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Relationships Among Anthropometric Characteristics, Physical Fitness Qualities and Sprinting Performance: þÿ The Case of Ethiopian Youth Academy Male Sprinters

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RELATIONSHIPS AMONG ANTHROPOMETRIC CHARACTERISTICS, PHYSICAL FITNESS QUALITIES AND SPRINTING PERFORMANCE: "THE CASE OF ETHIOPIAN YOUTH SPORT ACADEMY MALE SPRINTERS

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Relationship among Anthropometric Characteristics, Physical Fitness Qualities and Sprinting Performance: "The Case of Ethiopian Youth Sport Academy Male Sprinters

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DECLARATION

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

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I hereby certify that I have supervised read and evaluate this thesis entitled “the relationship among anthropometry characteristics, physical fitness qualities and sprinting performance in the case of Ethiopian sport academy male sprinters” by ElsabetBirhanu prepared under my guidance. I recommended that the thesis be submitted for oral defense.

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We hereby certify that we have examined this thesis entitled "the relationship among anthropometry characteristics, physical fitness qualities and sprinting performance the case of Ethiopian sport academy male sprinters". We recommend that it is accepted as fulfilling the thesis requirement for the Degree of Master of Science in Athletics Coaching.

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DEDICATION

I dedicate this thesis to God who made this possible. Secondly, I would like to dedicate this thesis to my family members. I am forever grateful for their continual support and words of encouragement at times when it seemed like there was no way forward.

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Firstly, I would like to express my sincere gratitude to my Advisor Dr. ZerihunBirhanu(Assistant professor) for the continuous support throughout my study from the beginning up to completion. Without his kindness, motivation and suggestions on the various phases of this research, it would not have been completed on time and successfully.

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Abstract

The main purpose of this study was investigating the cross sectional relationship of anthropometric characteristics, physical fitness qualities and sprinting performance in the case of Ethiopian youth sport academy male sprinters. The study applied quantitative research approach and employ correlational design to attain the intended objectives.in this study 35 sprinters from Ethiopian youth sport academy two campuses (Addis Ababa and Assela) were involved comprehensively. Descriptive statistics (Mean and standard deviation) and inferential statistics (Pearson correlation and multivariate regression) analysis were undertaken to analyze and predict which factor predicts sprinting performance from in dependent variables dimensions at the data at the 5% level of significance. The result has shown positive significant relationship between weight and standing long jump ($r=0.352^{*}$), significantnegative relationship between height and 1RM test ($r=-0.294^{*}$), significant negative relationship between leg length and 1RM test ($r=-0.308^{*}$), significant negative relationship between body fat percentage and standing long jump($r=-0.367^{*}$). All anthropometric characteristicshave no significant relationship with speed, body fat percentage has no significant relationship with 1RM test, weight has no significant relationship with 1RM test, height has no relationship with standing long jump, and leg length has no relationship with standing long jump. alsohas negative significant relationship between body fat percentage and sprinting performance, all anthropometric characteristics has no significant relationship with sprinting performance except BF%. And also has positive significant relationship between speed and sprinting performance, has negative significant relationships between 1RM and sprinting performance and has negative significant relationships between standing long jump and sprinting performance. Finally Multivariate regression test revealed that the physical fitness qualitiesspeed positively predicted sprinting performance and the physical fitness qualities (1RM and standing long jump)negatively predicted sprinting performance.

Key words: anthropometric characteristics, physical fitness quality, sprinting performance

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List ofAbbreviations

1 RM One Repetition maximum

BF% Body Fat Percentage

BMI Body Mass Index

CDCP Centres for Disease Control and Prevention

CHDP Child Health and Disability Prevention

CRT Critical Race Theory

IAAF International Amateur Athletics Federation

WHOWorld Health Organization

CHAPTER ONE

1. INTRODUCTION

1.1 Background of the Study

In athletics and track and field, sprints (or dashes) are races over short distances. They are among the oldest running competitions. A rapid movement from one place to another place is required in many athletic activity especially in sprint running (Kukolji et al.,1999; Pinero et al., 2010).

Sprinting is an ancient event in athletics starting in the first Greece Olympic Games and it is a human ability to perform a maximum running velocity (Haneda et al., 2002). At the professional level, sprinters begin the race by assuming a crouching position in the starting blocks before leaning forward and gradually moving into an upright position as the race progresses and momentum is gained. The set position differs depending on the start.

Body alignment is of key importance in producing the optimal amount of force. Ideally the athlete should begin in a four-point stance and push off using both legs for maximum force production. Athletes remain in the same lane on the running track throughout all sprinting events with the sole exception of the 400 m indoors. Races up to 100 m are largely focused upon acceleration to an athlete's maximum speed. All sprints beyond this distance increasingly incorporate an element of endurance (Pinero et al, 2010).

Anthropometry is the science that deals with the measurement of the size, proportions, and composition of the human body. In most cases it is the sizes that are directly measured, and these direct measurements can be combined to indicate the shape of the whole body or body segments(Abernethy et al., 2013).The anthropometric measurements are used to determine the morphological status, that is, body constitution and body structure of an athlete. It is well known fact that a general relationship exists between morphology and performance. Anthropometry

has been shown key role in athlete selection and performance criteria in sports (Hapuarachchi et al., 2020).

Physical fitness has been defined as a measure of how well one performs physical activity. In other words, it can also be labeled as body movement produced by muscle action that increases energy expenditure (Kyrolainenet al., 2010). Physical fitness can be divided into health-related physical fitness and motor-related physical fitness. Health-related physical fitness includes muscular strength, muscular endurance, cardiorespiratory endurance and flexibility. Motor-related physical fitness consists of agility, power and balance (Heyward, 2002 & Choi, 2010). Besides, Dean el al.(2005) also indicated that muscular strength is one of the elements of physical fitness.

Several anthropometry and body composition values are well known to be related to running performance in elite Caucasian middle and long-distance(Arrese AL, 2006)and ultra-marathon (Knechtle et al., 2007) runners. As an example, body height and mass(Maldonado-martin, 2002), fat and skim mass(Winter et al., 1976), arm circumference(Knechtle et al., 2007), totally different lower limb skin folds and circumferences (Arrese, (2006); Legaz, (2005); Tanaka & Matsuura, 1982) and conjointly total of three (Kong & Heer, 2008) and (Legaz, 2005) skin folds are associated with running performance.

Runners with a proportionately smaller quantity of body mass focused within the extremities, notably within the legs, would perform less work moving their body segments throughout running if all different factors area unit unchanged(Myers & Steudel, 1985). Therefore, leg mass and also the distribution of leg mass may well be necessary characteristics of distance runners' performance (Myers & Steudel, 1985).

Thomas (1956) noted that physical fitness results in higher athletic performance and chronic coaching can typically develop physical fitness. Careful analyses of the anatomic and physiological characteristics of famed athletes show that it's doable to form fairly reliable predictions of athletic performance

Anthropometric and physical fitness characteristics offer necessary data regarding normality of body size, health condition, and body form (Muñoz-cachón et al.,2007). Human body proportions provide data regarding the expansion of each body segment.

The goal of most studies has been to spot the amount of physical fitness characteristics at totally different ages; to judge anthropometric characteristics for talent identification or for the amount of body development; to calculate the proportional ratios in predicting some diseases; or to judge the harmony of the body. All are necessary for screening for health risks, particularly for metabolic and vessel diseases (Antonino De Lorenzo a, b, et al.(2011)Ashwell & Hsieh, 2005). In addition, physical activity is a very important suggests that to cut back and management, weight and various health risk factors (Zaccagni et al., 2014).

Anthropometric characteristics and physical fitness qualities play an important role within the performance of runners. A number of the variables which will usually have an effect on performance are body weight, body height, limb length, and circumference of limbs. Therefore, the purpose of this study was investigating the cross sectional relationship of anthropometric characteristics, physical fitness qualities and sprinting performance the case of Ethiopia youth sport academy male short distance athletes.

1.2 Statement of the problem

There are different studies conducted on the relationship between anthropometric characteristics, physical fitness qualities and sprinting performance of short distance athletes (Degati & Kumar, 2017; Hapuarachchi et al., 2020; Kebede et al., n.d.; Mahendra et al., 2011).

There are studies which have contradicted variables and results on the relationship between anthropometry variables and sprinting performance, physical fitness qualities and sprinting performance and also anthropometry variable and physical fitness qualities respectively.

In the study of (Kebede et al.,n.d.) Using the anthropometric variables BMI, leg length, and height, he found that Male sprinters best time has a significant positive correlation with BMI and negative correlation with leg length and total

leg length mean. Other anthropometric variable height had no significant relationship with sprinting performance.

In contrast, Hapuarachchi et al. (2020) conducted a research on the anthropometric variables height, body mass, limb length, girth measurement, and skin fold measurementthe result shown that upper arm length, upper leg length positively related to the performance of sprinters even, skinfold measurement were also negatively related to performance of sprinters. And other variables height, body mass, and girth measurement had no relationship with the performance of sprinter.

Whereas the study by Mahendra et al. (2011) found that the anthropometric characteristics were weight, sitting height, standing height, limb length, girth measurement, and lean body mass.He found that the sprinters of 200 m run shown significant positive relationship between height, weight chest girth and upper arm girth with the performance and there is no significant correlation between sitting height, leg length and lean body mass with sprinting performance.

There are also physical fitness qualities that are tested by different researchers to identify the performance of sprinter and different contradicted studies result on the relationship between physical fitness qualities and sprinting performance, aaccording to the study of (Kebede et al., n.d.), the test and variable were sit and reach for flexibility, shuttle run for speed, wall sit for strength, standing long jump for power and he founds has positive significant relationship between power and sprinting performance, there is negatively significant relationship between speed and sprinter performance,has negative significant relationship betweenflexibility and sprinter performance.

While in the study of (Degati& Kumar, 2017), the physical fitness quality tests were broad jump for power, wall squat sit for strength, sit and reach for flexibility, and 300m run for speed endurance then the findings show that there is significant positive relation between speed and performance of sprinter. There is also insignificant relation between power and sprinting performance,

flexibilityand sprinting performance, strengthand sprinting performance and speed enduranceand sprinting performance respectively.

The above mentioned researches showed that there are contradictions between, the anthropometric characteristics of athletes that areused by researchers and athletes' physical fitness quality and testthat are used by different researchers. Additionally the relationship between anthropometric characteristics and sprinting performance, physical fitness qualities and sprinting performance andalso were examined. This is one of the researcher's intentions to compromise and to fill the gap of these issues which seems controversial. Also all the above mentioned researches are conducted on both sex.

Moreover, the relationship among anthropometric characteristics, physical fitness qualities and sprinting performance of short distance athletes and also the prediction of sprinting performanceparticularly in sprinter is not well examined.Therefore, the aim of this study was analyze the relationship among anthropometric characteristics, physical fitness qualities and sprinting performance of Ethiopia youth sport academy male sprinters.

1.3Objective of the study

1.3.1 General Objective

This study wasconducted to investigate the relations between anthropometric characteristics, physical fitness qualities and sprint performance, the case Ethiopian Sports Academy Addis Ababa and Asela Campus male sprinter.

1.3.2 Specific Objective

1. To determine the relationship between anthropometric characteristics and physical fitness qualitiesof young male sprinter.
2. To examine the relationship between anthropometric characteristics and sprintingperformance of young male sprinters.
3. To describe the relationship of sprinting performance and physical fitness qualities in youth male sprinters.

4. To identify the relationship among anthropometric characteristics, physical fitness qualities and sprint performance in young male sprinters.
5. To identify anthropometric and fitness characteristics of athletes those might significantly predict sprinting performance of male sprinter.

1.4 Hypothesis

1. H_0: There might not be a significant association between anthropometric characteristic and physical fitness qualities on youth male sprinters,
2. H_0: There might not be a significant association between anthropometric characteristics and sprinting performance on youth male sprinter.
3. H_0: There might not be a significant association between physical fitness quality and sprinting performanceon young male sprinter.
4. H_0: There might not besignificant association among anthropometric characteristics, physical fitness qualities and sprint performance in young male sprinter.
5. $H_{0:}$Anthropometric and fitness characteristics of athletes are not significant predictive variables to sprinting performance of male sprinter.

