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Effects of Twelve Weeks Circuit Training Program on Speed and Agility of Male þÿ S t u d e n t S I n T h e C a s e o f D a m Preparatory School

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EFFECTS OF TWELVE WEEKS CIRCUIT TRAINING PROGRAM ON SPEED AND AGILITY OF MALE STUDENT'S IN THE CASE OF DAMOT PREPARATORY SCHOOL

BY

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Bahir Dar, Ethiopia

EFFECTS OF TWELVE WEEKS CIRCUIT TRAINING PROGRAM ON SPEED AND AGILITY OF MALE STUDENT'S IN THE CASE OF DAMOT PREPARATORY SCHOOL

A Thesis Submitted To Department Of Sport Science Post Graduate Program In Partial Fulfillment Of The Requirements for the Degree of Master Of Education In Teaching Physical Education

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This is to certify that the thesis prepared by Zemenu Ademe titled*:* effects of twelve weeks circuit training program on speed and agility of secondary school students and submitted in partial fulfillment of the requirements for the degree masters of education (teaching physical education) complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

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ETHIOPIA

BIOGRAPHICAL SKETCH

The researcher was born at a place called Merawi Worda in West Gojjam Zone Amhara region state in Aug, 1972 E.C. He learnt his elementary School from grade 1-8 in Merawi elementary school and he learnt 9-12 Merawi secondary schools. He joined his higher education institution in Bar Dar University for his higher education in Sport Science program in the year of 1998 E.C and graduate in 2002 E.C. In July 2010 E.C, he joined Bahir Dar University to pursue his Med program in teaching Physical education. The researcher has 16 years of teaching experiences.

ACRONYMS AND ABBREVIATION

ACSM: American College of Sport Medicine

CG: Control Group

CRE: Center for Diseases Control and Privation

CVE: Cardiovascular endurance

EG: Experimental Group

HPE: Health and Physical Education

MD: Mean Difference

ME: muscular endurance

MHR: Maximum Heart Rate

NASPE: National Association for Sport and Physical Education

POT: Post Test

PT: Pre Test

RHR: Resting Heart Rate

SD: Standard Difference

UDHHS: United state Department of Health and Human Services

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Zemenu Ademe

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ETHIOPIA

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ABSTRACT

The present study attempted to *investigate the effect of circuit training on agility and speed variables. The design of this research was quasi experimental method. Thirty five male students of Damot secondary school aged 16-17 years had divided randomly into 2 equal groups. Both the exercise group (n = 18) and control group (n = 17) participated in the typical 1 classes of 40-minute Physical education per week in schools, but only participated in additional 2 sessions per week of 60 minutes per session of exercise training, which comprised as 60 meter run, and agility illusion test. Both groups had taken pretest and post-testing and only thirty five the subjects participated in speed and agility tests: agility was measured using agility illusion test and speed was by 60 meter speed test. The collected data was analyzed using statistical method Analysis of independent sample t-test with level of significant 0.05. The results showed circuit training significantly improved speed and agility in at p>0.05. Therefore this research confirmed as twelve week circuit training could improve the agility and speed of high school students. Hence the allocated physical education period in Ethiopian education system is very low and high school students should get additional times to improve their fitness and health.*

Key words:- *circuit training, physical education, agility and speed.*

CHAPTER ONE:
INTRODUCTION

1.1 Background of the Study

According to (Scholich, 1990) Circuit training is simply defined as a series of physically, resistance based and aerobic activities, separated by short defined time period to complete each station. Circuit training is a method of fitness training that is designed to develop general, all round physical and cardiovascular fitness. It is based on sound anatomical, kinesiological and physiological principles designed to increase strength, power, flexibility, quickness and cardiovascular endurance. Circuit training provides a strenuous workout entirely suited to an individual's specific needs, existing capacity and rate of adjustment to progressive vigorous exercises.

Pangrazi & Darst, (2002) suggested that Physical education has long and established tradition in schools being linked to with an Aristotelian concept of harmonious development of both body and mind. In other word, it is an important component of the overall school program and integral part of the educational program that contributes, primarily through physical activity experiences, to the total growth and development of all students. As noted Brubaker (2011) it provides students with many opportunities to improve their overall lifestyle; first and foremost, it provides students the opportunity to improve their physical fitness, development and health.

Schools have the potential to improve the health of students by providing instruction in physical education that promotes enjoyable lifelong physical activity. Unfortunately, many schools have reduced physical education opportunities in order to dedicate more class time to meet these academic standards (Lavall, 1984). Similarly, Ethiopian Ministry of Education has been developing physical education curriculum in secondary schools with a one day class schedule in a week 40 minutes long. It is limited class compared with

other academic subjects to ensure and develop students optimal physical fitness; to achieve their personal goals for various work related, sport, and leisure activities (Virginia department of education, 2006) Despite, the main aim of Ethiopian education system provision for quality education for all is to strive productivity, social and individual problem solving capacity (Ministry of Education, 1994).

The reality in Damot secondary school shows low time allotment of physical education than other subjects. Because of these students showed limitations on their physical fitness status when the researcher evaluates in his physical education practical classes particularly in grade eleven students. The researcher thought that if the number of periods given in one week is increased with contents of calisthenics circuit training, it would have influence on speed and agility qualities otherwise the situation made students to have poor speed and agility. Due to this, the aim of the study is to explore the effect of circuit training on speed and agility in secondary school students.

Many research studies show the effect of different exercises for the development of physical fitness but now a day's few studies were done specifically on the area of circuit training program on selected physical fitness variables. Circuit training program are one of important physical activities which are at center of attention in recent years (Yildirim, 2012). Today, most students aware of circuit training program can positively affect physical fitness. Unfortunately, they do not engage in circuit training and their physical fitness quality, especially health related fitness quality, which they are expected to achieve, is poor.

Providing physical education course is very common in many universities, colleges, high schools and vocational schools and improves students' health and promotes enjoyable lifelong physical activity. In line with this Brubaker (2011) physical education provides students with many opportunities to

improve their overall life style; first and foremost, it provides students the opportunity to improve their physical fitness, development and health. On the other hand, as far as the researcher is concerned, many local studies were conducted in relation to effect of different exercises for the development of physical fitness in Ethiopian context. Fisha (2008) conducted a study about the effect of training with and without ball on speed improvement of football in the case of Ginager town secondary school students at grade nine level.

However, the study didn't try to examine the effect of circuit training on physical fitness particularly on speed and agility at grade eleven. As a result of this, it is difficult to know whether circuit training improves preparatory school students' speed and agility. This study, therefore, focused on examining effect of twelve weeks circuit training on speed and agility at grade eleven in light of (1) To explore the effect of twelve weeks circuit training on students' Agility and (2) To find out the effect of twelve weeks circuit training on students' speed. Based on the above issues, the researcher is highly inspired to conduct a study on effects of twelve weeks circuit training on students speed and agility at grade eleven.

1.2 STATEMENT OF THE PROBLEM

Circuit training program can have miraculous health benefits on cardio respiratory endurance, flexibility, agility and speed improvement. It is expected that after this scheduled circuit training program the students will recognize the importance of circuit training and choose to participate regularly in physical activities designed to maintain and enhance healthy lifestyles (Connecticut State Department of Education, 2009) and students want to be fit and active, but the opportunities offered in secondary schools has been decreased in providing physical fitness lessons (Pangrazi & Darst, 2002). In addition to this the time allocated to physical education in the majority of

schools has declined with a consequent increase in time allocation for other academic subjects (Hillman *et al.*, 2008). As such, in Ethiopian secondary school physical education curriculum developed one credit hour per week (40 minutes) for classroom as well as practical sessions. This is too little to improve the physical fitness components required to meet in the grade level with regard to set norms and standards of physical fitness at different age and sex levels.

According to a study conducted by UCAM research center for high performance sport in Spain, participation in circuit training will yield significant health benefits, while the world health organization (2009) suggests that one should take at least 10,000 walking step counts per day for health promotion. According to U.S. Department of Health and Human Services, children and teens should be physically active for at least 60 minutes on most, if not all days of the week. But, the reverse is true where the researcher employed and working in Damot secondary school observed poor status of physical activity and physical fitness qualities when measuring during their physical education classes. Even though male students particularly show high motivation to participate in physical education classes the time allocated in Damot secondary school had few credits than any other subjects that might limit them further progression and intensity of exercise. This trend might made students developing poor fitness levels against expected norms in each grade level.

Many research studies show the effect of different exercises for the development of physical fitness but now a day's few studies were done specifically on the area of circuit training program on selected physical fitness variables. Circuit training program are one of important physical activities which are at center of attention in recent years (Yildirim, 2012). Today, most students aware of circuit training program can positively affect physical fitness. Unfortunately, they do not engage in circuit training and their physical fitness quality, especially health related fitness quality, which they are expected to achieve, is poor.

Many research studies circuit training are important for the development of all physical fitness qualities but no research was done in Finoteselam city administration especially in secondary school students on their physical fitness problems. However, the improvement and development of physical fitness quality of students is the responsibility of every physical education teachers in the school. In addition to this, it is our obligation to create conducive environment for students to participate in calisthenics circuit training so as to improve their physical fitness quality. Due to this the researcher wants to investigate the effect of twelve weeks circuit training program on students' agility and speed. Among the endless number of possible tests and measurements the fitness test fall 12 minute run test, sit and reach test, and 60m speed test.

1.3 Objectives of the Study

1.3.1 General Objective

The general objective of this study is to investigate the effect of twelve weeks circuit training program on speed and agility training program on male students in the case of damot preparatory school students.

1.3.2. Specific objective

This quasi experimental study is to address the following specific objectives:

1. To explore the effect of twelve weeks circuit training on students' Agility.
2. To find out the effect of twelve weeks circuit training on students' speed.

1.4 Hypotheses

The basic constructs of the study is twelve weeks circuit training program and speed and agility students. To see the relationship among this constructs, effects of twelve weeks circuit training program on students' speed and agility is studied. In line with this, the following null hypotheses are posed.

1.4.1. (null hypothesis): There is no significant difference between control and experimental group on speed within twelve weeks circuit training

1.4.2. (null hypothesis): There is no significant effect difference between control and experimental group on agility within twelve weeks circuit training

1.5 Delimitation of the Study

In research, delimitations address how the study is narrowed in scope (Creswell, 1998). The study is designed to investigate the effects of twelve weeks circuit training in Damot preparatory school students. This study is delimited in the following areas.

