

**ASSESSMENT AND COMPARISON OF SOME SELECTED  
PHYSICAL FITNESS LEVEL OF PHYSICAL EDUCATION  
VERSUS AESTHETICS STUDENTS IN ARBAMINCH  
COLLEGE OF TEACHERS' EDUCATION**

**BY  
MEZGEBE MENA**

**A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF  
ADDIS ABABA UNIVERSITY IN PARTIAL FULLFILMENT FOR THE  
REQUIREMENTS OF THE DEGREE OF MASTERS OF SCIENCE IN  
SPORT SCIENCES**

**April 2014  
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## **ACKNOWLEDGEMENT**

The achievement for the completion of this study is credited to the contributions made by a number of persons. First and for most I express my deepest gratitude to my adviser Dr.Solomon Teka for all guidance, support and giving me suggestive and educative comments in the process of conducting my thesis work. In line with this I want to express my thanks to Adisu Daniel for providing me with necessary assistances and he help me in the statistical analysis to conduct the study.

I also extend my thanks to Dr. Degafe Darzo for role they played by sharing ideas and technically supporting the thesis work. And also I would like to forward my tanks to Addis Ababa University for financial support.

I would like to express my gratitude to my staff members Efrementiba, Tsegaye Tsemi and Zenabech Abera they help me throughout the field experimental fitness test

In addition to this my gratitude will further go to Arba Minch College of Teachers' Education and Arbaminch Unieristy for providing me all necessary facilities, materials and transportation for the accomplishment of my work.

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## ACRONYMS

<b>AAHPERD</b>	American Alliance of Health, Physical Education, Recreation, and Dance
<b>ACSM</b>	American College of Sport Medicine
<b>AHA</b>	American Heart Association
<b>AMSE</b>	Abdominal Muscle Strength and Endurance
<b>ANOVA</b>	Analysis Of Variance
<b>As</b>	Aesthetics students
<b>BEMSF</b>	Back Extensor Muscle Strength and Flexibility
<b>BIA</b>	Bioelectric Impedance Analyzer
<b>BMI</b>	Body Mass Index
<b>BSSR</b>	Back-Saver Sit-and-Reach
<b>CDANR</b>	College of Dry-land Agriculture and Natural Resources
<b>CDC</b>	Centre for Disease Control and Prevention
<b>CDE</b>	California Department of Education
<b>CVF/E</b>	Cardio-Vascular Fitness/Endurance
<b>DEXA</b>	Dual X-Ray Absorptiometry
<b>df</b>	Degree of freedom
<b>HHS</b>	U.S. Department of Health and Human Services
<b>HRPF</b>	Health-Related Physical Fitness
<b>Hp</b>	Physical education students
<b>LBHMF</b>	Low Back and Hamstring Muscle Flexibility
<b>MS</b>	Muscular Strength
<b>NCD</b>	Non-Communicable Disease

<b>PA</b>	Physical Activity
<b>PACER</b>	Progressive Aerobic Cardiovascular Endurance Run
<b>PCPFS</b>	President's Council on Physical Fitness and Sports
<b>PE</b>	Physical Education
<b>PFT</b>	Physical Fitness Test
<b>Sd.</b>	Standard Deviation
<b>SPSS</b>	Statistical Package for the Social Sciences
<b>US</b>	United States
<b>Vs</b>	Versus
<b>VO<sub>2</sub>max</b>	Maximal Volume of Oxygen uptake
<b>WHO</b>	World Health Organization

## **ABSTRACT**

Physical fitness, especially health-related physical fitness is one aspects closely associated with good health. Participation in regular physical activities is rapidly decreased specially in the college. In collage level professional physical education courses(practical and theoretical) are offered for both linear physical education and cluster Aesthetics only. Due to this, ,this research was conducted to identify the difference points between them in some selected physical fitness parameters and also aimed to assess and compare physical education verses Aesthetics students in selected physical fitness by formulating null hypotheses to accept or reject( whether there is significant difference between physical education and aesthetics group students) by deciding the variables which cause the effect on some behavior of research subjects as independent variables (different health and physical education courses given to both groups in practice or in theory ) to this research and dependant variables of physical fitness and control variables' such as sex difference(for group), age, weight, height, attitude/ interest, academic achievement, balanced diet, and other external factors. To attain this objective 80 research subjects are selected from third year linear and cluster group students as the subject of the research from total population of 2407 of college students both by simple random ( lottery ) and purposive sampling method were selected, and the data were collected through measure by their respective measuring device and procedures. To do this quasi-experimental was designed and statistical tools of independent sample t-test and one/single sample t-test with 5% error ,two tail hypothesis test from the SPSS version-19 were implemented. Finally relative to research subjects generally there is no significance difference between two groups in selected physical fitnesses variables in independent sample t-test but significance difference of both groups from standard range mean value in single sample t-test .when we compare the mean relatively linear groups have better performance. Based on this the researcher recommend that students should participate in regular physical exercise in order to enhance their fitness level.

**Key words** fitness. aesthetics, health, linear, cluster, participation and exercise.

# **CHAPTER ONE**

## **INTRODUCTION**

### **1.1. Back Ground Of The Study**

Human body is a gift by nature which need movement and physical activities in order to improve their whole functional aspect of the organs and to lead healthy and good life. Life in the computer age is not less than the blessings of God. Scientific discoveries have changed the entire face of our planet. It has changed the thorny life into the bed of roses. Good health provides sound and solid foundation on which fitness rests and at the same time fitness provides one of the most important key to health and living one's life to fullest (Kamla-Raj, 2010). The human body is created to function well when it is in active condition. Physical fitness avoids an individual from being infected or suffers from illness, stay healthy both mentally and physically throughout their lives. In short term, they are able to perform daily chores easily and able to prevent chronic diseases such as heart attack, high blood pressure, cancer, diabetes, and osteoporosis (Omar-Fauzee 2010).

Physical fitness is a crucial pillar contributing a lot for the health of an individual so that it affects our ability to function and be physically active, and at poor levels is associated with such health outcomes as diabetes and cardiovascular diseases(Institute of Medicine, 2012). Physical fitness according to the President's Council on Fitness, is a broad quality involving medical and dental supervision and care immunization and other protection against disease, proper nutrition, adequate rest, relaxation, good health practices, sanitation and other aspects of healthful living. It further states that exercise is an essential element to achieving and maintaining physical fitness (Jourkeshet *al*, 2011). In order to live quality of life, an individual should develop overall fitness aspects(physical, psychological, social, spiritual...etc). All-round fitness is a key to quality of life. To be able to carry out daily tasks without undue fatigue or to enjoy leisure-time pursuits require a certain degree of fitness. A physically fit person looks better, feels better, thinks better, and so lives better. Physical fitness, especially health-related physical fitness is one aspects closely associated with good health(Degele Shomoro, 2013).

As described in the previous studies, physical fitness can be thought of as an integrated measure of most, but not all body functions (skeleton-muscular, cardio-respiratory, psycho-neurological, and endocrine– metabolic) involved in the performance of daily physical activity and/or physical exercise(Degele Shomoro, 2013).

Fitness, a broad term, which can commonly be defined as the ability to live a happy and well-balanced life involving not only physical factors, but it also has intellectual, emotional, social, and spiritual components. These components interact and are interdependent so that if any component deviates from normal, it affects the overall fitness and ability of an individual to meet the demands made by his or her way of life(Degel, 20012). On the other hand, physical fitness is a combination process of physiological aspect, biochemical, psychological, social and methodology of training which will construct to the level of high performance(Omar-Fauzeeet al., 2010).The benefits of a physical fitness program include improved capability to perform specific physical tasks, improved ability to mobilize the body efficiently, improved tolerance to fatigue, reduced risk during physical attacks, better psychological preparation, and reduced stress and associated health risks(Cooper Institute,2008).

Regular physical activity, in addition to healthy lifestyle is a critical means with no alternatives to keep the body fit sustainably. It can be defined as any bodily movement produced by skeletal muscles that result in energy expenditure. Physical fitness is required not only by athletes for better performance, but also by non-athletes for maintenance of a healthy body and healthy mind (Bennett and Plum,1996 as cited in Jourkeshet al.,2011).Regular involvement in sport and movement activities leads to gain in health-related physical fitness. How students feel about themselves can be influenced by their physical skills. Students who have achieved fundamental motor skill competence have been found to perceive themselves as being competent, socially accepted and to have a positive attitude towards physical activity. In essence, fundamental motor skill competence assists in preparing students for a healthy lifestyle(Victoria State Department of Education, 2009).

Health of an individual should be primary concern of any nation. As described, it is self-evident that the fit citizens are a nation's best assets and weak ones its liabilities. It is therefore the

responsibility of every country to promote physical fitness of its citizens because physical fitness is the basic requirement for most of the tasks to be undertaken by an individual in his daily life. If a person's body is under-developed or inactive and if he fails to develop physical prowess, he is undermining his capacity for thought and for work, which are of vital importance to one's own life and society in a welfare state (Kumar and Singh,2012).Participation in physical activities is rapidly decreased specially in the college and university education. Academic education in the collage focuses on the specialization in preferred fields(Sinku,2012).One area of research that has been understudied in relation to improving physical fitness and PA is health-related fitness knowledge. Having appropriate health related fitness knowledge may be important for adults to be able to understand and apply principles of exercise in their daily lives aimed at exercise adherence and overall health (Ferkel, 2011).The physical fitness of the citizens has been the prime concern of many countries; several researchers in different countries have assessed the fitness of their children, youth and adults ( Olaitan, 2010). In this sense, data on physical fitness status of students in Arbaminch collage of teacher education seem to be scarce. Therefore, the aim of this study is to assess and compare the physical fitness level of Aesthetics and physical education students so that the results obtained can be very helpful to promote good physical fitness in the college students.

## **1.2. Statement of the Research Problem**

Poor locomotion and inactive participation in regular physical activity is because of the technological advancement and predominance of machine over the man's life and disseminated as ordinary way of modern life, can cause human physically less active and leading them to health problems at different age level.

Academic education in the college students focuses on the specialization of different fields which does not consider physical fitness development. The only specialization that give great contribution to the improvement of physical fitness is physical education department. The development of physical fitness is not only the matter of health, but also has a positive relationship with good academic achievement. The main means to transmit knowledge and skill in physical education is physical exercise, this physical exercise also has the way that improve physical fitness components, there for, it is mandatory to participate in regular physical activity for physical education and aesthetics students in order to increase their physical fitness level in

order to be active and competent in their profession. Arbaminch collage physical education and Aesthetics stream students devote most of their time for academic and theoretical oriented tasks instead of participating in regular physical activity that help them to develop their fitness level high, resulting in different factors. On the other hand, inactive lifestyle predominated over active lifestyle in college physical education and Aesthetics stream students may be due to different barriers such as lack of time, shortage of facility lack of interest to participate in regular physical activity. As observed in the practical class of physical education lesson, Aesthetics and physical education students show different performance. In addition to this; when the students assigned to school for fulfillment of third year practicum course they are effective in theoretical aspect of physical education lesson but they were not actively perform/engage in practical aspect of physical education session and also has big different observed in linear physical education and cluster Aesthetics students in teaching process of practical session of physical education as well as in practicum course ; that may be the result of less physical fitness. In collage level physical education courses offered for both linear physical education and cluster Aesthetics students so that attention should be given to physical fitness promotion and active style of life for those students through identifying their fitness level. Therefore, this research aimed to assessment and comparison of some selected physical fitness of third year physical education versus Aesthetics students in Arbaminch collage of teachers' education.

### **1.3. Objective of the study**

#### **1.3.1. General objective**

- The aim of this study is to assess and compare some selected physical fitness of Aesthetics students versus Physical education students of Arbaminch collage of teacher education with each other and with standard parameter.

#### **1.3.2 Specific objective**

- To identify whether there is significance difference in some selected physical fitness between physical education and Aesthetics students both in groups and with the same sex.
- To evaluate whether there is significance difference between linear physical education and cluster aesthetics students with standard parameter of fitness

- To compare fitness level of linear physical education and cluster Aesthetics students with standard value.
- To suggest the result of the present study for the concerned body in way that possible solution can be obtained for physical fitness improvement among students

## **1.4. Hypothesis**

The hypothesis is an explicit statement as to what the researcher believe to be true about the observed phenomena. In this research both null hypothesis and alternative hypothesis are formulated and presented, but null hypotheses are tested by statistical tools (independent and single sample t-tests) in order to accept or reject it and /reject or accept alternative hypotheses. The followings are formulated null and alternative hypotheses.

### **1.4.1. Null Hypotheses (H<sub>0</sub>)**

- H<sub>0</sub> 1 physical education and Aesthetics Students have no significant difference in aerobic cardio vascular endurance
- H<sub>0</sub> 2 Physical education and Aesthetics Students have no significant difference in Muscular strength/endurance in curl-up.
- H<sub>0</sub> 3 Physical education and Aesthetics Students have no significant difference in Muscular strength/endurance in trunk lift.
- H<sub>0</sub> 4 Physical education and Aesthetics Students have no significant difference in Flexibility in sit and reach test.
- H<sub>0</sub> 5 There is no significance difference between linear physical education students' fitness mean value and standard good range parameter mean value in physical fitness of aerobic cardio vascular endurance , muscular strength ,and flexibility.
- H<sub>0</sub> 6 There is no significance difference between cluster /Aesthetic education students' fitness mean value and standard good range parameter mean value in physical fitness in aerobic cardio vascular endurance , muscular strength ,and flexibility.
- H<sub>0</sub> 7 There is no significance difference between cluster Aesthetic education male and linear physical education male students' fitness in aerobic cardio vascular endurance , muscular

strength ,and flexibility.

H<sub>0</sub> 8 There is no significance difference between cluster Aesthetic education female and linear physical education female students' fitness in aerobic cardio vascular endurance , muscular strength ,and flexibility

#### **1.4.2.Alternative Hypotheses ( H1)**

H<sub>1</sub> 1 Linear physical education and cluster Aesthetics Students have significant difference in aerobic cardio vascular endurance

H<sub>1</sub> 2 Linear physical education and cluster Aesthetics Students have significant difference in Muscular strength/endurance in curl-up and .

H<sub>1</sub> 3 physical education and Aesthetics Students have significant difference in Muscular strength/endurance in trunk lift

H<sub>1</sub> 4 physical education and Aesthetics Students have significant difference in Flexibility in sit and reach test.

H<sub>1</sub> 5 There is significance difference between linear physical education students' fitness mean value and standard good range parameter mean value in physical fitness in aerobic cardio vascular endurance , muscular strength ,and flexibility.

H<sub>1</sub> 6 There is significance difference between cluster Aesthetic education students' fitness mean value and standard good range parameter mean value in physical fitness in aerobic cardio vascular endurance , muscular strength ,and flexibility.