1.5 Significanceof the study

The researcher were investigate the relationship between anthropometric characteristic, physical fitness qualities and sprinting performance The significance of the study was important in the following respect, firstly, the study may increase the awareness of short distance athletes about the relationship between anthropometric characteristics, physical fitness qualities and sprinting performance. Secondly, the study may provide meaningful information about the variable relation to those who involves in this study for the improvement athlete performance.

Thirdly, it helps physical education teachers, coaches and sport science experts to know further about the relationship between the variables and its significant effect on an athlete's performance. Fourthly, it can be served as an important resource for those who want to pursue similar studies.Fifthly, the study may helpful to

create good performer and competitive athletes in the short distance runner. Sixthly, the study may also help other researchers as a springboard to conduct further researches. Finally, the study may give additional knowledge to the area of research and the researcher herself to improve his experience in conducting additional researches.

1.6 Delimitation of the study

To make the study more specific and manageable this study mainly focuses on to examiningthe relationship among anthropometry characteristics,physical fitness qualities and sprinting performance of male sprinter in case of Ethiopian youth sport academyAsela and Addis Ababa with 35 male athletes who are participating in 100m, 200m and 400m events.

The scope of this study was selected physical fitness qualities and anthropometric characteristics as independent variable. Whereas the independent variable was sprinting performance.

1.7 Organizational structure

The study has five chapters. The first chapter deals with an introductory part of the paper which highlights the background of the study, statement of the problem, research objectives, hypothesis , significance of the study, delimitation of the study, limitation of the study, the definition of operational terms, and organization of the study. The second chapter deals with the review of related literature in which basic terms and related ideas to the study were conceptualized. The concern of chapter three is on the methods of the study, particularly, the description of the study area, research design, population, sampling and sampling technique, source of data, instruments of data collection, method of data analysis, and ethical issues were discussed. Chapter four presented the results of the study, which presented the study data analysis, chapter four data analysis and interpretation and findings of the study and the final chapter presented the summary, conclusion, and recommendation part of the study.

1.8 Operational Definition

Operational definition on the description of the core /basic/ words that found in the study staring from the research title will.

- **Anthropometry:** is the study of the measurement of human body in terms of the dimensions of bone, muscle and adipose (fat) tissue.
- **Sprinter:** a sports person who participates in short distance(100,200 and 400) athletics
- **Performance:**the accomplishment of a 100m, 200m and 400m measured against present known standards of accuracy and completeness.
- **Physical fitness:** refers to the ability of your body systems to work together efficiently to allow you to be healthy and perform activities of daily living.
- **Physical fitness qualities:** is the sprinter ability to move the body in one direction as fast as possible (speed),the maximum effort of sprinter force that can apply against a load(strength) and (power) the ability of muscle to exert maximum force in shortest amount of time.
- **Sprinting:** is running over a short distance in a limited period of time in athletics sprints (or dashes) are races over short distances.

CHAPTER TWO

REVIEW OF RELATED LITRATURE

2.1.The Sprints or Short Distance

(Tipton et al., 2007)declared that the sprint events covered distances from sixty to four hundred meters this event relies primarily on the improvement of power through anaerobic energy, the creatine phosphate systems for energy. A sprint consists of a full-scale effort for a brief amount of your time and it's the art of running as quickly as attainable. Power and coordination are the essential ingredients within the production of speed.

2.1.1 History of sprinting

In (Logan, 1986), described a new approach to commercial product development that would increase speed and flexibility, based on case studies from manufacturing firms in the automotive, photocopier and printer industries. They called this the holistic or rugby approach, as the whole process is performed by one cross-functional team across multiple overlapping phases, where the team "tries to go the distance as a unit, passing the ball back and forth" In rugby, a scrum refers to the manner of restarting the game after a minor infraction.

In the early 1990s, Ken Schwaber used what would become Scrum at his company, advanced development methods, and Jeff Sutherland (2004), with John Scumniotales and Jeff McKenna, developed a similar approach at Easel Corporation, and was the first to refer to it using the single word Scrum. In 1995, Sutherland and Schwaber jointly presented a paper describing the Scrum methodology at the business object design and implementation workshop held as in Austin, Texas, its first public presentation Schwaber and Sutherland collaborated.

During the following years to merge the above writings, their experiences, and industry best practices into what is now known as Scrum. In 2002,

Schwaberworked with Mike Beedle to describe the method in the book agile Software development with Scrum. Although the word is not an acronym, some companies implementing the process have been known to spell it with capital letters as scrum. This may be due to one of Ken Schwaber's early papers, which capitalized scrum in the title.

2.1.2 Determinants of Sprint Performance

(Slater et al., 2019), defined that sprint performance, is important to competitive success across a range of athletics events and the track sprinter is concerned only with generating maximum velocity/speed and with limiting the loss of this as the sprint progresses and According to Ross et al., (2001) sprint performance is determined primarily by reaction time, acceleration, maximum running velocity,

2.1.3 Short distance races

For the shortest running races, contestants must stay in lane at all times and will be disqualified if they change lanes. According to (ayalew , 1994) The short distance races consist of:

100m – The shortest running event in athletics, the 100m sprint requires the athlete to start well, leaving the block with massive power and speed. Record breakers' men: Usain Bolt (Jamaica) -9.58 sec at Berlin Olympic women- Florece Griffith Joyner (USA)-10.49 sec. 16/07/1998

200m- As with the 100m, the 200m requires instant acceleration but it also needs stamina to preserve the speed for duration of the race. Record breakers' men Usain Bolt (Jamaica) Women- Florence Griffith Joyner (USA) - 21.34 sec. 29/09/1988

400m – The distance of one circuit around the track, the 400m requires the whirs maintain enough stamina and energy to make a sprinting finish at the end of the race (http://en. Talkathletics.co.UK)

2.1.4 The Phases of short Distance running

Thomas & Anita (2008) pointed out the following components of sprint race: The Warm up: the competition warm up is sometimes over looked when evaluating the entire scope of a sprint race. However; it is essential for optimal performance readiness and injury preclusion. 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 the most effective means of training-not merely a preparation for training, later several different session methods including the active dynamic, the continuous, and the segment variety will be identified. The start: is a series of complicate motor skills that, when executed properly produce the force (Haugen et al., 2019)necessary to overcome inertia and begin acceleration. Often occurring in below one second, the start includes reaction time, force application, and the first two running steps.

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 are representing 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.

Transition: This competing phase completes the link to maximum velocity sprinting. It must be differentiated from pure acceleration because of [gradual 35 and subtle mechanical changes in the running stride. Transition skills are among the last lessons learned by the developing sprinter. Speed maintenance: What some refer to as the deceleration phase, Should be refer to as speed maintenance. This is a lesson in Nero-linguistics. Coaches should never suggest to their sprinters, even subtly, they should expect to reduce speed at any time in a sprint race! Rather, the performance objective should be maintaining 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.

Maximum Velocity: Usually achieved after four to five seconds of at most effort, the maximum velocity phase 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.

Finishing Form: Many races have been lost or qualifying standards barely lost because of the lack of finishing technique. Perfecting this skill can reduce a sprinters time by that critical one or two one-hundredth of a second needed for success

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 sprinters 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.

2.1.5 Sprint Performance Development

According to (Haugen et al., 2015)Sprint performance capability evolves and devolves throughout life via growth, maturation, training, and aging and in keeping with (Hollings et al., 2014) Age of peak performance in world category sprinters is often 25–26 years. Athletes who started with specialized coaching at a young age might also tend to achieve their peak performance at an earlier age than their counterparts who specialize somewhat later.

According to (Haugen et al., 2018) for world high one hundred sprinters within their early 20s; mean an annual enhancement were in the variety of solely zero.1–0.2%. (Haugen et al., 2015)informed that the world's all-time best male and female sprinters improved by a mean of 8% from eighteen years older. On alternative hand trainability variations across performance level might also be explained by other factors (e.g., coaching standing, responsiveness to coaching, coaching job quality, nutrition, etc.). (Lloyd et al., 2015) outlined that taken all findings jointly, sprinters who perform at a high junior level while not excessive specialization are at the optimum purpose of departure for senior success.

2.2 Anthropometry

Anthropometry is that the branch of human anthropometrical measurements is non-invasive quantitative measurements of the body. In keeping with the Centres for Disease Control and prevention (CDC), anthropometry provides a valuable assessment of nutritional status in kids and adults (Fryar et al., 2016).

Usually they're employed in the medical specialty population to evaluate the overall health standing, nutritional adequacy, and the growth and developmental pattern of the kid. Growth measurements and traditional growth patterns are the gold standards by that clinicians assess the health and well-being of a baby(Fryar et al., 2016)In adults, body measurements will facilitate to assess health and dietary standing and future disease risk. These measurements may also be used to verify body composition in adults to assist verify underlying nutritional status and diagnose over weight (Gavriilidou et al., 2015).

The core components of anthropometry are height, weight, head circumference, body mass index (BMI), body circumferences to assess for fattiness (waist, hip, and limbs), and skinfold thickness. in keeping with the American Academy of Pediatrics' and the Child Health and Disability Prevention (CHDP) Program Health Assessment pointers (guideline #4), correct serial anthropometrical measurements will facilitate determine underlying medical, nutritional, or social issues in kids.

Abnormal anthropometrical measurements, particularly within the medical specialty population, warrant more analysis. Anthropometrical measurements may also assess body composition in athletes; this has been shown to optimize the competitive performance of athletes and to assist determine underlying medical issues, like ingestion disorders. Anthropometry-driven fitness programs in athletes have been shown to boost cardiorespiratory fitness and strength (Santos et al., 2014). anthropometrical measurements also are used to assess nutritional status in pregnant women and to assess patients with over weight (Ververs et al., 2013).

2.2.1 Anthropometric Equipment

Reliable and consistent measurements are needed to get meaningful information from anthropometrical measurements. As such, clinicians ought to make sure the use of well-calibrated, quality instrumentation that's checked frequently for accuracy. Typical instrumentation list needed to get anthropometrical measurements includes:

- ✓ Weight scale
- ✓ Calibration weights
- ✓ Stadiometer
- ✓ Knee calliper
- ✓ Skinfold callipers
- ✓ Non stretchable tape measure
- ✓ Infantometer to measure the recumbent length

2.2.2 Anthropometric Measurement Technique

2.2.2.1 Height

For youth who can stand, a stadiometer ought to be used. The youth ought to get up straight, with buttocks, shoulder blades, and heels together touching the rear of the stadiometer. The feet ought to face outward at a 60-degree angle. If the patient has genu valgus, separate the feet enough to avoid overlapping the knees whereas maintaining contact between the knees. Arms ought to be loosely hanging at the edges with palms facing the thighs. The horizontal bar of the stadiometer ought to be lowered till the hair is compressed to the crown of the head. Take away any objects on the head and hair which will impede the bar from compressing the hair to the crown of the head. The measurement ought to be scan to the closest 0.1 cm or 1/8 of an inch. Repeat the measurement doubly to get two readings among 0.2 cm or 0.25 inches. The average of the two nearest measurements ought to be recorded.

2.2.2.2 Weight

Body weight (BW), or simply standardized as *weight* in the literature, is defined as the measurement taken when the subject is able to stand unassisted using a calibrated scale. The subject should wear minimal clothing, and should also remove shoes and socks. Before starting, the scale should be zeroed and then the subject must stand in the center of the scale, without support and with equal distribution of weight between both feet Measurements should be taken to the nearest 0.1 kilogram (kg). To account for diurnal variation, the most accurate measurement is taken in the morning after voiding. When measured correctly, ABW can be used to compare with other anthropometric measurements, for example with height to calculate body mass index (BMI = weight/height^2) (Marfell-Jones et al., 2018; WHO, 1995).

2.2.2.3 Limb Measurements

To measure higher leg length, have the patient sitting with legs at a 90-degree angle. Then, run the measure tape from the region crease to the proximal facet of the patella. To measure the upper arm length, notice the superior edge of the spine of the scapula. Then, run the measure tape down the middle of the triceps to the olecranon. In real time once measure the upper arm length, the mid-point of the arm ought to be marked in preparation to measure the mid-upper arm circumference. The patient stands upright with the arm hanging freely at the facet. The patient shouldn't flex the arm muscles. Measuring tape ought to be placed snugly round the mid-point of the arm while not press the skin.

