during each stride or pedal revolution would decrease to a lower percentage of maximal values, and have improved endurance-specific muscle power as they are able to

produce higher maximum running or cycling velocities through an improved ability to rapidly absorb and create force against the ground or pedal. Core muscles initiate movement and act as stabilizers for our joints (Kris Beattie 2008).

Sprint training in Athlete Tirunesh Dibaba Athletics Training Center is a concern, because training like core strength training has not been well emphasized by coaches of the training center when it compares to its benefit. Coaches mostly focus on other physical fitness components like endurance, flexibility, speed, and lower and upper limb strength only that does not include core body strength training. Lack of attention and ignoring for core strength training may have an impact to the performance of sprint runner. During sprinting training by coaches of the center, observing this problem was the issue of the researcher initiated to study.

1.3. Objective of the Study

1.3.1. General Objective

The General objective of the study was to investigate the effects of core strength training on sprinters performance in case of Athlete Tirunesh Dibaba Athletics Training Center.

1.3.2. Specific Objective

The specific objectives include:

1. To evaluate the effects of core strength training on abdominal muscle strength of sprinters using plank test.
2. To determine the effects of core body strength training on speed endurance status of selected athletes' performances.
3. To examine the effects of core strength training on 400m sprinting.

1.4. Hypothesis of the Study

The following alternative hypothesis is formulated.

1. Core strength training significantly improves abdominal muscle strength of sprinters.
2. Core strength training significantly improves the speed endurance status of sprinters.
3. Core strength training significantly improves speed consistency (maintaining the speed they have) of sprinters.

1.5. Significance of the Study

The purpose of this study was to investigate the effect of 8-weeks core stability training on sprinters performance. Moreover, the results of the study would generate pieces of evidence in strength, speed, endurance, and the overall speed endurance of sprinters. It would benefit the athletes to become a better sprinter, throughout the training program.

Moreover, core strength training fits well into a sprint training program and will help our overall performance when planned appropriately.

Generally this paper will have the following contribution:-:

- ❖ It may serve as the groundwork for other researchers to conduct further studies on the importance of 8-weeks core stability/strength training in track and field events.
- ❖ It will provide information and suggest some relevant ideas for coaches and other stakeholders about the implementation of core stability/strength training.

1.6. Delimitations of the study

In order to investigate the effect of 8-week core stability/strength training on sprinting performance, it will be delimited by the following:

- The study was delimited to only Athlete Tirunesh Dibaba Athletics Training Center.
- The study would be delimited to only the male trainees' age ranging from 16 to 20 years.
- The study would conducted only on short distance trainees of the center specifically on 200m, 400m dash trainees and 400m hurdle sprint trainees.
- The study was delimited by the need for track based tests with standardize protocols. Such as, core strength, 150m speed endurance and 400m sprint test.
- The training was given only for 8-weeks, three days per a week and for 60 minutes per session.

1.7. Limitation of the study

The following limitations have been faced in the time of study.

- The covid-19 pandemic virus was the big challenge to accomplish my research study.
- Lack of experienced professionals and comprehensive local previous research literature in the area was also the other limitation for this study**.**

However, the researcher was tackling such kind of the problems with the help of my advisor and had come this result.

1.8. Operational Definition of Terms

Athletics Training: the practice physical conditioning and reconditioning of athletes and prevention of injuries incurred by them.

Core: is comprised of several groups of muscles including the transversus abdominus, multifidus, diaphragm and pelvic floor muscles.

Core strength: it a person's ability to stabilize their core.

Short distance athletics: it is athletics events that comprises of 60m, 100m, 200m, 400m, 100m hurdle, 110m hurdle, 400m hurdle, 4*100m relay and 4*400m relay.

Speed: is the ability to complete the given distance within a short period of time.

Speed endurance: is the ability to prolong the amount of time where a near maximal speed can be maintained.

Sprint: Running at full speed over a short distance.

Stability: The ability of the system to return to its original position or state in response to an internal or external perturbation.

Strength: the ability to overcome resistance or to act against resistance.

Trainee: a person being trained for athletics.

Training: is a systematic process to improve an athlete's fitness in a selected activity. It is a long term process that is progressive and recognizes the individual athletes' needs and capabilities.

1.9. Organization of the study

The content of the study organized into five chapters. The first chapter deals with background of the study, statement of the problem, hypotheses, objectives of the study, significance of the study, delimitation of the study, limitation of the study, operational definition of key terms, organization of the study and ethical consideration in order to give essential information on the general picture of the study.

Chapter two deals with review of related literature and related points of basic concept of core body strength training on physical fitness performance variables.

Chapter three is deals about methods and procedure which includes research methodology, study area, research design, population and sampling techniques, inclusion and exclusion criteria, Source of data, data gathering instruments, training procedures, test procedures, method of data analysis.

Chapter four includes analyses and interpretation of data. In doing so it presented all findings of the study with their implication and chapter five presents the summery, conclusions and recommendation parts of the study.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

2.1. The Concept of Core

The "core" is comprised of several groups of muscles including the transversus abdominus, multifidus, diaphragm and pelvic floor muscles. These muscles work together to produce maximum stability in the abdominal and lumbar (lower) back region, as well as coordinate the movement of the arms, legs, and spine. Engaging these muscles is not something that most people do consciously, therefore it is important to learn how to effectively co-contract these muscles while performing these rehabilitation exercises (Dasteridis, 2011).

2.2. The Concept of Stability

Stability is the ability of the system to return to its original position or state in response to an internal or external perturbation (Dasteridis, 2011).

2.3. The Meaning of Core Strength

Core strength usually refers to the core of the torso, including the spine and pelvis and its surrounding muscles. The core we mean that the body below the ribs and pelvis area, it contains the muscles have abdominal muscles and back muscles, transverse pickled muscle and pelvic floor muscle, staggered pelvic and lower extremity muscles. Lumbar physiological mechanism of the core muscles of the pelvic-hip includes 29 muscles are located in the core position of the human body. These muscles in the human body motion play roles in stabilizing balance, transmitting power and reducing the force effects (Shengfu, 2015).

2.4. Components of the Sprint Race

The components of sprint race include the following content.

The Warm-up

The competition warm-up is often overlooked when evaluating the entire scope of a sprint race; however, it is essential for optimal performance, readiness and injury prevention. While the purpose of the competition warm-up is to optimize readiness for racing, the purpose of a training session warm-up is quite different. The training session warm up can be a most effective means

of training not merely a preparation for training. Later, several different training session methods including the active dynamic, the continuous and the segment variety will be identified (John, 2012).

The Start

The start is a series of complicated motor skills that, when executed properly, produce the force necessary to overcome inertia and begin acceleration. Often occurring in less than one second, the start includes reaction time, force application and the first two running steps (John, 2012).

Acceleration

This performance phase is the first of two links between the initial movements of the start and maximum velocity sprinting. The initial eight to ten steps represent this phase. The sprint mechanics of acceleration are very different from maximum velocity sprinting. The body position desired here is similar to the posture found when pushing a car or pulling a sled (John, 2012).

Transition

This racing phase completes the link to maximum velocity sprinting. It must be differentiated from pure acceleration because of gradual and subtle mechanical changes in the running stride. Transition skills are among the last lessons learned by the developing sprinter (John, 2012).

Maximum Velocity

Usually achieved after four-to-five seconds of utmost effort, the maximum velocity has of the sprint race is characterized by the highest stride frequency and the most optimal stride length. The duration of maximum velocity is often as short as two to three seconds. Maximum Velocity should be the first training focus (John, 2012).