H<sub>1</sub> 7 There is significance difference between Aesthetic education male and physical education male students' fitness in aerobic cardio vascular endurance , muscular strength ,and flexibility.

H<sub>1</sub>8 There is significance difference between cluster Aesthetic education female and linear physical education female students' fitness in aerobic cardio vascular endurance , muscular strength ,and flexibility

#### **1.5 Significance of this study**

- It can be used as a spring board for further investigation in the related areas.
- It helps curriculum/course designers to determine which group are more benefited from physical education lesson and to design the program accordingly

- It helps college of teachers educations(Arba Minch college of teachers education) to fulfill the necessary materials to students to develop students in physical fitness and to lead the program accordingly without significant gap between two groups.
- Readers can benefit from this study in developing a clear understanding about physical fitness as not only physical mater, but also health matter.
- The study may add the quantum of knowledge in the area of physical fitness.

## **1.6 Delimitation**

In Arbaminch collage of teacher education there are five main streams and twelve department in which students categorized in to year one up to three and different group in each year. From those collage student's this study focused on third year linear physical education and cluster Aesthetics students in Arbaminch collage of teacher education, by comparing some selected health related physical fitness components of two groups.

## **1.7 Limitation**

Limitations those conditions beyond the control of the researcher may have influence over the accuracy of results of findings. Those are effective willingness, motivation and participation of participants in the study based on variables of the research , the time scheduled, Shortage of material ,and accurate instrumental reading and related problems.

## **1.8 Operational Term Definitions**

**cluster Aesthetics education students** those students who are studying three combine subjects those are physical education, music and art.

**Linear physical education students-** are those students who learn to make physical education major subject and biology minor

**Physical Fitness-**is a set of attributes that people have or achieve that relates to the ability to Perform physical activity (Hakkinen, 2010).

**Health-related fitness** refers to the state of physical and physiological characteristics that define the risk levels for the premature development of diseases or morbid conditions presenting a relationship with a sedentary mode of life Singh& Singh, 2012).

**Cardio respiratory fitness (endurance)** is a health-related component of physical fitness that is the ability of the circulatory and respiratory systems to supply oxygen during sustained physical activity (Degele, 2013).

**Muscular strength (MS)** is the amount of force that can be exerted by a muscle, or a group of muscles, in one single, maximal effort(Exercise Science & Wellness Department, 2012).

**Muscular endurance**-is the ability of a muscle to repeatedly apply a sub maximal force or to sustain a sub maximal muscular contraction for a certain period of time (Walls, 2007).

**Flexibility**-is defined as the joints ability to move through a full range of motion (Caldwell & Huitt, 2004).

**Physical activity**- is defined as any bodily movement by the contraction of skeletal muscle that increases energy expenditure above a basal level (Degele, 2013).

**Physical exercise**- is a subset of physical activity that is planned, structured, repetitive, and Purposeful in the sense that improvement or maintenance of physical fitness is the objective.

**Fitness gram** is a fitness testing program developed by the Cooper Institute (Morrowet *al*,2013

## **1.9 Organization of the study**

This research contains five chapters. The first chapter deals with back ground of the study, statement of the problem, significance of the study, hypothesis, delimitation of the study, limitation of the study, definition of some key terms and concepts and others. Chapter two deals with review of related literature. Chapter three comprises methods, subject selection, measurement variables and procedures of the study. Chapter four include data presentation, analysis, and interpretation. At last chapter five deals about summary, conclusion, and recommendation.

## **CHAPTER TWO**

### **REVIEW OF RELATED LITERATURE**

The literature covers the evolution of ideas for fitness, types and definitions of physical fitness, types of tests for each fitness components, benefits of physical fitness, health-related consequences of low level of physical activity and physical fitness, and general recommendations of physical activity for different age groups.

Materials used in this literature include:

- Journals
- Reference books/Manuals
- Institutional Reports And Documents, Magazines, etc

#### **2.1 The Evolution of Notions for Fitness**

As we enter the 21st century, one of the greatest accomplishments we can celebrate is our continuous pursuit of fitness since the beginning of humankind. Throughout prehistoric time, the quest for fitness was driven by a need to survive through the arduous tasks of hunting and gathering. Today, though no longer driven by subsistence requirements, fitness remains paramount to people's health and well-being(Dalleck and Cravitz, 2002). Concept of physical fitness is as old as mankind, keeping in mind the survival of the fittest, down through the ages, only strong and agile people could defend invaders, protects themselves and their property. It is a hard fact that physically fit people are in a better position to bear the rigorous and abnormal stress and strain than those who are less physically fit. The basic movements like running, jumping, climbing, throwing, lifting etc., require specific physical attributes such as muscular strength, muscular endurance, cardio-respiratory endurance, strength, balance and co- ordination(Kumar and Singh, 2012). Throughout the history of mankind physical fitness has been considered an essential element of everyday life. The ancient people were mainly dependent upon their individual strength, vigor and vitality for physical survival. This involved mastery of some basic

skill like strength, speed, endurance, agility for running, jumping, climbing and other skills employed in hunting for their livings(Degele 2010).

According to (Ferkel, 2011) over 100 years there has been an interest in youth fitness testing, but it was not until World War II that fitness was stressed as something of high importance. The fear of boys not being physically fit enough for military service provided a movement for improving fitness levels and testing those levels. In the 1950s, the need to enhance physical fitness prompted President Dwight D. Eisenhower to create the President's Council on Youth Fitness and a Citizens Advisory Board to the Council. In an attempt to reverse this trend, President John F. Kennedy signed an executive order to expand the council and create a catalyst for improving the quality of physical education programs in American public schools. It was called the 'President's Council on Physical Fitness and Sports. 'As a result, physical education programs were targeted to receive increased support that would enable them to upgrade so that the physical fitness levels of American youth might improve (OFRNARS, 1956 and 1964 as cited in Perry, 2002).

## **2.2 Definitions and Types of Physical Fitness**

Physical fitness defined from different angles based on Bouchard and Shepard, 1993 as cited in PCPFS, 2004 there is no universally agreed upon definition of fitness and of its components. In the present context, we are particularly interested in what is no referred to as Health-related fitness, i.e. in the physical and physiological components of fitness that impact more directly on health status. A generally accepted approach is to define physical fitness as the ability to carry out daily tasks with vigor and alertness, without undue fatigue, and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies. Physical fitness thus includes cardio respiratory endurance, skeletal muscular endurance, skeletal muscular strength, skeletal muscular power, speed, flexibility, agility, balance, reaction time, and body composition (DHHS, 1996 as cited in Degele Shomoro,2013).

Physical fitness is the capacity to carry out, reasonably well, various forms of physical activities, without being unduly tired and includes qualities important to the individual's health and well-being. Every person has a different level of physical fitness which may change with time, place

of work, situation and there is also an interaction between the daily activities, and the fitness of an individual, the point if where to put the level of optimum fitness. From the physiological point of view physical fitness may say to be ability at the body to adopt and recover from strenuous exercise(Tarandeep 2012).Also it can be defined as the ability to meet life’s daily demands, without undue fatigue, while maintaining sufficient energy for leisure time pursuits and to overcome emergency situations that may arise personally and professionally (Smith and Tooker, n.d. cited in Sonia 2009).

Table 1 **Common Physical Fitness and Fitness Related Terms**(PCPFS, 2010)

Physical Fitness			Skills
Physiological	Health-Related	Skill-Related	Sports
Metabolic	Body Composition	Agility	Team
Morphological	CardiovascularFitness	Balance	Individual
Bone Integrity	Flexibility	Coordination	Lifetime
Other	Muscular Endurance	Power	Other
	Muscle Strength	Speed	
		Reaction Time	
		Other	

### 2.2.1 Health-Related Physical Fitness

These aspects of fitness are an important health determinant factor different from other aspect of fitness. According to Kumar and Singh, 2012 “Physical fitness is one’s richest possession; it cannot be purchased, it has to be earned through a daily routine of physical exercises.” A high level of physical fitness is desirable for a full, productive life. Sedentary living habits and poor physical fitness have a negative impact on both health and daily living. Physical fitness testing in American youth was established on a large scale in the 1950s. In the intervening decades, the

underlying philosophies that have guided development of fitness testing protocols and specific test items used in test batteries have evolved considerably. An early focus on performance-related fitness, measured by test items that relied heavily on power and speed, gradually gave way to an emphasis on health-related fitness, composed of components that were linked to health outcomes (Institute of Medicine, 2012). Prior to the last 40 years the distinction between health-related physical fitness and skill related physical fitness was not typically made. When tests of physical fitness are administered in school, medical and other settings it is typically health-related fitness components that are measured. Health-related physical fitness consists of those components of physical fitness that have a relationship with good health. The components are commonly defined as following

- Cardio respiratory endurance: Ability to provide oxygen to muscles
- Muscle strength: Ability to exert force during a single effort
- Muscle endurance: Ability to execute repeated contractions over time
- Flexibility: Ability to move through a range of motion
- Body composition: % body fat, central vs. peripheral obesity (PCPFS, 2010).

Health-related fitness refers to the state of physical and physiological characteristics that define the risk levels for the premature development of diseases or morbid conditions presenting a relationship with a sedentary mode of life. However, the degree of development of each varies with the type of physical activity (Singh and Singh, 2012). Also it can be defined as the capacity to take part in daily physical activities without overexertion in combination with demonstrating a number of characteristics and abilities that are associated with low risk of developing hypokinetic diseases (Pate, 1988 as cited in Degel 2013). Therefore, an excellent level of HRPF does not demand extreme levels of physical fitness nor does it require individuals to perform similarly to athletes, who generally perform exceptionally well in a range of physical tests. The components of HRPF can be maintained at healthy levels through physical exercise directed at improving aerobic resistance, muscle strength, muscle resistance and flexibility and lowering overall body fat levels (Petroski 2012 cited in Degele, 2013). Health-related fitness focuses on optimum health and prevents the onset of diseases and problems associated with inactivity. Maintaining an appropriate level of health-related fitness allows a person to:

- meet emergencies;

- reduce the risk of disease and injury;
- work efficiently;
- participate and enjoy physical activity (sports, recreation leisure); and
- Be one's physical best (Connecticut State Department of Education, 2009).

Fitness tests are used in schools as educational tools to teach youth and their families about the importance of physical fitness and to guide individuals to identify and achieve attainable goals for maintaining fitness and health (Institute of Medicine, 2012). Typically lab and field tests of health-related fitness involve some type of performance such as running, stretching, or doing a specific muscle exercise. Because body composition (also referred to as relative leanness) is not a performance measure, some question its inclusion as a component of health-related physical fitness. Possessing good health-related fitness is related to lower risk of illness and improved quality of life(PCPFS, 2010). The principal mission of the FITNESSGRAM program is to promote lifelong physical fitness; physical activity patterns that lead to improved health-related fitness and help youth find some form of activities in which they can participate for a lifetime (Corbin and Pangrazi, 2008).The FITNESSGRAM is designed to assess six key fitness areas that represent three broad components of fitness: (1) aerobic capacity, (2) body composition, and (3) muscle strength, endurance, and flexibility. The third component is divided into four areas: abdominal strength and endurance, trunk extensor strength and flexibility, upper body strength and endurance, and flexibility (California Department of Education, 2007).

### **2.2.1.1 Aerobic Capacity**

As cited in numerous literatures, aerobic capacity (cardio respiratory fitness)unlike other fitness components, are the most important area of any fitness program where acceptable levels of aerobic capacity that are associated with a reduced risk of high blood pressure, coronary heart disease, obesity, diabetes, some forms of cancer, and other health problems in adults (Missouri Department of Elementary and Secondary Education, 2000).This health-related physical fitness component- aerobic capacity has been described using different terms interchangeably such as cardiovascular fitness, cardio respiratory fitness, cardio respiratory endurance, aerobic fitness, maximal aerobic power, aerobic work capacity and physical work capacity(Cooper Institute, 2008). For all practical purposes, these terms are used interchangeably. A subtle distinction is

that cardio respiratory endurance, aerobic work capacity and physical work capacity are typically used to refer to performance ability (the capacity to perform large-muscle activity for a prolonged period of time), whereas aerobic capacity refers to a functional (physiological) capacity. Because the underlying functional capacity is the construct of most interest in relation to health, and because field tests are actually validated against VO<sub>2</sub>max measured in the laboratory, the term aerobic capacity has been used in the FITNESSGRAM materials (Welk and Meredith, 2008). Aerobic capacity indicates how well your body uses oxygen. It tells you how well you would do running, cycling, or playing sports at a high level (Cooper Institute, 2008).

Cardio respiratory Endurance, the ability of the blood vessels, heart and lungs to take in, transport, and utilize oxygen, is a critically important component of health-related physical fitness because it impacts other components of fitness and decreases the risk of cardiovascular diseases (Virginia Department of Education, 2006). Aerobic capacity is a sign of how well the body uses air or oxygen during a workout or exercise. Active high-energy exercise improves aerobic capacity by strengthening the heart muscle and improving the function of the rest of the cardio respiratory system. You may recall that at the start of a workout or exercise plan people often tire quickly and breathe hard because their bodies cannot get enough oxygen. As their fitness levels improve, their aerobic capacity improves, allowing them to exercise with less effort and for longer periods of time. Aerobic capacity may well be the most important physical fitness area, as good aerobic capacity has been connected with a reduced risk of metabolic syndrome. Metabolic syndrome is a group of risk factors that together increase the chance of cardiovascular disease and the risk of diabetes. These risk factors include: High fasting glucose, High waist circumference, High triglycerides, Low high-density lipoprotein cholesterol, and High blood pressure (California Department of Education, 2011-12).

**VO<sub>2</sub>max** is an abbreviation for aerobic capacity. Aerobic capacity is the most important- area of any physical fitness program. Acceptable levels of aerobic capacity are associated with a reduced risk of high blood pressure, coronary heart disease, obesity, diabetes, some forms of cancer, and other health problems. Aerobic capacity is also commonly referred to as cardiovascular fitness, cardio respiratory fitness, aerobic fitness, aerobic work capacity, physical working capacity, and aerobic endurance (Connecticut State Department of Education, 2009). Aerobic capacity (VO<sub>2</sub>max) reflects the maximum rate that oxygen can be taken up and utilized by the body

during exercise. The magnitude of  $VO_2\text{max}$  depends on the capacity of the lungs to exchange oxygen between the air and blood in lung capillaries, the capacity of the cardiovascular system to transport oxygen to the muscles, and the muscles' capacity to use oxygen. The highest rate of oxygen uptake and use reflects the upper limit in the ability of the body to supply energy via aerobic metabolism to the active muscles during strenuous exercise. Aerobic capacity is most commonly expressed relative to body weight to account for differences in body size and to reflect a person's ability to carry out weight-bearing tasks(Welk and Meredith, 2008). Aerobic capacity relative to body weight (maximal oxygen uptake,  $VO_2\text{max}$ ) is considered to be the best indicator of a person's overall cardio respiratory capacity.  $VO_2\text{max}$  is mathematically estimated from the student's performance on the PACER assessment(Cooper Institute, 2008).