2.2.2.4 Skinfold Measurements

Common sites for skinfold measure embrace the biceps muscle, triceps, iliac crest, thigh, calf, subscapular, abdomen, and chest. The precise technique will vary, however we'll discuss one technique using the triceps as an example. For the triceps skinfold, grab the skin two centimetre on top of the centre of the correct upper arm with the thumb and finger to make a skinfold. Then, place the callipers at the centre to get the measure. Similarly, at alternative sites, the skinfold measure is obtained by grabbing the skin two centimetres far from the measuring

site. Despite standard measuring techniques, skinfold testing has high variability and has restricted use to this point within the clinical setting.

2.2.3 Anthropometry Profile and Runners Performance

Several anthropometric and body composition values are known to be related to running performance in elite Caucasian middle and long-distance (Arrese AL, 2006) and ultra-marathon (Knechtle et al., 2007) runners. For instance, body height and mass (Maldonado-martin, 2002), fat and light mass (Winter and Hamley, 1976), arm circumference (Knechtle, etal.,2008), different lower limb skinfolds and circumferences (Arrese AL, 2006);(A Legaz, 2005); (Tanaka & Matsuura, 1982) and additionally add of three (Kong & Heer, 2008) and (A Legaz, 2005)skinfolds are associated with running performance.

Runners with a proportionately smaller quantity of body mass targeted within the extremities, notably within the legs, would perform less work moving their body segments throughout running if all alternative factors are unchanged. Therefore, leg mass and therefore the distribution of leg mass may be necessary characteristics of distance runners' performance (Myers & Steudel, 1985).

Despite variety of studies describing different anthropometric parameters associated with running performance over different distances (Bircher et al., 2006); (Kong & Heer, 2008); (Kong & Heer, 2008); (Kong & Heer, 2008); (Maldonado et al., 2002);(Tanaka, K., & Matsuura, 1982), there's scarcity of studies work the associations between specific anthropometric ratios of lower limb and running performances in several running events. However, there's a study (Lucia et al., 2006) that has represented leg length ratio to body height in peak level Spanish distance runners compared with one in all the simplest Eritrean runners.

Numerous evident have shown body size and strength contributes to motor performance. The rise in strength is related to extend in total muscle mass (Ostojic et al., 2006). Important correlational statistics between strength and performance indicate that stronger people were the people who performed higher(Ball et al., 1992).

However, the pattern of improvement of strength and physical performance isn't uniform in all tasks. Strength could also be necessary to the winning performance of some motor performances however not as necessary to others. It's likely that performance associated with power events would show an identical trend to that of strength. Physique and body structure has typically been found to have significant relation to physical performance (Gabbett & Georgieff, 2007).

While, physique doesn't markedly influenced performance except at the acute of the time. High degree of endomorph definitely restricted physical performance capability, whereas a high degree of mesomorph is a lot of tailored to motor performance. Nevertheless, correlations between physique, strength and performance are at the best moderate and not sufficiently high for predictive functions(Malina, R.M.; Bouchard, 2005).

Correlations between skinfold thicknesses and performance are repeatedly negative suggesting the negative impact of fat on motor performance(Vučetić et al., 2008). Body fat influenced physical performance both mechanically and metabolically(Boileau & Lohman, 1977). Mechanically, excess fat is harmful to performance involving acceleration of weight as a result of it adds non-force manufacturing mass to the body. Metabolically, excess fat will increase the metabolic price of performing work in activities requiring movement of the whole body mass. Thus, one would expect that in most style of performance involving translocation of the body mass and small relative fat to be advantageous in each mechanical and metabolic sense.

It ought to be noted that correlation kind analyses relating a particular body dimension to and motor performance could has its limitation. Anthropometric factors influencing strength and performance are themselves connected, thus, a group of selected anthropometric dimensions would account for a major variation in physical performance(Saugher et al., 1982).

Using the reduction regression procedure, height, upper arm circumference, abdominal and calf skinfolds were known as important predictors of physical performance. Canonical correlation on two sets of variables, anthropometric and physical performance conjointly indicated that kids with bigger weight, thigh

volume, and height can perform well on performance measures requiring high intensity work production (Docherty & Gaul, 1991).

Regular physical training is thought to hurry up the speed of development of physical performance(Gabbett & Georgieff, 2007). Increased in physical performance, in turn, may be consistent in several sport activities. for instance, competitive-level performance could need that top forces be generated speedily so as to realize sufficiently high speed in movements like throwing, jumping, kicking, or sprinting(Thorland et al.,1988) Evidently, high performance athletes need specific biological profiles with outstanding bio motor ability and powerful psychological traits. Biometric quality or anthropometric measurements of a personal are vital plus for many sports, and so, thought of among the most criteria for fulfilment in several sports (Bompa, 1999).

However, that physique characteristic is vital for fulfilment in numerous varieties of physical performance? On paper, it'd be expected that people who are successful made to own the acceptable structures equal with their physical performance task.

Research showed overwhelming proof showing variations in body size between athletes in numerous sports, whether or not measured by weight, height, lengths, breadths, girths, or skinfolds; between sports or with in sports (Haileyesus, 2017) studied thirty middle distance and thirty long distance runners from completely different colleges of Delhi University. The anthropometric measurements, physical and physiological variables of all subjects were tested and therefore the results showed that the performance in long distance running was found to be considerably related to with cardiorespiratory endurance, weight, leg length, resting heart rate, and body composition.

Performance wasn't considerably related to with muscular strength, endurance, calf girth, thigh girth and pressure level. The performance of middle distance runners was found to be significant correlated to with muscular strength, endurance, however not connected with height, weight, leg length, thigh length, fore leg length, calf girth, thigh girth, pressure level and body composition.

(Ansari, 2006) conducted a study on physical and physiological variations between elite middle and long distance runners of India. For the aim of this study three sample teams numerous classes of runners from various National level competitions (1st cluster contains of fourteen elite 800 m runners, second cluster contains of seventeen elite 1500 – 5000 m runners and third cluster contains of nineteen elite 5000 – ten thousand m runners) were elite.

Analysis of variance was applied to assess the numerous distinctions within the physical and physiological variables of the three teams. statistical analysis of this study indicated that the 800 m runners' were bigger in mean weight, stature, sitting stature, shoulder breadth, hip breadth, upper arm length, fore arm length, thigh length, lower leg length, biceps muscle girth, calf muscle girth, total of 5 skin fold, endomorphic rating, mesomorph rating, thigh length – lower leg length index, hip breadth – stature index, pulse rate and content than 1500 – 5000m and 5000-10000m runners, Whereas 5000-10000m runners were bigger in mean ponderable index than the 800m and 1500-5000m runners.

But no important variations were found in arm bone bi-epicondyle diameter, thighbone bi-epicondyle diameter, mortal rating, sitting height – stature index, higher arm length – lower arm length index and shoulder breadth – stature index of 800 m 1500-5000m and 5000 – ten thousand m runners of Indian.

2.2.4. Height and Weight Measures of Runners

Height and Weight will considerably influence success in sports looking on however the planning of the sport is connected to factors that are height and weight biased because of physics and biology. The balance of the difficult array of links can verify the degree to that height and weight plays a task in success.

(Carter, 1984) studied the athletes who participated within the 1928 Olympic Games at Amsterdam and he discovered that the best sprinters within the world were 64.5kg in weight and 1.72m tall, with a weight/height index of 2.17 as average measurements. The four hundred meters runners were slightly taller (1.76m), slightly heavier (65.2 kg), and a lot of linear (2.10). The middle distance runners' averaged 66.5kg in weight, 1.50m tall, 2.19 for body designed. The long

distance runners' averaged 60.2kg in weight, 1.70m tall, 2.10 for body designed. Jumpers were found to be tall with long legs and faster.

Vaulters, hurdlers and middle distance runners were quite similar in designed.(Sidhu, 1990) determined a 150 university athletes and noted that the sprinters were average in age 20.68 years previous, tall they were 170.65 cm tall and in weight they were 57.44kg heavy. Middle distance runners were 19.78 years previous, 169.51 cm long and 57.34 weight heavy, whereas long distance runners were 20.99 year, 169.63 cm long and 56.26 weight unit in respect age, height and weight. Among athletes from Rome, Tokyo, Munich and Montreal Olympic, the short and middle distance runners and jumpers were, as a whole, younger, however the long distance runners and throwers were older.

These knowledge indicated that the participants in events which require nice muscular strength reached the climax within the early amount, whereas the participants in events, that required a lot of endurance or technique, had delayed climax, that continuing longer. As the distance increasingly exaggerated from a 100 m to 200m, 400m and 800m, the runners step by step become a bit taller and leaner. However in Munich and Montreal Olympics, the 400m men were taller than the opposite three teams. The tendency of increasing thinness was determined from sprinters to the long distance athletes, altogether the Olympics referred. Concerning 1500m, 5000m and 10000m runners, they step by step become somewhat less tall additionally as lean.(Gedefaw, 2017)

The walkers were as large as the sprinters however leaner. On the opposite hand, the hurdlers and steeple chasers were found to be large and lean than the sprinters (Hirata, 1966). Speaking of physique of athletes, (Tanner, 1964)in his study decided that the sprinters were short and muscular men as compared to middle distance runners. Their shortness was chiefly because of short trunks undue to short legs. The 110m hurdlers were giant, long leg like sprinters. They were as muscular because the 100m sprinters however that they had long legs than sprinters. The leg length proportionately was same as those of 400m runners.

The 400m runners were large leg like, broad body shoulder in regard to their hips, and fairly serious muscled whereas long distance runners were little, short legged, slender shoulder and inferior in musculature. The 5km walkers were found to be like 1500 runners.(Eiben, 1991)examined 125 women athletes who were taking part in European Athletic Championship. It absolutely was noticed that the women runner athletes had little dimensions in every anthropometric character as compared to different women athletes. Their legs were longer as compared to their trunk. Their heights were found shorter because of little trunk. The results indicated that sprinters had less muscular higher extremities however the lower extremities chiefly the lower legs were found to be a lot of muscular and stronger. Athlete runners had same stature as sprinters. They conjointly had longer legs with shorter thighs however their trunks were a bit longer than the sprinters, whereas view runners had longer and narrower trunks.

In the study disbursed by(Costill et al., 1970)on 114 marathon runners throughout 1968 United State Olympic Marathon runners; it absolutely was found that the common age of the marathon runners was twenty six.1 year, average height was one hundred seventy five.7 cm, weight was sixty four.2kg and body fat proportion was seven.5%.(Rameshkumar & Jayanthi, 2019) studied the purposeful capability and body composition of the throwers, jumpers, sprinters, and middle and long distance runners. The track men and jumpers were found to possess the next lean body mass with less fat content than the throwers UN agency were tall and heavily designed. The center and long distance runners had highest and also the throwers, the bottom most atomic number 8 intake capability values in terms of weight and lean body mass. Similarly, the trackmen had lower most pulse than the opposite teams of athletes. The jumpers and throwers had stronger muscle power; however, the latter were sturdy in arm and shoulder muscle strength too.

2.2.5. Skinfold, Girth and Breadth Measures of Runners

Skinfold, girth and breadth measurements have become a lot of and a lot of well-liked amongst personal trainers thanks to the actual fact that they are doing not need expensive instrumentation or years of training to good and produce reliable

measurements. Skinfold analysis could be a common field assessment utilized by Sport Science professionals to predict body fat. The technique is predicated on the actual fact that 50-70% of keep fat lies between the skin and muscle, named as connective tissue fat. According to the American College of Sports Medicine, skinfold measurements of body fat are up to 98% correct, especially, once performed by a trained and experienced person(Lupash, 2009).

Skinfold add provides Associate an index to see adiposity .as an example, connective tissue fat reflects the quantity of fat gift within the adipose tissue. In fact, 40- 60% of body fat is within the subcutaneous region(Wagner et al., 2012)). On the opposite hand, explicit skinfold determinations offer data regarding local fat depots and fat distribution within the body. Skinfold value may be simply and directly obtained victimization callipers. The data provided may be quickly understood, permitting the comparison between completely different sport groups. Important variations were determined in skinfold thickness in arithmetic suggests that of various sport groups. On the study of twenty eight track runners and marathon runners, (Novak et al., 1968) determined that 400 m runners and 800 m runners had considerably higher skin folds at striated muscle and subscapular sites than the marathon runners.