Speed Maintenance

What some refer to as the deceleration phase, should be referred to as speed maintenance. This is a lesson in neuro-linguistics. Coaches should never suggest to their sprinters, even subtly, they should expect to slow down at any time in a sprint race! Rather, the performance objective should be to maintain as much top speed as possible. Of course, it is likely that a gradual decline in velocity will occur due to various elements of fatigue (John, 2012).

Finishing Form

Many races have been lost or qualifying standards barely missed because of the lack of finishing technique. Perfecting this skill can reduce a sprinter's time by that critical one or two one hundred this of a second needed for victory (John, 2012).

Coast and Stop

The truth is the majority of sprinting injuries do not occur at the start or during the race. All too often, athletes turn off their concentration while passing the finish line and allow the ground to apply abrupt breaking forces to their legs. Proper coasting and stopping techniques are essential in preventing post-race trauma and injury (John, 2012).

Restoration and Recovery

Sprinters are routinely required to run several events during the course of a single track meet. After the race is run, the sprinter's work is not finished. It is necessary to bring the body's physiological systems back to the basal level quickly and then effectively prepare for either the next race or tomorrow's training session (John, 2012).

2.5. Developing a Core Exercise Program

Exercise of the core musculature is more than trunk strengthening. Lack of sufficient coordination in core musculature can lead to decreased efficiency of movement and compensatory patterns, causing strain and overuse injuries. Thus motor relearning of inhibited muscles may be more important than strengthening in patients with LBP and other musculoskeletal injuries. A core exercise program should be done in stages with gradual progression. It should start with restoration of normal muscle length and mobility to correct any existing muscle imbalances. Adequate muscle length and flexibility are necessary for proper joint function and efficiency of movement. Muscle imbalances can occur where agonist muscles become dominant and short while antagonists would become inhibited and weak. One example of a muscle imbalance pattern includes tightness and over-activity of the primary hip flexor (iliopsoas), which in turn causes reciprocal inhibition of the primary hip extensor (Aurora, 1985).

2.6. Core Training Exercises

According to Gareth Jones, 2013, there are many exercises that help to improve our core part of our body. Some are mentioned bellow:

Bridge:

Activates and strengthens the muscles of your lower back and hips, helping to stabilize your pelvis, improving pregnancy postures, and even helping reduce back pain.

Abdominal crunch

You should be able to perform the exercise without flattening your back or tucking your hips. If you can't, you should focus on achieving correct hip placement and lumbar stability with exercises such as heel slides, reverse curls, and stars.

Plank

You should be able to perform the exercise without sagging through your spine, dropping your hips, or rotating your lower back. If you can't, you should focus on strengthening your gluts, lumbar spine, and deep abdominals with exercise such as darts, superman's, and bridges.

2.7. Beginning of Core Strengthening program

Warm-up can include the ''cat'' and ''camel'' stretches and a short aerobic program. A core stability exercise program begins with recognition of the neutral spine position (midrange between lumbar flexion and extension), touted to be the position of power and balance for optimal athletic performance in many sports. The first stage of core stability training begins with learning to activate the abdominal wall musculature. Individuals who are not adept at volitionally activating motor pathways or individuals with chronic low back pain and fear-avoidance behavior may require extra time and instruction to learn to recruit muscles in isolation or with motor patterns. Cueing individuals on abdominal hollowing, which may activate the trans versus abdominals, as well as abdominal bracing, which activates many muscles including the trans versus abdomen is, external oblique, and internal oblique, is an important beginning step. One study showed that performing abdominal hollowing and bracing prior to performing abdominal curls facilitated activation of the Trans versus abdominals and internal oblique throughout the abdominal curling activity (Moore 1985).

2.8. Core Strengthening and Injury Prevention

Some evidence in the literature supports the notion that core stabilization programs may be used to help prevent injury in athletics. Leeton and colleagues performed a prospective study looking at 140 male and female intercollegiate basketball and track athletes. They found that injured athletes [injuries included anterior cruciate ligament (ACL) rupture, iliotibial band syndrome, patellofemoral pain, and stress fracture in the lower extremity] had significantly decreased strength in hip abduction and external rotation compared with non-injured athletes. Hip external rotation strength was most useful in predicting injury. Some literature supports using neuromuscular training to prevent ACL injuries in athletes. These programs include muscle co-contraction to provide joint stability, balance and perturbation training, and plyometric exercises. Hewitt and colleagues conducted a prospective study comparing injuries in female high school athletes with preseason neuromuscular training, including single-leg functional core stability training, with a control group of female and male athletes without preseason neuromuscular training. Non-contact ACL injury risk was significantly less in the group of female athletes with neuromuscular training. In a similar study, Heidt and colleagues found that preseason neuromuscular training in female high school soccer players led to significantly fewer injuries overall, but no difference in ACL injuries between groups. Specific core stability programs in prevention of athletic injuries have not been well studied. Additionally, core programs have not been proven to enhance athletic performance. Despite these facts, many of these programs have been promoted in lay literature for use in performance enhancement (Moore 1985).

2.9. Importance of Core Stabilization and Strength

Proximal stability is fundamental for distal mobility. “The core is a “muscular corset that works as a unit to stabilize the body and spine, with and without limb movement”. (Richardson et al. 1999)

Dynamic core exercises-core exercises that involve movement such as spinal flexion, extension, lateral flexion, and rotation- are better suited for targeting individual muscles and teaching the core to produce and reduce force.

Core stability exercises-core exercises that keep the spine in a static, or isometric, position- are better suited for teaching the body to resist movement and engage the inner core unit. Both types of exercises are important for optimal core function and performance.

2.10. Effects of Core Strength in Sports Training

In recent years, core strength is a fresh thing in athletics sports. The core strength training is used in various sports teams. The core strength training has become a hot spot of physical training. It is very effective to develop the core muscle strength and body central balance stability and is also an effective means to improve the motion ability and injury prevention (Xue Bing, 2009).

A. Raise Stability of Technical Action

From the angles of biomechanics of the human body in motion, core strength training will be regarded as a chain. Each part of the body is a link on the chain, the movement technology to complete, depending on the momentum transfer in the chain to the core strength to play a pivot role in transfer process dynamic chain implementation, coordination of upper and lower limbs sports, improve the power transfer, to improve the technical stability. We use some of its non-steady state strength exercises and balance exercises in core strength to increase the training methods of the suspension training non steady state. Traditional strength training is in steady state. In the process of movement and broke the stable state of the body, which makes the strength to play a better role. Core strength training has obvious effect on core muscle strength improved. More emphasis on the control ability of nerve is put on the muscle to improve movement stability (Xue Bing, 2009).

B. Improve Muscle Work Efficiency

Research found that the force at the core of a good sprinter during the flight period quantity is less which can make the muscles relaxes during the flight time; reduce unnecessary energy consumption while relaxing the muscles for the next contraction ready shot for shot motion. Each segment by the trunk fixed support point each link of bone around a fixed point, fixed point of bone for relative movement, need core stability participation, core stability will be lower extremity and trunk muscle forces of efficient delivery to the upper limbs, body force is applied to the instrument set. Standing triple jump in three, 100 and 800 meters run are lower limb as the last point of application of force of upper limb movement, also need the participation, and

control the core muscles to state stability of the core area, is the upper and lower extremity strength transfer key in the process of running, the body center of gravity in along with the movement and change, center of gravity and large amplitude change will consume too much energy. Core strength is strong enough to control the center of the stability and reduce the energy consumption (Xue Bing, 2009).