- Subjects are selected at Damot preparatory school students. And healthy, untrained that has not any physical disabilities or medical conditions and volunteers participated in this study.
- Selected skill related physical fitness variables are speed measured using 60 meters, agility measured using the time of training is limited to two days per week and 60 minutes per sessions.

1.6 Significance of the Study

The Significance of any research is the increase in knowledge; the study which carried out by one researcher may be further studied and would be studied by others many times which is the increase in knowledge upon a specific issue. The main objective of this study is to investigate effects of circuit training

program to improve secondary school students' speed and agility. Generally, this study will have the following significances.

- It motivates and encourages students to engage in circuit training to boost their speed and agility.
- It may provide meaningful information for students who involves on circuit training program for the improvement of speed and agility.
- May help physical education teachers to know further about the effect of circuit training and the methods of evaluating students' speed and agility and Provide to assess and compare the performance of their students on schools.
- May help experts to depend on context of our student's speed and agility status to develop norms and appreciate more circuit training to be found in school physical education lessons and programs. This also provides an opportunity to review and improve physical education programs.
- It will serve as an important resource for those who want to pursue similar studies.

Generally, the researcher believes students, physical education teachers, and experts in general will be beneficiaries from this study.

1.7. Limitations of the Study

There were various uncontrolled factors that may have influenced the outcomes of this study. One limitation was that it would be realistic to expect and achieve significant improvement on students' performance in speed and agility with in a time of twelve weeks. Hence, the researcher strongly believes that the time and financial constraints used for this study was to be the biggest limitation for the study.

In addition, the researcher believes that the stated number of the subjects is insufficient to make generalizations. This absent of some students in the group affected their group discussion. Some students were also rarely absent during

experimental teaching. This absent of some students in the group affected their group discussion.

Furthermore, five students were unwilling to participate in the treatment after the lot was drawn and they assured to participate in treatment. Therefore, the researcher was enforcing to conduct the study within thirty five students.

1.8. Operational Definitions

Circuit training- is simply defined as a series of physically, resistance-based and aerobic activities, separated by short defined time period to complete each station. (Grice2003).

Speed - the ability to cover distance or perform a motor skill as quickly as possible. It is generated by a combination of the skills listed above (e.g., sprints).

Agility- is one component of skill related physical fitness. It refers to person ability to move their body quickly and easily. This also includes the ability to quickly change their direction. (e.g., zigzag ran and hexagonal obstacle.)

1.9 Organization of the Study

This study was organized on the basis of the common scientific procedures. The research consisted of five chapters. Chapter one deals about introduction, consisting of back ground, statement of the study, objectives, hypothesis, significance, delimitations, and limitation of the study & operational definition. Chapter two is all about the reviews of related literature. Chapter three deals about methodology of the study, the research area, research design, population and sampling technique, inclusion and exclusion criteria, source of data, instrument of data collection, and data analysis method. The fourth chapter deals with results & discussions and in chapter five summery, conclusion & recommendation are made and cited.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1. THE DEFINITION OF PHYSICAL FITNESS

Physical fitness has defined by many scholars in different literature. Baltimore *et al.*, (1995), defined physical fitness as, the ability of the body to perform moderate to vigorous levels of physical activity without undue fatigue and capability of maintaining such abilities throughout the life. American College of Sports Medicine has also defined physical fitness as a set of characteristics (i.e. the work capacity of heart and lungs, the strength and endurance of muscles and the flexibility of joints) that relate to the ability to perform physical activities (Singh*etal.,*1999). Physical fitness is associated with a person´s ability to work effectively, enjoy leisure time, be healthy, resist hypo kinetic diseases or conditions, and meet emergency situation (Corbin *et al.,* 2006). So, it is the basic requirement of life, which is achieved through participating in regular movement.

Although physical fitness is influenced by genetics and environmental factors, physical exercise is one of the main determinants (Andersen, 2003). Physical educators classify physical fitness as skill related (related to sport performance) and health related fitness (associated with disease prevention and health promotion) which includes components such as cardio-respiratory endurance, muscular strength and muscular endurance, body composition, agility, speed, power and flexibility (Hawley, 2001).

2.2. Definition of Speed

According to John (1996) speed is basically how fast you can move partial your body or the whole 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 activates that require sudden changes in place. Speed is the displacement per unit time and is typically quantified as the time taken to cover a fixed distance (Baechle& Earle 2008). Dick (2007) and Bompa &Haft (2009) also defined speed in training theory as the capacity of moving a part of body or the whole body to cover distance with the greatest possible velocity.

In context of competition, Bompa & Claro, (2009) defined speed as the capacity to move quickly as fast as possible in the field according to the game conditions and placement of the opposing players, and described that the term of speed includes three element components: reaction time, stride frequency per second and the speed to cover a given distance. Thus the ability to be quick and react is important elements of speed that are needed for every player in the game. On the other hand Steinhöfer (2003) defined speed, as a conditional coordinate that determined performance requirement to respond stimulations or signals in the shortest possible time, and cyclic or acyclic movements at low resistance that performed at the highest possible speed.

In context of athletics Clark et al., (2010) defined speed as the "rate of performance" of an activity, which can refer to any movement or action and especially for sprinter. Acyclic and cyclic could be described as forms of speed, which are characteristic of a large number of field team sports such as soccer and rugby union, but this description isn't enough as a clear definition of both speed forms.

2.2.1 Structure of Speed

Speed of movement is important to sports performance and in many sports such as soccer and rugby union, is the basis for player selection and successes in competitions. Thus, sports performance may depend more on the players to accelerate quickly and change their direction in game situations than to maintain speed over a longer distance. While sprint speed in a straight line (linear sprint) and agility (non linear) or change of direction sprint are related, they are clearly different skills and every each of them depends on many factors.

According to Little& Williams, (2005) the high speed actions during competition, they stated that high speed action can be categorized into actions requiring acceleration, maximal speed, or agility. Acceleration is the rate of change in velocity that allows a player to reach maximum velocity in a minimum amount of time. Maximum speed is the maximal velocity at which a player can sprint. Agility is often recognized as the ability to change direction and start and stop quickly. Therefore, acceleration, deceleration and change of direction movements are important specific qualities in field games. Due to the variable nature of match play and high speed movements activities, may be initiated from a variety of starting positions. Multidirectional acceleration from both standing and moving starts must therefore be provided for in sport specific agility and speed training design. In this view, speed and agility in field team sports such as soccer and rugby union occurs in response to game situations (Young et al., 2001). From this view point, practice related strategies that are specific to the sport have application in speed and agility training. Little & Williams, (2005); Schnabel, et al., (2003); Young, et al., (2001) stated that the speed movements categories as running in linear and non-linear sprint. The understanding of multidirectional speed and agility movements are important and useful in field team sports in current study.

2.2.2 Speed Training

While strength and power training alone can increase an athlete's speed, combining it with sprint training is more effective. Basic sprints help to improve reaction time, acceleration, top speed and deceleration. Keeping the exercise intervals short (i.e. <20seconds) or the work to rest ratio relatively high (i.e. 1:5), prevents blood lactate from accumulating. Sprints had repeated at near maximal velocity, which is necessary to induce the right neuromuscular adaptations. A basic speed-training program cans be adapted by running uphill and downhill. Incline running helps to improve power during hip flexion and extension. Downhill running is effective at improving co-ordination and stride frequency. Practicing and accelerating faster helps to condition the neuromuscular system to improve the firing patterns of fast twitch muscle fibers. Two variations of basic speed training are assisted and resisted speed training. Assisted training (also called over speed training helps to improve stride frequency. Resisted speed training helps to improve speed-strength and stride length (https://www.google.com.et/search?q=SpeedTraining.

2.2.3. Speed improvement

Speed is highly genetically inherent motor ability of as quickly as possible passing from one place to another. Even with well-designed training that takes into account the individual abilities of players, it is very small chance of developing this capability in its original "pure" form. However, the development of speed can be done indirectly, by improving the technique of movement and by working on developing the necessary muscle groups. The elements that influence the development of speed we can include(according to Virgo, 2007): length, frequency and rhythm of steps, hand speed, ply metric jumps, dynamic flexibility, a sense of relaxation, mental focus, heart stability, posture, a series of downhill training, development of appropriate muscle groups (lower limbs, abdomen, chest, back). Straight rapid movement is not the only moving in

soccer and developing just this form of movement would not be enough to prepare players for the match.

Improving speed training requires a variety of methods including sprint drills, sprinting against resistance, weight training, ply metrics, and, most important, well-planned and-executed short-interval sprint training (Faction A.. 1993).

Regardless of the methods employed, it has been suggested that poor technique and lack of flexibility are major reasons for the lack of speed; many team-sport players have suitable maximal and reactive strength, (Faction A. 1993 Young W, McLean B, ArdagnaJ.1995), but are unable to show any substantial improvements in speed with training. For the development of the basic speed training the following methods can be used (according to Drabik, 1996):-

- Interval method, characterized by repeated practice, and between each exercise, the rest is taking place.
- The method of repetitive work, characterized by the duration of rest between exercises which are determined by individual evaluation of players about readiness for the next exercise.
- The method of changing work is consisted of more basic ways- various acceleration, in which during each exercise, intensity of work is gradually increases from section to section. providing maximum speed at the final section, running with a flying start, in which after the arbitrary phase of acceleration, the determined length of the section is running,
- running down the slope (slope increases running speed above the maximum),
- rapid response to audio and visual sign (player performs the given movement immediately after the sign - with the shortest latent reaction time),
- Relay form of speed running (more players makes the team, relay is transmitted by the direction of the columns or in a circle) and handicap-running (slower player receives a certain advantage at the start).

2.3. Concepts of Agility

Nowadays, there is no consensus among the sports science community for a clear definition of agility. Agility has classically defined as simply the ability to change direction rapidly (Bloomfield, Auckland, & Elliot, 1994; Clarke, 1959; Mathews, 1973), but also the ability to change direction rapidly and accurately (Barrow & McGee, 1971; Johnson & Nelson, 1969). In recent publications, some authors have defined agility to include whole-body change of direction as well as rapid movement and direction change of limbs (Baechle, 1994; Draper & Lancaster, 1985). Even more confusing has been the introduction of the term "quickness" (Baker, 1999a; Moreno, 1995), which is seemingly used interchangeably for both agility and change of direction speed. Quickness has been identified as "a multi-planar or multidirectional skill that combines acceleration, explosiveness, and reactivates" (Moreno, 1995).Agility refers to the ability to change direction quickly without losing balance. It is an important attribute of good soccer players, both when dribbling a ball past an opponent and countering the movements of an opponent in possession of the ball. On comparing elite 15–16-year old players with age-matched sub-elite soccer players, Reilly et al.(2000) found that performance in an agility run test was the best distinguishing feature of the elite individuals. Agility is a function of the nervous system, incorporating prospection and co-ordination of muscle activity in both lower limbs and in upper body for control of balance. There has not been a comprehensive research investigation of agility training due to the difficulty of identifying the mechanisms of adaptation.