When the sum of triceps, subscapular, iliac rest, umbilical, thigh and calf were calculated from the mean, the values declined from 1500-3000 m runners (33.7mm) to 400m to 800m runners (33.5 mm) to five000-10000m runners (28.7mm) and to marathoners (22.6mm).

(De Garay et al.,1975) investigated athletes who participated in United Mexican States Olympic Game. They found that the sum of 3 skin folds values of all track clusters was low; however the sprinters were with bigger skinfolds than alternative track athletes. A number of the leanest athletes among them were track athletes; however most were within the long distance runners. all-time low skinfold recording was 11.2 millimetre for a distance runners however one runner was all-time low with 11.7 mm. once examination athletes between completely different athletics events, they conjointly found that the jumpers, pole vaulters,

javelin throwers and decathlete men had low average skinfolds similar as track athletes, whereas throwers had the next mean and wider vary. The throwers had considerably broader shoulders and longer trunks than alternative field athletes. They conjointly mentioned that the hips of the jumpers were narrower than throwers.

(Singh, H., & Koley, 2002) tested skinfold thickness of seventy one sprinters, sixty five long distance runners, twenty six high hurdler and twenty four low hurdlers of interuniversity, national and international level Indian athletes. The result showed extremely important variations in subscapular skinfold between sprinters and long distance runners and between long distance runners and high hurdlers. There have been statistically important variations in suprailliac skinfold between sprinters and long distance runners. No important variations were found in between the other teams.

(Gedefaw, 2017) Singh and Ansari conducted a study on elite middle and long distance runners of Republic of India. They noted that no important variations were found in elbow/bi epicondyle arm bone breadth, biepicondyle leg bone breadth between the teams. (Kansal, 1981) in a trial to develop scientific criteria for the choice of budding athletes supported their morphological standing , studied 246 male students within the age bracket of eleven to seventeen years . Their bisacromial, humerus, bi-condyler breadth and performance in one hundred meters running, field event and standing broad jump were examined. He finished that the on top of aforesaid body mensuration showed important degree of relationship with individual performance tests.

Additional with the assistance of those differential roles, preparation of choice criteria for selecting budding athletes at a young age was conjointly tried. Carter et al. (1982) in their study on city athletic competition athletes finished when examination that the jumpers were heavier and had larger thigh and calf girth than the sprinters and distance runners; they conjointly had larger lower extremity length than the sprinters and bigger add of six skinfold than the space runners. The space runners had smaller higher arm and forearm girth than runner or

jumper, however larger biilliac breadths than sprinters. There have been no important variations in biacromial breadths.

2.2.6. Anthropometric profiling for performance

The profiling system suggested by the International Society for the advancement of Kin anthropometry (Carter et al., 2006) is currently wide used round the world, and in is back up by an authorization system strict rigorous demonstration of accuracy and exactitude in measurement. “Gold standard” strategies of assessing fat and fat free mass (hydro densitometry, Dual-Energy X-ray Absorptiometry) are expensive , invasive and complicated, and supply very little data that easy skinfolding cannot offer. Bioelectrical impendent analysis is just too sensitive to association standing and to alternative factors to be used for routine profiling.

“Virtual anthropometry” using three-dimensional whole-body scanners(Olds et al., 2007)offers a non-invasive anthropometric assessment that permits new potentialities for quantifying vital morphological characteristics like body surface area, projected cortical region, and limb volumes. Whole-body scanning offers promise in assessing variations within the distribution of mass over the body. The world’s 1st sports anthropometric survey using 3D scanning materialized in March 2007 at the Australian National sport Championships.

2.3 Physical Fitness

Physical fitness may be a state of health and well-being and, additional specifically, the ability to perform aspects of sports, occupations and daily activities. Fitness is usually achieved through correct nutrition (Tremblay et al., 2016)moderate-vigorous physical exercise,(de Groot & Fagerström, 2011). And sufficient rest at the side of a proper recovery arrange (Malina, R.M.; Bouchard, 2005).

Fitness is outlined the quality or state of being match and healthy. (www.merriam-webster.com). Around 1950, maybe in line with the economic Revolution and also the writing of war II , the term "fitness" redoubled in western

vernacular by an element of 10. ("Google Books Ngram, 2021) the modern definition of fitness describes either someone or machine's ability to perform a particular perform or a holistic definition of human ability to deal with numerous things. This has led to an interrelationship of human fitness and physical attractiveness that has mobilized international fitness and fitness instrumentation industries.

Regarding specific perform, fitness is attributed to persons who possess important aerobic or anaerobic ability (i.e., endurance or strength). A well-roun9(d fitness program improves someone all told aspects of fitness compared to active only one, like solely cardio/respiratory or solely weight training.

A comprehensive fitness program tailored to a personal usually focuses on one or additional specific skills, (Colfer, 2011)and on age(Nied & Franklin, 2002).Or health-related desires like bone health (NIH, 2021.). Several sources (Australian Bureau of Statistics,2015.) conjointly cite mental, social and emotional health as a vital a part of overall fitness. This can be often given in textbooks as a triangle created from three points, which represent physical, emotional, and mental fitness.

Physical fitness can also prevent & treat several chronic health conditions brought on by unhealthy way of life or aging. (U.S. Department of Health & Human Services, 2014.) Understanding can even facilitate some individuals sleep higher by build-up sleeping pressure and probably alleviate some mood disorders in bound people (CDCP, 2013)

2.3.1 Physical fitness qualities

Physical fitness is a set of attributes that people have or achieve. Being physically fit has been defined as the ability to carry out daily tasks with vigor and alertness, without undue fatigue (Gutin et al., 1992). Fitness is defined as a condition in which an individual has enough energy to avoid fatigue and enjoy life. Physical fitness is divided into five health related and six skill related (agility, balance, coordination, speed, and power and reaction time) components. Skill related

fitness components are fitness types which enhances one's performance in athletic or sports settings (Karol, 1993)

Power:-is the ability to transfer energy swiftly in to force. And also it is an explosive strength, is the ability to effectively integrate strength and speed to produce maximum muscular force at a maximum speed. It is the rate at which energy is expended or work is done. Then (Shorkey,1997) defined power as work divide by time, or the rate of doing work if one can perform the same work better than the other with in the same time interval, then we have got a better power. It combines strength (force) and velocity or speed (Distance/time). Power is measured by throwing heavy object or vertical jumping (Hetzler, 2015). According toBosco and Gustafson (2003), power is function of force and time (power = work / time) is defined as the rate of performing work (work= Force x Distance). Since work is a production of force x distance; Power is the combination of strength with explosiveness (speed), maximum muscular force released at speed. Power is a fundamental factor in jumping, throwing and striking (Flaherty, 2013)

Speed: - is the ability to perform a movement quickly. It is the time that takes us to respond to a stimulus. (David et al., 2014) also state that speed is basically how fast you can move partial your body or the whole of your body, and is measured in meters per second. Therefore, speed is the rate of movement and often refers to the ability to move rapidly and it is an important factor in all explosive sports and activities that require sudden changes in 14 spaces. The simplest measures of speed is a 30m, mark a non-slip surface and sprint as hard as the competent can perform from a flying start over the course and record the time taken(Wesson, 2002).

Muscular strength: -is a health-related component of physical fitness that relates to the ability of the muscle to exert force (USDHHS, 1996). Strength is specific in nature. For true assessment it would be necessary to test each major muscle group

of the body. Lab and field tests are similar and involve the assessment of one repetition maximum (the maximum amount of resistance you can overcome one time). 1RM tests are typically conducted on résistance machines. Strength can also be assessed using dynamometers. Strength can be measured isometric ally (static contractions) or isotonic ally (dynamic contractions) (USDHHS, 1996). The (Gettman et al., 1979)who conducted the study on comparing the effects of strength-training and jogging program; the study revealed that both programs were effective in producing significant improvement in treadmill times and V02max. However, circuit strength-training produced significant improvements in VO2max and resting heart rate. Guttmann also found significant reductions in body fat percent, fat weight, sum of six skin folds and waist girth as a result of circuit strength-training, as well as significant increases in lean body weight, biceps girth, isotonic and Isometric Strength. Hoeger (2002) has condemned the idea that strength is a basic component of fitness and wellness which necessary for the normal physical activities and enjoyment for happier life. Strength refers to the maximum tension or force muscles develop in a single contraction against a given resistance. It is crucial for optimal performance in daily activities such as sitting, walking, running, lifting, carrying objects and doing household work or even enjoying recreational activities.

2.4 Studies on the Relationship between Anthropometric Characteristics and Physical Fitness Qualities

(Kebede et al., n.d.) Conducted on Selected Anthropometric and Physical Fitness Variables Relationship with Performance of Sprinters, Middle and Long Distance Runners of Ethiopian Athletics Training Centers on this study he found that With the exception of a modest association in the 10–20 m sprint, there were no significant relationships between sprint and anthropometrics.

(Soodan, 2016) conducted research on the relationship between anthropometric variables and physical fitness of male cross-country athletes and discovered that Standing broad jump (SBJ) has demonstrated significant correlation with all anthropometric parameters at 5% and 1 % level also revealed that the 30 meter

dash has a highly significant correlation with all anthropometric parameters at 5% and 1%, with the exception of sitting height, upper arm girth, waist girth, and hand span.

(Kutlay, 2020) studies on the relationship between anthropometric characteristics and physical fitness parameters of figure skating athletes found that physical fitness variable and skinfold thickness were considerably stronger in male athletes.

(Article, 2022) Correlations between anthropometric characteristics and physical fitness profile in different age and level categories of soccer player and The correlations from the study show that the percentage of body fat is typically negatively connected to the standing long jump in adults, and this conclusion is also supported by .

Ram and Kumar (2015), revealed a positive correlation between athletes' performance and anthropometric measurements and fitness levels. The negative anthropometric variables may negatively impact the speed and coordination test, according to (Levels et al., 2017). Additionally, he found that standing long jump values and weight had a significant link with fat body mass.

2.5 Studies on the Relationship between Anthropometric Characteristics and Sprinting Performance

There was no link between race performance and body mass, height, leg length, or limb circumference in the eight male finishers, according to the findings provided by (Knechtle et al., 2007).According to research done by Mahendra et al. (2011) on the association between anthropometric measurements and lean body mass and sprinter performance, there is a strong correlation between certain anthropometric characteristics and relative body fat in men of college age.

According to (Vucetic, Matkovic, &Sentija, 2008), The consistently negative correlations between skinfold thicknesses and performance indicate that being overweight has a negative impact on performance. (Dessalew et al., 2019)

discovered that a higher body fat percentage had a detrimental impact on male athletes' ability to perform better. Male Japanese college sprinters, distance athletes, jumpers, throwers, and decathletes were studied for the relationship between height, body mass, muscle mass, fat mass, and the percentage of fat with athletic performance (Aikawa et al., 2020).

The findings demonstrate in the sprinter group, there was an insignificant association between weight, height, muscle mass, and fat mass, and a significant negative correlation between the percentage of fat and the IAAF scores of sprinter performance. (Hapuarachchi et al., 2020) The study's findings revealed a positive correlation between sprinters' upper arm and upper leg length and a negligible correlation between sprinters' lower arm and lower leg length. Biceps skinfold, supraspinal skinfold, thigh skinfold, and calf skinfold were also negatively correlated with sprinters' performance.

Additionally, a study by Elizbeth (1979) demonstrates a substantial correlation between a few anthropometric factors and relative body fat in men of college age. A study by Ellen (1989) demonstrates a significant correlation between height and weight and the sprinting abilities of college men.

(Kebede et al., n.d.) He conducted research on the relationship between a few anthropometric and physical fitness factors and the performance of sprinters, middle distance runners, and long distance runners at Ethiopian athletic training centers and he found that the best time for male sprinters is significantly correlated with their BMI (0.51) and leg length (-.43) ($p=0.01$ and $p=0.05$, respectively).

The ability to sprint is inversely correlated with extra body weight (Pinero et al., 2010; Onyewadume et al., 2004). (Dessalew et al., 2019) conducted study on the association between anthropometric variables and race performance; the results showed that body weight, height, and BMI demonstrated that being heavier, taller, and larger in size had a detrimental effect on improved performance for men.