C. Prevent Sports Injury

Core strength and core stability are initially proposed to come from the field of rehabilitation. It itself is a kind of treatment of disease and injury means. Steady state contributes to the improvement of spinal strength and the core to improve the stability, avoid such as the occurrence of standing triple jump in three unbalanced lateral lumbar injury situation landing. At the same time, through the coordination role of the core area, it can reduce and buffer extremity and joint load by the establishment of a stable fulcrum for the upper and lower limbs strength to prevent the occurrence of sports injury **(**Xue Bing, 2009**)**.

D. Raise Competitive Ability of Sprint Athletes
E. Reduce Sports Injury of Rowing Athletes
F. Enhance Stability of Landing in Freestyle Skiing Aerials Athletes

2.11. Benefit of Core Strength Training for Sprint Run

While cardiovascular fitness is a priority for runners, good posture is also vital. This reduces lateral movement and improves the speed and efficiency of the runner's stride, reducing the risk of injury.

Core stability reduces unwanted secondary movement, such as the unintended side to-side sway of a runner's torso. These small movements are a major obstacle to achieving maximum performance-both for short- and long-distance runners—since they reduce momentum by diverting energy from its intended purpose, placing uncontrolled strain on your body and potentially causing injury. For athletes who run on uneven surfaces core training improves posture and spinal alignment with positive benefits for balance. Additional benefits mentioned by Gareth Jones, (2013) are:

- It enables you to achieve an optimal body position when running, taking the strain off your back and hips.
- It improves back and hip alignment and mobility, and strengthen hip placement, minimizing the stress placed on your joints as a result of running.
- It improves your rotational strength and mobility. This increases the speed at which you can roll your hips, and so improves your running speed.

Gareth Jones, (2013), added the other addition benefits of core strength

A balanced and focused core-training program can have a positive impact on your physical well-being as a whole. The benefits of core training include:

- Improved posture
- Increased protection and "bracing" of your back
- Greater balance and coordination
- Greater power and speed

2.12. Strength Endurance

This is the ability of the muscles to continue to exert force in the face of increasing fatigue. Strength endurance is simply the combination of strength and duration of movement. Performing an exercise, such as sit-ups, to exhaustion would be a test of strength endurance. This strength characteristic determines an athlete's performance where a movement is repeated over a fairly long period of time. Runs between 60 seconds and 8 minutes, for example, require a lot of strength endurance. The ability to sprint, hurdle, throw or jump repeatedly in training or competition and maintain performance levels also requires strength endurance (Thompson, 1991).

2.13. Speed endurance training

This is often overlooked as a component within speed development primarily because of the overlap into the domain of anaerobic endurance; however, despite this overlap it should be considered as a component of speed development. As with peak-speed development, training for this component is usually conducted with repetitions in excess of the race distance, but it should be at near maximal speed with 90–95 per cent of maximal effort. The sessions can be manipulated by either altering the duration of the trial or manipulating the recovery period between each trial. Speed endurance within the speed training domain will focus on ATP-PC and anaerobic glycolysis reserves (Dan Gordon, 2009).

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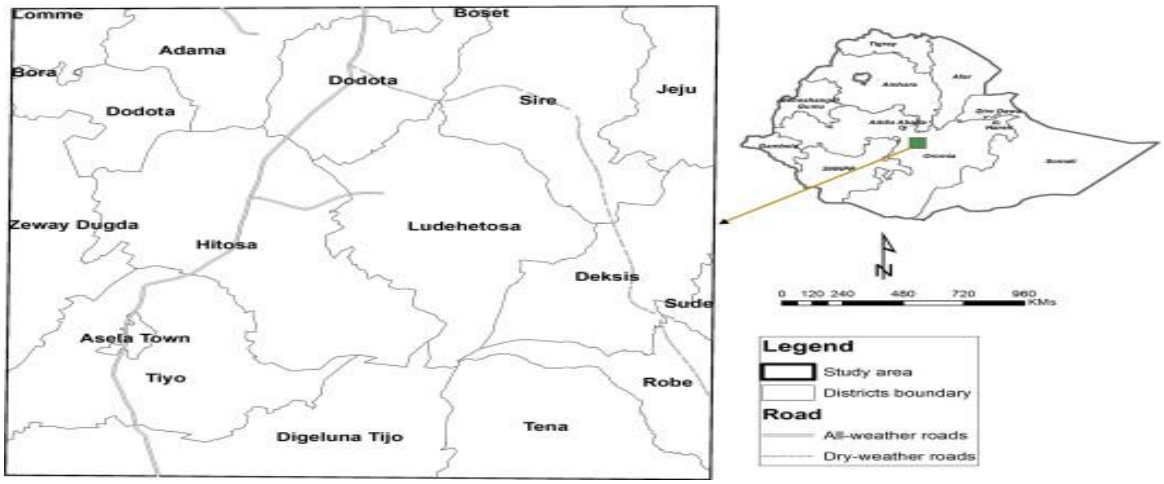
CHAPTER THREE

RESEARCH METHODS

3.1. Description of the Study Area

The study was conducted in Athlete Tirunesh Dibaba Athletics Training Center which is found in Asella, Arsi zone, Oromia Region. The training center is one of the centers which were established in 2002 E.c. The training center is found 175km far from Addis Ababa and 75km from Adama at the south east direction.

As we know Arsi zone is the source of athletes for long years and the area contributed many famous and legend athletes such as Haile Gebresilassie, Derartu Tulu, Kenenisa Bekele, Tirunesh Dibaba, Genzebe Dibaba etc. Athlete Tirunesh Dibaba Athletics Training Center is a Governmental Training center governod by Federal Sport Comission that contributed many expectant athletes by all track and field events. For instance, Lemecha Girma, Jiksa Tolosa, Tesfaye Diriba, Ariyat Dibo, zinash Tesfaye, Ebise Kebede, Zegeye Moga, Derese Tesfaye, Omed Okugni, Utege Ubang, Tadesse Takele are those who represent our country by different competition stages.



Map of study area

3.2. Research Design

The study followed a true-experimental study design. The researcher used this design that helps to provide different types of information and to establish cause-and-effect relationships among variables.

3.3. Target Population

According to Mekonnen and Bedilu (2018) 'A survey that include every element in the population is called census', in the cause of small number of athletes in the training center, the researcher utilize study subjects was 30 male sprinter athletes from each events.

3.4. Sampling Techniques

All athletes have been selected purposively from events of 200m, 400m dash, 110m and 400m hurdle sprint young (16-20 years) men athletes because of their lower in number and divided in two through random sampling technique as control and experimental groups. There are thirty athletes in Tirunesh Dibaba Athletics training center of 200m, 400 dashes, 110m and 400m hurdle sprint and all male athletes was participated in this study. Participants have been selected through randomly method and divided in two (n = 15; as experimental) and (n = 15, as a control group). In case of the total populations of the subject have been all male athletes from four events. The study conducted by a source of both primary and secondary data sources.

3.5. Methods of Data Collection

The data was collected with the help of three assistances, and it was collected by taking three measurements and the average of the test have been taken as the final test for both pre-test and post-test to reduce bias introduced during measurement. Data collectors have received training regarding which data and information should be collected from the participants. The baseline measurements are served as pre-tests while the measurements taken at the end of the training served as the post-test.

- Dependent Variables and their Respective Tests

No	**Variables**	Test	**Unit**
1.	Core muscle strength	Core Muscle Strength Test by using plank	Per Second
2.	Physical fitness status	150m speed endurance	Meter/second
3.	Physical fitness status	(400m sprint test)	Meter/second

Table 1: Dependent Variables and their Respective Tests

3.6. Exercise Training Protocols

The experimental group was performing core stability/strength training program for about 45-1:30 minutes under the supervision of the researcher and the control didn't involve in the core strength training.