Cardiovascular fitness is also referred to as cardiovascular endurance, aerobic fitness and cardio respiratory fitness. A Max  $V\bullet O_2$  test in the laboratory setting is considered to be the best measure of cardiovascular fitness. Commonly administered field tests include the mile run, the 12 minute run, the 1 mile run, the mile walk, the PACER run for children and various bicycle, step, and treadmill tests(PCPFS, 2010).A study conducted by Sinku, 2012 found that the health related fitness program in the physical education schedule have beneficial effects in on the improvement of cardio vascular of sedentary students so that physical fitness make education more active and effective in physical education colleges that educate students in movement basis.

### **Aerobic Capacity Test Options**

Aerobic capacity is measured in the laboratory using a graded exercise test during which the rate of oxygen uptake is measured continually using sophisticated equipment. A graded exercise test is a test typically administered on a treadmill or cycle ergo meter in which the intensity of exercise is progressively increased. The rate of aerobic metabolism and oxygen uptake increases as intensity of exercise increases up to the point at which the aerobic capacity is reached. At this point, even though the exercise intensity can be increased, the oxygen uptake no longer increases proportionally, and there is a plateau in the relation of the rate of oxygen uptake to work rate (exercise intensity). The rate of oxygen uptake at the plateau is aerobic capacity. The measurement of aerobic capacity in the laboratory is technically demanding, requiring expensive equipment and highly-trained technicians. It also is time consuming; a test requires about 30

minutes and only one person can be measured at a time. Therefore, the direct measurement of aerobic capacity is not possible or practical for most field settings, such as schools where large numbers of people must be tested.

Three field tests are used in FITNESSGRAM to assess aerobic capacity: the PACER (Progressive Aerobic Cardiovascular Endurance Run), the one-mile run, and a walk test (for adolescents 13 years of age or older). Two of these tests estimate aerobic capacity from running performance and participant characteristics such as age, gender, body weight and the ratio of weight to height, and the third estimates aerobic capacity from heart rate response to a one-mile walk and selected subject characteristics. The reliability of the three field tests of aerobic capacity is, for the most part, high. Consistently high reliability coefficients have been reported for the PACER and mile walk test. High coefficients also have been reported for children over 9 years of age for distance runs such as the one-mile run. However, reliability of distance runs in younger children is lower, probably because of variation in motivation and pacing (Welk and Meredith, 2008).

Aerobic capacity is the most important area of any fitness program. The PACER, Walk Test and the Mile Walk/Run provide estimates of  $VO_{2max}$ , so direct comparisons can be made between the results of these tests. If you are not administering all the tests, the PACER is one of the recommended tests because students are more likely to have a positive experience, and students who have a poorer performance will finish first and not be subject to the embarrassment of being the last person to finish the test (Virginia Department of Education, 2006).

The P.A.C.E.R. (Progressive Aerobic Cardiovascular Endurance Run) is a multi-stage aerobic fitness test that provides a built-in warm-up and helps children pace themselves effectively. It is suggested that the test be set to a musical pace to create a valid, fun alternative to the one-mile run for aerobic endurance. Pilot testing shows that most students had a positive experience in performing the PACER, the test helps students to learn the skill of pacing, and negative experience of some students in finishing last in a distance run is eliminated in this test (Connecticut State Department of Education, 2009).

The One-Mile Run/Walk has been used for many years as a field test of aerobic capacity. For students who enjoy running and are highly motivated, it is a very good assessment. The objective

of the test is to run one mile as fast as possible. Walking is permitted if necessary. The score on the test is the length of time in minutes and seconds (Cooper Institute, 2008). Because the rate of oxygen uptake is related in part to the pace sustained, it is possible to estimate the highest rate of oxygen uptake possible from the average pace sustained (Welk and Meredith, 2008). Many students enjoy distance running and are highly motivated by the activity both for sport and recreation. Numerous physical education and athletic programs across the state include curricular and extra-curricular distance running activities. There is significant research that has been conducted over a long period of time that supports the value of running for children as well as the validity and reliability of evaluating aerobic fitness with the one-mile run test (Connecticut State Department of Education, 2009). All three Aerobic Capacity test options (i.e., One-Mile Run, 20m PACER, and Walk Test) are reported in terms of  $VO_2\text{max}$ . To calculate  $VO_2\text{max}$  for the One-Mile Run, in addition to gender, age, and time, the student's height and weight must be provided. Similarly, to calculate  $VO_2\text{max}$  for the 20m PACER, the student's height and weight is needed along with gender, age, and number of laps completed. The Walk Test requires the student's weight along with gender, age, and the heart rate in beats per minute (California Department of Education, 2012).

#### **2.2.1.2 Muscle Strength and Endurance and Its Test Options**

Improvements in musculoskeletal fitness (strength and endurance) may have a positive and significant impact on the risk factors for cardiovascular disease; namely, blood based lipid and lipoprotein profiles, hypertension, abdominal obesity, and glucose homeostasis (Warburton, Gledhill, and Quinney, 2001 as cited in Faktor, 2009). The muscle strength, endurance, and flexibility fitness area determines the health status of the musculoskeletal system (i.e., muscles and bones throughout the body). Balanced, healthy functioning of this system requires that muscles work forcefully (i.e., strength), over a period of time (i.e., endurance), and be flexible enough to have a full range of motion at the joints (i.e., flexibility). This component of fitness is important, because it can reduce potential restrictions in independent living as adults (e.g., chronic lower back pain). To determine the health level of the musculoskeletal system, four major areas are tested: (1) abdominal strength and endurance, (2) trunk extensor strength and flexibility, (3) upper body strength and endurance, and (4) flexibility (California Department of Education, 2011). The most important components of fitness in relation to healthy functioning of

the low back are muscular strength, muscular endurance, and flexibility. It is necessary that each separate muscle group possess both strength/endurance and flexibility, and that anatomically opposing muscle groups are balanced in strength/endurance and flexibility. The goal in relation to the low back region is that the vertebra will be kept in proper alignment without excessive disc pressure throughout the full range of possible motions. The research evidence shows that regardless of the testing mode (that is, whether the test is one of static or dynamic function), individuals with low back pain exhibit lower strength values of both the abdominals and back extensor groups than do individuals without LBP. Only two studies looked at trunk extensor endurance specifically, but both of these found that individuals with LBP severe enough to limit function had scores lower than those without such limitations (Plowman, 1992).

The skeletal system in general and the spine in particular are the primary supporting structures of the body. As pointed out in Table 13.2, if the weight the spine supports is largely muscular and the muscles are strong and flexible, healthy functioning should result. However, if a large portion of the body mass is fat, this adds excess weight and pressure on the discs without any positive assistance. The few studies which have utilized body mass index (WT/HT<sup>2</sup>) (BMI) and/or skin folds as an indication of body composition have shown split results. However, an analysis of NHANES-II the national probability sample data set did show a substantial increase in LBP prevalence (1.7 times higher) in the most obese 20% compared with the least obese 20% of the 10,404 adult subjects when obesity was defined by both BMI and skin fold measures (Plowman, 1992).

Upper body strength is important for maintaining functional health and correct posture, thereby reducing possibilities of lower-back pain and restrictions in independent living. It is important to educate students regarding the prevention of problems that can affect them as adults (Missouri Department of Elementary and Secondary Education, 2000).

Muscular strength (MS) is the amount of force that can be exerted by a muscle, or a group of muscles, in one single, maximal effort. For example, if you went into the weight room and decided to see how many pounds you could bench press; the absolute heaviest weight you could press successfully one time would indicate the strength of muscles responsible for that movement. Not everyone needs to have the muscular strength of a body builder to be considered

adequately fit in this area. Having adequate muscular strength decreases the likelihood of injuries and also enhances activities of daily living(Exercise Science and Wellness Department, 2012).

American College of Sport Medicine (ACSM) defines muscular strength as maximal force that can be generated by a specific muscle or muscle group specific to: muscle group, type of contraction, speed of contraction, joint angle tested, results from a test are specific to the procedures used, and no single test exists for evaluating total body muscular endurance or muscular strength(ACSM, 2013).

Musculoskeletal fitness, as developed by resistance exercise, clearly has benefits for preservation or regaining function. To promote and maintain good health and physical independence, adults will benefit from performing activities that maintain or increase muscular strength and endurance for a minimum of two days each week. Participation in aerobic and muscle-strengthening physical activities above minimum recommended amounts provides additional health benefits and results in higher levels of physical fitness. Many adults, including those who wish to improve their personal fitness or further reduce their risk for premature chronic health conditions and mortality related to physical inactivity, should exceed the minimum recommended amounts of physical activity. Strength and endurance of the abdominal muscles are important in promoting good posture and correct pelvic alignment. The latter is particularly important in the maintenance of low back health (Missouri Department of Elementary & Secondary Education, 2000). On the other hand the abdominal/trunk region have been selected as areas for testing because of their perceived relationship to activities of daily living, correct posture, and the development/ maintenance of a healthy, well-functioning back (Kesaniemiet *al.*, 2001as cited in ACSM & AHA, 2007).

There is promising evidence that muscle strengthening (resistance) exercise reduces the risk of falling and fractures among the elderly (DHHS, 1996 cited in Degele,2013). To produce force (energy) while performing various physical activity/exercises, our muscles or group of muscles undergo different forms of muscular contractions. These have two broad categories. Firstly, **Static (Isometric)**– Muscle generates force without movement (i.e. muscle does not change length). Secondly, **Dynamic**– Muscle generates force while lengthening or shortening. The dynamic muscular contractions fall into sub-forms; **Concentric**: Muscle shortens, **Eccentric**:

Muscle lengthens, **Isotonic**: Fixed resistance, and **Is kinetic**: Fixed movement speed(ACSM, 2013).

Assessments of muscular strength, muscular endurance, and flexibility have been combined into one broad fitness category because the primary consideration is determining the health status of the musculoskeletal system (muscles and bones).It is important to remember that training to develop muscle strength, endurance, and flexibility is very specific. The movements included in these assessment items are only a sampling of the many ways that the body is required to move and adjust during physical activity. (Cooper Institute, 2008).

The **90<sup>0</sup> push-up** is a test of upper body muscle strength and endurance. Strength and endurance of the muscles of the upper body are important in activities of daily living, maintaining functional health and promoting good posture (Connecticut State Department of Education, 2009). The objective is to do as many push-ups as possible to a specified cadence (three seconds per repetition). This movement is repeated as many times as possible. The student should push up and continue the movement until the arms is straight on each repetition. The rhythm should be approximately twenty (20) 90<sup>0</sup> push-ups per minute or one (1) 90<sup>0</sup> push-up every 3 seconds.

Students who score poorly in upper body strength should be encouraged to participate in calisthenics and other strengthening and stretching activities that will develop the muscles in the upper body. However, it is essential to remember that physical fitness training is very specific and that the areas of the body being assessed represent only a fraction of the total body (Georgia Department of Education, 2012).

**The curl-up** is a test of abdominal strength and endurance. Strength and endurance of abdominal muscles are important in promoting good posture and correct pelvic alignment, both important elements in good back health. The previous version of the curl-up sometimes caused neck strain and did not account for the differences in the length of arms and legs of growing children. The improved version addresses both of these problems as well as better isolating the abdominal muscles for a more accurate indication of strength and endurance (Connecticut State Department of Education, 2009). Abdominal strength and endurance are important in promoting good posture and correct pelvic alignment. The latter is important in the maintenance of lower back health. The Curl-Up is the only test that is used to determine this area of fitness(California

Department of Education, 2011). In testing and training the muscles of this region, it is difficult to isolate the abdominal muscles. It is important to note that the new partial (abdominal) curl-ups and curl-ups with a cadence, done slowly with the knees bent and feet not held, are a better indicator of the strength and endurance of the abdominal muscles than the timed curl-ups. Furthermore, compression of the spine and assistance of hip flexor muscles are minimized in these tests (Missouri Department of Elementary and Secondary Education, 2000). **Refer Picture 2 and 3 in appendix 3** indicate how curl-up test measurement taken; picture 2 indicate Starting Position for the Curl-Up Test (Cooper Institute, 2007) and Figure 3 direct Position of the student in the “up” position for the curl-up test (Cooper Institute, 2007)

### **Trunk Extensor Strength and Flexibility-*Trunk Lift***

This is an important aspect of fitness because it predicts first time and recurrent lower back pain, a major source of disability and discomfort. Awareness and attention to trunk strength and flexibility may reduce the risk for future back problems. There is only one option for this fitness area-*Trunk Lift*. The goal of this test is to lift the upper body a maximum inches off the floor using the muscles of the back. Students hold this position long enough to allow for the measurement of the lift distance (California Department of Education, 2012 – 13). It is important that attention be given to performance technique during this test. The movement should be performed in a slow and controlled manner. While some flexibility is important, it is not advisable (or safe) to encourage hyperextension.

Test-retest studies of the trunk extension test (done without limiting the lift to 12 inches) have reported high reliability in high school and college aged students. There are no data on the consistency results for younger children. Research results have shown that is kinetic trunk endurance, torso length, body weight, passive trunk extension, trunk extension endurance, trunk strength, and flexibility all contribute to performance of the trunk lift. However, a single repetition, partially body weight limited, restricted range item, this test is a minimal assessment of the components of trunk strength and flexibility. Most school-aged individuals will pass this test easily (Cooper Institute, 2007).

**Refer Figure 4 in appendix part 3** shows the proper procedure how the trunk-lift test administration performed it taken from: *FITNESSGRAM / ACTIVITYGRAM* Test Administration Manual Fourth Edition, 2007,.

### **2.2.1.3 Flexibility**

The development and maintenance of healthy low back function requires a balance of flexibility, strength, and endurance. Specifically, the critical components are: Low back lumbar flexibility, hamstring flexibility, hip flexor flexibility, Strength and endurance of the forward and lateral abdominals, and strength and endurance of the back extensor muscles (Plowman, 1992).

Maintaining adequate joint flexibility is important to functional health. Decreased flexibility is generally not a significant health problem for young people. However, students need to understand the importance of maintaining flexibility and range of motion as they age (Missouri Department of Elementary and Secondary Education, 2000).

Flexibility is a major component of health-related fitness. The research data shows that poor flexibility can be associated with a number of health problems. It is important for students to maintain an appropriate level of flexibility. As students get older, they tend to lose flexibility, and tasks such as tying shoes and getting in and out of cars and the bath may become difficult without assistance. It is very important for physical education teachers to help students learn about the importance of flexibility training and to work on flexibility in their classes (Alabama Department of Education, 2011).