Body mass, body mass index, limb circumferences, skin-fold thicknesses, and body fat were found to be significantly and favorably correlated with the split time of running (Knechtle et al., 2011). In addition, sprinters in the 200-meter race demonstrated a substantial correlation between performance and height, weight, chest circumference, and upper arm circumference (Mahendra et al., 2011).

2.6 Studies on the Relationship between Physical Fitness Qualities and Sprinting Performance

Degati& Kumar, (2017) conducted study on The Relationship between Selected Physical Fitness Variables and the Performance of Ethiopian Junior Sprinters and Middle Distance Athletes Across Genders, the study's findings indicate that while speed and 100 m best performance were positively correlated (r=.609, p.01), broad jump and 100 m performance of female sprinters were negatively correlated (r=-.394, p.05). Significant relationships exist between the chosen physical fitness characteristics and the sprinter who achieved the highest performance in the 100-meter test (speed 40m, sit and reach and broad jump). According to some studies (Peterson, Alvar, and Rhea, 2006; Almuzaini, and Fleck, 2008; Kale et al., 2009), there is a significant correlation between standing long jump ability and sprinting acceleration and velocity.

This finding demonstrates a connection between strength traits and sprinting performance (BarianMc et al.,1995). Furthermore, this finding was backed up by further researchers (Cavinato& Abad, n.d.) Large associations were found between speed tests and competitive 100-m times ($r = 0.54$, $r = 0.61$ and $r = 0.66$ for 10-, 30- and 50-m, respectively, $P < 0.05$). The jump tests were very largely associated with 100-m dash performance ($r = -0.82$ and $r = -0.81$ for standing long jump, and horizontal jump, respectively, $P < 162\ 0.01$). (Misjuk&Viru, 2016) None of the jump tests substantially connected with the running time during the 30 m sprint from the flying start.

The results of the study by Misjuk and Viru (2016), which found a significant negative correlation between the results of the countermovement jump and the sprinting time, and no significant correlation between the standing long jump result and the running time, are in disagreement with this finding. No correlation between sprinting metrics and standing wide jump was identified, according to (Reserved et al., 2008), and the distinct muscles involved in the two activities as well as the type of contraction must be investigated to provide an explanation for this finding. According to the findings of his study (De Lorenzo et al., 2013), there is a considerable positive correlation between the parameters of a 40-yard sprint and broad-jump performance.

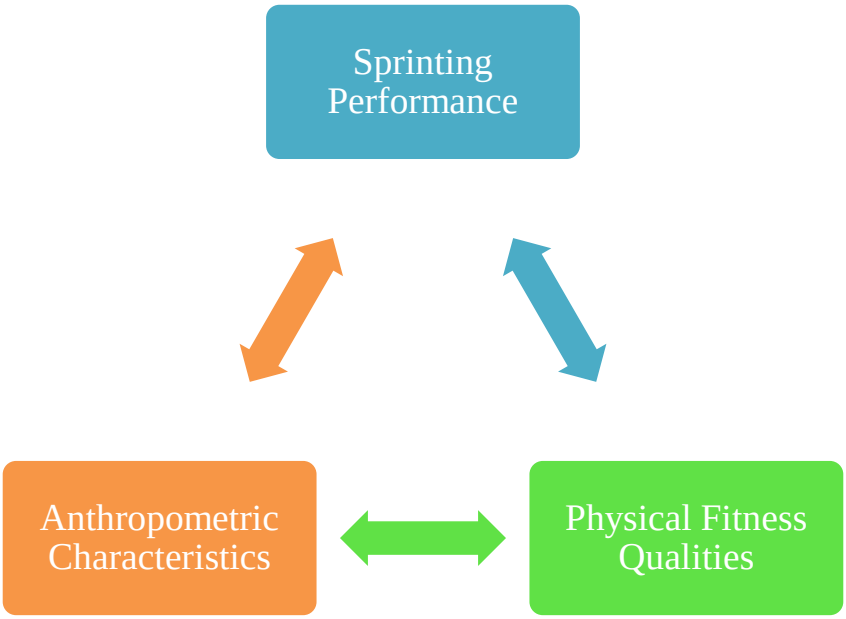

figure 2. 1:conceptual frame work for the correlation among anthropometric characteristics, physical fitness qualities and sprinting performance

CHAPTER THREE

MATERIALS AND METHODS

3.1 Design of the Study

The study was a correlational design that mainly addresses the association amonganthropometry characteristic, physical fitness qualities and sprinting performance on male sprinter in the case of Ethiopian youth sport academy.

3.2 Description of Study Area

Ethiopian Youth Sports Academy is a public institution entrusted to train potentially endowed youngsters in Olympic Sports. The Academy also renders capacity building training to professionals in different sport fields. The Academy was envisaged by H, E the late Prime Minister MelesZenawi, and was inaugurated may 28, 2013 (2005 EC) by H, E Prime Minster HilemariemDesalegneAthlete TiruneshDibaba Sports Training centre (the Asela Campus) which was previously established October of 2009. Academy's two campuses are working to produce physically & mentally competent & ethically sound Young Sport elites for national and international competitions. Addis Ababa campus located in Bole Sub City is only two minutes' drive North from Bole International Airport. Athlete TiruneshDibaba sports Training Centre situated in Assela city, 175 Kms. South East of Addis Ababa.

3.3 Population and sampling technique

The total populations of the study were35male sprinters from Addis Ababa and Asela campus male short distance runners. This research was conduct 23 male athletes from Asela campus and 12 male athletes from Addis Ababa campus who are participating in 100m, 200m and 400m events.

In this study, the researcher had used comprehensive sampling technique for the total populationsand purposive sampling for study area respectively.

Then, random assignment technique was used at Ethiopia youth sport academy both campuses.

3.4 Source of Data

3.4.1 Primary Data Source

Primary data is the first and most immediate recording of a situation to express findings. Primary data can provide information about virtually any facet of the surroundings. With this regard, the primary data resources used in the research were physical fitness character test(60 m test for speed test, vertical jump test for power test, 1RM for muscular strength test) , Anthropometric measurement (height measurement, weight measurement, body mass index measurement,body fat percentage measurement) and sprinting performance test(200 m sprint time test) .

3.5 Data Collection Instruments and Procedures

In order to get reliable information from the research participant, theresearcher used different data collection instruments to gather information such as physical fitness test (60-m speed test, vertical jump & 1RM test), anthropometric measurement (height, body weight, skinfold & leg length) and sprinting performance test (200M sprint time test).

Before beginning data collection the athletes was fill personal information in to test sheet after filling the form the athletes warming up for 15 min begin from walking to dynamic stretching in the end of warming up begin fitness test.

3.5.1 Physical fitness test

3.5.1.1. 60-m speed test

Objective: is to monitor the development of the athlete's acceleration and pick up to full flight.

Required resources: To undertake this test you will require:

- 400m – 60m marked section on the straight
- Stop watch

- Assistant.

How to conduct the test

The test comprises of 3 x 60m runs from a standing start and with a full recovery between each run.

The athlete uses the first 30m to build up to maximum speed and then maintains the speed through to 60m.

The coach should record the time for the athlete to complete 30m and 60m.

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.

Target group: This test is suitable for sprinters but not for individuals where the test wouldbe contraindicated.

Reliability: Reliability would depend upon how strict the test is conducted and theindividual's level of motivation to perform the test.

Validity: There are no published tables to relate results to potential performance incompetition.

3.5.1.2. Standing Long Jump Test (Broad Jump)

The Standing long jump, also called the Broad Jump, is a common and easy to administer test of explosive leg power. It is one of the fitness tests in the NFL Combine..

Purpose: to measure the explosive power of the legs

Equipment Required: tape measure to measure distance jumped, non-slip floor for takeoff, and soft landing area preferred. Commercial Long Jump Landing Mats are also available.

Procedure: The athlete stands behind a line marked on the ground with feet slightly apart. A two foot take-off and landing is used, with swinging of the arms and bending of the knees to provide forward drive. The subject attempts to jump as far as possible, landing on both feet without falling backwards. Three attempts are allowed. See some long jump video examples.

Scoring: The measurement is taken from take-off line to the nearest point of contact on the landing (back of the heels). Record the longest distance jumped, the best of three attempts. The table below gives a rating scale for the standing long jump test for adults, based on personal experiences. See some athlete results for the long jump test. You can also use this calculator to convert cm to feet and inches.

Reliability: Test reliability refers to how a test is consistent and stable in measuring what it is intended to measure. Reliability will depend upon how strict the test is conducted and the individual's level of motivation to perform the test. The following link provides various factors that may influence the results and therefore, test reliability.

Validity: Test validity refers to the degree to which the test measures what it claims to measure and the extent to which inferences, conclusions, and decisions made based on test scores are appropriate and meaningful. This test provides a means to monitor training on the athlete's physical development.

3.5.1.3. Leg Press 1RM test

Purpose: to evaluate an athlete's lower body strength.

Equipment required: To undertake this test you will require: Leg press machine, Assistant

Procedure:

- Select a weight close to your one repetition maximum load
- Conduct as many leg presses you can before failure
- Assistant to count the number of successful bench presses
- If the number of bench presses exceeds 12 then:
    - ✓ Rest for 15 minutes
    - ✓ Increase the weight
    - ✓ Repeat the test.

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.

The following equation provides a good estimate of the maximum loadproviding the number of repetitions does not exceed 12.

- 1RM = Weight / (1.0278 – (0.0278 x Number of repetitions))

For an assessment of your one repetition maximum divide your one repetitionmaximum (kgs) by your body weight (kgs) and then determine an assessment of your score from the normative table.

3.5.2. Anthropometric Measurement

3.5.2.1. Standing Height (Stature) Measurement

The measurement of height is a standard component of most fitness assessments. Height (or lack of height) is an important attribute for many sports.

Equipment required: stadiometer (or steel ruler or tape measure placed against a wall)

Steps to Measure Your Height:

- ✓ First, find a flat, uncarpeted section of floor and a flat section of wall.
- ✓ Take off your shoes.
- ✓ Remove braids, headbands, or anything else on your head that may get in the way of an accurate measurement.
- ✓ Remove any bulky clothing that may make it difficult to stand flat against the wall.
- ✓ Stand with your feet flat on the floor with your heels against the corner where the wall and floor meet. Make sure your head, shoulders, and buttocks are touching the wall.
- ✓ Stand up straight with your eyes looking straight ahead. Your line of sight and chin should be parallel to the floor.
- ✓ Have someone place a flat object (like a ruler or hardcover book) against the wall at a right angle. Then have them lower it until it rests gently on top of your head, keeping it at a right angle to the wall.

- ✓ Lightly mark the wall with a pencil at the point where the ruler or book (or other flat object) meets your head.
- ✓ Use a tape measure — ideally a metal one that will remain straight — to measure the distance from the floor to the mark on the wall.
- ✓ Take note of the measurement to the nearest 1/8th of an inch or 0.1 centimeter.

Reliability: Height measurement can vary throughout the day, usually being higher in the morning, so to ensure reliability height should be measured at the same time of day.

3.5.2.2. Body Weight

Body weight is commonly measured in fitness testing sessions. Measuring body weight in sports is important for assessing body composition and for monitoring changes in weight following diet and exercise.

Purpose: measuring body mass can be valuable for monitoring body fat or muscle mass changes, or for monitoring hydration level.

Equipment required: Scales, which should be calibrated for accuracy using weights authenticated by a government department of weights and measures

Procedure: the person stands with minimal movement with hands by their side. Shoes and excess clothing should be removed.

Reliability: To improve reliability, weigh routinely in the morning (12 hours since eating). Body weight can be affected by fluid in the bladder (weigh after voiding the bladder). Other factors to consider are the amount of food recently eaten, hydration level, the amount of waste recently expelled from the bodys, recent exercise and clothing. If you are monitoring changes in body mass, try and weigh at the same time of day, under the same conditions, and preferably with no clothes on. Always compare using the same set of scales.

3.5.2.3. Skinfold Measurement

Taking skinfold measurement is a common method for determining body fat composition. Calipers are used to measure the thickness of the skin at a range of

sites around the body. Accurate measurement technique is important. Here is the standard technique that is used. You should read this information in conjunction with the description of each of the standard measurement sites.