Exercise	**Wk1**	**Wk2**	**Wk3**	**Wk4**	**Wk5**	**Wk6**	**Wk7**	**Wk8**
Plank full support	3x30 sec	3x45 sec	3x45 Sec	3x60 Sec	3x60 Sec	3x60 sec	3x1:30 sec	3x1:30 Sec
Flutter Kicks	2x30 sec	2x45 sec	2x45 sec	2x60 sec	2x60 sec	2x60 sec	2x1:30 sec	2x1:30 sec
Sit-up leg raise	2x30 sec	2x45	2x45 Sec	2x45 Sec	2x60 Sec	2x60 sec	2x60 sec	2x60 Sec
Side plank (left & right)	2x30 sec	2x30 sec	2x30 Sec	2x45 Sec	2x45 Sec	2x45 sec	2x60 Sec	2x60 Sec
Medicine ball crunch	2x30 sec	2x30 Sec	2x45	2x45 Sec	2x60 Sec	2x60 sec	2x60 sec	2x60 sec
Grounded Russian twist with dumbbell	2x30 Sec	2x45 Sec	2x45 Sec	2x45 Sec	2x45 Sec	2x45 sec	x60 sec	x60 sec

Table 2: Exercise Training Protocols for 8 weeks

The experimental group was performing core body strength exercises three days per a week for 60 minutes total time under the supervision of the researcher and the control was not involved in followed session plan.

Unit	Content	Organization	Coaching point
Warm-up 15’	- 3 laps easy run and mobilization exercises for 10 minutes on grass field like skipping, high knee, side step, carioca, easy stride etc	- Carry out safety check on the ground, grouping the athletes. - Check the athletes for injury. - They work in group and walk back recoveries between each exercises.	- Observe the athlete good posture for exercise, toe up, knees / hips high - Their body movement slow to fast active to dynamic - Use questioning how is their feeling.
Fitness 35’	3x45x for each exercises mentioned below Plank full support, 3 support, 2 support, Flutter Kicks, Sit-up leg raise, Side plank (left & right), Medicine ball crunch, Grounded Russian twist with dumbbell	-Introduce and explain the session. -The athletes work together for the same exercises.	-Check for understanding after explains the session. -Observe their position for each exercises -Checking their feeling while they are working for each exercise. -Observe their running posture.
Cool down 10’	Easy jog & walk -Statics starch	- Half circle formation and working together leading by representative athlete - Check athlete response to training - Hydrate - Review the session	- Athlete relax and lose - Hold starch for 6’’-10’’ - Give feedback by asking question & “telling”. Evaluating over all the session.

Table 3: Session for Experiential Group Athletes

3.7. Procedures of Data Collection

The data was recorded with the help of three assistances. And it would be collected by taking three measurements and the average of the test is taken as the final test for both pretest and posttest to reduce bias introduced during measurement. Data collectors were received training regarding which data and information should be collected from the participants. The baseline measurements were served as pre-tests while the measurements taken at the end of the training served as the post-test.

400m sprint test was monitored the development of the athlete's lactic anaerobic power and capacity and leg speed. The test is conducted as follows: Place a cone every 50m around the 400m track; Athlete use a standing start with leading foot behind the starting line, and on the command "Go", the athlete sprints as fast as possible around the 400m track. Analysis of the result is by comparing in independent t- test and paired sample t-test with the results of previous tests. It is expected that, with appropriate training between each test, the analysis would indicate an improvement (Brian Mackenzie 2005).

150 meter endurance test was to monitor the development of the athlete's specific endurance for sprinters.

The test is conducted as follows: The athlete undertakes a 150m run from a standing start. The assistant records the time for the athlete to complete 150m.

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 (Brian Mackenzie 2005).

The core muscle strength test using plank was used to monitor the development of the athlete's core strength. To undertake this test it was required a flat surface, an assistant, a mat or something to support the elbows and arms and a watch.

The plank test was conducted as follows: The assistant is 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

Press Up position as in Figure below. Once the correct position is assumed the assistant starts the watch. Hold this position for 60 seconds.

Analysis of the result is 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.

3.8. Methods of Data Analysis and presentation

For the statistical processing, data would be entered and analyzed by using the computer software SPSS version 24 program. Appropriate assumptions like normality and equality of variance have been checked. The descriptive summary is conducted using mean, paired sample t-test and standard deviation (SD) of the independent sample t-test used for this study. The test mean difference was between the control and experimental group by P value ‘P<0. 05’. finally, the result is presented using text, tables and graphs.

3.9. Methods of Controlling Validity and Reliability of the Data

To maintain the validity and reliability of data, data collection tools like watch was standardized by comparing it with a different similar watch. Also, both pretest and posttest measurements have been taken by three different data collectors and the average of the three measurements is taken as final data.

3.10. Ethical consideration

A formal letter was submitted to Athlete Tirunesh Dibaba Athletics Training Center and the study participants have been informed about the objective of the study and adequate explanation was given. Informed consent was taken from each participant. All appropriate standard principle was strictly followed during the overall study period to avoid injury during the training.

CHAPTER FOUR

RESULT OF THE STUDY

4.1. Analysis and interpretation of the data

In this chapter the data gathered will be analyzed and interpreted as follows:

4.1.1. Descriptive summary of the participants

A total of thirty participants were included in the study. All the subjects completed the training program, and none reported any training-related injury. Descriptive data were calculated for all variables and presented as group means values and standard deviations. Since the control and experimental groups are randomly selected, the groups did not differ at baseline in any physical characteristics.

4.1.2 Demography

Effect of core strength training on sprinting performance in the case of Athlete Tirunesh Dibaba athletics training center total participants were thirty athletes divided randomly in to control and experimental group (n=30; 18.30 ± 0.98 years, 1.772 ± .056m) were participated in the study.

4.2. Data analysis

4.2.1 Pre- Test 400m Sprint test, 150 Sprint test and core strength test using plank

The researcher was assessing in week 0, each subject complete, to records and additional tests for experimental and control group was prepared for last test.

Descriptive mean

Group Statistics

D. Variable	Exper. & control	N	Mean	Std. Deviation	Std. Error mean
150m S. Endurance	Experimental	15	18.176	.94476	.2439
	Control	15	17.818	.72647	.18757
400m Sprinting	Experimental	15	55.904	1.87826	.48497
	Control	15	55.8293	1.76699	.45624
Core B. Strength (Plank)	Experimental	15	1.5887	.45671	.11792
	Control	15	1.8220	.71938	.18574