Nevertheless, it is clear that top soccer players perform well on tests of agility and that this function is amenable to training.

Agility had combined with fast-feet drills in movements specific to soccer. A series of cones may have placed over 10–12 m with players first maneuvering their way through with strides shorter but faster than normal. The movements

then performed backwards, sideways to the right and sideways to the left. Players can do the sequences in pairs to provide an element of competition between them. The trainer can design a whole variety of such drills. Pearson (2001) described a range of drills that has used for agility training using various items of portable equipment. These items included roped ladders for 'fast-feet' work, cones and poles for marking turning points in a run and belts or harnesses for assistance or resistance work. Exercises for agility had best incorporated early in the training session when players are still relatively fresh.

This definition suggests that quickness consists of cognitive and physical reactive abilities and explosive acceleration. If this is an identifiable physical quality, then one might infer that quickness is a component of agility, as the proposed definition (Moreno, 1995) for quickness does not include deceleration or changing direction. However, the available literature includes skills and tests that involve changing direction and deems these quickness drills and tests (Baker, 1999a; Moreno, 1995).

In addition, the term "cutting" has been used with reference to a directional change during a sprint movement (Bernier, 2003; Bezier, Lloyd, Auckland, & Cochrane, 2001a;Bezier, Lloyd, Cochrane, &Auckland, 2001b).Unlike the term quickness, cutting seemingly refers only to the specific portion of a directional change where the athlete's foot contacts the ground to initiate the change of direction. In 1976, Chelladurai proposed a thorough definition of agility, noting that although there was agreement on the importance of agility in many sports, there were many varied definitions of agility.

Furthermore, Chelladurai noted that none of these definitions included appropriate recognition of the perceptual and decision-making components that are involved in many sports. The author outlined a classification of agility so that tasks were deemed to be simple, temporal (no spatial uncertainty, but

temporal uncertainty), spatial (no temporal uncertainty, but spatial uncertainty), or universal (temporal and spatial uncertainty).

Most research on agility testing has applied the term "agility" to describe any dynamic sporting action that involves a change in body position (Draper & Lancaster, 1992; Hasted & Lacy, 1994). The application of the term agility varies, but has included lunge(Cronin, McNair, & Marshall, 2003). A 3-yard run forward and back from a stationary start (Hoyle & Holt, 1983).climbing over and under a track and field hurdle (Alricsson, Harns-Ringdahl, & Werner, 2001). Sprinting forward, stopping and returning from a1808 turn (Draper & Lancaster, 1985), simple hopping movements (Booher, Hench, Worrell, & Stikeleather, 1993), but most commonly sprinting with directional changes (Fulton, 1992; Gabbett, 2002; Gambetta, 1996; Meir et al., 2001; Reilly et al., 2000;Rigg& Reilly, 1987; Twist & Benicky, 1996). According to Chelladurai (1976), all of these movements has classified as simple agility only, in that there is no temporal or spatial involved. Recently, Young, James and Montgomery (2002) outlined a comprehensive definition of agility as it related to running sports such as football codes.

The researchers addressed the multi-faceted influences involved in agility performance. In particular, the authors outlined that there are two main components of agility – change of direction speed and perceptual and decision-making factors.

2.3.1. Agility Training

Liner speed training aims to improve speed and acceleration, requires maximal effort, and near maximal velocity. This had best achieved when running in a straight line. However, most team sports require rapid deceleration and changes in direction. Agility training aims to convert basic speed into sport-specific speed. As with basic sprint training, the work to rest ratio should allow

adequate recovery between intervals and sets. Agility training relies on a high degree of co-ordination and movement quality, which becomes difficult in the presence of fatigue. Many of the coaching points for proper sprinting technique have applied to agility training. Sprint technique, basic speed training and agility training should all occur at the start of a training session when the athlete is fresh. A 20-minute period is enough to combine basic sprints, technique practice and agility drills or they had split up over several training days (http://www.sport-fitnessadvisor.com/agility-exercises.html).

Agility is the ability rapidly changes directions without the loss of speed, balance, or body control. As with other fitness components, agility is specific to a particular movement pattern. One problem with agility training is that an athlete can learn to anticipate the next movement. Therefore, the athlete should be required to respond to a directional order (Craig BW, 2004.).

Testing agility is the vast majority of tests purported to assess agility are tests for change of direction speed, as acknowledged by Ellis et al in Gore (2000, p. 132). The basic movement patterns of many team sports require the player to perform sudden changes in body direction in combination with rapid movement of limbs . . . The ability of the player to use these maneuvers successfully in the actual game will depend on other factors such as visual Processing, timing, reaction time, perception, and anticipation. Although all these factors combined are reflected in the player's on field "agility", the purpose of most agility tests is simply to measure the ability to rapidly change body direction and position in the horizontal plane. In their review of the literature, Draper and Lancaster (1985) found no valid attempts at evaluating agility. The Illinois agility test (Cure ton, 1951; Has tad & Lacy, 1994)), 20-m sprint, up and- back test and the 505 test has compared. At the time, the Illinois test had considered a standard test of agility. The researchers concluded that the 505 test was the most valid test of agility examined because

it resulted in the highest correlation with acceleration in the turning phase of the test, but did not correlate highly with velocity. Draper and Lancaster (1985) deemed the Illinois agility test to be less valid than the 505 test, as it correlated strongly with top speed. The authors' viewpoint was that agility tests should be independent of top speed, whereas acceleration had more related to the demands of a change of direction and reacceleration. Draper and Lancaster (1985) did not consider any decision-making factors in their test design of agility. In fact, they accepted traditional definitions for agility that do not address perceptual factors (Baumgartner & Jackson, 1975). Both the 505 and the up-and-back test involved pre-planned movements. The common theme in the tests of agility used by Baker (1999a), Draper and Lancaster (1985), Webb and Lander (1983) and Young et al. (1996, 2002) is that there is no stimulus present, and therefore none of these tests requires any cognitive and reactive component

2.4 concepts of Circuit Training

Circuit training is a method of fitness training that is designed to develop general, all-round physical and cardiovascular fitness. Morgan and Adamson at the University of Leeds first developed circuit training in the 1950s. It is a versatile training method as it can be adapted for many different situations, sections of the population and fitness requirements, and can be used at any time of the year. While the exercises are normally laid out in a circular pattern, the pattern can be varied for motivational purposes to that of a star, square, semi-circle, V-shape, line or zigzag. The athlete and his or her background, the sport, the time of year and the facilities available will dictate the type of circuit that is designed and implemented. Circuit training can be designed to develop a number of fitness components, including cardiovascular endurance (CVE), muscular endurance (ME), power, and anaerobic endurance. All of these components of fitness are extremely applicable to team sports.(Morgan and Adamson 1950s)

In addition, sport-specific circuits can be designed to address the specific skill and fitness requirements of a sport. Information related to the design of the various types of circuit is contained in this fact sheet. The instruction and delivery of circuit sessions is a key element in the effectiveness of this training method, and important relevant information is also provided at the end of the fact sheet (Scholich, 1990).

2.4.1 Progressive Overload and Variation in Circuit Training

The principles of progression and overload are important to consider when planning a circuit training program. The principle of overload indicates "your body systems must be stressed beyond their normal levels of activity if they are to improve." The three main dimensions of overload are intensity (how hard?), time (how long?) and frequency (how often?). These dimensions are altered to ensure overload occurs, e.g. increasing the 'time on' for each exercise. During the alarm, or shock, phase, the body experiences a new or more intense stress, such as during the first circuit training session of the training year. The response to the new stimulus is generally shock, and the athlete experiences soreness, stiffness and a temporary drop in performance (Williams, 1993). The principle of progression deals with the manner in which this overload is applied. Highlighted the importance of this principle when, he said that it is "necessary to provide a progressive heightening of the stressor to oblige the body to seek a higher status of adaptation." The stressor is the exercise stimulus; circuit training in this case. (Dick, 2002)

It is necessary to apply this principle to circuit training to ensure that physiological adaptations continually occur. General Adaptation Syndrome (GAS) model refers to the manner in which humans react to stress. Selye's GAS model contains three stages: Alarm, Resistance and Exhaustion.

During the alarm, or shock, phase, the body experiences a new or more intense stress, such as during the first circuit training session of the training year. The response to the new stimulus is generally shock, and the athlete experiences soreness, stiffness and a temporary drop in performance.

During the resistance phase, however, the body begins to adapt to the repeated stressor. Initially the body will return to a normal functioning level and if the stressor continues, the physiological changes will go to a higher level. This phase of adaptation is often called super-compensation. If the stressor is continually applied or the intensity continually increased for prolonged periods, the athlete will reach the exhaustion phase. At this point physiological functioning drops below that which would be considered to be normal functioning levels, i.e. the athlete underperforms. The athlete is now beginning to over-train, and the same symptoms experienced during the alarm phase will reappear.

Selye's GAS model has to be applied to the principle of progressive overload to ensure that the athlete reaches the super-compensation phase, while avoiding the exhaustion phase. The following guidelines relate the application of this principle to circuit training.

Progression in circuit training is achieved by altering the frequency, intensity or time dimensions of overload. Specifically, progression is achieved by: Increasing the number of repetitions of each exercise Increasing the amount of time on Increasing the number of circuits Increasing the degree of difficulty of each exercise Decreasing the time off between exercises Reducing the recovery time between circuits Making the recovery time more active Increasing the resistance of the exercises by altering the body position or using weight. (Hans Selye 1956)

The manner in which these guidelines are applied depends on the goal of the circuit. If CVE is the goal, progress will be achieved by, for example, decreasing the time off between exercises and reducing the recovery time between circuits. Increasing the degree of difficulty and the resistance of each exercise or the number of repetitions is appropriate.

Guidelines for the application of these methods of progression are as follows: Change only one variable at a time, increase the time on before adding resistance, decrease the repetitions of each exercise or the time on when adding another circuit. To avoid overtraining and the exhaustion phase of Selye's GAS model, incorporate weeks where the level of intensity of the stressor is reduced. (HanesSely 1956)

For anaerobic circuits, the above methods of progression and the guidelines for the application of these methods would not apply. Quality and speed of movement is central to the effectiveness of an anaerobic circuit, so more is not necessarily better. The progression guidelines for an anaerobic circuit are the opposite of the above guidelines. You progress by ensuring that the exercises are performed at maximum intensity and that the speed and quality of the exercises are increased.(Selye's, 1956).