Purpose: to estimate body fat level by the measurement of skinfold thickness

Equipment: skinfold calipers (e.g. Harpenden, Slimglide, Lange), tape measure, marker pen, recording sheets. Read the Skinfold Guide for a comparison of available calipers.

Procedure: Skin-fold thickness measurements will be taken from nine different standard anatomical sites around the body (chest, midaxillary, triceps, biceps, subscapular, abdominal, suprailiac, thigh and calf). For every skinfold measurement, a pinch of skin and associated subcutaneous adipose tissue were raised from the appropriate site of the body. The skin-fold caliper will use and apply 1 cm below and at right angles to the pinch. The reading will take to the nearest millimeter (mm). The Measurement Sites, descriptions and landmarks of the skinfold measurement are shown in table 2.

Validity: using skinfold measurement is not a valid predictor of percent bodyfat, however they can be used as a monitoring device to indicate changes in body composition over time. It is important to maintain correct calibration of the calipers (more about calibrating calipers)

Reliability: the reliability of skinfold measurement can vary from tester to tester depending on their skill and experience. There are accreditation courses available through ISAK.

Table 3.1: The below Standard sites, descriptions and land marks for measuring skin-fold thicknesses were adapted from Nhanes III (1988); Anthropometry

Skinfold sites	Descriptions and landmarks
Chest skinfold site (diagonal fold)	Men: one-half the distance between the anterior axillary line and the nipple.
Midaxillary skinfold site (vertical)	Midaxillary line at the level of the xiphoid process of the sternum
Triceps skinfold site (vertical fold)	At the level of the mid-point of the arm length measurement at the (+) mark (over the triceps m).
Subscapular site (Diagonal fold)	Over the inferior angle of the scapula
Abdominal skinfold site (Vertical)	5 cm to the right side of the umbilicus
Suprailiac skinfold site (Diagonal)	On horizontal line at the level of iliac crest just anterior to the midaxillary line.
Thigh skinfold site (Vertical fold)	The mid-point of the anterior surface of the thigh at the (+) marks of thigh length measurement.

Body fat percentage calculation: Percentage of body fat (%BF) will calculate using the Parillo equation (Ball et al. 2004) formula of total body fat percentage develop into a calculator site in linear software.com (2006), shown in annex III.

3.5.2.4. Leg Length

Length measures are made at standard anatomical sites around the body, measured with a tape measure, ruler or caliper. See also the body size tests of breadth.

Equipment required: steel ruler or flexible metal tape measure (or caliper) andpen for marking the skin. If a plastic or cloth tape is used, it should bechecked regularly against a metal tape as they may stretch over time.

Procedure: The sampler stood on the athlete's right side for all measurements of the lower limb and the athlete will ask to sit straight on the measuring box with the right knee bent at a 90 degree angle.

Length of the leg will be taken from the proximal end of the medial border of the tibia to the lower border of the medial malleolus of the right leg. The athlete will ask to sit on the table and cross the right leg over the opposite knee. The fixed blade of the large sliding caliper was placed under the heel of the right leg just below the medial malleolus of the tibia. The leg will be raised so that the knee and ankle are both at a 90 degree angle supported by placing the moveable blade of the caliper on the anterior surface of the right thigh, above the condyles of the femur. The shaft of the fixed blade of the sliding caliper was held parallel to the shaft of the tibia. Then, the measuring tape will be extended between the palpable proximal ends of the medial border of the tibia to the lower border of the medial malleolus of the right leg.

The measurement was taken to the nearest 0.1 cm. The midpoint of this measurement was marked (+) for the circumference and skinfold measurement of the calf.

Reliability: Things that may affect reliability are changes to the testers, constant and even tension on the tape, and correct land marking (finding the correct anatomical sites for measurement).

3.5.3. Sprinting performance test

3.5.3.1. 200m- Sprinting time Test

Measure finishing time by second or minute the distance that given to cover.

Purpose: measuring the finishing time of 200-m distance

Equipment: stop watch, assistant

Calibration: every day before taking the measurements

Method: the time to finish the distance will take when athletes arrived at the finishing line in three different times within their four weeks of final preparation.

Reliability: Reliability is greatly improved if timing gates are used. Also weather conditions and the running surface can affect the results, and these conditions should be recorded with the results. If possible, set up the track with a crosswind to minimize the effect of wind.

Validity: Precisely measures acceleration and speed. This test should be performed 3 times during 1 session to find an average score

3.6. Data Analysis

Statistical analysis was performed with the SPSS version 23. Sprinting performance or the time to finish the distance was the dependent variable. On the other hand the directly measure anthropometric parameters (body mass, height, weight, mean skin-fold thickness, length of the leg), physical fitness test (60-m speed test,1RM test and Vertical jump) and the calculated parameters such as %BF were taken as independent variables. All the data was presented as mean ± S.D. The Pearson product moment test was used to determine the correlation between the parameters and finishing time for male athletes. In addition, a stepwise multiple linear regression analysis was applied to identify performance predictor variables from the set of already associated variables obtained from the correlation results of male sprinters. The level of significance for all statistical tests was set at $p < 0.05$.

3.7. Ethical Consideration

Ethical clearance for the study was obtain from Ethiopiayouth sport academy Adiss Ababa before the conduct of the study. Each subject was inform of the purpose of the study and confidentiality of personal information by the inform consent form. Only subjects who voluntarily sign the informed consent form was include in the study.

CHAPTER FOUR

RESULT

4.1. Introduction

This chapter deal with the analysis of data from 35 male short distance athletes (N=35) under the study. The purpose of this study was to examine the relationship among anthropometric variable, physical fitness qualities and sprinting performance of male sprinters.y. The data was collected through 1RM leg press test, 30-m speed test and broad jump for physical fitness qualities. For Anthropometry characteristics test through height, body fat percentage, weight and leg length used .The collected data were analysed by using Pearson's correlation, partial correlation and multiple linear regression the relationship between anthropometric characteristics and physical fitness qualities, between anthropometric characteristics and sprinting performance and sprinting performance with physical fitness qualities.

4.2. Result of the Study

Table 4.1 descriptive statistics of age and experience

Variables	N	Mean	Std. Deviation
Age	35	19.1143	1.58618
Experience	35	2.3143	1.38843

Note: **Age-** chronological age of athletes and **Experience-**training age of athletes

As shown the above table 4.1, descriptive characteristics of 35 study participants from Ethiopian youth sport academy both campus male short distance athletes mean and standard deviation of age (M=19.1143 and SD=1.58618) and training

experience (M=2.3143 and SD= 1.38843) subjects where relatively had the same age, training experience.

Table 4.2: the descriptive statistics of anthropometric characteristics

Variables	N	Mean	Std. Deviation
Height	35	1.7834	.05708
Weight	35	65.31	5.609
Leg length	35	1.1034	.04221
BF%	35	8.2697	1.59329

Note:Height- height of athlete in meter, **Weight-**weight of athlete in kilo gram, **Leg length-** total leg length of athlete and **BF%-** body fat percentage of athlete based on skin fold calliper result

As shown the above table 4.2, descriptive characteristics of 35 male short distance athletes of Ethiopian youth sport academy both campuses mean and standard deviation of height (M= 1.7834, SD = 0.05708) and weight (M = 65.31, SD= 5.609), leg length (M=1.1034, SD=0.04221) and body fat percentage (M=8.2697, SD=1.59329).

Table 4.3: the descriptive statistics of physical fitness qualities and sprinting performance

Variables	N	Mean	Std. Deviation
Speed	35	3.3109	.22208
1RM	35	4.2794	.68647
Standing L.	35	2.5797	.18834
200 m	35	23.2809	1.11189

Note:Speed- 60m speed of athlete in second, **1RM-** leg press test of athlete, **standing L.-**standing long jump test of athletes in meter &**200M-** 200m sprinting time in second.

From the above table 4.3 35 Participants had shown the following physical fitness qualities and sprinting performance scores 60-m speed (M = 3.3109, SD =0.22208) was in priority and followed by 1RM leg press test (M = 4.2794, SD = 0.68647) followed by standing long jump (M = 2.5797, SD =0.18834) and finally 200 m sprinting (M = 23.2809, SD = 1.11189).

Table 4.4 the correlation between anthropometric characteristics and physical fitness qualities

Variables	Speed	1RM	Standing L.
Height	.077	-.294*	-.041
Weight	.002	.034	.352*
Leg length	.085	-.308*	-.183
BF%	.242	-.256	-.367*
Speed	1	-.113	-.309*
1RM		1	.527**
Standing L.			1

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

Note:Height- height of athlete in meter, **Weight**-weight of athlete in kilo gram,**Leg length**- total leg length of athlete in meter ,**BF%-** body fat percentage of athlete based on skin fold calliper result **, Speed**- 60m speed of athlete in second, **1RM**- leg press test of athlete and **Standing L**.-standing long jump test of athletes in meter.

From the above table 4.4 showed that there were no significant relationship between anthropometric variable of height with speed and standing long jump or broad jump, weight with speed and strength or 1RM, leg length with speed and standing long jump or broad jump and body fat percentage with speed and strength or 1RM test. But there was a partially positive relationship anthropometric characteristic of weight with standing long jump (r=0.352) and there is partially negative relationship between height with strength or 1RM test (r=-0.294) leg length with strength or 1RM (r=-0.308) and body fat percentage with standing long jump or broad jump (r=-0.309).

Table 4.5: the correlation between anthropometric characteristics and sprinting performance

Variables	**200M**
Height	.102
Weight	-.080
Leg length	.137
Bf%	.439**
200M	1

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

Note:Height- height of athlete in meter, **Weight**-weight of athlete in kilo gram, **Leg length**- total leg length of athlete in meter,**BF%-** body fat percentage of athlete based on skin fold calliper result and **200M**-200M sprinting time in second.

The finding of the study showed that there were no significant relationship between anthropometric variable of height with sprinting performance or 200M sprint, weight with sprinting performance or 200M sprint and leg length with sprinting performance or 200M sprint But there was a partially positive relationship anthropometric characteristic of body fat percentage with sprinting performance or 200M sprint time (r=0.439),

Table 4.6.Correlation between physical fitness qualities and sprinting performance

Variables	200 M
Speed	.791**
1RM	-.475**
Standing L.	-.601**
200 M	1

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

Note:Speed- 60mspeed of athlete in second, **1RM-** leg press test of athlete, **Standing L**.-standing long jump test of athletes in meter &**200M-** 200m sprinting time in second.

The finding of the study showed that there was a partially positive relationship physical fitness qualities of speed (r=0.352) and there is partially negative relationship between strength or 1RM test with sprinting performance or 200 M sprint(r=-0.475) and there was negative relationship standing long jump or broad jump sprinting performance or 200 M sprint (r=-0.601).

Table 4.7: summary of regression prediction of anthropometric characteristics, physical fitness qualities an sprinting performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.915[a]	.838	.796	.50211

Table 4.8: ANOVA result of the relationship between anthropometric characteristics and physical fitness qualities with sprinting performance

	Model	Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	35.227	7	5.032	19.961	.000[b]
	Residual	6.807	27	.252		
	Total	42.034	34			

a. Dependent Variable: sprinting performance of athletes

b. Predictors: (Constant), standing long jump test of athletes , height of athletes, 60-m speed test of athletes, BF%of athletes, weight of athletes, 1rm leg press test of athletes , leg length of athletes

Table 4.9 coefficient regression prediction of anthropometric characteristics and physical fitness qualities with sprinting performance

NO	Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	18.331	3.597		5.096	.000
	Height	-.665	2.381	-.034	-.279	.782
	Weight	.014	.018	.073	.797	.433
	leg length	-1.009	3.156	-.038	-.320	.752
	BF%	.105	.061	.150	1.719	.097
	speed	3.289	.420	.657	7.825	.000

	1RM	-.421	.158	-.260	-2.660	.013
	StandingL.	-1.413	.636	-.239	-2.220	.035

Dependent variable: sprinting performance

Predictors: speed,1RM and standing long jump

$$Y = \beta_0 + \beta_1 x_1 + \ldots\ldots + \beta_k x_k + \varepsilon$$

*Y=18.331+(speed*3.289)-(standing L.* 1.413) – (1RM*0.421)*

The above table 4.7 result shows that the correlation between anthropometric characteristics and physical fitness with sprinting performance is (R=91.5%), the independent variable anthropometric characteristics and physical fitness explain sprinting performance by (R^2= 83.8%) this model is explain the data by (adjusted R^2=79.6%) and from the above table 4.8 the ANOVA result shows thatthe independent variables statistically significantly predict the dependent variable, F (7,27) =19.961 this model feet model for the data with significant level (p<0.000) additionally table 4.9 predict that one second increase in the speed the sprinting performance will increase by 3.289 second holding on all the independent variable are fixed) with a relative importance of (T=7.825), one centimetre increase in the standing long jump the sprinting performance will decrease by -1.413 second holding on all the independent variable are constantwith a relative importance of (T=-2.660). And alsoone unit increase in the 1RM test the sprinting performance will decrease by -0.421 second's holding on all the independent variable are constantwith a relative importance of (T=-2.220).