Table 4: The mean difference among groups for pre-test

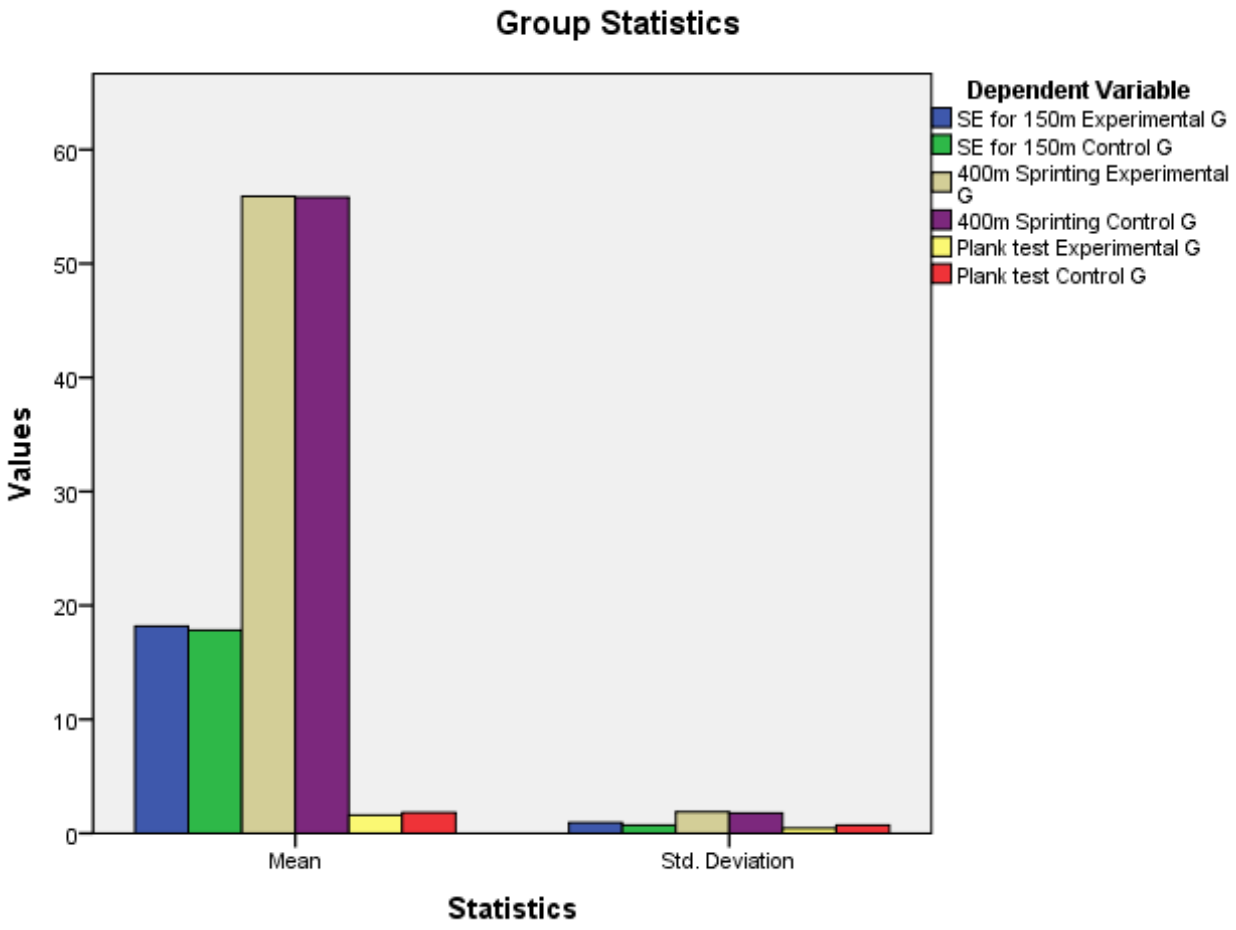


Figure 1: mean description of pre- test in bar graph

Independent t-test

Dependent Variables	Level Test for equality of variance			t-test for equality of mean					95% confidence	
		F	Sig.	T	Df	Sig.(2 tailed)	Mean Diff.	Sta. Err Diff.	Lower	Upper
Speed Endurance for 150m	Equal v. assumed	.593	.448	1.163	28	.254	.3580	.30772	-.2723	.9883
	Equal v. not assumed			1.163	26.26	.255	.3580	.30772	-.2742	.9902
400m Sprinting	Equal v. assumed	.140	.711	.112	28	.912	.0746	.6658	-1.289	1.438
	Equal v. not assumed			.112	27.89	. 912	.0746	.6658	-1.289	1.438
Plank	Equal v. assumed	1.155	.292	-1.061	28	.298	-.2333	.22001	-.6840	.2173
	Equal v. not assumed			-1.061	23.70	.300	-.2333	.22001	-.6840	.2173

Table 5: Independent t- test result for pre –test

The mean value of subjects of normal training method (control) in this study 17.81 seconds of 150m Speed Endurance, 55.82 of 400m sprinting and 1.82 minutes of Core Body Strength (Plank), was record before the intervention at the time of pre-test. Similarly pre measurement was found for treatment group, which was almost equivalent to 18.17 seconds of 150m Speed Endurance, 55.90 seconds of 400m sprinting and 1.58 of Core Body Strength (Plank), were recorded and the initial value of statistically significantly no difference of among both groups ($p=0.254$, $\alpha=0.05$), ($p=0.912$, $\alpha=0.05$) and ($p=0.298$, $\alpha=0.05$) respectively. Therefore, athletes of experimental and control groups almost have similar 150m speed endurance, 400m sprinting and core body strength using plank performance before intervention.

4.2.2 Post - Test 400m Sprint test, 150 Sprint test and core strength test using plank

The researcher was assessed in week 8 and conducted the last test, each subject complete, to records and additional 2^{nd} tests for both groups was prepared and organized for week 8 of post-test.

Descriptive mean

Group Statistics

D. Variable	Expe. & control	N	Mean	Std. Deviation	Std. Error mean
150m S. Endurance	Experimental	15	16.5207	.51348	.13258
	Control	15	17.7027	.76408	.38920
400m Sprinting	Experimental	15	50.5067	1.5073	.38920
	Control	15	53.0420	1.8023	.46538
Core B. Strength	Experimental	15	5.4007	.71254	.18398
	Control	15	3.2793	1.0931	.28225