2.4.2 Instruction and Delivery of Circuit Training Session

To ensure that circuit training sessions are well planned and implemented in a safe environment, the following guidelines should be followed. Screen athletes at the start of the session for illnesses and injuries, include a warm-up at the start of the session and a cool-down at the end, and ensure that the room is properly ventilated. Check that the equipment is safe, e.g. collars tight on dumbbells. Ensure that the exercises selected and the progressions are not only appropriate to the experience and fitness levels of the athletes but also safe. Check the athletes' clothing; avoid wearing long tracksuits, heavy cotton

clothing and jeweler, check to ensure that shoelaces are tied. Ensure that the floor surface is safe; if the surface is hard, use gym mats for any exercise where the body is in contact with the floor. Know where the nearest First Aid kit is and who is qualified to provide first aid, if required. Monitor the athletes throughout the session. Ensure that the athletes' technique is correct at all times. (Morgan. 1961)

Monitor athletes: this has to be done throughout the session to ensure that the athletes are gaining the training benefit while not getting into difficulty, it can be done by monitoring athletes' heart rates, breathing rates, appearance and exercise technique; you can simply ask them how they feel and/or use the rate of perceived exertion scale.

Feedback/correction of faults: provide feedback and encouragement throughout and at the end of the session. Make sure you observe the athletes' technique when carrying out the exercises, and if a fault occurs, correct it. Try to avoid just telling the athlete what the fault was. Give the correction rather than the fault. Always try to be positive before giving this correction; this is known as constructive criticism

The American College of Sports Medicine (ACSM) and the American Heart Association (AHA) recommend the following. Do moderately intense cardio 30 minutes a day, 5 days a week or do vigorously intense cardio 20 minutes a day, 3 days a week and do 8-10 strength training exercises, eight to 12 repetitions of each exercise, 2 days a week

While these well-intentioned guidelines may seem unattainable to some, circuit training is an efficient, effective way to achieve them – and to reap results. Cardio and strength combined Developed in 1953 at the University of Leeds in England, traditional circuit training is comprised of 8-12 stations where individuals perform strength-training exercises using a resistance of about 40%

to 60% of one-repetition maximum (1RM) for a specific duration (30 seconds to two minutes), with either rest or cardio intervals of 15 seconds to three minutes (or longer) between stations. Research continually shows that circuit training confers numerous benefits, given that it simultaneously develops cardiovascular fitness and strength. In fact, according to the prestigious Cooper Institute in Dallas, Texas, circuit training "is the most scientifically proven exercise system. It's time efficient and incorporates strength, flexibility and cardio in the same workout." Circuit training maximizes the advantages of individual cardio and strength workouts for greater conditioning and valuable psychological benefits. One new, convenient way to circuit train is which is available on Octane Fitness standing elliptical cross trainers. Physiological responses to circuit training, greater cardiovascular endurance, and numerous studies report that when performed consistently over 8-12 weeks, circuit training can increase aerobic oxygen consumption and VO2 max, resulting in greater stamina and overall fitness. Increased muscular endurance and strength Resistance training overloads muscles for improved endurance and strength. Studies indicate that strength gains of 7% to 32% are evident with circuit training. Strength training is particularly important for women, who lose muscle mass of 1 percent per year in their 30s and 40s, along with people over age 65 to help minimize bone loss.

Significant caloric expenditure the amount of calories burned per workout depends on its intensity and duration, the exercises selected and the exerciser's body weight. Circuit training has been reported to burn approximately 5-9 kcal/minute; however, this number increases significantly when exercisers also perform aerobic intervals. For example, heart rates fluctuate between aerobic and anaerobic zones, demanding more calories than either a traditional steady-state cardio or strength session alone. Improved body composition and higher metabolism Research demonstrates that circuit training decreases fat mass, and strength training increases lean body mass, which is more metabolically active than fat. Routine strength training builds

muscles that burn more calories both during exercise and at rest (basal metabolic rate) for a higher metabolism, which helps with weight control. In today's 24/7/365 eternally plugged-in world, people feel busier and more stressed than ever, and lack of time is most commonly cited as a barrier to exercise. Circuit training provides an effective option that breaks this barrier and yields significant advantages. According to the Specific Adaptation to Imposed Demand (S.A.I.D.) principle, the body adapts over time to stressors such as exercise. Circuit training delivers continually varied cardio and strength training challenges that work the body in new ways and stimulate additional progress and better results.(ACSM & AHC)

Psychological and practical advantages; maximum efficiency Combining cardiovascular and strength-training sessions yields a greater return on the time investment, with more total work completed in a shorter amount of time. In fact, research shows that circuit training recruits the major muscle groups up to twice more than cycling, and five times more than walking. Renewed motivation the inherent variety in circuit training breaks up workouts which engages exercisers and keeps them working at a higher overall intensity versus going through the motions or skipping workouts altogether. Greater enjoyment positively impacts exercise performance and overall adherence. Valuable variety Circuit training is an excellent way to cross train, as it complements all other workouts by adding change and interest. (Scolich, M, 1990)

2.4.3 Benefit of Circuit Training on speed and agility

There have been numerous studies on circuit training and its effects on the body. Studies indicated that circuit training met the qualifications for an effective muscular workout, cardiovascular workout and this exercise method is the most effective method for increasing muscular endurance. Studies have also revealed that circuit training for women is the most effective method of exercise that, when combined with diet, was helping them lose weight and keep it off long term. Today, circuit training is completed by individuals and groups,

men and women alike. The exercise method is trained as being the most effective way to build explosive power for sports of all types, including fighting styles. It is also considered the best way to improve muscle strength and endurance which is important for today's athlete. (Adeniji, B. A 2007)

There were many benefits to using circuit training in your exercise program. These benefits stem from the fact that you were moving continuously throughout your workout. You were enjoying the benefits of strength training as well as the benefits of cardiovascular fitness. One of the major benefits of circuit training was that it was versatile. You can include whatever exercises you want in your circuit training. This means that you can work with what you have instead of forcing the need for exercise machines and expensive weight sets. You can use your own body weight, dumbbells, medicine balls or simple tools like jump ropes. Circuit training can include from 6 to 15 stations, depending on your personal work out goals and your level of fitness prior to starting this type of training. Variability also allows for the individual to keep from becoming bored with their fitness training. This keeps people interested in their work out routines and makes them less likely to stop before reaching their fitness goals. Additionally, variability means that you can easily choose exercises based on your fitness level. This makes circuit training ideal for beginners and expert strength trainers alike. Circuit training serves athletes as a way to keep their body fit and generally conditioned without the stress of in season sports. This way you can keep yourself conditioned and in good physical shape even on the off season. (Williams, 1995)

Additionally, if you do suffer an injury you can simply remove that type of exercise from your circuit and replace it with something you are physically capable of doing. For example, if you sprain an ankle, you can take jumping rope out of the circuit and add in some bench presses until your injury is healed. This way you can continue to get a work out and nurse your injury at the same time. Scholich (1990).

2.5 FACTORS AFFECTING PHYSICAL FITNESS

Physical fitness is affected by various factors. Sharkey (1990) recommended that physical fitness is mainly influenced by the following factors.

1. **Heredity:** Genetically we inherit many factors that contribute to aerobic fitness, including the maximal capacity of the respiratory and cardiovascular systems, a larger heart, more red blood cells and hemoglobin and a high percentage of slow oxidative and fast oxidative-glycolytic muscle fibers. Mitochondria, the energy producing units of muscle and other cells, are inherited from the maternal side. Recent evidence indicates that the capacity of muscle to respond to training may also be inherited.
2. **Training**:- Training improves the function and capacity of the respiratory and cardiovascular systems and boosts blood volume, but the most important changes takes place in the muscle fibers that are used in the training. Aerobic training improves muscles ability to produce energy aerobically and shifts metabolism from carbohydrate to fat, which may produce the single most important health effect of exercise. Burning fat reduces fat storage, blood fat levels, and cardiovascular risk. It also improves insulin sensitivity and reduces the risk of some cancers. Of course, training enhances the ability to perform, but the improvement is limited to the activity used in training.
3. **Gender:-**Before puberty, boys and girls differ a little in aerobic fitness, but from then on girls fall behind. Young women average 15 to 25% less than young men in aerobic fitness, depending on their level of activity. But highly trained young female endurance athletes are but 10% below male endurance athletes of the same age in vo_2max and performance times.

CHAPTER THREE

RESAERCH METHODOLGY

Introduction

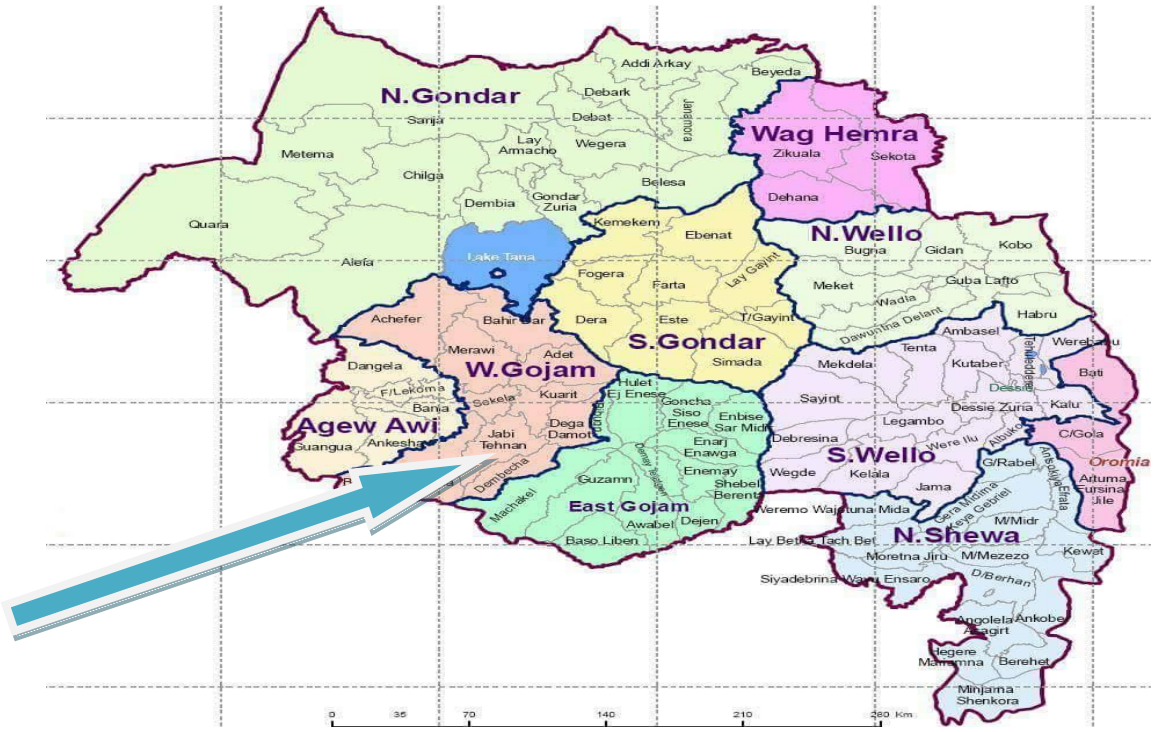
This chapter presents the research methodology which employed in the study. Hence, issues such as research design, research area, sample and sampling techniques, inclusion and exclusion criteria, source of data, data collection instrument and methods of data analysis are presented in separate sections.