According to the above interpretation, the predictor variable speed have positive significant effect on sprinting performance and another predictor variable 1RM and standing long jump has negative significant effect on sprinting performance. Based on the result shown in Table 4.9 the regression equation is described as follows:

*Y=18.331+ (speed*3.289) - (standing L.* 1.413) – (1RM*0.421)*

CHAPTER FIVE

DISCUSSION AND IMPLICATION

The goal of the present study was to examine the relationship among anthropometric characteristics, physical fitness quality and sprinting performance in the case of Ethiopian youth sport academy both campuses. The present study has focused on the correlation of anthropometric characteristics with physical fitness quality, anthropometric characteristics with sprinting performance, physical fitness quality with sprinting performance and the correlation among anthropometric characteristics, physical fitness qualities and sprinting performance.

There are a few researches conducted on the field of athletics as far as the investigator knowledge is concerned , studies conduct on the relationship among anthropometric characteristics, physical fitness qualities and sprinting performance Ethiopia youth sport academy

5.1.The Relationship between Anthropometrics Characteristics and Physical Fitness Qualities

The result obtained from correlations indicated that anthropometric characteristics and physical fitness qualities, in the pursuit of its objectives, had a positive and significant relationship between anthropometric characteristics weight with standing long jump (r=.352*). Had significant negative relationship between height and 1RM test (r=-.294*), leg length and 1RM (r=-.308*) and body fat percentage and standing long jump (r=-.367*) respectively.

Has no relationship between all anthropometric characteristics and speed, weight and 1RM ,body fat percentage and 1RM test, height and standing long jump also has no relationship between leg length and standing long jump.

The finding suggests that the athlete's anthropometric characteristics although it can positively and negatively influence physical fitness qualities, have much higher impacts on physical fitness qualities. In addition the researcher observed that all anthropometric characteristic has no any impacts on speed. The data found in the present study is compatible with the research findings of (Article, 2022; Kebede et al., n.d.; Kutlay, 2020; Soodan, 2016) and in compatible with the study of (Lloyd et al., 2015; Robert M. Malina & DOI:, 2007; Stuelcken et al., 2007) ,

The result of the finding partially supported by (Kebede et al., n.d.)Conducted on Selected Anthropometric and Physical Fitness Variables Relationship with Performance of Sprinters, Middle and Long Distance Runners of Ethiopian Athletics Training Centers on this study he found that With the exception of a modest association in the 10–20 m sprint, there were no significant relationships between sprint and anthropometrics. (Soodan, 2016) discovered that Standing broad jump (SBJ) has demonstrated significant correlation with all anthropometric parameters at 5% and 1 % level. The correlations between physical fitness variable and skinfold thickness were considerably stronger in male athletes (Kutlay, 2020). The correlations from the study show that the percentage of body fat is typically negatively connected to the standing long jump in adults, and this conclusion is also supported by (Article, 2022).

The study's findings, which were also somewhat disputed by Ram and Kumar (2015), revealed a positive correlation between athletes' performance and anthropometric measurements and fitness levels. The results of a study by Soodan (2016) on the relationship between anthropometric variables and physical fitness of male cross-country athletes revealed that the 30 meter dash has a highly significant correlation with all anthropometric parameters at 5% and 1%, with the exception of sitting height, upper arm girth, waist girth, and hand span. The

negative anthropometric variables may negatively impact the speed and coordination test, according to (Levels et al., 2017). Additionally, he found that standing long jump values and weight had a significant link with fat body mass.

The majority of researchers discovered a strong correlation between an athlete's anthropometric traits and physical fitness, and most studies discovered a positive relationship between the variables of physical fitness and anthropometry. The timing of the testing in this study may account for the discrepancy in findings. According to our knowledge, this study is the first to examine the relationships between anthropometric traits and levels of physical fitness.

Finally, the findings of this study and other studies indicate that an athlete's anthropometric characteristics have a significant impact on their level of physical fitness and highlight the significant role that anthropometric traits play in the growth of an athlete's physical fitness. The null hypothesis (H_{01}) is rejected with a significant level of p0.05, that (H_1) there might be significant relationship between anthropometric characteristics and physical fitness qualities is accepted depending on the findings.

IMPLICATION: Depending on the result of this study, anthropometric variables of athletes have significant effects on the performance of athletes.In order to establish baseline physical activity levels, it is also necessary to comprehend fundamental anthropometric and physical fitness measures (Keogh et al., 2009). Depending on this coaches should be able to conduct the test of anthropometry variables and physical fitness qualities. And the athletes should perform different activities in order to burn fat and develop lean body mass so as to improve power of athletes. According to Malina et al. (2011) Higher fat mass seems to have a negative effect on activities like running, jumping, and vaulting.In addition to the above the result of this study implies that athletes with taller body are low in strength so, coaches should give different strength training to get better performer athletes.

5.2.The Relationship between Anthropometric Characteristics and Sprinting Performance

The results of the correlations showed that there was a positive and significant relationship between body fat percentage and sprinting performance ($r= 0.439^{**}$) in the achievement of its goals. With the exception of body fat percentage, none of the anthropometric factors are related to sprinting performance. The results imply that the athlete's anthropometric characteristics have little to no influence on their sprinting performance, but that the anthropometric variable body fat % has a far greater negative impact on sprinting performance because the athletes who has high body fat percentage also has high sprinting time so when the sprinting time increase the performance is decrease because of this reason has negative relationship between BF% and sprinting performance. The result of finding supported by research findings of (Aikawa et al., 2020; ; Knechtle et al., 2007; Mahendra et al., 2011; Haileyesus G., 2017;Dessalew et al., 2019; Hapuarachchi et al., 2020) and are in compatible with the data found in the current study (Kebede et al., n.d.; Knechtle et al., 2011; Mahendra et al., 2011)

There was no link between race performance and body mass, height, leg length, or limb circumference in the eight male finishers, according to the findings provided by (Knechtle et al., 2007).According to research done by Mahendra et al. (2011) on the association between anthropometric measurements and lean body mass and sprinter performance, there is a strong correlation between certain anthropometric characteristics and relative body fat in men of college age. According to (Vucetic, Matkovic, &Sentija, 2008), The consistently negative correlations between skinfold thicknesses and performance indicate that being overweight has a negative impact on performance. (Dessalew et al., 2019) discovered that a higher body fat percentage had a detrimental impact on male athletes' ability to perform better. Male Japanese college sprinters, distance athletes, jumpers, throwers, and decathletes were studied for the relationship between height, body mass, muscle mass, fat mass, and the percentage of fat with athletic performance (Aikawa et al., 2020). The findings demonstrate In the sprinter group, there was an insignificant association between weight, height, muscle mass, and fat mass, and a significant

negative correlation between the percentage of fat and the IAAF scores of sprinter performance. (Hapuarachchi et al., 2020) The study's findings revealed a positive correlation between sprinters' upper arm and upper leg length and a negligible correlation between sprinters' lower arm and lower leg length. Biceps skinfold, supraspinal skinfold, thigh skinfold, and calf skinfold were also negatively correlated with sprinters' performance. Additionally, a study by Elizbeth (1979) demonstrates a substantial correlation between a few anthropometric factors and relative body fat in men of college age. A study by Ellen (1989) demonstrates a significant correlation between height and weight and the sprinting abilities of college men.

This finding's outcome led to complaints from (Kebede et al., n.d.) He conducted research on the relationship between a few anthropometric and physical fitness factors and the performance of sprinters, middle distance runners, and long distance runners at Ethiopian athletic training centers and he found that the best time for male sprinters is significantly correlated with their BMI (0.51) and leg length (-.43) ($p=0.01$ and $p=0.05$, respectively). The ability to sprint is inversely correlated with extra body weight (Pinero et al., 2010; Onyewadume et al., 2004). (Dessalew et al., 2019) conducted study on the association between anthropometric variables and race performance; the results showed that body weight, height, and BMI demonstrated that being heavier, taller, and larger in size had a detrimental effect on improved performance for men. Body mass, body mass index, limb circumferences, skin-fold thicknesses, and body fat were found to be significantly and favorably correlated with the split time of running (Knechtle et al., 2011). In addition, sprinters in the 200-meter race demonstrated a substantial correlation between performance and height, weight, chest circumference, and upper arm circumference (Mahendra et al., 2011).

The majority of researchers discovered a strong correlation between an athlete's anthropometric characteristics and their sprinting performance. However, most studies also discovered a partially positive and partially negative relationship between the variables of sprinting ability and anthropometry. This study's findings

may have varied because of the stage of the training cycle in which the testing took place. According to our knowledge, this study is the first to examine the relationships between anthropometric characteristics and levels of sprinting performance.

Finally, the findings of this study and other studies indicate that an athlete's anthropometric traits have a significant impact on their sprinting performance and highlight the importance of anthropometric traits in the growth of an athlete's sprinting ability. The null hypothesis (H_{02}) is rejected with a significant level of p0.05, and the alternate hypothesis (H_2) there might be significant relationship between anthropometric characteristics and sprinting performance is accepted depending on the finding results with significant level of $p<0.05$.

IMPLICATION: Based on the result of this study,body fat percentage has negative effect on sprinting performance so;coaches should give appropriate training to decrease the percentage of fat in athletes' body.

Additionally depending on the finding other variable except BF% all anthropometric characteristics have no significant effect on athletes performance but coaches should conduct continues anthropometric measurement testto identify talents of athletes.

Coaches were select athletes only by looking their body structure without analyzing the anthropometric parameters of sprinters. Even though athletes were trained to develop the performance of athletes by developing various factors like acquired skill level and physical fitness rather than considering the anthropometric parameters.

The results of this study revealed that anthropometric parameters can be considered as criteria for selection and talent identification of young athletes. Not only that but also results confirmed that how some of the anthropometric parameters influence the performance of sprinter. Using anthropometric parameters, coaches could be able to select athletes effectively to specific events

and help athletes to develop and achieve highest level in the sport area with less effort.

It is supported byMahendra et al. (2011) that utilizing anthropometric characteristics, one might efficiently pick athletes for particular sports and train them to achieve the maximum level in the sporting arena with the least amount of work.

5.3.The Relationship between Physical Fitness Qualities and Sprinting Performance

The results reveal that has strong correlation between an athlete's physical fitness qualities and their sprinting performance, the physical fitness qualities such as strength (1RM) and power (standing long jump) have a far greater positive impact on sprinting performance. The correlation result shows has significant positive correlation between speed and sprinting performance (r=0.791), has significant negative correlation between 1RM and sprinting time (r= -0.475), if 1RM test negatively affect sprinting time this leads high sprinting performance so has positive correlation between 1rm and sprinting performance.

And also has significant negative correlation between standing long jump and sprinting time,if standing long jump test negatively affect sprinting time this leads high sprinting performance so has positive correlation between standing long jump and sprinting performance.