Table 6: The mean difference among groups for post-test

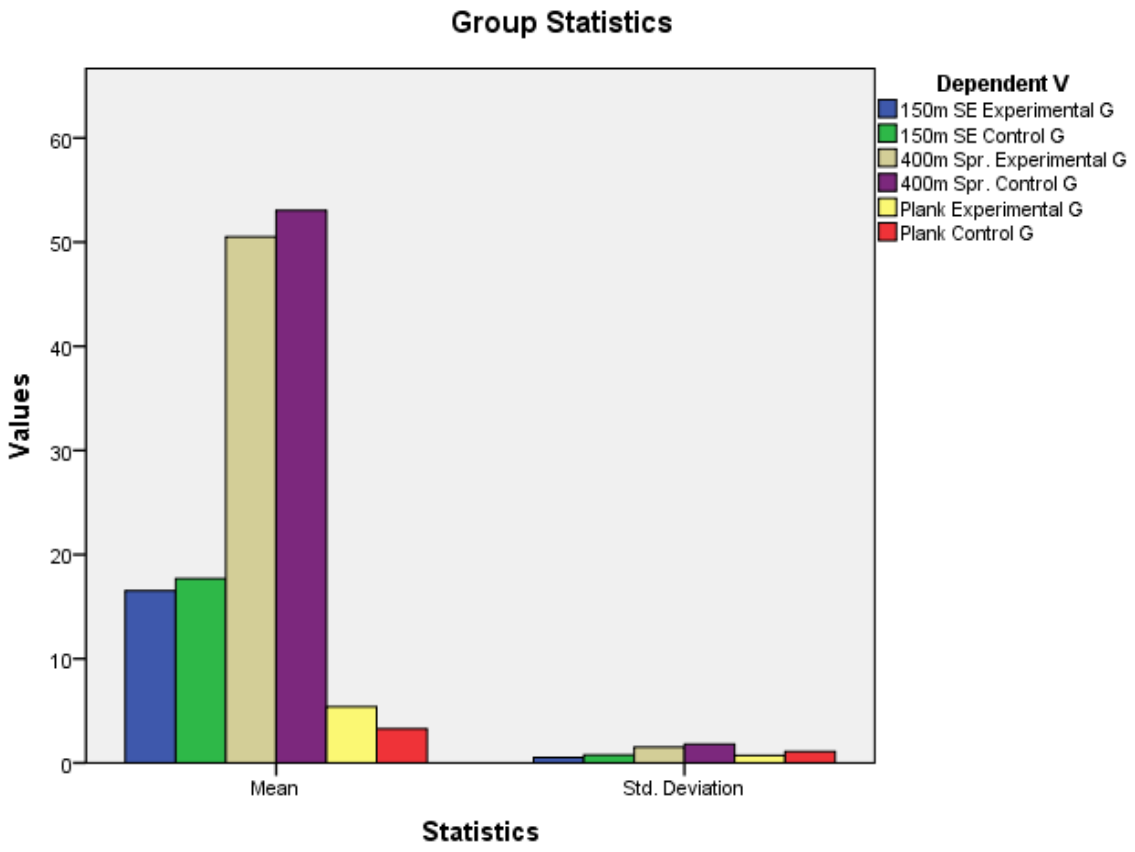


Figure 2: Bar graph to indicate mean difference of post- test

Paired sample t-test

Variables	Control group							Experimental group						
	95% confidence Inter/ Difference		Mean	Std. Deviation	P value	T	Df	95% confidence Inter/ Difference		Mean	Std. Deviation	P value	t	df
	Lower	Upper						Lower	Upper					
150m Speed Endue pre& post test	.6820	1.548	1.115	.782	0.000	5.52	14	2.32	2.72	2.52	.361	0.000	27.03	14
400m sprinting pre and posttest	2.36	3.21	2.787	.767	0.000	14.06	14	9.93	5.85	5.39	.826	0.000	25.29	14
Strength (plank) pre and posttest	-2.02	-.756	-1.39	1.144	0.006	-4.70	14	-4.13	-3.48	-3.81	.583	0.000	-25.31	14

Table 7: Paired sample t-test within the control (posttest-pretest) and experimental group (posttest-pretest) of eight-week Core strength training.

Control Experimental

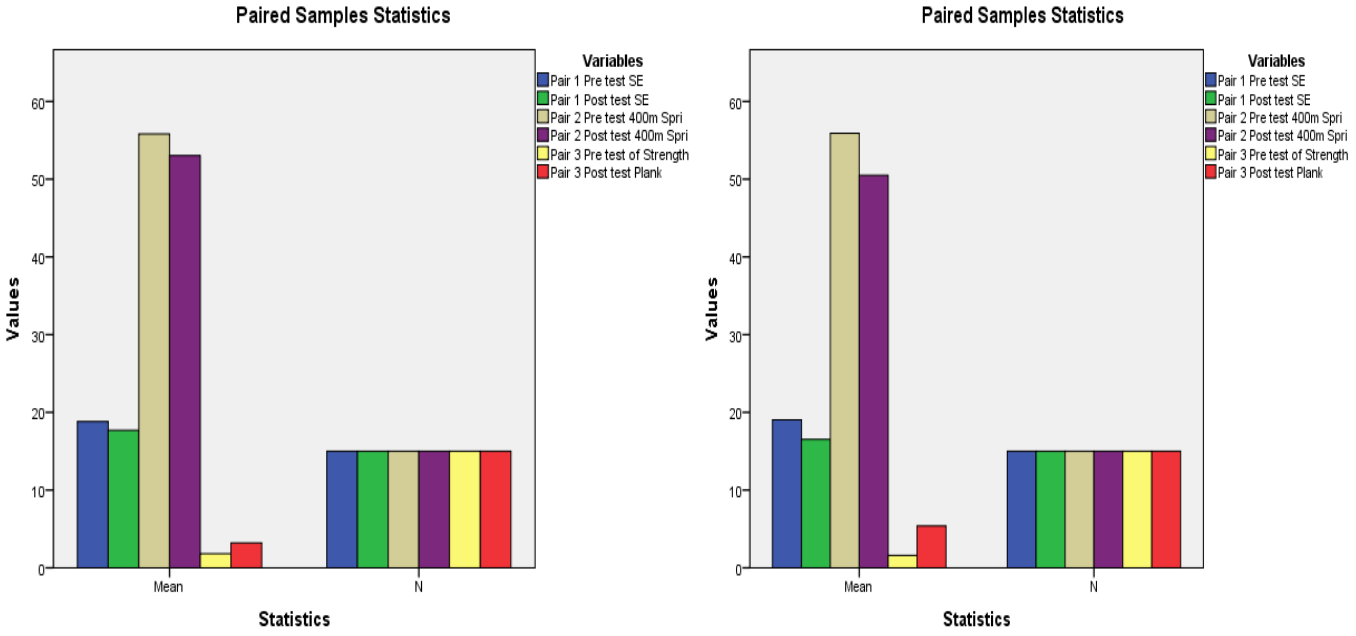


Figure -3: Bar graph to indicate Control and Experimental group mean difference of pre-test and post- test

Control group

Based on paired sample t-test, 150meter speed endurance pre and posttest of control group showed a mean difference of M= 1.11 which was significant t (14) =5.52, P<0.000. And the mean difference of 400m sprinting pre and posttest in control group M=2.78, significant t (14) =14.06, P=0.000. The core body strength (plank) test has also shown a mean difference of -1.39 at t (14) = -4.70 which was also Significant at P<0.006 (Table 7).

Experimental group

The paired t-test was also conducted to test the difference between pretest and posttest in the experimental group. The 150m speed endurance test showed a mean difference of M= 2.52 which were significant t (14) =27.3, P<0.000 and 400m sprinting test has also shown a mean difference of M=5.39 at t (14) =25.29, P< 0.000. A core strength (plank) test has also shown a

significant mean of M= -3.81 deference between pretest and posttest significant t (14) =-25.31, P=0.000(Table 7).

According to the result mentioned above core strength training has showed a significant effect on experimental groups who have been involved on 8 weeks training program than control group who have didn't participated on the training program. This indicates for coaches and other stakeholders core strength training should be planned and implemented for sprinters.

Independent t-test

Dependent Variables	Level Test for equality of variance			t-test for equality of mean					95% confidence	
		F	Sig.	T	Df	Sig.(2 tailed)	Mean Diff.	Sta. Err Diff.	Lower	Upper
SE for 150m	Equal v. assumed	.388	.539	-4.973	28	.000	1.1820	.23770	1.6689	-.6951
	Equal v. not assumed			-4.973	24.503	.000	1.1820	.23770	1.6720	-.6919
400m Sprinting	Equal v. assumed	.663	.422	-4.179	28	.000	2.5353	.60667	3.7780	-1.2926
	Equal v. not assumed			-6.951	27.151	.000	2.5353	.60667	3.7798	1.2926
Plank	Equal v. assumed	1.878	.181	6.296	28	.000	-.2333	.33692	.4311	.81148
	Equal v. not assumed			6.296	24.077	.000	-.2333	.33692	.4260	2.8165

Table 8: Independent t- test result for post –test

150m Speed Endurance

Using an α= 0.05, an independent-samples t-test was conducted to evaluate whether athletes' 150m speed endurance performance improved through using core body strength training methods in the 8 weeks training program showed that mathematically significantly different. The results indicated that experimental groups was significantly show higher performance, statistically (M = 16.52, SD = 0.51) with t (28) = -4.97, p = 0.000. While control group athlete's mean difference performance mathematics indicated (M = 17.70, SD = 0.76), with t (24.50) = -4.97, p = 0.000, α= 0.05, with significance effect (d = 0.53). The 95% confidence interval for the mean difference between the two methods of instruction was -1.66 to -0.69.