3.1. Research Design

The aim of this study was to investigate the effect of twelve weeks circuit training program on selected physical fitness variables specifically on agility and speed in the case of Damot preparatory school students. Depending on the nature and appropriateness of the pre-test and post-test data the research approach designed in this study were employed quasi experimental design, since it helped to find out the effect of circuit training the independent variable on the dependent variables; these are agility and speed.

3.2. Research Area

The study is conducted in Amahara region, West Gojjam zone, Finote Selam town administration Damot preparatory school. It is 180 kilometers far from the capital city of Amhara region which is Bahir Dar and 387 kilometers far from the capital city of Ethiopia which is Addis Ababa. The Finote Selam city administration bordered on the south by Jabitehnan, on the north Sekela, on the west Jabi thenana and on the eastern Jiga city administration.



(Www. Google.com/search)

Figure 3.1 Map of the study area

3.3. Population, Samples and Sampling Techniques

Damot Preparatory School was selected as the center of this experimental study. In order to select the sample school, purposive sampling technique was used. The sample school was purposefully selected to be the setting of the study because the geographical location of the school was close to the researcher and is accessible to collect data for the study. In addition, this making it convenient for frequent follow up of the experiment, school administrators and physical education teachers were willing to cooperate in giving all the help asked by the researcher. Concerning the students' selection, simple random sampling technique was employed to select participant students in the study. There are a total of 542 students in the school as the researcher obtained information from the school principal. From these 40 male sample students were taken from a population of 169 male students' age ranged 16 to 17 years by the means of simple random sampling technique.

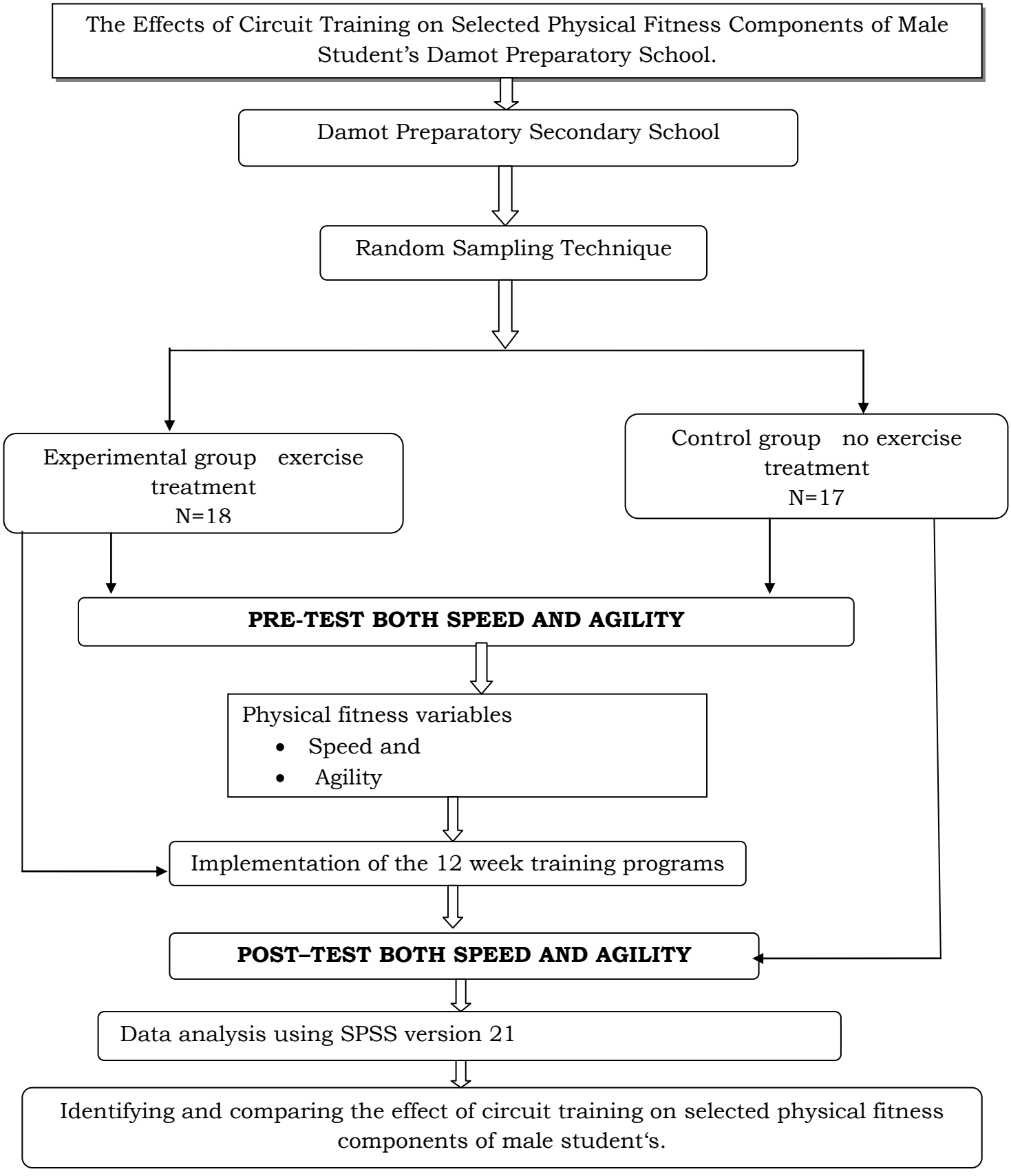
Macmillan and Schumacher (1997) as if the research is for comparison of groups with different independent variable, the number of the samples can be between twenty and fifty. Therefore, the conclusion made with these samples can be taken as ideal. Besides, Simple random sampling technique was used to assign control and experimental group. 18 students were randomized to control group whereas the other 17 students were randomized to experimental group. After the samples were assigned in this way, the pre-test on speed and agility was administered to both experimental and control group. The pre-test was conducted for both control group and experimental group in order to check whether or not the selected sample students of the groups were found to be at a similar level of speed and agility. Then 12 weeks circuit training interventions were given for only experimental group. Finally, the post-test was conducted for both control group and experimental group in order to check the effect of 12 weeks circuit training on students speed and agility.

Table3. 1. The study Design Layout:

no	Items	Duration
1	Frequency	2 days/week
2	Set	**2**
3	Repetition	'n' numbers/60 seconds.
4	Intensity	55%-70%MHR
5	Duration of whole training	12 weeks
6	Duration of training/session	40 minutes/session
7	Duration for each exercise	60 seconds/station
8	Active rest among stations	30 seconds/station
9	Days of training	Tuesday and Thursday(11:20-12:10P.M)

3.4 follow chart

Figure 2: follow chart



3.5. Inclusion and Exclusion Criteria

Individuals with cardiac conditions such as hypertension or uncontrolled diabetes or other conditions that will be contraindicate for exercise testing and training wasn't be admitted to the study. Individuals having bone and joint problem, diabetes mellitus, bad habits and those taking medications wasn't include into the study.

3.6. Source of Data

The data for the study were collected from the results of test given from pre to post test of both experimental and control group. Quantitative data were collected through the appropriate speed and agility test measures such as, 60 meters run and illusions test for speed and agility respectively. Before the experimental groups were going to twelve weeks circuit training, the pretest was taken from both control and experimental groups. Posttest was also taken from both groups after 12 weeks circuits training programs for experimental groups completed.

3.7. Data gathering instrument

Even though there are different data gathering instruments, in this experimental study, performance test such as 60m run speed test and agility test (each test has pre-test and post-tests) were used as the major source for the quantitative data needed for the study from both experimental and control group. Data were collected through the appropriate performance test measures such as, Illinois for agility test and 60 meters speed test for speed. Before the experimental group was going to circuit training, the pre-test was taken for both control and experimental groups. Post-test was also taken for both groups after 12 weeks circuits training programs for experimental groups completed.

3.7.1. Performance Test

In this experimental study, pre-test and post-tests were administered for both experimental and control groups of students to measure their performance on speed and agility. The purpose of the pre-test was to see whether there was statistically significant difference between students' performance on speed and

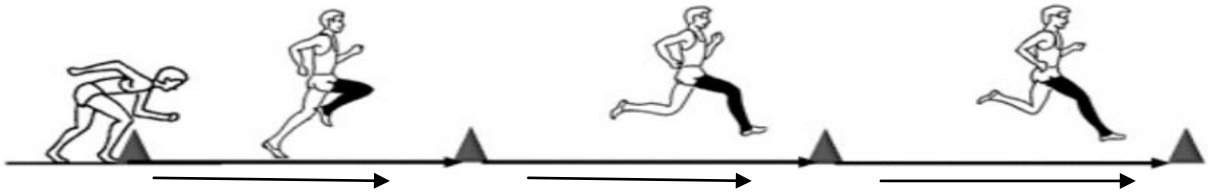
agility of the experimental group and the control group before they started the treatment. The post-test was also administered at the end of the experiment to see if there is any difference between the experimental group and the control group students' performance on speed and agility.

3.7.1.1. Speed Test

Two Speed tests were given for both control and experimental group. It was measured using the 60meter accelerate run test. The objective of this test was to evaluate the development of the students' ability to effectively and efficiently accelerate from a standing start or from starting blocks to maximum speed. To take this test measure distance of 60 meter and placed a cone\marker at the start and finish lines.