Flexibility is a health-related component of physical fitness that relate to the range of motion available at a joint. It helps in synchronizing the various movements. It has been a common belief that a high degree of flexibility is necessary in all endeavors. Greater amount of flexibility decreases the expenditure of energy and reduces the resistance while performing gymnastic movements (Hellenic Olympic Committee, 1970 as cited in Singh and Singh, 2012). Although it is often times overlooked, flexibility is yet another key component to health related fitness. Flexibility is defined as the joints ability to move through a full range of motion. Excellent flexibility provides various health related benefits, which include improved physical performance, greater freedom of movement, improved posture, an increase in physical and

mental relaxation, and a decrease in the risk of injury. Although an individual's level of flexibility is primarily due to genetics, gender, and age, it is important to recognize that the level of physical activity plays an important role as well. In simple terms, the less physically active we are, the less flexible we are likely to be (Caldwell and Huitt, 2004). Broadly, flexibility is a property of the musculoskeletal system that determines the range of motion achievable without injury to a joint or group of joints (Holt and Pelham, 1996 as cited in PCPFS, 2000). Flexibility plays an important role in our health and well-being, whether or not a person is involved in a sports activity. Flexibility may reduce the possibility of injury during an activity. Another important aspect of flexibility is the fact that adequate flexibility enables the body to move with ease during every day, normal type of tasks. In addition, some research suggests that regular maintenance of joint flexibility might possibly reduce the severity of future joint problems such as arthritis or bursitis.

The development of flexibility is mainly acquired through stretching programs. Two of the most common types of flexibility training are *static* and *dynamic*. Static flexibility exercises involve moving a joint into an extended position and holding that position for a minimum of 15-30 seconds. Dynamic flexibility involves conscious, controlled movement through the joint's range of motion. Muscles and tendons stretch most effectively when the temperature within the muscle is slightly higher than normal. This is where the term *warm up* comes from: before exercise, perform light movements that mimic the activity to be performed. Dynamic stretching should be done during the warm-up phase, whereas static stretching should be done after the body is thoroughly warm (Exercise Science and Wellness Department, 2012). Static flexibility tests measure the limits of the achievable motion but these limits are subjective. Dynamic flexibility tests are more objective and measure the stiffness of a passively stretched muscle group. Normal ranges of static flexibility are well documented for most joints. Major deviations (top or bottom 20% of the distribution) from the norm may be associated with a higher incidence of muscular injury. While there is a theoretical association between flexibility and several musculoskeletal problems, there are few prospective studies showing significant associations. Currently, there is little scientific evidence on which to base individual prescriptions for static flexibility development beyond the maintenance of normal levels. More longitudinal studies of dynamic flexibility may provide a greater insight into the role of flexibility in health and performance

(PCPFS, 2000). Injuries to bones and joints are many times the result of muscle imbalance at a specific joint; the muscles on one side may be much stronger than the muscles on the other side or may not have adequate flexibility to allow complete motion or sudden motion to occur (Cooper Institute, 2008). Studies support the fact that individuals who have suffered low back pain have weaker, more fatigable, and less flexible muscles in the trunk region even after the acute pain episode has subsided than do those who are pain free. Continued weakness, low endurance, and restricted range of movement appear to be contributing factors to recurrent low back pain (Plowman, 1992). When flexibility tests are used as measures of health-related physical fitness, the rationale is usually based on a presumed relationship between flexibility and low back pain or upon functional independence. One of the components of the Health Related Physical Fitness Test, for instance, was abdominal and low back-hamstring musculoskeletal function measured by modified sit-ups and sit and reach tests. The FITNESSGRAM, a health-related criterion-referenced fitness test currently endorsed by AAHPERD, includes the BSSR and shoulder stretch tests as measures of musculoskeletal functioning because the upper body and abdominal/trunk regions were deemed important for "maintaining functional health and correct posture, thereby reducing possibilities of future low back pain and restrictions in independent living (AAHPERD, 1992 and 1980; Cooper Institute, 1992 and 1999 as cited in Short and Winnick, 2005).

Tests of muscular strength, muscular endurance, and flexibility have been combined into one broad fitness category to determine the functional health status of the musculoskeletal system. It is equally important to have strong muscles that can work forcefully over a period of time that are flexible enough to allow full range of motion at the joint (Virginia Department of Education, 2006). Flexibility is specific to each joint of the body, thus there is no general measurement of flexibility as there is for cardiovascular fitness. Flexibility is typically measured in the lab using measurement devices such as a goniometry, flex meter and in the field with tests such as the sit and reach and the zipper performance (PCPFS, 2010).

**Back-saver sit-and-reach and shoulder stretch** are the most widely used tests.

The back-saver sit-and-reach is a measure of joint flexibility, which is important to overall functional health. Stretch ability and symmetry of the hamstring muscles at the back of the legs,

and flexibility of the spine are important to general fitness, injury avoidance and long-term back health. The revised version of the test allows greater accommodation for the differences in the length of the arms and legs of growing children, thus is more accurate, and reduces strain on the knees(California Department of Education, 2012).Refer **figure 5 in appendix 3** that taken from California Physical Fitness Test Reference Guide shows method of Back-Saver Sit and Reach test.The **shoulder stretch** has been added as an optional activity (results not reported to state database) for instructional purposes. The shoulder stretch is a single test of upper arm and shoulder girdle flexibility. If used in conjunction with the back-saver sit-and-reach, it may be useful in educating students that flexibility is specific to each joint and that maintaining flexibility in the shoulder complex is as important as other joints for general fitness and injury avoidance (Connecticut State Department of Education, 2009).

#### **2.2.1.4 Body Composition**

Body Composition is the amount of fat versus lean mass (bone, muscle, connective tissue, and fluids). While some fat is essential for insulation and providing energy, too much fat can cause serious health problems (Virginia Department of Education, 2006). The relative percentage of lean body mass and fat is largely determined by heredity, level of activity, and gender (females are genetically programmed to have a higher percentage of fat than males). Because of these factors, using a weight scale to monitor body fat levels is not effective: the scale measures total body weight and not the amount of lean mass or body fat (Exercise Science and Wellness Department, 2012).Body composition provides the individual with an estimated amount of their overall percent of body fat. It is important because it is also linked to risk factors of coronary heart disease, hypertension, type 2 diabetes mellitus, and a variety of other chronic diseases(DHHS, 2008 cited in Degele,2013).The Body Composition fitness area targets the various factors that contribute to an individual's total weight (i.e., percent of muscle, bone, organ, and fat content). Assessments of body composition estimate the level of body fat or the appropriateness of student's weight relative to his or her height. This component of fitness is considered important because excessive fat content is associated with health problems, such as coronary heart disease, stroke, and diabetes. FITNESSGRAM provides three test options to estimate body composition: Skin fold Measurements, Bioelectric Impedance Analyzer, and Body Mass Index(California Department of Education, 2012).

The body composition test results provide an estimation of the percent of a student's weight that is fat in contrast to fat-free body mass (muscles, bones, and organs). Maintaining appropriate body composition is vital in preventing the onset of obesity, which is associated with increased risk of coronary heart disease, stroke, and diabetes (Missouri Department of Elementary and Secondary Education, 2000). Body composition is an important component of health-related physical fitness because excess body fat is associated with disease. Various methods are available to assess body composition by measuring the fat free and fat masses of an individual. These methods include: hydrostatic weighing, bioelectrical impedance, dual energy X-ray absorptiometry (DEXA), and skin fold measurements. Of these methods, skin fold measurement is the least expensive method and is relatively easy to administer. Measurements of skin fold thickness are made at a variety of body sites and these measurements are entered into an equation that predicts body fat percentage. Body fat percent predictions made from skin fold measurements are highly correlated with body fat measurements made during hydrostatic weighing (Nieman, 2003as cited in Malina 2008). The relative percentage of lean body mass and fat is largely determined by heredity, level of activity, and gender (females are genetically programmed to have a higher percentage of fat than males). Because of these factors, using a weight scale to monitor body fat levels is not effective: the scale measures total body weight and not the amount of lean mass or body fat. For example, two individuals of the same age, same height and same weight of 140 pounds may actually be drastically different in bone structure, muscle mass, and activity level; one of the individuals may have a much lower percentage of body fat than the other(Exercise Science and Wellness Department, 2012).The range of normal body fat is approximately 10-25% for boys and 18-32% for girls (Going, Lihman and Falls, 2008 in Welk and Meredith, 2008).Research has shown that excessive fatness (above 25% fat for boys and above 32% for girls) is associated with higher levels of cardiovascular disease risk factors (e.g., blood pressure and blood lipids (Williams et al., 1992as cited in Welk and Meredith (2008). Most laboratory and field methods have errors of 2.5 to 4.0% for estimation of body fatness. The laboratory approach that combines underwater weighing, total body water and total bone mineral (called a multi component approach) is the most accurate with an error of 2% or less. Underwater weighing and dual energy x-ray absorptiometry (DEXA) have errors of 2.5% to 3.0% for estimating fatness. Skin folds and circumferences have errors of 3 to 4% fat, and BMI estimates fatness with an error of >5%(Welk and Meredith, 2008).The three body composition

options estimate the level of fat in the body: Skinfold Measurement, Body Mass Index (BMI), and Bioelectric Impedance Analyzer-BIA(California Department of Education, 2010).

FITNESSGRAM uses skin folds as the preferred field method to estimate body fatness. Measurement of two skin folds (triceps plus calf) can be successfully used to estimate % fat in children of all ages. Skin folds have proved to be one of the most effective field methods for estimating body fatness with standard errors of estimate of 3 to 4 % body fat (Lohman and Going, 1998 as cited in(Welk and Meredith, 2008). **Refer Figure 6 in appendix 3** how Skin fold Measurement estimate body fat by taking the median or middle value from three ordered measurements of the thickness of skin folds on the triceps and calf of the right side of the body. A device called a skin fold caliper is used to take these measurements. Using the Body Composition Conversion Chart (found in the FITNESSGRAM Test Administration Manual), the measurements are converted to percentages of body fat. Automated skin fold calipers are computerized devices used to acquire, calculate, and display the percentage of body fat together with computer-entered data, such as age and gender (California Department of Education, 2011). A second method, based on height and weight, called **Body Mass Index (BMI)**, is also available for estimating body fatness, however, the prediction error is considerably larger (5.6%) and therefore this approach is not as effective in identifying moderately over fat children (Lohman and Going, 1998 as cited in Welk and Meredith, 2008).The Body Mass Index, which is commonly referred to as the BMI, is not an estimate of body fat. Instead, it provides information on the appropriateness of a student's weight relative to his or her height. The Body Mass Index is not the recommended body composition test particularly for some students with high muscle mass (California Department of Education, 2011). **Refer Figure 7 in appendix 3.**

To calculate the BMI, a student's weight and height measurements are inserted into a formula to produce an index of the relationship between weight and height. Although not as accurate an indicator of body composition as skin fold measurement, particularly for students with high muscle mass, it is an acceptable option in school districts where policies limit the use of skin fold measurement.

**Bioelectric Impedance Analyzer (BIA):**The BIA is a device that measures body fat by sending a safe, low energy electrical signal through the body and generating an index of resistance. The

resistance value (along with other values such as height, weight, age, and gender) is used to estimate the percentage of body fat (California Department of Education, 2010).

FITNESSGRAM physical fitness assessment program includes a variety of health related physical fitness tests designed to assess cardiovascular fitness, body composition, muscle strength, muscular endurance, and flexibility. The figure below taken from FITNESSGRAM/ACTIVITYGRAM: Test Administration Manual (3rd. ed) (Cooper Institute, 2004), lists the various tests available in the battery and denotes the recommended(primary) assessment in each category(Welk and Meredith, 2008).

Table 2: FITNESSGRAM/ACTIVITY GRAM Test Items ( Welkand Meredith, 2008).

<b>Muscular Endurance, Strength, and Flexibility</b>					
<b>Aerobic Capacity</b>	<b>Body Composition</b>	<b>Abdominal Strength &amp; Endurance</b>	<b>Trunk Extensor Strength &amp; Flexibility</b>	<b>Upper Body Strength &amp; Endurance</b>	<b>Flexibility</b>
The PACER*	Skin fold Measurements*	Curl-Up Test*	Trunk Lift*	90° Push-Up*	Back Saver Sit & Reach*
Mile Run	Body mass index			Modified Pull-Up	Shoulder Stretch
Walk Test**				Pull-Up	
				Flexed Arm Hang	

FITNESSGRAM/ACTIVITY GRAM Test Items (Welkand Meredith, 2008).

### **2.2.2 Skill or performance related physical fitness**

Physical fitness is an umbrella term which captures both the variety of components which are assessed as motor and/or health related fitness and the different motor abilities (e.g. endurance, speed, strength, power, flexibility, coordination) which need to be maintained or developed by physical activity and exercise (Brettschneider and Naul, 2004). Fitness also falls into two major categories—one related to health and the other to the ability to perform a task or sport. These components of fitness have important distinction. Though speed and agility are needed to play sports, like tennis or golf, skill in sports is not a predictor or measure of health( Degele Shomoro, 2013 ).

#### **Performance-Related Fitness includes**

Speed; ability to perform as quickly as possible

Agility; ability to change position of body quickly

Balance, ability to maintain equilibrium and Coordination (Stewart,2005). In some other literatures sources skill-related fitness grouped into six physical fitness components and is an important component of instruction, because students who are more proficient in a specific sport's skills will be more inclined to pursue that type of physical activity outside the school setting. Specific skill-related fitness assessments can allow students to measure these skills. Improved skill-related fitness enables students to perform at a higher level, resulting in their being more physically active and leading to a corresponding improvement in health-related fitness. The skill-related components of fitness are agility, balance, coordination, power, speed and reaction time(National Association for Sport and Physical Education 2009).

Bouchard, Shephard, and Stephens developed a comprehensive model for physical fitness that includes morphological fitness, bone strength, muscular fitness, flexibility, motor fitness, cardiovascular fitness, and metabolic fitness. PCPFS defines each of these fitness components but use a single multidimensional hierarchical model. Figure 1 below taken from ((Bouchard, Shephard, and Stephens, 1994 cited in PCPFS, 2010) provides a clear distinctions.

## 2.3 Benefits of Physical Fitness and Physical Activity

The least active people in the population generally have the highest risk of a variety of negative health outcomes. Although the minimum amount of physical activity needed to decrease this risk is not clear, increasing evidence suggests that participating in no more than 1 hour per week of moderate-intensity physical activity is associated with lower risk of all-cause mortality and the incidence of coronary heart disease. At this lower amount and intensity of activity, the benefits usually are less than that observed with greater amounts of activity and studies are much less consistent about the nature and magnitude of these benefits. Nevertheless, the dose-response curves for the major health benefits clearly indicate an inverse relation between the dose of activity and rate of disease. Although the minimum amount of activity needed to produce a benefit cannot be stated with certainty, nothing would suggest a threshold below which there are no benefits. Reasonably strong evidence demonstrates that participating in moderate to vigorous physical activity for more than 150 minutes per week is associated with greater health benefits for a variety of health outcomes, including chronic disease prevention, improvement of various disease biomarkers, and the maintenance of a healthy weight. However, in a number of studies where such a dose response is observed in preventing chronic disease or reducing all-cause mortality, the relation appears to be curvilinear. This means that the absolute increase in benefits becomes less and less for any given increase in the amount of physical activity (HHS, 2008 cited in Degele,2013).