400m Sprinting Test

An independent samples t-test was performed comparing the mean consistency scores of 400m Sprinting performance of experimental group and control group athletes of Tirunesh Dibaba Athletics training center, diagnosed after conducting core body strength training in the last 8 weeks training program. As predicted, there was a significant difference in the scores for experimental (M = 50.50, SD = 1.50, N = 15) and control groups (M= 53.04, SD= 1.80, N = 15) conditions; t (28) = -4.17, p = 0.000 two-tailed with significant effect (d=0.42). The 95% confidence interval around the difference between group means was relatively precise (-3.77 to -1.29). These result suggested that core strength training for 8 weeks have an effective performance of 400m sprinting for 200m, 400m dash and 400m sprint hurdle athletes.

Core body Strength Test Using plank

In the other independent t-test of plank for core body strength, 15 participants who received a training program that have an effect on their core body part for 8 weeks intervention (M= 5.40, SD = 0.71) compared to the 15 participants in the control group (M = 3.27, SD = 1.09) demonstrated significantly difference and better peak flow scores, t (28) = 6.29, p = 0.000. That means, core strength trainings have an effect on sprinting performance.

According the result mentioned on the above tested variables the core strength training which was given for 8 weeks' intervention for experimental groups the speed endurance, core body strength, overall speed consistency (maintaining the speed they have) and the overall sprinting performance has been improved significantly.

4.3 Discussion

The present study was designed to investigate the effects of core strength training on speed endurance performance, core body strength ability and overall sprinting performance of 200m, 400m dash and 400m sprint hurdle trainees in Athlete Tirunesh Dibaba Athletics Training Center. The results showed that eight weeks of core body strength training had significant effects on the mentioned variables which have been tested among short distance athletes.

Speed Endurance

The paired t-test was conducted to test the difference between pretest and posttest in the experimental group. The 150m speed endurance test showed a mean difference of M= 2.52 which were significant t (14) =27.3, P<0.000(Table 7). The study results showed that athletes from the Experimental Group improved their sprinting performance respectively, while in the Control Group the improvement was not showed. At the baseline the greater percentage of speed endurance improvement in the athletes from the Experimental as compared with the Control Group resulted from the core strength training program. Thus the well organizes core body strength training programs had a beneficial effect on young sprinters' training profile as revealed in the 150m sprint trial. Like in some previous research Dasteridis, (2011), the results of the present study confirm that the improvement in core strength combined with coordination and technique can contribute to the athlete's running speed improvement as well to the best time at the initial acceleration phase. Furthermore, strength training that targets all part of athlete's body has a positive and linear relationship with the athlete's sprint ability to increase their speed from the starting position to the attainment of maximum speed as well as speed consistency to the finishing (Dasteridis, 2011). The findings of the above studies led us to state that the combination of core body strength training with sprints at the highest intensity is suitable for the development of sprinters' best performance.

Core Body strength

The present data-analysis shows an overall large beneficial effect of the eight-week core strength training interventions on experimental group in highly trained short distance runners when compared with the control group. A core strength (plank) test has shown a significant mean of M= -3.81 deference between pretest and posttest significant t (14) =-25.31, P=0.000(Table 7).

According to Dasteridis, (2011), a strength program should be tailored to the current strength level of the athlete and should evolve as they increase their force capabilities. Programming for a weak, or neuromuscular inefficient, athlete can be completely different (exercise, load, velocity, volume and frequency) to a strong athlete. Continual improvements in strong athletes require the development of programs that target a specific strength quality (strength endurance, maximal-strength, strength-speed, speed-strength, and reactive-strength) in the force–velocity relationship.

In contrast, athletes with low levels of strength, even though they may be a well-trained athlete, can display improvements in neuromuscular function and force production from relatively non-specific and general strength programs. This could be an explanation for why there were significant improvements in running economy from all types of strength training. However, future studies that investigate longitudinal strength adaptations in athletes should consider specifically prescribed programming for long-term gains. Research in untrained subjects has shown that the neuromuscular adaptations from general strength training can result in a shift of the force–velocity curve in which force production is greater at any given velocity. Recent work from Cormie et al. 2011, found that in weak strength athletes, especially where long-term improvements are the goal, a core-strength emphasized program may initially be an efficient and effective training modality for improving several strength qualities together.

400m Sprint

Sprinting (Lactic anaerobic power): - In the sport of track and field, or athletics, the short distance events refer to distances run over 150 up to 400 m, which needs run at high speeds. Research found that the force at the core of a good sprinter during the flight period quantity is less which can make the muscles relaxes during the flight time; reduce unnecessary energy consumption while relaxing the muscles for the next contraction ready shot for shot motion (Xue Bing, 2009).

According to Gareth Jones, (2013) while cardiovascular fitness is a priority for runners, good posture is also vital. This reduces lateral movement and improves the speed and efficiency of the runner's stride, reducing the risk of injury. Core stability reduces unwanted secondary movement, such as the unintended side to-side sway of a runner's torso. These small movements are a major obstacle to achieving maximum performance both for short- and long-distance runners since they reduce momentum by diverting energy from its intended purpose, placing uncontrolled strain on your body and potentially causing injury. For athletes who run on uneven surfaces core training improves posture and spinal alignment with positive benefits for balance.

According Arthur L., (2011) acceleration power refers to the capacity to increase speed rapidly. Like speed, sprinting acceleration depends on the power and quickness of muscle contractions to

drive the arms and legs to the highest stride frequency, the shortest contact phase when the foot reaches the ground and the highest propulsion when the leg pushes against the ground for a powerful forward drive. Recent studies show that this latter characteristic the ground reaction force during the drive phase is the most important variable in reaching high speed (Frank D., 2007). In this study, the 8-week core strength training in the experimental group showed a significant improvement in 400m sprinting run ($p=0.000$, $\alpha=0.05$) ($M = 50.50$, $SD = 1.50$, $N = 15$) and control groups ($M= 53.04$, $SD= 1.80$, $N = 15$) conditions; $t (28) = -4.17$, $p = 0.000$, two-tailed improvement throughout the 8 weeks. The improvement of core body strength, sprinting and running economy results on significant improvement on consistent of performance and it was with proper training and follow up method. This study showed that core strength training for short distance runners has a great role in the improvement of their performance in general.

The use of core body strength training as interventions to develop the athletes speed endurance, sprinting and core body strength in these conditions is essential and supported for the athletes age stage as the result showed. Core strength training in particular further provides performance benefits for develop young athletes. It seems workable for coaches and elite athletes, especially on the power event side (short distance) of athletics, to investigate the use of core strength training.

In general, it has been widely discussed whether the use of core strength training enhances the potential adaptations of speed endurance, sprinting ability and improving core strength plank test results, greater performance seen on experimental group athletes than control group. So, implementing a part of the standard training with eight -week program of core strength training could improve the overall athlete's speed and quality of sprints.

CHAPTER FIVE

5. SUMMARY, CONCLUSION AND RECOMMENDATION

5.1. Summary

The main finding of this study demonstrated that 8 weeks of core strength training can significantly improve sprinting qualities, as well as speed consistency and core strength level of short distance runners. Consequently, the research alternative hypotheses significant difference in 150m speed endurance, core strength using plank test, 400m sprinting and consistency of performance is accepted. Amusingly, the improvements in all variables were attained without any problem in the last 8 weeks training program on younger short distance athletes. Experimental group was shows significant improvement through the 8 week period, and it maintained over three sessions per week as programming shifted towards core body strength by researcher's training program. On other hand the control group physical and other important strength quality of running was changed through their coach training program at the period of the study.