Required Resources: To undertake this test you will require:

- Flat non-slip surface
- Measuring tape
- 2 cones(start to finish)
- Stopwatch
- An assistance



Start 20 m 20 m 20 m finish (60m)

Figure 3 speed checking exercise

3.7.1.2. Agility Test

The length of the course was 20 meters and the width (distance between the start and finish points) was 5 meters. On the track you could use 5 lanes. 4 cones can be used to mark the start, finish and the two turning points. Each cone in the center was spaced 3.3 meters apart. The assistant records the total time taken from their command to the students completing the course.

Objective: The objective of the Illinois Agility Run Test (Getchell, 1979) is to monitor the development of the athlete's agility.

Required Resources: To undertake this test you will require:

•Flat non-slip surface

•Measuring tape

•8 cones

•Stopwatch

•Assistant

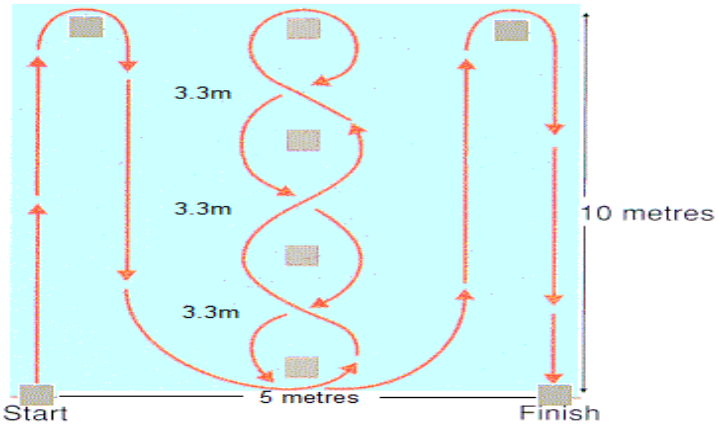


Figure 4 agility illusion tests

3.8. Instruments and facilities

In order to collect the data necessary for analysis, the researcher was used performance test. The use of appropriate tests helped to collect data from selected physical fitness variables such as speed and agility. For the success of the study necessary materials and facilities such as cones, corner flags, stop watch, whistle, record sheets, measuring tape (meter) and chair were used.

3.9. Methods of Data Analysis and interpretation

This study had two null hypotheses which were proposed as major objectives of the study. The score differences between pre-training test result and post-training test result of the control and experimental groups were compared by using mean scores, standard deviation, and t-test particularly, independent samples t-test and paired sample t-test. Data were analyzed using computerized statistical package software SPSS version 21.

Both independent sample t-test and paired-sample t-test were used to analyze the performance test results in the study. Independent sample t-test was used to compare the results of the experimental and control groups that are independent of each other.

CHAPTER FOUR
RESULTS AND DISCUSSIONS

This chapter deals with the analysis of pre-test, and post-test data collected from randomly selected experimental and control groups under this study. The performance test were administrated to experimental (n=18) and control (n=17) students. From the sample students, five of them (two from experimental and three from control group) were not taken the performance test properly that means they took only one test. Therefore, the number of samples was reduced to 35. The aim of this study was to investigate the effect of 12 weeks circuit training program on selected physical fitness variables of grade eleven students at Damot preparatory and secondary school. Circuit training program was given for 12 consecutive weeks and attendance was taken for experimental throughout the training. The physical fitness components selected for this study were agility and speed. Pre-test and post-tests data were taken from both experimental and control groups. The collected data were analyzed using independent t-test using SPSS version 21.

4.1. Demographic information of the participants

Table 4.1.Demographic information of the participants

Group	N	Age		Height		Weight	
		Mean	S.D	Mean	S.D	Mean	S.D
Experimental Group	18	16.533	0.516	1.68	0.039	48.233	1.5796
Control Group	17	16.466	0.513	1.64	0.0375	47.94	1.5300

As can seen in the above table, based on the data taken prior to circuit training for the experimental group, the mean age, height and weight were almost similar for experimental and control group. The overall mean values of age, height and weight were 16.5, 1.66 and 49.5 respectively. In all parameters the simple randomization process resulted with insignificant slightly higher values in control group than values in the experimental group.

4.2. Analysis and interpretation of pre-test result

Students of the experimental group and the control group were administered a pre-test in order to see whether the two groups were at a similar level of 60 meters speed and agility, or not.

Table4.2 Descriptive statics' Pre-test on speed

test	Group	N	mean	std. deviation	Std. Error Mean
Pretest	experimental	18	8.9950	.20988	.04947
	Control	17	8.9347	.39603	.09605

The above table revealed that the pre-test results of 60 meters speed test results between control group and experimental group. The mean score of 60 meters speed test results of the experimental group (M=8.9950, SD=.20988) and the control group (M=8.9347, SD=.39603). This indicated that the experimental group means score result greater than (0.0503) the control group means score result so both groups have almost the same performance on speed. However, in order to conclude whether there is significant difference between the groups or not, an independent sample t-test must be sought.

Table4.3. Independent sample t-test pre-test results on speed

pre-test 60 meters speed	MD	SD	95 % interval difference		t	Df	Sig. (2-tailed)
			Lower	Upper			
Equal variances assumed	.06029	.10627	-.15591	.27650	.567	33	.574
Equal variances not assumed	.06029	.10804	-.16268	.28327			

P<0.05

As can be seen in the above table, whether or not there is statistically significant difference between control group and experimental group an independent sample t-test was sought. An independent sample t-test revealed that there is no statistically significant difference between the mean scores of the experimental group and control group on 60 meters speed (t=.567, df=33,

p(.574)>.05). Therefore, it can be conclude that the difference between condition were likely due to chance. It is with this consideration that the rest of the study was carried out.

Table 4.4. Descriptive statistics result of Pre-test between two groups on agility

	group	N	Mean	Std. Deviation	Std. Error Mean
pretest	experimental	18	18.4422	.61051	.14390
	control	17	18.4547	.79501	.19282

The above table showed that the comparison of pre-test results of agility test results between control group and experimental group. The mean score of agility test of the experimental group (M=18.4422, SD=.61051) and the control group (M=18.4547, SD=.79501). This depicted that the experimental group mean score of agility test equal to the control group mean score agility test so both experimental group and control groups have the same agility performance before the intervention. However, in order to conclude whether or not there is statistically significant difference between control group and experimental group, an independent sample t-test was sought.

Table 4.5 An independent sample t-test result between experimental and control group on agility

Test	MD	SD	95 % interval difference		t	Df	Sig. (2-tailed)
			Lower	Upper			
Equal variances assumed	-.01248	.23877	-.49827	.47330	-.052	33	.959
Equal variances not assumed	-.01248	.24059	-.50383	.47886			

P<0.05

As can be seen in the above table, whether or not there is statistically significant difference between control group and experimental group an independent sample t-test was sought. An independent sample t-test revealed that there is no statistically significant difference between the scores of the

experimental group and control group on agility (t=-.052, df=33, p(.959)>.05). Therefore, one can be conclude that the difference between condition were likely due to chance. It is with this consideration that the rest of the study was carried out.

4.3. Analysis and interpretation of Post-Test Results

The experiment which lasted for twelve consecutive weeks' was conducted on 60 meters speed and agility to the experimental group. Later, to measure the performance of the two groups following the twelve weeks intervention for only experimental group, the post-test was administered and independent sample t-test were chosen for the statistical computation of the post-test result. Below is an independent sample t-test of the post-test results of the experimental group and control group.

Table 4.6.Descriptive statics' of Post-test result between the groups on speed

test	group	N	Mean	Std. Deviation	Std. Error Mean
post-test	experimental	18	8.9042	.24334	.05736
	control	17	9.1676	.35501	.08610

Table 4.6 revealed that the experimental group and control group post-test mean and standard deviations score on 60 meters speed. The experimental group post-test result is (M=8.9042, SD=.24334). On the other hand the control group the results of the post-test on speed is (M=9.1676, SD=.35501). When we compare the mean scores of the experimental and control groups, the control group slightly greater than the experimental group. However, whether or not this difference statistically significant, an independent sample t-test must be sought. An independent sample t-test presented as follow.

Table 4.7. An independent sample t-test result between experimental and control group on speed

	MD	SD	95 % interval difference		T	Df	Sig. (2-tailed)
			Lower	Upper			
Equal variances assumed	-.26343	.10236	-.47169	-.05517	-2.573	33	.015
Equal variances not assumed	-.26343	.10346	-.47531	-.05155			

P<0.05

The above table revealed that whether or not there is statistically significant difference between control group and experimental group on 60 meters speed, an independent sample t-test was sought. An independent sample t-test revealed that there was statistically significant difference between the mean scores of the experimental group and control group on 60 meters speed (t=-2.573, df=33, p(.015)<.05). Therefore, it can be conclude that there was statistically significant difference between the experimental group and control group because of twelve week circuit training.

Table 4. 8. Paired sample t-test of pre-test and posttest on speed

speed test	Paired Differences					t	Df	sig(2-tailed)
	mean	Std	Std Error M	95% Confidence Interval of the Difference				
				Lower	Upper			
pre-post EG	.09111	.12658	.02983	.02816	.15406	3.054	17	.007
pre-post CG	-.23294	.25127	.06094	-.36213	-.10375	-3.822	16	.062

The above table 4.8 depicted that a comparison of the experimental group pre-test and post test result on speed and the comparison of the control group pre-test and post-test result on speed using paired sample t-test. Paired sample t-test indicated in the above table that there is statistically significant difference on the experimental group on pre-test and post test result on speed (t= 3.054, df=17, p=0.007) at usually the significance limits (<.05). This can be done the effects of twelve weeks circuit training. In addition the above table revealed

that the comparison of the pre-test and post test results of the control group on agility. Paired sample t-test result indicate that there is no statistical significant difference between pre-test and post-test result of the control group (t=-3.822, df= 16 and p=0.062) at usually the significance limits (> 0.05).