Physical activity and physical fitness are often used interchangeably, but they refer to two distinct concepts. Physical activity is defined as a bodily movement that results in energy expenditure, while physical fitness is characterized as a set of skills- or health-related qualities (Caspersen, Powell and Christenson, 1985 as cited in Blasingame, 2011). On the other hand, physical activity and physical fitness are closely related in that physical fitness is mainly, although not entirely, determined by physical activity patterns over recent weeks or months. Genetic contributions to fitness are important but probably account for less of the variation observed in fitness than is due to environmental factors, principally physical activity (Bouchard, C. *et al.* 1994 as cited in Blair, 2004). Physical fitness is often discussed with physical activity; it is a state or a condition which permits the individual to carry out her/his daily activities without

undue fatigue and with sufficient reserve to enjoy active leisure pursuits. Physical fitness was historically viewed in terms of three components: muscular strength and endurance, cardio respiratory endurance, and motor ability (Clarke, 1971 as cited in Malina and Little, 2008).

The clear distinction between the two terms, physical fitness and physical activity is best explained as;

***Physical Fitness have measured as follow***

- o Measured as capacity to perform or sustain physical work
- o Measured as performance such as time to complete an event or lift a weight
- o Measured as a physiological variable such as maximal oxygen uptake or heart rate response

***Physical Activity***

- o Measured as habitual patterns of energy expenditure during work or leisure time activities or tasks measured by self-report or interview surveys, direct observations, or electronic monitoring devices (Stewart, 2005).

Promoting the many healthy aspects of youth development through physical activity requires putting knowledge into practice and assessing the outcomes. “Best practices” refers to the “gold standard” for evidence-based activities, strategies, and methods that successfully achieve the targeted, replicable, and sustainable outcomes of positive youth development through physical activity (PCPFS, 2009). One of the major benefits of physical activity is that it helps people improve their physical fitness. Fitness is a state of well-being that allows people to perform daily activities with vigor, participate in a variety of physical activities, and reduce their risks for health problems. Five basic components of fitness are important for good health: cardio respiratory endurance, muscular strength, muscular endurance, flexibility, and body composition (percentage of body fat). A second set of attributes, referred to as sport- or skill-related physical fitness, includes power, speed, agility, balance, and reaction time. Although skill-related fitness attributes are not essential for maintaining physical health, they are important for athletic performance or physically demanding jobs such as military service and emergency and rescue service. Healthy active living benefits both individuals and society in many ways, for example, by increasing productivity, improving morale, decreasing absenteeism, reducing health-care

costs, and heightening personal satisfaction. Other benefits include improved psychological well-being, physical capacity, self-esteem and the ability to cope with stress (Canadian Ministry of Education,2000).

The importance of physical fitness to health for all individuals has been well documented. Physical fitness is a required element for all the activities in our society. Health related physical fitness of an individual is mainly dependent on lifestyle related factors such as daily physical activity levels. It was believed that the low physical fitness level of an individual is associated with higher mortality rate. Physical fitness is also considered as the degree of ability to execute a physical task under various ambient conditions (Jourkeshet *al*,2011).

Recent study conducted on Finnish young men indicated that higher physical fitness and leisure-time physical activity level promotes certain dimensions of health-related quality of life, while morbidities impair them all. The results highlight the importance of health related physical fitness while promoting health-related quality of life (Häkkinen *et al.*, 2010). In addition to improving quality of life, health-related fitness:

- Increases muscle tone and strength;
- Decreases susceptibility to injuries and illness;
- Improves bone mineral density;
- Reduces risk of osteoporosis;
- Improves posture;
- Increases efficiency of the respiratory and circulatory systems;
- Decreases risk of cardiovascular disease and stroke;
- Improves blood pressure;
- Decreases risk of diabetes and some cancers;
- Improves self-esteem and self-confidence;
- Decreases body fat and improves metabolism;
- Increases energy level and academic achievement (Virginia Department of Education, 2006).

A higher level of physical fitness is associated with a lower risk of developing hypertension, which is related to coronary heart disease (Marti,1991as cited in Parveen, 2007).Evidence obtained from one study conducted on the “Effect of Health-Related Physical Fitness Programs

on the Cardio-Respiratory Function of Sedentary Students” concluded that, twelve weeks of health related physical fitness programs resulted in a significant decrease in the resting heart rate and respiratory rate with significant increase in the vital capacity. According to the results it can be concluded that diet and health related physical fitness programs in physical education department is not only beneficial to increase the cardio respiratory functions and improve physical fitness of sedentary students but also improve the cardio respiratory functions of players of various sports disciplines and general people (Sinku,2012)

The achievement of a high standard of health depends on the development of physical wellbeing, fitness, and good habits for healthy living. The promotion of physical wellbeing and fitness is one of the ways to attain good health, which results from continuous and regular participation in PA. Optimum physical fitness cannot be attained without consideration of emotional, mental, and social fitness, as well as the development of habits of healthful living(Baley &Field 1976 as cited in Aboshkair,2012). Previous findings clearly indicated that -Male player subjects(students) are found more positive in self-evaluation, integration of personality, autonomy and environmental mastery than male non player subjects, and in overall mental health there is significant difference between male player and male non -player subjects so that exercise has an important role to play in promoting sound mental health(Gahlawat&Gahlawat, 2012).

Physical fitness has an important role in the education of new generation in the frame of physical and mental health and nowadays it is treated as a piece of education in the developed societies and education programs(Sinku 2009 as cited in Sinku 2012).

The study done on the “Effect of Physical Exercise on Reaction Time among Mentally Retarded Students” concluded that there was a significant improvement in audio and visual reaction time after the eight weeks of physical exercise. It was also concluded that six days per week for eight weeks of training period will help to improve the mentally retarded students on audio and visual reaction time(Raja and Neethi, 2012). Enhanced physical fitness levels are thought to help an individual’s mental state of mind. Several studies have shown that an increase in aerobic levels do not necessarily result in a reduction of stress or depression or cause improvements in mood or self-perception. It is thought that the associated increase in body heat, along with the reduction in muscle tension as the result of a physical workout, may therefore contribute to an improved mental thought process (Neeser, 2005). Research suggests two ways in which physical activities

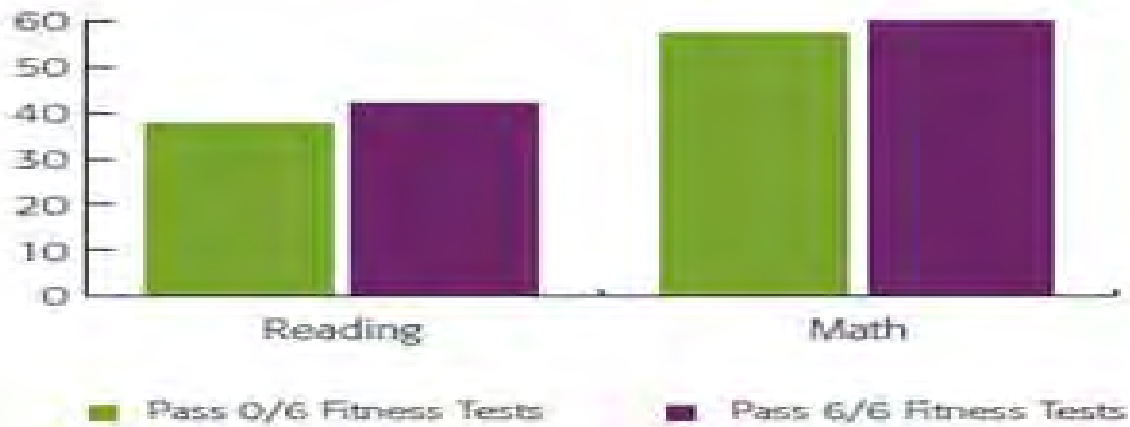
can contribute to mental health in adolescents. Firstly, there is fairly consistent evidence that regular activity can have a positive effect upon boys' and girls' psychological well-being. Secondly, research has indicated that physical activity can contribute to the reduction of problematic levels of anxiety and depression. Evidence is beginning to be gathered for exercise as a treatment for clinical depression, with studies finding that physical activity is as effective a treatment as anti-depressants and psychotherapy (Dimeo et al., 2001; Martinsen, 1994 as cited in Gahlawat and Gahlawat, 2012).

Findings on some studies showed that the relations between BMI and health-related physical fitness in adolescents were non-linear. Overweight/obese and underweight adolescents had poorer performance in push-up and sit-up tests than normal weight adolescents. Different aspects of health-related physical fitness may serve as immediate indicators of potential health risks for underweight and overweight adolescents (Maket, 2010). In addition to issues regarding obesity, many studies on physical activity have shown that the body responds to exercise in ways that have positive effects on the cardiovascular, respiratory, endocrine, and musculoskeletal systems. More specifically, physical benefits of exercise such as increased muscle strength, range of motion, flexibility, posture, and endurance, all promote self-sufficiency and decrease feelings of depression, dependence, and lack of control. Regular participation in physical activity also appears to reduce anxiety, improve mood, and enhance an individual's ability to perform daily tasks. Also, emerging research in animals and humans alike suggests that physical exercise may boost brain function, improve mood, and otherwise increase the capacity for learning (Kong, 1999 as cited in Caldwell and Huitt, 2004). The result obtained from the study on "Is physical activity or physical fitness more important in defining health benefits?" shown that men who made greater improvements in fitness had greater reductions in mortality than was observed in men with little or no change in fitness (Blair, 2001).

Another findings from the study on "Physical Fitness and Academic Achievement" suggest that physical health is related to academic performance in addition to national health goals and, as such, warrant consideration in educational and public policy making (Castili, 2007) supporting another finding which has shown that there is a significant positive relationship between physical activity and academic performance (Singhet *al*, 2012). Similar studies have also shown that students who spend more time in PE do not have lower grades or achievement test scores, and

sometimes, more PE leads to higher scores (Shephard,1997 and Salliset *al.*, 1999 as cited in San Diego State University, 2008).Statistics on the graph below,taken fromSan Diego State University, 2008.Physical Education Matters: A Full Report has shown higher grades or achievement test scores of students who spend more time in PA.

*Students with Higher Fitness Scores Have better Scores for Reading and Math*



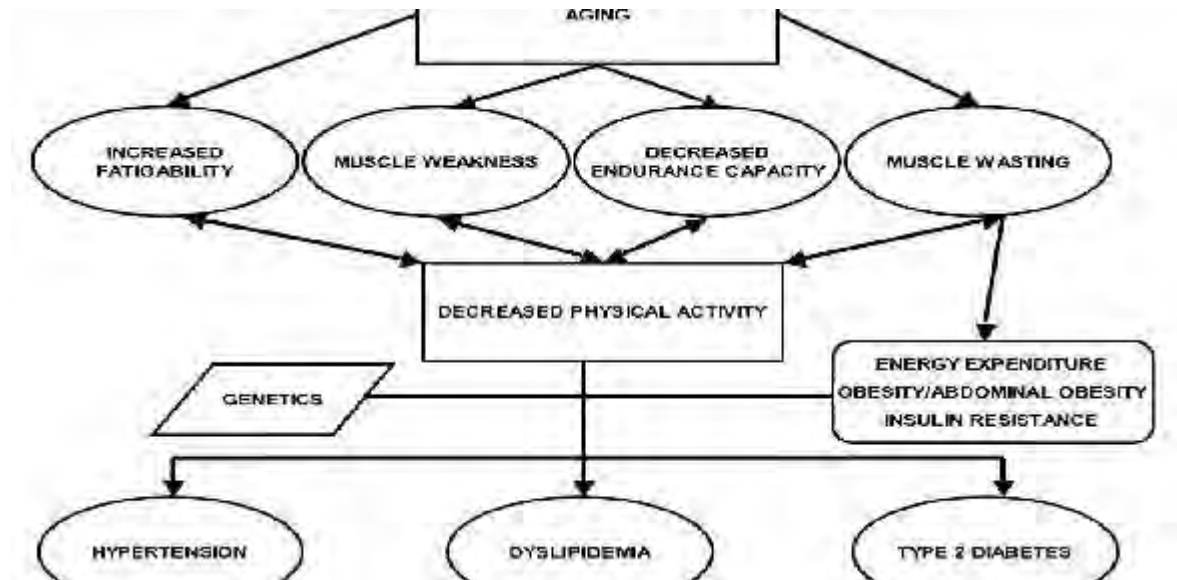
**Graph 1: Students with Higher Fitness Scores have better Scores for Reading and Math**(San Diego State University, 2008) On the other hand, the WHO guidelines also outlined some of the benefits of physical activity that fall into three broad categories: physiological, psychological, and social. Some physiological benefits are immediate, such as improvement in glucose, catecholamine levels, and improved sleep. The longer-term benefits of physical activity include improvement in aerobic or cardiovascular endurance, muscle strengthening, flexibility, balance, and velocity of movement, which is a critical factor in the definition of frailty. Immediate psychological benefits include relaxation, reduction of stress and anxiety, and enhanced mood state. The longer-term effects are improvements in some of these quality-of-life measures plus improvements in cognitive ability, motor control, and skill acquisition. There are also several social benefits that accrue from being active. An important immediate benefit of physical activity is to empower older people to gain a sense of control over what they do and increased involvement in social and cultural activities (Stewart,2005).