5.2. Conclusion

The purpose of this study was to investigate the effect of eight weeks core strength training intervention on key performance indicators for short distance athletes, 150m speed endurance, 400m sprinting, core body strength (plank) and the consistency of the developed performance and specialization level of short distance runners. According to the data gathered and analysis done the following conclusions are prepared based on the results and findings of the study.

These are:

- As the result of the study showed core strength training could significantly improve speed endurance status, sprinting, core body strength ability and consistency of sprinting performance of short distance runners of Athlete Tirunesh Dibaba Athletics Training Center.
- Amusingly, the improvements of the above mentioned variables were significantly changed without any problem via the last 8 weeks core training program. These results strongly support the application of core strength training on short distance running athletes; demonstrating that to optimize sprinting and quality of running performance.
- The use of core body strength training as interventions to develop the athletes speed endurance status, sprinting performance and core body strength in these conditions is essential and supported for the athlete's age stage.
- As the result showed, core strength training in particular further provides performance benefits for develop young athletes and it seems workable for coaches and elite athletes, especially on the power event side (short distance) of athletics, to investigate the use of core strength training.
- In general, it has been widely discussed about the use of core strength training enhances the potential adaptations of speed endurance, sprinting ability and improving their core strength, greater performance seen on experimental group athletes than control group. So, implementing a part of the standard training with eight -week program of core strength training could improve the overall athlete's speed and quality of sprints.

5.3. Recommendations

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

- Core body strength training is relevant to maximizing the core body strength level, speed consistency and a better ability to improve the overall enhancement of sprinting performance as the result showed.
- This study showed that in younger short distance runners those who need to develop speed endurance, sprinting quality and core strength ability, core body strength can be considered as solution, especially sport academy, training center level coaches should consider including core strength workouts in their training method. Even though, short distance runners who are already on best training condition or peak performance may need to place a greater emphasis on keeping the performance consistence.
- Core body strength training should be included in the annual plan for sprinters and should be implemented properly by considering the fitness, age and performance status of the athletes. Because a well-planned core strength training program showed significant improvement of overall athlete's performance in the last 8 week intervention.
- Researcher suggested for stakeholders about core strength training program for progressive improvements of speed endurance, core strength ability and the overall sprinting performance of sprinters.
- Based on the core finding of this study, the researcher strongly recommend that athletics coaches, national athletic teams, different clubs, and training centers to implement core strength training to enhance the performance of their athletes.
- The researcher would also encourage further investigation of the neuromuscular mechanisms contributing to the observed gains in performance. As well as researchers should extend the further study on other groups of subjects to examine the effect of core strength training on running performance.

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Appendix 1

Samples of experimental and control groups of Athlete Tirunesh Dibaba Athletics Training Center

No	Name (code) of the athletes	Profile	
		Age	Height
1	NG	18	1.70
2	AM	18	1.72
3	YG	19	1.80
4	GA	19	1.70
5	BM	17	1.81
6	BK	18	1.76
7	MA	19	1.76
8	RC	18	1.90
9	OA	17	1.82
10	AE	18	1.78
11	EG	17	1.75
12	AG	17	1.82
13	AD	18	1.69
14	KG	18	1.82
15	YA	17	1.71
16	TS	20	1.78
17	BY	19	1.70
18	NN	18	1.83
19	SG	19	1.77
20	YT	19	1.79
21	DD	20	1.82
22	GA	19	1.77
23	BG	18	1.79
24	AL	17	1.76
25	YA	18	1.76
26	SA	17	1.82
27	YG	18	1.89
28	DK	19	1.69
29	HM	20	1.79
30	DB	20	1.68

Appendix 2

Pre- Test 400m Sprint test, 150 Sprint test and core strength test using plank

Experimental Group

No	Coded Name	400m Sprint test/Seconds	150m Sprint test/Seconds	core strength test using plank/ minutes
		Pre- Test	**Pre- Test**	**Pre- Test**
1.	NG	53.07	18.67	1.18
2.	AM	54.27	18.68	2.28
3.	YG	54.81	18.93	1.17
4.	GA	53.08	18.46	2.37
5.	BM	55.25	19.17	1.59
6.	BK	55.09	18.30	2.17
7.	MA	54.20	18.11	1.47
8.	RC	57.16	18.87	1.75
9.	OA	56.10	19.13	1.75
10.	AE	55.65	19.80	1.93
11.	EG	58.25	18.95	1.01
12.	AG	57.56	19.70	1.08
13.	AD	56.94	19.25	1.68
14.	KG	58.14	20.29	1.02
15.	YA	58.99	19.33	1.38

Control Group

No	Coded Name	400m Sprint test	150m Sprint test	core strength test using plank/ minutes
		Pre- Test	Pre- Test	Pre- Test
1.	TS	52.85	18.28	3.86
2.	BY	54.20	18.48	1.58
3.	NN	53.29	17.84	1.32
4.	SG	56.26	18.79	1.51
5.	YT	53.56	18.53	1.19
6.	DD	57.12	17.71	2.08
7.	GA	55.11	18.38	1.60
8.	BG	57.17	19.50	1.06
9.	AL	56.60	19.33	1.31
10.	YA	57.85	19.43	2.49
11.	SA	55.51	18.99	1.93
12.	YG	55.43	18.77	1.42
13.	DK	58.59	18.22	2.59
14.	HM	56.13	19.70	1.49
15.	DB	57.77	20.32	1.90

Appendix 3

Post - Test 400m Sprint test, 150 Sprint test and core strength test using plank Experimental Group

No	Coded Name	400m Sprint test/Seconds	150m Sprint test/Seconds	core strength test using plank/ minutes
		Post-Test	**Post-Test**	**Post-Test**
16.	NG	48.50	16.11	5.83
17.	AM	49.19	16.02	5.17
18.	YG	49.27	16.07	4.06
19.	GA	48.08	16.22	6.19
20.	BM	50.95	16.15	5.37
21.	BK	51.51	16.16	5.70
22.	MA	48.64	16.18	5.29
23.	RC	50.73	16.30	5.53
24.	OA	50.44	16.77	5.55
25.	AE	50.34	17.36	6.23
26.	EG	51.68	16.51	4.36
27.	AG	51.14	16.45	5.02
28.	AD	51.67	16.61	6.81
29.	KG	52.08	17.59	4.95
30.	YA	53.38	17.31	4.95

Control Group

No	Coded Name	400m Sprint test	150m Sprint test	core strength test using plank/ minutes
		Post-Test	Post-Test	Post-Test
16.	TS	50.50	17.20	4.03
17.	BY	51.33	17.88	2.93
18.	NN	50.74	17.41	1.57
19.	SG	53.01	16.21	4.60
20.	YT	50.52	17.42	2.44
21.	DD	53.56	18.02	3.51
22.	GA	52.70	17.17	3.20
23.	BG	53.61	17.70	2.02
24.	AL	54.79	19.42	5.53
25.	YA	54.14	17.90	2.73
26.	SA	51.59	17.69	2.51
27.	YG	52.86	17.65	3.23
28.	DK	55.81	17.39	2.68
29.	HM	55.10	17.39	3.51
30.	DB	55.37	19.09	3.69

Appendix 4

Pictures during Pre-test, Post-test and Intervention