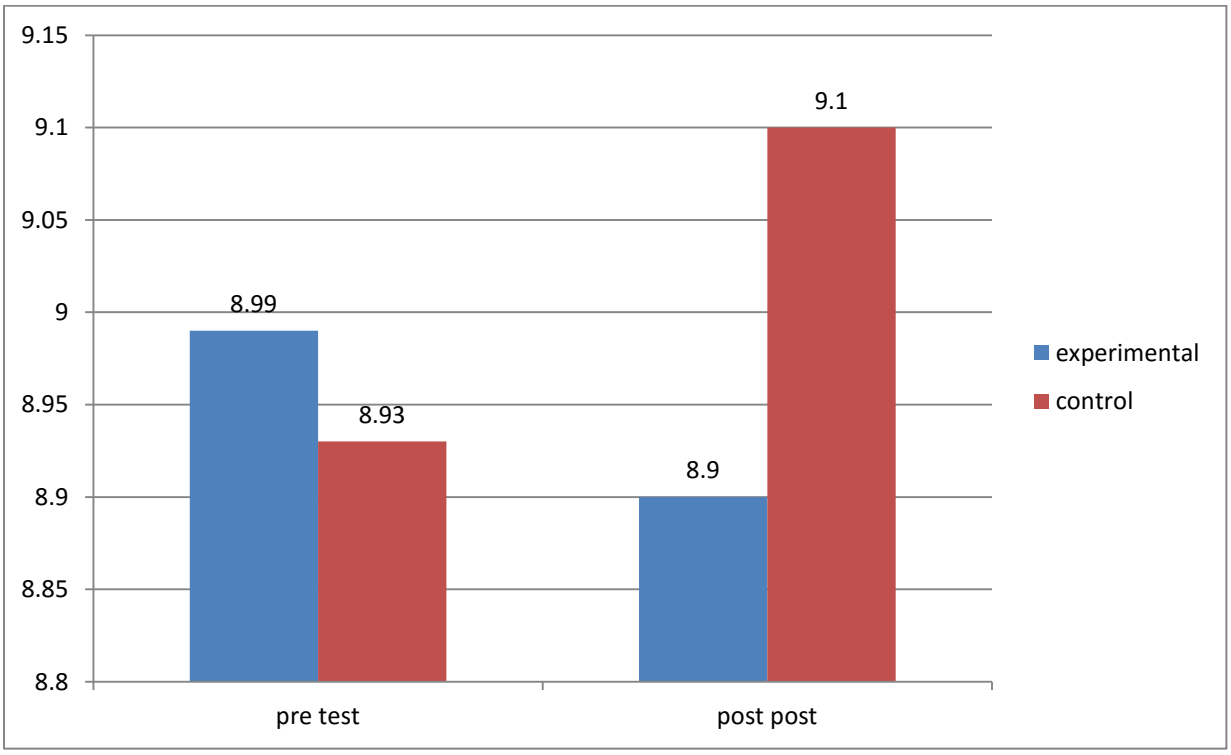


Figure 5: paired sample t-test of speed

Table 4.9. Descriptive statics' Post-test between control and experimental group on agility

	Group	N	Mean	Std. Deviation	Std. Error Mean
posttest	experimental	18	17.2144	.54477	.12840
	control	17	18.4929	.65478	.15881

The above table showed that the post-test results of Illinois agility test results between control group and experimental group. The mean score of Illinois agility test results of the experimental group (M=17.2144, SD=.54477) and the control group (M=18.4929, SD=.65478).This indicated that the experimental

group mean score result less than by 1.2785 from the control group mean score result so the experimental group has good Illinois agility performance than the control group. But by looking the mean score only, it is impossible to say statistically significant difference between the groups. Hence, in order to conclude whether this difference is significant or not, an independent sample t-test is sought.

Table 4.10. Independent sample t-test post-test result between experimental and control group on agility

post-test	MD	SD	95 % interval difference		t	df	Sig. (2-tailed)
			Lower	Upper			
Equal variances assumed	-1.27850	.20313	-1.69177	-.86522	-6.294	33	.000
Equal variances not assumed	-1.27850	.20422	-1.69490	-.86209			

P<0.05

Table 4.9 revealed that the post-test result P value of the experimental and control group were calculated and presented by independent sample t-test. In this part statistical tool SPSS were applied to check whether there was a difference between the post test level of the experimental and control groups. The post-test experimental group and control group on Illinois agility test results were calculate during independent sample t-test the significant value was (P= 0.000,df=33 and t=-6.294)which was found less than 0.05. Hence it can be assumed that there was significant difference it was provided that P< 0.05. Therefore, the mean value score of Illinois agility test revealed that, after twelve week intervention training there was significance difference between experimental and control group on agility.

Table 4.11. Paired sample t-test of agility

test	Paired Differences					t	df	sig(2-tailed)
	mean	Std	Std Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
pre-post EG	1.22778	.81545	.19220	.82226	1.63329	6.388	17	.000
pre-post CG	-.03824	.67830	.16451	-.38698	.31051	-.232	16	.819

The above table shows that a comparison of the experimental group means score in the pre-test and post test in agility and the comparison of the control group pre-test and post-test result on agility using paired sample t-test. Paired sample t-test revealed in the above table that there is statistically significant difference on the experimental group on pre-test and post test result in agility (t= 6.388, df=17, p=0.000) at usually the significance limits (<.05). In addition the above table revealed that the comparison of the pre-test and post test results of the control group in agility. Paired sample t-test result indicate that there is no statistical significant difference between pre-test and post-test result of the control group (t=0.232, df= 16 and p=0.819) at usually the significance limits (> 0, 05).

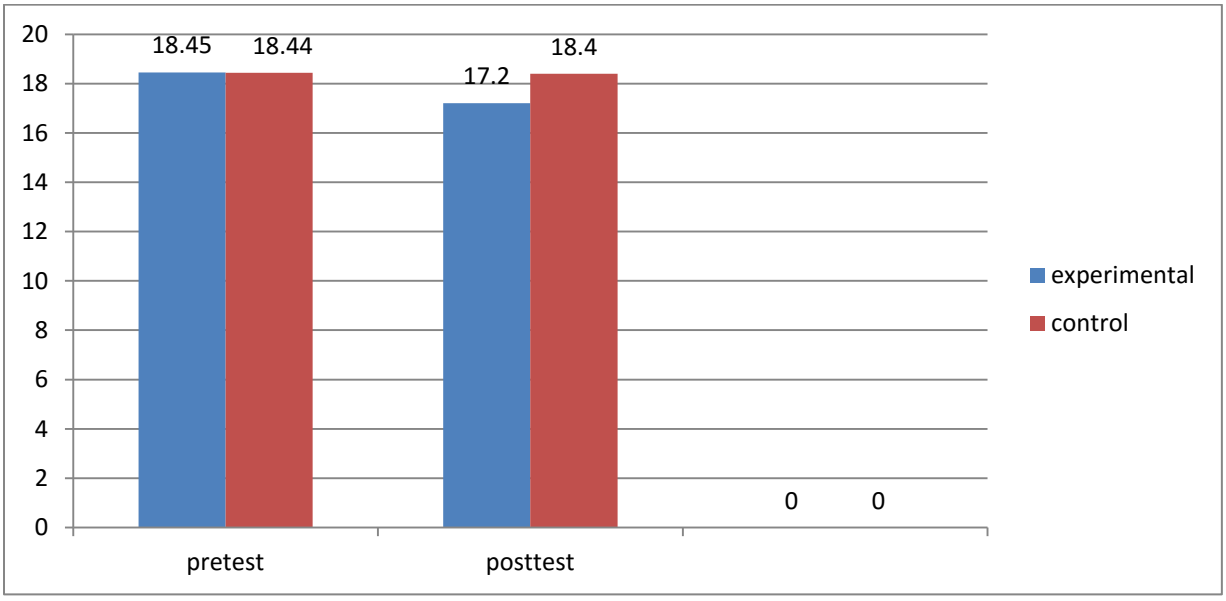


Figure 6 paired sample t-test of agility

4.4. DISCUSSION OF FINDINGS

In this sub-section, discussions on the findings are made based on the results from the analysis of the data. The findings are discussed according to two null hypotheses addressed to fulfill the purpose of the study.

As stated earlier, a pre-test on speed and agility was administered to see whether the students from the two groups had equal performance or not. Comparison of pre-test results of both groups by applying statistical analysis revealed that there was no significant difference between the two groups (as shown table 3), and both groups were almost equal in their performance in speed and agility.

The experimental group, however, performed significantly better than the control group on speed and agility in the post-test. The speed test mean scores revealed the difference between the post-test mean scores of the two groups was significant at .05 levels (as shown in table 2). Thus, the null hypothesis that says “there is no statistically significant difference between experimental group and control group on speed” was rejected at .05 levels in favour of the experimental group.

With regard to agility, the mean score of the post-test showed that the experimental group students slightly outperform the control group. Results of an independent sample t-test also revealed that there was statistically significant difference between control group and experimental group. Therefore, twelve week circuit training had positive effect on secondary school students’ agility.

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATION

The aim of this study was to find out the effects of twelve week's circuit training on speed and agility of Damot secondary school students. To this end, this chapter deals with summary of the major finding of the study, the conclusion drawn from finding and recommendation forwarded.

5.1 Summary of the Major Findings

The purpose of this study was to find out the effects of twelve weeks circuit training on secondary school students speed and agility in Damot secondary school by allowing them to participate in two groups for twelve weeks. For this purpose 35 students (age 16-17years) were participated in this study. The subjects were assigned random in to two groups of each group. Group I (N=18) as experimental group and Group II (N=17) as control group.

The experimental group received treatments and control group (Group II) did not receive any treatment. The training program of experimental group was twelve weeks, three day per week with 60 minute duration each session.

To know the effects of twelve weeks circuit training two variables (speed and agility were selected.

The data were collected on speed and agility variables from both groups. Before treatment the pre-test data was collected and after twelve weeks treatment post-test data was collected. The following tools (Illinois Agility Run Test and 60-Meter Sprint Test) Procedures of administration of test were well planned and prepared to meet the purpose of study and accuracy of data.

To analysis the data descriptive statistics was applied to process the data prior to employing inferential statistics. Further analysis of an independent sample

t-test was applied to found out the significant difference if any, between experimental groups and control group on selected criterion variables separately. Level of significance was set at 0.05the result show that there was significant improvement on speed and agility variable of secondary school students. Twelve weeks circuit training revealed a better improvement on speed and agility 0.05 level of significant.

5.2 Conclusions

Based on the major findings of the study, these points were stated as conclusion

- The finding of the present research revealed that Twelve week's Circuit training had significantly improved the performance of the participants agility
- The finding also indicated that selected circuit training exercises contribute to the improvement of secondary school students' speed.
- This study found that there was progressive improvement in the selected physical fitness variables such as agility and speed during training periods in experimental groups, while not in control groups.