## **2.4 Health-Related Consequences of Poor Physical Fitness**

Global health is being influenced by three trends: population-ageing, rapid unplanned urbanization, and globalization, all of which result in unhealthy environments and behaviors. As a result, the growing prevalence of NCDs and their risk factors has become a global issue affecting both low- and middle-income countries. Nearly 45% of the adult disease burden in these countries is now attributable to NCDs. Many low- and middle-income countries are beginning to suffer the double burden of communicable and non-communicable diseases, and health systems in these countries are now having to cope with the additional costs of treating both (WHO, 2010). Day by day the importance of young population is being declared in many platforms by international organizations, politicians and scientists. According to the statistics of world health organization the deficiency of physical activities of adults is approximately 17% in the world. In developed countries 10 to 15% of young population involve in sports, with a trend of decrease in the percentage in the developing and undeveloped countries. Participation in physical activities is rapidly decreasing especially in the college and university education, academic education in the universities focuses on the specialization in preferred fields (Berggren, 2005, Angilley and Haggas, 2009 and Yitzhak, 2009 as cited in Sinku, 2012). Parallel with the general fall of physical and locomotor activities in the recent years, a remarkable increase in mortality and symptoms of cardiovascular diseases are witnessed among developed and underdeveloped communities. Several evidences indicate the prevalence of diseases, neurologic and psychological disorders in the modern communities. Many citizens enjoying welfare and facilities of mechanized life suffer from different organic, muscular and particular problems. (Asadiand Ahmadi, 2000 as cited in Eshraghi, 2012). Cardiovascular problem and heart diseases are common problems of modern times. Many conditions like improper diet, lifestyle, sleeping pattern and negative thinking trigger heart diseases and affect the cardiovascular health. These problems are witnessed now not only in the old-age but also the young generations are falling prey to such impairments. The way of life today needs to be changed to improve the cardiovascular health (Saha, 2012). Studies show that low levels of health-related physical fitness (HRPF) during adolescence are associated with an increased risk of developing chronic degenerative diseases and a higher mortality risk in adulthood( Erikssen, 2001 as cited in Degele,2013).

Recent study on the association between physical activity and better health and psychological well-being of first year university students has shown that insufficiently active students scored lower on psychological well-being and were twice as likely to have consulted a physician regarding an illness compared with sufficiently active students(Bray and Kwan, 2006).

Physical inactivity speeds up the aging process in many people, whereas increased physical activity slows it down in others. The typical aging curve suggests that most physiological functions improve from birth through the late teens.



**Table 3:** Typical Aging Curve: A commonly presented figure showing selected pathways by which changes upon aging lead to disease. All of the arrows in the original figure taken from Stewart, 2005 pointed one way, with increased fatigue ability, muscle weakness, decreased endurance capacity, and muscle wasting leading to decreased physical activity, and eventually to disease. The arrows in the middle have been modified to point in both directions, indicating that physical activity itself (independent of aging) causes increased fatigue ability, muscle weakness, decreased endurance capacity, and muscle wasting.

Most of these functions commonly level off in the mid-20s and then it's generally downhill from there for most physical and cognitive functions. However, the rate of change is not equal among individuals. What is clear is that there are several modifiable mediating factors on the aging

curve. Among the key modifiable factors are physical activities, nutrition, body fat, muscle mass, and smoking, each of which can either delay or accelerate the aging process(Stewart,2005).

The consequences of the sedentary lifestyles lived by so many of our young people are grave. In the long run, physical inactivity threatens to reverse the decades-long progress we have made in reducing death and suffering from cardiovascular diseases. A physically inactive population is at increased risk for many chronic diseases, including heart disease, stroke, colon cancer, diabetes, and osteoporosis. In addition to the toll taken by human suffering, surges in the prevalence of these diseases could lead to crippling increases in our national health care expenditures. (DHHS and Department of Education,2000)

Being physically active plays an essential role in ensuring health and well-being, and there is a large body of research investigating the benefits of exercise. Physical activity benefits many parts of the body – the heart, skeletal muscles, bones, blood (for example, cholesterol levels), the immune system and the nervous system (Swedish National Institute of Public Health, 2010) and can reduce many of the risk factors for NCDs.

These risk factors include:

- Reducing blood pressure;
- Improving blood cholesterol levels and
- Lowering body mass index (BMI).

A lot of problems have been reported related with physically active life among youth. Recent evidence indicated that the participating youth across ages groups were easily able to identify the benefits of physical activity as relates to physical, mental, and emotional (social) health. Youth in each focus group defined *being healthy* in a very balanced manner including nutritious eating, getting enough sleep, exercising to stay fit through sports and activity, avoiding substance abuse and smoking, having a positive peer relationships, and good mental health. Older youth also identified the importance of having the financial resources necessary for a healthy lifestyle. Responses to the word *physically inactive* highlighted negative values and behaviors such as lazy and couch potato.

Barriers to physically active living identified by youth were similar with some variations between gender, age, and community (rural or urban). The majority of youth shared that technology (i.e. computers, video games, and cable TV), poor eating (junk food), lack of gym class or open gym time in school, lack of personal motivation, unsupportive peers, jobs and homework, lack positive role models in their family and community, lack of facilities and equipment, and lack of accessible programs (including the issues of transportation and funding) were the main barriers to them being more physically active (Youth Net Halifax for the N.S. Sport and Recreation Commission, 2001).

## **2.5 Guidelines for Developing Physical Fitness**

### **Guidelines for the Participation in Physical Activity**

The development of civilization is leading to lifestyle changes and diminishing physical activity as well as various types of sicknesses caused by a lack of movement. In order to reduce these negative effects we should maintain a proper level of physical activity, which is often regarded as a contributing factor to positive health levels (Kotwica and Majcher, 2012). Physical inactivity is a major public health problem, and compelling evidence suggests that it is a contributing factor in several chronic diseases and conditions. Recognition of the health and functional hazards of a sedentary way of life has led numerous groups to promulgate public health recommendations for physical activity (Blair *et al.*, 2004).

As defined earlier physical activity is any body movement that uses more energy than one would use while resting. Physical activity may be unplanned movement, whereas exercise generally refers to planned activity. Physical activity is divided into two intensity levels:

- Moderate-intensity aerobic physical activity increases heart rate. Brisk walking, biking, taking the stairs, dancing, and raking leaves are examples.
- Vigorous-intensity aerobic physical activity causes one to sweat and breathe rapidly. Running, jogging, playing soccer, fast dancing such as salsa dancing and fast biking is examples.

Regular physical activity with healthy eating habits is the most efficient and healthful way to achieve physical fitness (Center for Family Health, 2012). Physical activity has been defined as any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level. However, in the guideline, the term “physical activity” will generally refer to bodily movement that enhances health. Bodily movement can be divided into two categories:

**Baseline activity** refers to the light-intensity activities of daily life, such as standing, walking slowly, and lifting lightweight objects. People vary in how much baseline activity they do. People who do only baseline activity are considered to be inactive. They may do very short episodes of moderate- or vigorous-intensity activity, such as climbing a few flights of stairs, but these episodes aren’t long enough to count toward meeting the Guidelines. The Guidelines don’t comment on how variations in types and amounts of baseline physical activity might affect health, as this was not addressed by the Advisory Committee report.

**Health-enhancing physical activity-** is activity that, when added to baseline activity, produces health benefits. In the guideline, the term “physical activity” generally refers to health-enhancing physical activity. Brisk walking, jumping rope, dancing, lifting weights, climbing on playground equipment at recess, and doing yoga are all examples of physical activity. Some people (such as postal carriers or carpenters on construction sites) may get enough physical activity on the job to meet the Guidelines (HHS, 2008). A number of activity and lifestyle strategies effectively contribute to enhancing and maintaining a young person’s health, such as regular active free play, walking, bicycle riding, good nutrition, and sufficient rest. If participation in organized recreational and competitive sports, however, is the primary means for meeting health promoting physical activity requirements, then certain physical activity criteria (specifically, frequency, intensity, and duration), appropriate supplemental or cross-training (that is, concomitant training for more than one sport or multiple fitness components, such as endurance, strength, and flexibility), and other factors should be considered for such an approach, so that optimal enjoyment and health are more likely realized (Bergeron, 2007).

Following these guidelines can reduce the risk of premature death, coronary heart disease, stroke, hypertension, colon cancer, breast cancer, type-2 diabetes, and osteoporosis and improve fitness,

body composition and indicators of mental health. The potential benefits far exceed the potential risks associated with physical activity (Canadian Society for Exercise Physiology, 2011)

Because of the many benefits for health of physical activity, recent analysis has suggested that reaching the recommended minimum level of physical activity compared with no activity was found to lead to a reduction in all-cause mortality of 19 per cent – and this rises to 24 per cent if an hour a day is spent in physical activity. In addition, there is a 31 per cent lower risk for all-cause mortality in active individuals (Woodcock *et al.*, 2011 and Warburton *et al.*, 2010). This demonstrates a positive dose-response – in other words, that the benefits of physical activity increase as the amount and intensity of the activity increases.

There are numerous variations of guidelines available and there is currently debates as to which provide different age groups with the optimal amount of physical activity (PA) to assess physical fitness level of participants. The optimal dose of physical activity is controversial and undoubtedly depends on the desired outcome. Prevention of weight gain, weight loss, and weight maintenance after loss likely requires different levels of energy expenditure. Current recommendations, released jointly by the CDC and ACSM in 1995, and later endorsed by the U.S. Surgeon General, The National Institutes of Health, and the American Heart Association, promote “30 minutes or more of moderate intensity physical activity on most, preferably all, days of the week,” which equates to about 150 minutes of moderate intensity exercise or approximately 1,000kcal/week of energy expenditure (Pate, Pratt, Blair, *et al.*, 1995; USDHHS, 1996; NHI, 1996; Fletcher, Balady, Blair, *et al.*, 1996 as cited in PCPFS, 2004).

According to WHO, the recommended levels of physical activity have been identified for three age groups: 5–17 years old, 18–64 years old and 65 years old and above. These age groups were selected taking into consideration the nature and availability of the scientific evidence relevant to the selected outcomes. The recommendations do not address the age group of children less than 5 years old. Although children in this age range benefit from being active, more research is needed to determine what dose of physical activity provides the greatest health benefits.

In adults aged 18–64, physical activity includes leisure time physical activity, transportation (e.g. walking or cycling), occupational (i.e. work), household chores, play, games, sports or planned exercise, in the context of daily, family, and community activities. By reviewing the different

literature sources, the guidelines recommended that in order to improve cardio respiratory and muscular fitness, bone health, and reduce the risk of NCDs and depression:

- Adults aged 18–64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity.
- Aerobic activity should be performed in bouts of at least 10 minutes duration.
- For additional health benefits, adults should increase their moderate-intensity aerobic physical activity to 300 minutes per week, or engage in 150 minutes of vigorous-intensity aerobic physical activity per week, or an equivalent combination of moderate- and vigorous-intensity activity.
- Muscle-strengthening activities should be done involving major muscle groups on 2 or more days week(WHO, 2010).

The recommended guidelines for the amount of physical activity that individuals should engage in on a routine basis in order to obtain and/or maintain health and wellness has been developed by leading national/international bodies and, although they may vary on specifics, the general features are all similar(Haskell, 2007). The American College of Sports Medicine and the American Heart Association guide lines recommend physical activity for different age groups in type and amount as presented below.

- To promote and maintain good health, adults aged 18–65years should maintain a physically active lifestyle.
- They should perform moderate-intensity aerobic (endurance) physical activity for a minimum of 30 minutes on five days each week or vigorous-intensity aerobic activity for a minimum of 20 minutes on three days each week.
- Combinations of moderate- and vigorous-intensity activity can be performed to meet this recommendation. For example, a person can meet the recommendation by walking briskly for 30 minutes twice during the week and then jogging for 20 minutes on two other days.
- These moderate- or vigorous intensity activities are in addition to the light intensity activities frequently performed during daily life (e.g. self-care, washing dishes, using

light tools at desk) or activities of very short duration (e.g. taking out trash, walking to parking lot at store or office).

- Moderate-intensity aerobic activity, which is generally equivalent to a brisk walk and noticeably accelerates the heart rate, can be accumulated toward the 30-minute minimum by performing bouts each lasting 10 or more minutes.
- Vigorous-intensity activity is exemplified by jogging, and causes rapid breathing and substantial increase in heart rate.
- In addition, at least twice each week adults will benefit by performing activities using the major muscles of the body that maintain or increase muscular strength and endurance.
- Because of the dose-response relation between physical activity and health, persons who wish to further improve their personal fitness, reduce their risk for chronic diseases and disabilities, or prevent unhealthy weight gain will likely benefit by exceeding the minimum recommended amount.
- For **older adults** (over 65s, or those aged 50–64 with chronic conditions such as arthritis), the recommendation is the same, with balance exercises also recommended. It is also the case that goals below this threshold may be necessary for older adults who have physical impairments or functional limitations.
- **Children(aged 6–17)** should do at least an hour of physical activity every day. This can include either moderate-intensity aerobic activity or vigorous-intensity activity (although the latter should be included on at least three days each week). Muscle-strengthening activities (such as gymnastics) and bone-strengthening activities (such as running or skipping rope) are also recommended on at least three days a week. **An example: Walking**
- For good health, 10,000 steps a day is recommended – this is about 5 miles (8km), depending on stride length, and is the equivalent of walking briskly for about 90 minutes.

This can be spread throughout the day. Brisk walking is an example of moderate-intensity activity; race walking becomes vigorous activity. Similarly, Surgeon general report on physical activity concluded that:

- ❖ For better health, physical activity should be performed regularly. The most recent recommendations advise people of all ages to include a minimum of 30 minutes of

physical activity of moderate intensity (such as brisk walking) on most, if not all, days of the week. It is also acknowledged that for most people, greater health benefits can be obtained by engaging in physical activity of more vigorous intensity or of longer duration.

- ❖ Previously sedentary people embarking on a physical activity program to start with short durations of moderate-intensity activity and gradually increase the duration or intensity until the goal is reached.
- ❖ Cardio respiratory endurance activity should be supplemented with strength developing exercises at least twice per week for adults, in order to improve musculoskeletal health, maintain independence in performing the activities of daily life, and reduce the risk of falling(HHS, 1996).

The above guidelines recommended for adults commonly by WHO, HHS, and ACSM & AHA are summarized as follows:

- ✓People of all ages should perform a minimum of 30 minutes of physical activity of moderate intensity (such as brisk walking) on most, if not all, days of the week.
- ✓Combinations of moderate- and vigorous-intensity activity can be performed to meet this recommendation.
- ✓Adults aged 18–64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity.
- ✓Muscle-strengthening activities should be done involving major muscle groups on 2 or more days a week
- ✓Cardio respiratory endurance activity should be supplemented with strength developing exercises at least twice per week for adults, in order to improve musculoskeletal health, maintain independence in performing the activities of daily life, and reduce the risk of falling

The Guidelines for adults focus on two levels of intensity: moderate-intensity activity and vigorous-intensity activity. There are two ways to track the intensity of aerobic activity: absolute intensity and relative intensity.

- ❖ **Absolute intensity** is the amount of energy expended per minute of activity. The energy expenditure of light-intensity activity, for example, is 1.1 to 2.9 times the amount of energy expended when a person is at rest. Moderate-intensity activities expend 3.0 to 5.9 times the amount of energy expended at rest. The energy expenditure of vigorous-intensity activities is 6.0 or more times the energy expended at rest.
- ❖ **Relative intensity** is the level of effort required to do an activity. Less fit people generally require a higher level of effort than fitter people to do the same activity. Relative intensity can be estimated using a scale of 0 to 10, where sitting is 0 and the highest level of effort possible is 10. Moderate-intensity activity is a 5 or 6. Vigorous-intensity activity is a 7 or 8(HHS, 2008).