The result implies that when the speed increase the sprinting time and sprinting performance also increase, when the 1RM and standing long jump increase sprinting times is decrease and also sprinting performance increase this implies the high 1RM and standing long jump leads low sprinting time this means the athlete who has low sprinting time has high level of performance so all physical fitness traits have substantially greater effects on sprinting ability.This finding is in agreement by (Cavinato & Abad, n.d.; Degati & Kumar, 2017; Misjuk & Viru, 2016;Barian Mc et al.,1995)) and this finding dis agreed by (Cavinato & Abad, n.d.; Misjuk & Viru, 2016; Reserved et al., 2008)

The findings of this study, Degati& Kumar, (2017) conducted study on The Relationship between Selected Physical Fitness Variables and the Performance of Ethiopian Junior Sprinters and Middle Distance Athletes Across Genders, the study's findings indicate that while speed and 100 m best performance were positively correlated (r=.609, p.01), broad jump and 100 m performance of female sprinters were negatively correlated (r=-.394, p.05). Significant relationships exist between the chosen physical fitness characteristics and the sprinter who achieved the highest performance in the 100-meter test (speed 40m, sit and reach and broad jump). According to some studies (Peterson, Alvar, and Rhea, 2006; Almuzaini, and Fleck, 2008; Kale et al., 2009), there is a significant correlation between standing long jump ability and sprinting acceleration and velocity. This finding demonstrates a connection between strength traits and sprinting performance (BarianMc et al.,1995). Furthermore, this finding was backed up by further researchers (Cavinato& Abad, n.d.) Large associations were found between speed tests and competitive 100-m times ($r = 0.54$, $r = 0.61$ and $r = 0.66$ for 10-, 30- and 50-m, respectively, $P < 0.05$). The jump tests were very largely associated with 100-m dash performance ($r = -0.82$ and $r = -0.81$ for standing long jump, and horizontal jump, respectively, $P < 162\ 0.01$). (Misjuk&Viru, 2016) None of the jump tests substantially connected with the running time during the 30 m sprint from the flying start.

In contrast, the results of the study by Misjuk and Viru (2016), which found a significant negative correlation between the results of the countermovement jump and the sprinting time, and no significant correlation between the standing long jump result and the running time, are in disagreement with this finding. No correlation between sprinting metrics and standing wide jump was identified, according to (Reserved et al., 2008), and the distinct muscles involved in the two activities as well as the type of contraction must be investigated to provide an explanation for this finding. According to the findings of his study (De Lorenzo et al., 2013), there is a considerable positive correlation between the parameters of a 40-yard sprint and broad-jump performance.

The alternate hypothesis (H3) that there might be a significant relationship between physical fitness qualities and sprinting performance is accepted and the null hypothesis (H_{03}) is also rejected with a significant level p0.05 based on the study's findings that physical fitness qualities have a significant partially negative and positive relationship with sprinting performance.

IMPLICATION: the above finding implies all physical fitness components are essential for sprinter so, coaches should give continuous and appropriate training to develop fitness level of athletes. There is moderate association between strength and sprinting performance so, in order to develop this association coaches should give different strength training that helps to develop lower body. According to (Abad et al., 2014), athletes need to enhance their strength and power in order to run at faster speeds for shorter distances.The capacity to run faster at maximum speed will enhance performance in the 200- and 400-meter sprints as well as the long- and triple jumps (Hanon and Gajer, 2009).

5.4.The Relationship among Anthropometric Characteristics, Physical Fitness Qualities and Sprinting Performance

In this study regression prediction analysis between the results of anthropometric characteristics, physical fitness qualities and sprinting performance was performed for Ethiopian youth sport academy short distance athletes. A significant regression equation was found with an R^2 (Adj.) of 0.796 (79.6%) variables were measured in unstandardized beta value.

If one unit increase in speed then sprinting performance of athletes increases by 3.289 each second on all independent variable are constant, if 1RM and standing long jump increased by on unit the sprinting time of athlete decrease -0.421 and-1.413units each second. This implies all variables are positively affected sprinting performance because when the 1RM getting low sprinting time is increased by 0.421 unit because of this the sprinting performance is low so when the 1RM

value is low the sprinting performance also low depending on this reason there is positive effect on the performance of sprinter the same to that of 1RM reason standing long jump also positively affected the sprinting performance and there is positive relation between standing long jump and 1RM with sprinting performance.

Multiple linear regressions were calculated to predict the sprinting performance of the athlete's based on the independent variables. As a result speed, 1RM and standing long jump was found to predict sprinting performance of Ethiopian youth sport academy male short distance athletes.

Finally, depending on the result and the ANOVA table the null hypothesis (H_{04} & H_{05}) is rejected and the alternate hypothesis (H_4)There might be significant association between anthropometric characteristics, physical fitness qualities and sprint performance in young male sprinters and (H_5) Anthropometric and fitness characteristics of athletes are significant predictive variables to sprinting performance are accepted with the significant level of $p<0.05$.

IMPLICATION: based on the study's findings, athletes with good speed, power and strength performance respectively strong sprinting abilities will outperform other competitors. As a result, several writers have recommended improving athletes' sprinting performance through physical fitness. This inference is validated by research Jump power is the best predictor of sprinting ability, according to Kale et al. A 100-m race's top speed is closely related to the overall race time (Slawinski et al., 2017. During a 100-meter race, sprinting at maximum speed is crucial. Furthermore, the capacity to run faster at maximum speed will enhance performance in the 200- and 400-meter sprints as well as the long- and triple jumps (Koyama et al., 2011). As a result, studying the factors that influence sprinting at maximum speed is useful for raising performance in a variety of events in addition to the 100-meter race (Panoutsakopoulos et al., 2016).

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMANDATION

6.1.Summary

The primary purpose of this study was to determine the relationship among anthropometric characteristics, physical fitness and sprinting performance the case of Ethiopian youth sport academy both campuses. For this purpose, the researcher reviewed the available literatures in order to decide the focus of the study. In order to attain the general objective of the study, the following specific research objectives were formulated.

- To identify the relationship between anthropometric characteristics and physical fitness qualities among young male sprinter.
- Determine the relationship between anthropometric characteristics and sprinting performance of young male sprinters.
- To recognize the relationship of sprinting performance and physical fitness qualities in youth male sprinters.
- To identify the relationship between anthropometric characteristics, physical fitness qualities and sprint performance in young male sprinters.
- To identify among anthropometric and fitness characteristics of athletes those might significantly predict sprinting performance

In order to address the above fundamental goals, this study focused on male short-distance athletes from Ethiopia Sport Academy's two campuses, which have a combined population of 35. Of these, 23 male athletes are from the Asela campus and 12 male athletes are from the Adiss Ababa campus, and both compete in the

100m, 200m, and 400m events. Only a few anthropometric measurements (height, weight, BMI, leg length, and body fat percentage), physical fitness traits (speed, strength, and power), and sprinting performance were examined in this study (200m sprint test).

Physical fitness tests (30m speed test, 1RM test, standing long jump), anthropometric variable measurements (meter, scale, and body skin fold calliper), and a sprinting performance test (200m sprint) were used to collect the data. The results were provided as mean S.D. The correlation between the parameters and the male athletes' finishing times was examined using the Pearson product moment test. In addition, a stepwise multiple linear regression analysis was used to isolate performance predictor variables from the pool of variables that had already been linked together based on male athletes' correlation results. All statistical tests had a threshold of significance of p 0.05 when the data were analyzed using SPSS version 23.0. The study's final findings revealed a strong association between anthropometric traits and levels of physical fitness, anthropometric traits and sprinting ability, levels of physical fitness and sprinting ability, and a significant relationship between the three variables. While there were little correlation between various anthropometric and physical fitness variables. In general, we can draw the conclusion that anthropometric traits, physical fitness, and sprinting ability are significantly correlated with male short-distance athletes.

The data was examined using Pearson correlation. Therefore, the investigation focused on the following key findings.

1. All anthropometric variables (height, weight, leg length and BF%) has insignificant relationship between speed, has insignificant relationship between height and standing long jump, leg length and standing long jump, and weight and 1RM, BF% and 1RM respectively, and also has negative correlationbetween BF% and standing long jump ($r= -.367^{*}$)
2. There were no correlation between the height and sprinting performance, weight and sprinting performance and leg length and the 200-meter

sprintrespectively. However, there is significant relationship between BF% and sprinting performance.

3. There was a significant negative correlation between standing long jump and 200 M sprint time (r=-.601**) due to this has positive correlation between standing long jump and sprinting performance,has significant negative correlation between 1RM and 200 M sprint time (r=-.475**) due to this has positive correlation between standing long jump and sprinting performance. And has significant positive relationship between speed and sprinting performance.
4. Ifspeed increase in one unit sprinting performance of athletes increases by 3.289 each second, if 1RM and standing long jump increase in one unit sprinting time decrease -0.421 unit and -1.413 meter each second but the sprinting increased by 0.421 unit and1.413 meter each second.

6.2.Conclusion

1. The correlation between anthropometry and physical fitness qualities shows has moderate significant positive relationship between weight and standing long jump, has weak significant negative relationship between height and 1RM and also has moderate significant relation between leg length and 1RM also BF% and 1RM.
2. Has moderate significant negative correlation between body fat percentages and sprinting performance so, have negative correlationbetween anthropometric characteristics and physical fitness qualities.
3. There was strong significant positive correlation between speed and sprinting performance, standing long jump and sprinting performance also has moderate significant positive correlation between1RM and spriting performance. So, physical fitness qualities and sprinting performance has significant positive correlation
4. The most predictor of sprinting performancewasspeed, 1RM and standing long jump.

6.3.Limitation of the Study

In the present study the following points were the limitation of the study Firstly, the lack of prior experience by the researcher would have an impact on the study's methodology. Secondly, there haven't been enough studies done on the association between anthropometric characteristics, physical fitness qualities and sprinting performance in male short distance runners. Thirdly, the influence of the assessed statistical results would be impacted by the small sample sizes in both campuses. Fourthly, the scope of this study is limited. Finally, the data collection period coincided with a competition, which made the sample size too small.

6.4.Direction for future investigations

1. Since the scope of the present study is potentially limited to the anthropometric variables and physical fitness qualities which explain the running economy of performance, a complete view of runners' performance has to be considered by taking other relevant factors such as Physiological (Vo2 max, lactate threshold concentration), training volume (duration) and intensity, injury, 16 topography, psychological factors into consideration which may complement the physical parameters.
2. It is recommended that athletes of various ages and levels of experience be used to examine the overall impact of anthropometric traits and levels of physical fitness on performance.
3. To determine the distinct anthropometric profile and level of physical fitness of the senior/elite Ethiopian runners, a comparison study between Ethiopian elite and non-elite athletes is advised, as well as between Ethiopian elite and non-Ethiopian elite athletes.
4. This study only includes male athletes; however it is advised to compare the anthropometric characteristics and levels of physical fitness of national-level Ethiopian male and female athletes.
5. Since there were only a few short distance runners from the Ethiopian youth sport academy included in the current study, it is advised to use a larger sample size and research area to obtain better results.

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APPENDIX 1

BAHIRDAR UNIVERSITY

SPORT ACADEMY

POST GRADUATE PROGRAM IN ATHLETICS COACHING

ANTHROPOMETRIC PARAMETER TEST SHEET

Name: _____ Age: _____ Sex: ____

Academy: _____

Specialization (running discipline): _____

Training age: _____

Testing time: _____

Body weight: _____, _____, _____

Height: _____, _____, _____

Length of Lower limb:

- Total leg length _____, _____, _____

Skinfold thickness:

- Chest _____, _____, _____

- Midaxillary _____, _____, _____
- Triceps _____,_____,_____
- Subscapular _____, _____, _____
- Abdomen _____, _____, _____
- Suprailiac _____, _____, _____
- Thigh _____,_____,_____

%BF: _____, _____, _____

%SM: _____, _____, _____

APPENDIX 2

BAHIRDAR UNIVERSITY

SPORT ACADEMY

POST GRADUATE PROGRAM IN ATHLETICS COACHING

PHYSICAL FITNESS TEST SHEET

Name: _____ Age: _____ Sex: ____

Academy: _____

Specialization (running discipline): _____

Training age: _____

Testing time: _____

Speed test:

- 60-m speed test:_____, _____, _____

Power test:

- Standing long jump test:_____, _____, _____

Strength test:

- 1-RM squat test: _____, _____, _____

APPENDIX 3

BAHIRDAR UNIVERSITY

SPORT ACADEMY

POST GRADUATE PROGRAM IN ATHLETICS COACHING

SPRINTING PERFORMANCE TEST SHEET

Race: 200m race

Academy: _____

ID	NAME OF ATHLETES	TIME
1		
2		
3		
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Appendix 4

Photos during data collection