5.3 Recommendations

This research finding proved that twelve weeks circuit training significantly improved of speed and agility of secondary school students. Based on the results, discussions of the findings and conclusions of this research, the following recommendation were drawn:

- The present researcher recommended that twelve weeks circuit training can be used by fitness programmers, coaches, athletic trainers and instructors to improve their trainees speed and agility.
- This study was conducted to compare the effect of twelve weeks circuit training students' physical fitness improvement such as agility and speed

only. So it is recommended for other researchers to evaluate the effect of these training methods on other fitness elements like strength, flexibility, coordination, balance, body composition, etc.

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APPENDIX A

PRETEST AND POST TEST RESULTS OF THE TWO GROUP

Subject	speed test result				subject	agility test result			
	experimental		control group			experimental		control group	
	Pretest	Posttest	pretest	posttest		pretest	posttest	pre-test	posttest
1	9.04	8.97	9.05	9.07	1	18.30	17.20	19.00	18.07
2	8.96	8.89	8.82	8.94	2	18.00	16.30	18.20	18.02
3	9.12	9.05	8.55	8.7	3	17.99	18.09	17.36	18.16
4	9.04	8.97	8.7	8.96	4	19.20	17.00	18.26	19.06
5	9.16	9.09	9.12	9.2	5	17.89	17.59	18.06	18.06
6	9.27	9.2	8.63	8.82	6	17.46	17.86	18.04	18.04
7	9.31	9.24	8.96	9.05	7	18.16	16.56	18.55	19.55
8	9.2	9.12	9.2	9.23	8	18.03	17.33	17.60	17.60
9	8.92	8.86	10.01	10.02	9	17.92	17.02	19.94	19.84
10	8.96	8.89	8.47	8.97	10	19.98	17.08	18.21	18.21
11	8.85	8.78	9.23	9.47	11	18.55	17.65	18.25	18.45
12	8.54	8.47	8.43	8.96	12	18.89	17.00	18.03	17.86
13	8.69	8.62	9.05	9.12	13	18.94	18.04	17.86	17.84
14	8.67	8.6	8.97	9.04	14	18.33	16.23	19.93	18.94
15	9.04	8.97	9.04	9.11	15	18.42	17.02	18.25	18.65
16	9.02	8.43	9.23	9.96	16	18.97	17.66	18.21	19.35
17	9.2	9.2	8.43	9.23	17	18.00	16.80	19.98	18.68
18	8.92	8.92			18	18.93	17.43		

experimental group				control group			
Subject	Age	Height	weight	subject	Age	Height	weight
1	17	1.59	47.00	1	17	1.49	46.50
2	17	1.56	48.00	2	16	1.55	47.50
3	16	1.59	48.70	3	17	1.60	49.50
4	17	1.53	47.60	4	16	1.58	48.40
5	17	1.58	50.50	5	17	1.55	50.50
6	17	1.56	48.00	6	16	1.57	48.00
7	16	1.61	50.00	7	16	1.56	50.00
8	16	1.50	46.00	8	17	1.57	49.30
9	17	1.59	47.00	9	17	1.50	45.70
10	16	1.48	45.30	10	16	1.55	47.00
11	17	1.53	47.60	11	17	1.57	48.00
12	16	1.55	46.40	12	16	1.50	46.00
13	17	1.62	50.50	13	17	1.58	49.20
14	16	1.56	49.00	14	17	1.55	47.50
15	17	1.59	48.00	15	16	1.49	46.00
16	16	1.61	48.50	16	16	1.50	46.00
17	17	1.58	49.50	17	17	1.58	49.20
18	16	1.59	48.70	18			

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Experimental	18	8.9950	.20988	.04947
	Control	17	8.9347	.39603	.09605

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pretest	Equal variances assumed	4.001	.054	.567	33	.574	.06029	.10627	-.15591	.27650
	Equal variances not assumed			.558	24.023	.582	.06029	.10804	-.16268	.28327

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Post test	Experimental	18	8.9042	.24334	.05736
	Control	17	9.1676	.35501	.08610

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Post test	Equal variances assumed	.768	.387	-2.573	33	.015	-.26343	.10236	-.47169	-.05517
	Equal variances not assumed			-2.546	28.136	.017	-.26343	.10346	-.47531	-.05155

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Experimental	18	18.4422	.61051	.14390
	Control	17	18.4547	.79501	.19282

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Pretest	Equal variances assumed	.668	.420	-.052	33	.959	-.01248	.23877	-.49827	.47330
	Equal variances not assumed			-.052	30.021	.959	-.01248	.24059	-.50383	.47886

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Experimental	18	17.2144	.54477	.12840
	Control	17	18.4929	.65478	.15881

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
pretest	Equal variances assumed	.947	.338	-6.294	33	.000	-1.27850	.20313	-1.69177	-.86522
	Equal variances not assumed			-6.260	31.206	.000	-1.27850	.20422	-1.69490	-.86209

Paired Samples Statistics

Speed experimental group		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pretest experimental	8.9950	18	.20988	.04947
	posttest experimental	8.9039	18	.24348	.05739

Paired Samples Test

Speed experimental group		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	pretest experimental – post test experimental	.09111	.12658	.02983	.02816	.15406	3.054	17	.007

Paired Samples Statistics

Speed control group		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	control group	8.9347	17	.39603	.09605
	control group post	9.1676	17	.35501	.08610

Paired Samples Test

Speed control group		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	control group - control group post	-.23294	.25127	.06094	-.36213	-.10375	-3.822	16	.062

Paired Samples Statistics

Agility experimental group		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	pretest experimental	18.4422	18	.61051	.14390
	posttest experimental	17.2144	18	.54477	.12840

Paired Samples Test

Agility experimental group		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	pretest experimental – post test experimental	1.22778	.81545	.19220	.82226	1.63329	6.388	17	.000

Paired Samples Statistics

control group agility		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	control group	18.4547	17	.79501	.19282
	control group post	18.4929	17	.65478	.15881

Paired Samples Test

		Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	control group - control group post	-.03824	.67830	.16451	-.38698	.31051	-.232	16	.819

FIGUR1APPENDIX A. FIGURE PLAYER DURING ILLUMESAND 60METER RUN TEST

APPENDIX B-TWELVE WEEKS CIRCUIT TRAINING PROGRAM

Day	Week	Contents of exercise	Cycles	Exercise duration (s)	Rest period between stations (s)	Rest period between cycles	Total duration (m)
Tuesday and Thursday	1	**Warming up exercise** (jogging, movements of hands and leg, stretch)					8
		Main part (Squat, pushup, jumping jack, lung, plank, sidelifts)	2	60	30	2	18
		Cooling down: (Cooling lower and upper body, starching ,breathing mediation)					5
Tuesday and Thursday	2	Warming up exercise (jogging, movements of hands and leg, stretch)					8
		Main part: Jumping rope, wall sit, abdominal crunch, side plank, step up, triceps dips	2	60	30	2	18
		Cooling down: (Cooling lower and upper body, starching ,breathing mediation)					5
Tuesday	3	**Warming up exercise**					8

and Thursday		(jogging, movements of hands and leg, stretch)					
		Main part: (Squat, push up, jumping jack, lung ,plank, side lifts)	2	60	30	2	18
		Cooling down: (Cooling lower and upper body, starching ,breathing mediation)					5
Tuesday and Thursday	4	**Warming up exercise** (jogging, movements of hands and leg, stretch)					8
		Main part: Jumping rope, wall sit, abdominal crunch, side plank, step up, triceps dips	2	60	30	2	18
		Cooling down: (Cooling lower and upper body, starching ,breathing mediation)					5
Tuesday and Thursday	5	**Warming up exercise** (jogging, movements of hands and leg, stretch)					8
		Main part: (Squat, push up, jumping jack, lung ,plank, side lifts)	2	60	30	2	18
		Cooling down:(Cooling lower and upper body,					5

		starching ,breathing mediation)					
Tuesday and Thursday	6	**Warming up exercise** (jogging, movements of hands and leg, stretch)					8
		Main part Jumping rope, wall sit, abdominal crunch, side plank, step up, triceps dips	2	60	30	2	18
		Cooling down:(Cooling lower and upper body, starching ,breathing mediation)					5
Tuesday and Thursday	7	**Warming up exercise** (jogging, movements of hands and leg, stretch)					8
		Main part: (Squat, push up, jumping jack, lung ,plank, side lifts)	2	60	30	2	18
		Cooling down:(Cooling lower and upper body, starching ,breathing mediation)					5
Tuesday and Thursday	8	**Warming up exercise** (jogging, movements of hands and leg, stretch)					8
		Main part: Jumping rope,	2	60	30	2	18

		wall sit, abdominal crunch, side plank, step up, triceps dips					
		Cooling down;(Cooling lower and upper body, starching, breathing mediation)					5
Tuesday and Thursday	9	**Warming up exercise** (jogging, movements of hands and leg, stretch)					8
		Main part: (Squat, push up, jumping jack, lung ,plank, side lifts)	2	60	30	2	18
		Cooling down: (Cooling lower and upper body, starching ,breathing mediation)					5
Tuesday and Thursday	10	**Warming up exercise** (jogging, movements of hands and leg, stretch)					8
		Main part Jumping rope, wall sit, abdominal crunch, side plank, step up, triceps dips	2	60	30	2	18
		Cooling down (Cooling lower and upper body, starching ,breathing					5

		mediation)					
Tuesday and Thursday	11	**Warming up exercise** (jogging, movements of hands and leg, stretch)					8
		Main part (Squat, push up, jumping jack, lung ,plank, side lifts)	2	60	30	2	18
		Cooling down (Cooling lower and upper body, starching ,breathing mediation)					5
Tuesday and Thursday	12	**Warming up exercise** (jogging, movements of hands and leg, stretch)					8
		Main part Jumping rope, wall sit, abdominal crunch, side plank, step up, triceps dips	2	60	30	2	18
		Cooling down (Cooling lower and upper body, starching ,breathing mediation)					5

APPENDIX C. PHYSICAL ACTIVITY READINESS QUESTIONNAIRE

Physical activity readiness questionnaire is the first step to take in to consideration if one planned to involve in regular exercise. Many health benefits are associated with participating in regular exercise. The Physical activity readiness questionnaire is designed to identify the small number of students for whom circuit training might be inappropriate or those who should seek medical advice concerning the type of activity most suitable for them. The following questions are prepared and distributed to students regarding to their health status for the participation of the designed circuit training.

For Students; please read the following questions carefully and indicate your correct responses to each question by encircle “YES” or “NO” options.

Students full Name: _____

Students Signature: _____

Date: _____

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

9	Do you have bone or joint problem which has been aggravated by exercise?		
10	Do you have upper or lower back pain which has been aggravated by exercise?		