Table 4 taken from the U.S. Department of Health and Human Services Guide lines lists some examples of activities classified as moderate-intensity or vigorous-intensity based on absolute intensity. Either absolute or relative intensity can be used to monitor progress in meeting the Guidelines.

<b>Moderate Intensity</b>
<ul style="list-style-type: none"> <li>• Walking briskly (3 miles per hour or faster, but not race-walking)</li> <li>• Water aerobics</li> <li>• Bicycling slower than 10 miles per hour</li> <li>• Tennis (doubles)</li> <li>• Ballroom dancing</li> <li>• General gardening</li> </ul>
<b>Vigorous Intensity</b>
<ul style="list-style-type: none"> <li>• Race-walking, jogging, or running</li> <li>• Swimming laps</li> <li>• Tennis (singles)</li> <li>• Aerobic dancing</li> <li>• Bicycling 10 miles per hour or faster</li> <li>• Jumping rope</li> <li>• Heavy gardening (continuous digging or hoeing, with heart rate increases)</li> <li>• Hiking uphill or with a heavy backpack</li> </ul>

**Table 4:** Examples of Different Aerobic Physical Activities and Intensities(HHS, 2008).

## **Summary of Literature Review**

In this study , review literature collected from different sources such as: books, journal articles, theses and dissertations, government reports and magazines. The ideas that taken from different aspect are appropriately cited or acknowledged. The whole idea of review literature which gather from different aspects embraced under the following major categories those are: The Evolution of Notions for Fitness, definitions and types of Physical fitness, health-related Physical fitness, aerobic capacity and its test options, muscle strength and endurance and its test options, flexibility, body composition, benefits of physical fitness and physical activity, health consequences of poor physical fitness and finally guidelines for developing physical fitness.

And finally this research focused on physical fitness parameters such as aerobic cardio vascular endurance, curl-up, trunk lift, and flexibility (sit and reach) based on the objectives stated, and by deciding the variables of the research ( independent, dependant, and control ) as mentioned in introduction part by doing the research in the form of the following chapter ( 3 )

## **CHAPTER THREE**

### **RESEARCH DESIGN AND METHODOLOGY**

The method of this study is comparison , it helps to conduct the experimental study in some group of people and compare the mean by using different statistical tools. The study is conducted in Arba Minch collage of teachers' education which is located at 505K.M from Addis Ababa in the region of SNNPRS Gamo Gofa Zone and 1200 altitude and average of 26 temperature. Physical fitness is considered as an important health-related marker already in youth. It can be objectively and accurately measured through laboratory methods, but due to the high cost, necessity of sophisticated instruments, qualified technicians, and the time constraints. Laboratory tests are not included in this study . In contrast, field-based fitness tests are easy to administer, involve minimal equipment, low cost and a larger number of participants can be evaluated in a relatively short period of time according to (Ortega *et al.*, 2008; Paineau *et al.*, 2008;Rodriguez *et al.*, 2005; Ruiz *et al.*, 2009; Ruiz *et al.*, 2008; España-Romero *et al.*, 2010 as cited in Degele,2013).

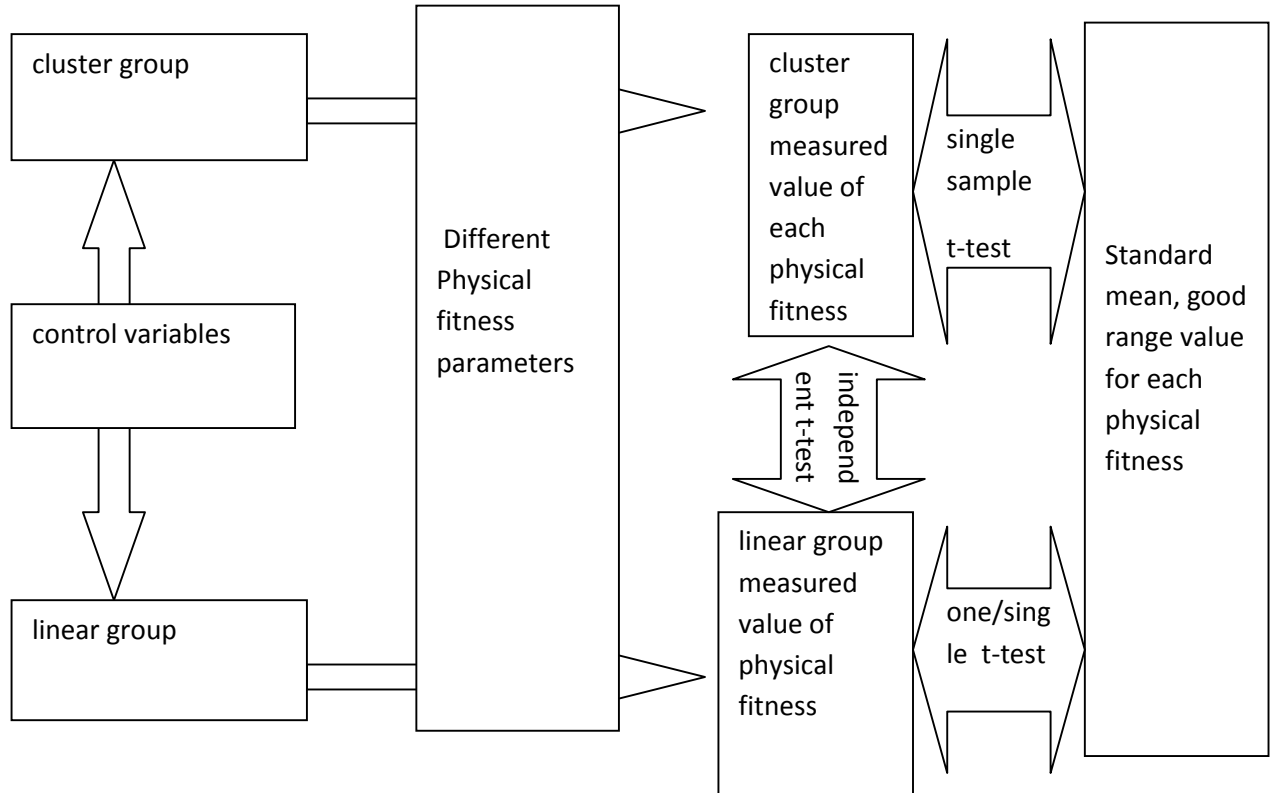
A number of different field tests were used to assess muscular strength, muscular endurance and flexibility ; there is also considerable variability in the measurement protocols used for these assessments ;and these variations can greatly influence the safety and purpose of the assessment as well as the reliability and validity of the assessments according to (Welk and Meredith, 2008).However, fitness gram program provides valid and reliable test options. Therefore, researcher have options for assessing the different dimensions of fitness. According to ( Degele 2013 ) cited for aerobic capacity researcher can choose the PACER (Progressive Aerobic Cardiovascular Endurance Run) test, the one-mile run, or the walk test. Muscular strength and endurance measures include the curl-up, trunk lift, push-up, pull-up, and flexed arm hang. The final component is flexibility, which was measured using the back saver sit and reach, or the shoulder stretch. Therefore, this research used the above recommended method to compare two independent group physical fitness

### **3.1 Research Design**

The research design is quasi- experimental, under this design the methodology (comparison type) with direct field tests were administered by practically taking measurements to analyze data

quantitatively by comparing two independent groups, and compare with standard good range of mean value for age of seventeen and above ( $\geq 17$ ) of each dependent variables.

**Graph 2. Structural / frame work of research design**



### 3.2 Sours of Data

Primary source of data were obtained from third year Aesthetics and physical educations students of Arbaminch collage of teacher education (through field test).

Secondary sources of data will be books, journal articles, theses and dissertations, government reports and magazines.

### 3.3 Data collection and measurement

The main means of data collection and measurement is experimental through practically testing the selected population

### **3.4 Population**

The total population of students in Arbaminch collage of teacher education are 2407. Physical education and aesthetics students are 204 from those the researcher select third year physical education and aesthetics students.

### **3.5 Sampling and Selection of subjects**

In this study, purposive and random sampling technique were used to select the subject. Purposive sampling was used to select physical education and Aesthetics stream students from the whole collage streams and department. Random sampling through lottery method was used to select the equal subject from two independent unequal groups.

#### **Exclusion Criteria**

Students with health problems and non voluntary were not allowed to take part in this study. In addition, students who voluntary to participate only in some tests partially will not permit.

### **3.6 Selection of variables**

There are three different programs that provide excellent examples of effective tools for measurement within physical education: FITNESSGRAM, Physical Best, and the President's Challenge. Physical Activity and Fitness Awards Program. The FITNESSGRAM is a comprehensive health-related fitness testing battery or assessment program designed specifically for youth that was developed in 1982. The items measure aerobic capacity, body composition, and muscular strength and endurance and flexibility according to (Morrowet *al.*, 2013). These tests all students regardless of age, gender, or ability. Students are encouraged to be self-aware of health-related fitness and take responsibility by setting personal fitness goals. When students focus on the process of doing their personal best, a more positive lifelong impact is achieved (Texas School Health Advisory Committee, 2008). It provides a number of options for each performance task so all students who have the maximum opportunity to complete the test.

In this present study, the variables will selected based on feasibility of the criteria, availability of tools, and the relevance of the variables to the present study. The Physical Fitness Test (PFT) measures four aspects so that the investigator selects the following variables. Cardiovascular fitness, muscle strength, muscular endurance, and flexibility.

### 3.7 Criterion measures

FITNESSGRAM is a fitness testing program developed by the Cooper Institute in 1982. The FITNESSGRAM testing battery includes a variety of reliable and valid field assessments for the primary dimensions of health-related physical fitness: aerobic capacity, muscular strength, muscular endurance, flexibility and body composition (Blasingame, 2012).

In this study the FITNESSGRAM requires students to complete the following four tests:

1. **One-Mile Run/ walk:** The one-mile run or walk test measures aerobic capacity and is an alternative to the PACER test. The objective of this test is to run one-mile as fast as possible. If a student is not able to run the entire distance, walking is permitted.
2. **Curl Up: Abdominal Strength Curl-up Test** - measures strength and endurance of abdominal muscles
3. **Trunk Lift:** Measures trunk extensor strength and flexibility - for low back health and proper vertebral alignment
- 4 **Sit and Reach:** Measure lower back and hamstring flexibility

### 3.8 Statistical Analytical Tools

In this study independent sample and single sample research T-tests are the main tools that were used from SPSS-19 to analyze the statistical data and to test the hypothesis of two groups value. The implemented tools are:

- ✓ **Independent sample t-test :** used to compare two independent groups with each other whether there is significance difference between the groups in the measured dependent variables, and two independent groups of the same sex groups with each other.
- ✓ **Single sample research T-test:** used to compare each group (linear and cluster) mean with standard mean value whether there is significance difference between the groups in the measured dependent variables with the standard mean/average value, set for each research dependent variables.

When the tools are implemented/used the followings are assumptions. The test is two tail hypothesis test with 0.05 level of significance, and equal variance is assumed.

### **3.9 Test Administration And Scoring**

For data collection first permission was taken from respective sources. All the necessary information about the study (purpose, procedures etc.) was explained for the participants primarily. Having experts, instruments for measuring purposes, facilities, and sufficient warming up exercises, necessary data was collected with standardized procedure by administering physical fitness tests already selected; and physical education department teacher were direct participant during practical test to help the researcher. Tests were administrated in proper sequence(Sit and Reach, Trunk Lift, Curl Up and One-Mile Run) on the same time of each day in a way that they can accomplish comfortably. Standardized equipments were used for the tests.

#### **One-Mile Run/ walk**

**Purpose:** To measure cardio respiratory fitness

**Procedure:** The objective of the test is to run one mile as fast as possible. Walking is permitted if necessary.

**Equipment used:**400 meters Track, Flag Markers, Score Sheet, Whistle and Stopwatch

**Scoring:** The score on the test is the length of time in minutes and seconds to complete the distance.

#### **Curl-Up**

**Purpose:** The Curl-Up test measures rectus as abdominal muscle strength and endurance, which is important in back support and core stability. The objective is to do maximum curl-ups to a specified cadence (three seconds per repetition).

#### **Procedure:**

The student begins by lying on their back, knees bent at approximately 140<sup>0</sup> degrees, feet flat on the floor, legs slightly apart, and arms straight and parallel to the trunk with palms of hands resting on the mat. The fingers are stretched out and the head is in contact with the mat. The measuring strip is placed on the mat under the students legs so that their fingertips are just resting on the nearest edge of the measuring strip. The feet cannot be held or rest against an object. Keeping heels in contact with the mat, the student curls up slowly, sliding their fingers across the measuring strip until the fingertips reach the other side, then curls back down until their head touches the mat. Movement should be smooth and at the cadence.

**Equipment required:** a flat, clean, cushioned surface. PACER CD with curl-up cadence track. In this test PACER CD with curl-up cadence track and 4.5" Curl-Up Measuring Strip were used.

**Scoring:** Record the total number of curl ups, up to a maximum (only those curl-ups performed with proper form and in rhythm). The test is continued until exhaustion (e.g. the subject cannot maintain the set rhythm). The test is also stopped if the student has two technique warnings - if the heels come off the floor, the head does not return to the mat, or the fingertip do not reach the far side of the measuring strip.

**Trunk Lift:** The Trunk Lift -back extensor strength test is part of the Fitness Gram and Brockport test batteries.

**Purpose:** This test measures trunk extensor strength, flexibility and endurance.

**Procedure:** the aim of the test is to lift the upper body off the floor using the muscles of the back and hold the position to allow for the measurement. The subject lies on the mat in a face down position, with toes pointed back behind the body and hands placed under the thighs. Place a marker on the floor in line with the student's eyes (a coin or other marker), which they must maintain focus on throughout the movement (to help keep head in alignment). When ready, the student lifts the upper body off the floor, in a very slow and controlled manner. The head should be maintained in a straight alignment with the spine. The position must be held long enough for a measurement to be made of the distance - from the floor to the student's chin. Once the measurement has been made, the student returns to the starting position. Two trials are allowed, with the best score recorded.

**Equipment required:** mat, measuring device (e.g. yardstick, ruler or tape measure), marker

**Scoring:** This test was assessed as the distance from the floor to the student's chin.

### **Sit and Reach**

This assessment primarily measures the flexibility of the muscles in the back of the legs. With the one leg straightened, the student reaches as far as possible toward the toes. Students who score poorly in flexibility should be encouraged to participate in stretching activities that will develop the flexibility in the back of the legs. To focus on activities that develop flexibility

without equal attention to the muscles that maintain strength will not accomplish the important objective, which is to develop an overall healthy musculoskeletal system.

**Purpose:** To measure lower back and hamstring flexibility by measuring how far the student can reach over the box from the right and left leg.

**Procedure:** Shoes should be removed first. Sit on the floor with two legs out straight and the two knees extended and not raised from the floor and not bent knees. Both outstretched feet are placed flush against the measurement box. With hands placed on top of each other and palms facing down, the subject reaches slowly forward along the measuring line as far as possible. After three practice reaches, the fourth reach is held for at least one second while the distance is recorded. The subject may repeat the test three times and the best score taken.

**Equipment required:** This assessment requires a sturdy box approximately 12 inches high (fourfold mat may be stacked to 12-inches in lieu of the box) and a measuring scale (yardstick/twelve inch ruler), Class Record Form, Pencil or pen.

**Set-Up:** The measuring scale is placed on top of the box with the 9-inch mark even with the near edge of the box. The “zero” end of the ruler is nearest the student.

**Scoring:** Record the highest number of inches reached (both over two legs,) to the nearest inch reached or centimeter half inch as the distance reached by the tip of the fingers.

### **3.10 Validity of the Tests**

This refers to the degree that a test measures what it's supposed to. If the test is not properly controlled, it lacks its validity.

To standardize the testing procedure and ensure accuracy and reliability of the tests and measurements, the following conditions were controlled during test administration.

- A warm up exercises were done thoroughly before performing physical fitness tests for about 5-10 minutes of light aerobic exercise followed by stretching to all the major muscle groups.
- The order of the fitness tests was kept. Short tests completed first. For example, Sit and Reach Test followed by Trunk Lift Test, Curl-Up Test, and One-Mile Run Test respectively.

- The tests were administered at the same time of the day and in similar environmental conditions.
- The same equipments were used throughout the testing schedule making sure it is properly calibrated before each testing session.
- The tests measurements were taken with the same examiner

Participants were advised to take meal before three hour of the test administration

## CHAPTER FOUR

### STATISTICAL DATA ANALYSIS, AND INTERPRETATION

In this part ,the data were presented ,analyzed ,and interpreted; but the detail of the data were presented at the appendix part of the paper.

Note: The detail data of table 5 up to table 15 are presented at appendix one

#### 4.1 Group Back ground Data presentation, analysis , and interpretation .

Table 5 .Back ground information of the experimental groups

Group	Sex	Descriptive Statistics	Age	Weight	Height
Cluster	M= 30	Sum	862	2347.5	66.6
	F= 10	Mean	21.55	58.688	1.66
	T = 40	S.D	1.768	7.90	0.076
		Variance	3.126	62.44	0.0057
Linear	M=30	Sum	868	2361	66.08
	F=10	Mean	21.7	59.02	1.652
	T = 40	S.D	2.065	4.989	0.072
		Variance	4.267	24.897	0.0052

As it can be seen in the above table-5 back ground information, the two experimental groups have equivalent/similar mean value of age ,weight, and height(21.55,58.688,1.66 of cluster respectively and 21.7,59.02,1.66 of linear respectively).When we see the SD value of each group, cluster group has small SD value than linear group in age , this shows that the cluster group is similar in age than linear ; and also when we see the weight SD value the cluster group has greater value than the linear group SD value, this implies that linear group has equivalent/more similar in weight than cluster group with each other, but the two groups have equivalent SD value in height, this show that the two groups have similar height distribution.

## 4.2 Experimented variables data presentation, analysis , and interpretation

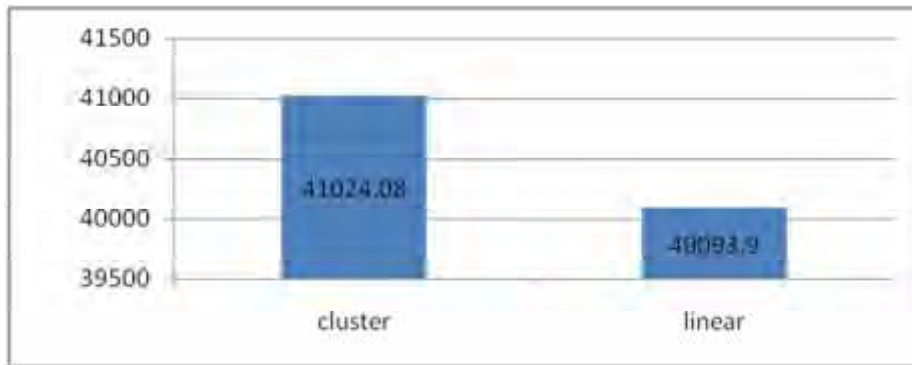
### 4.2.1 Group Aerobic cardiovascular data presentation, analysis , and interpretation

Table 6 .Independent sample t-test of aerobic cardiovascular endurance

Group	Measured variable	Descriptive Statistics		df	t-calculated	standard error difference	Mean difference	Sign(2-tail) P=
Cluster	Aerobic CVE in micro second	Sum	1640963	78	0.67	1387.716	930.175	0.505
		Mean	41024.08					
		S.D	5703.011					
		Variance	32524338					
Linear	Aerobic CVE in micro second	Sum	1603756					
		Mean	40093.9					
		S.D	6671.274					
		Variance	44505897					
t- critical=2 , level of significance 0.05,and equal variance is assumed								

As it indicated in the above table-6, the two groups have no significant difference in aerobic cardio muscular endurance in comparison of the mean by independent sample t-test with level of significance 0.05 and degree of free dam 78, and two tail hypothesis test ,because the obtained t-value (0.67) is less than the critical value of t-critical(2) and  $p(0.505) > 0.05$ , therefore; the null hypothesis ( $H_0$ ) is accepted and the alternative hypothesis ( $H_1$ ) is rejected by statistical t-test. But when we compeer the mean, the linear group has relatively better performance than cluster group, because the linear group scores small average time than cluster group did with mean difference of 930.17500.

The following graph-3 verify this.



Key  
 Vertical axis=mean  
 horizontal axis=groups

Graph-3. The cardio vascular endurance mean value of cluster and linear groups.

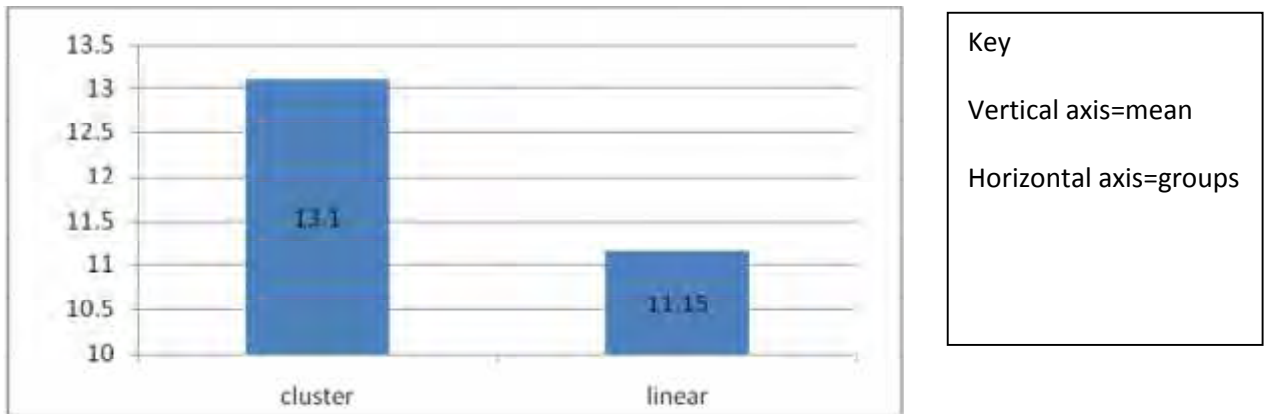
#### 4.2.2 Group Curl up data presentation, analysis , and interpretation

Table 7 .Independent sample t-test of curl-up

Group	Measured variable	Descriptive Statistics		Df	t-calculated	Standard error difference	Mean Difference	Sig(2-tail)=p
		Sum	Mean					
Cluster	curl-up	Sum	524	78	0.912		1.95	0.365
		Mean	13.1					
		S.D	9.763354					
		Variance	95.32308					
Linear	curl-up	Sum	446					
		Mean	11.15					
		S.D	9.354966					
		Variance	87.51538					
						2.14		
t- critical=2 , level of significance 0.05, and equal variance is assumed								

As it indicated in the above table-7, the two groups have no significant difference in curl-up muscular endurance in comparison of the mean by independent sample t-test with level of significance 0.05 and degree of freedom 78, and two tail hypothesis test, because they obtained

t-value (0.912) is less than the critical value of t-critical(2) and  $p=0.36 > 0.05$ , therefore; the null hypothesis ( $H_0$ ) is accepted and the alternative hypothesis ( $H_1$ ) is rejected by statistical t-test. But when we compare the mean, the cluster group has relatively better performance than linear group, because the linear group scores small average than cluster group did with mean difference of 1.95. The following graph verify this.



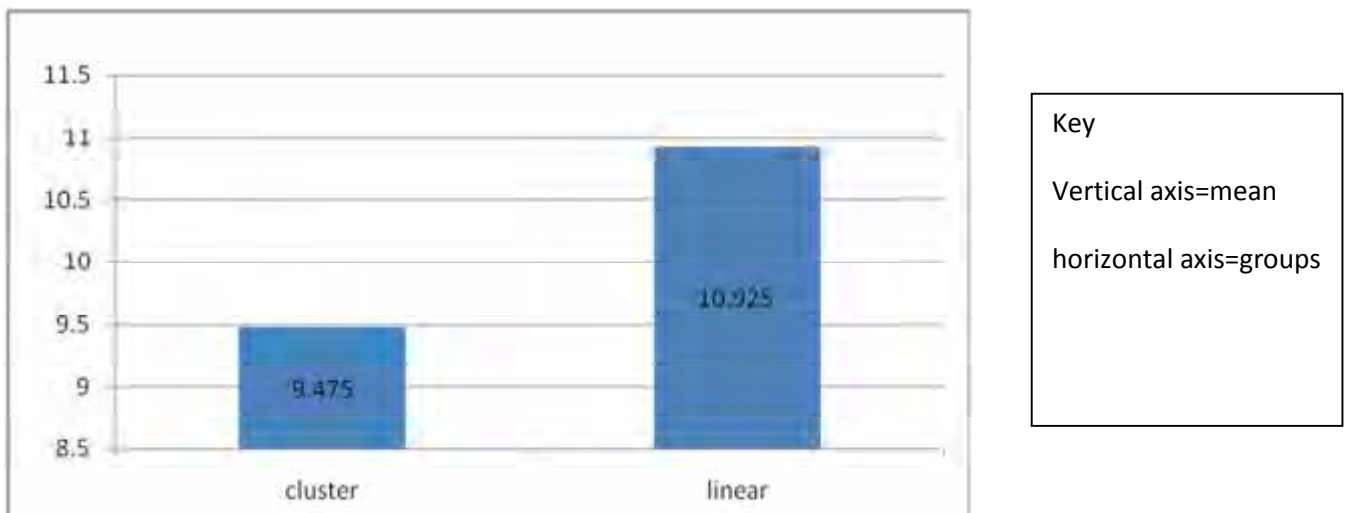
Graph- 4. Curl up mean graph of cluster and linear groups.

#### 4.2.3 Group Trunk lift data presentation, analysis , and interpretation

Table 8 .Independent sample t-test of trunk lift

Group	Measured variable	Descriptive Statistics		df	t-calculated	Standard error difference	Mean difference	Sig(2-tail) P=
Cluster	Trunk-lift	Sum	379	78	-2.074	0.6992	-1.45	0.041
		Mean	9.475					
		S.D	2.873285					
		Variance	8.255769					
Linear	Trunk lift	Sum	437	78	-2.074	0.6992	-1.45	0.041
		Mean	10.925					
		S.D	3.361833					
		Variance	11.30192					
t- critical=2 , with level of significance 0.05, and equal variance is assumed,								

According to the above table-8, the two groups have significant difference in trunk lift muscular endurance in comparison of the mean by independent sample t-test with level of significance 0.05 and degree of freedom 78, and two tail hypothesis test, because the obtained t-value ( $-2.07/2.07$ ) is greater than the critical value of t-critical(2), and  $p=0.041 < 0.05$ , therefore; the null hypothesis ( $H_0$ ) is rejected and the alternative hypothesis ( $H_1$ ) is accepted by statistical t-test. And also when we compare the mean, the linear group has relatively better performance than cluster group, because the linear group scores greater average value than cluster group did by the mean difference of 1.45. The following graph-5 verify this.



Graph-5. Trunk lift mean graph of cluster and linear groups.

#### 4.2.4 Group Sit up data presentation, analysis , and interpretation

Table 9 .Independent sample t-test of sit and reach

Group	Measured variable	Descriptive statistics		df	t-calculated	Standard error difference	Mean difference	Sig(2-tail)p=
Cluster	sit and reach	Sum	190	78	-0.565	0.841	-0.475	0.574
		Mean	4.75					
		S.D	3.959733					
		Variance	15.67949					
Linear	sit and reach	Sum	209					
		Mean	5.225					
		S.D	3.550063					
		Variance	12.60295					
t- critical=2 , and level of significance=0.05, and equal variance is assumed								

Based on the above table-9, the two groups have no significant difference in flexibility(sit up) in comparison of the mean by independent sample t-test with level of significance 0.05 and degree of freedom 78, and two tail hypothesis test ,because the obtained t-value  $-(0.565/0.841)=-0.565$  is less than the critical value of t-critical(2) and  $p=0.574 > 0.05$ , therefore; the null hypothesis ( $H_0$ ) is accepted and the alternative hypothesis ( $H_1$ ) is rejected by statistical t-test. But when we compare the mean, the linear group has relatively better performance than cluster group, because the linear group scores greater average value than cluster group did by mean difference of 0.475. The following graph-6 verify this.



Key  
 Vertical axis=mean  
 horizontal axis=groups

Graph-6.The mean value of sit and reach of cluster and mean groups.

## **Finding from group physical fitness measurements comparison by independent sample t-test**

Except trunk lift measurement, two groups in other physical fitness measurements (aerobic cardio vascular endurance, curl-up, flexibility (sit and reach)) have no significance difference in independent sample t-test. But when we compare the two groups' mean value, in all mean value comparison except curl up linear group has better performance than cluster. May be due to this the cluster and linear students has shown difference in practical work when they are assigned in schools and/or are may be difference or similarity with standard normal, good or excellent range of mean for each parameters of physical fitness and or may be with difference in motivational/interest or other external factors.

### 4.3. Group single sample t-test(single research t -test) data presentation, analysis ,and interpretation

**Note:** In all physical fitness measured values in this research, the standard measured value is taken for age greater or equal to seventeen to test it with single sample t-test, because all the research subjects are above age 17.

Table-10.One/single-Sample Test of aerobic cardio vesicular endurance

Group	Group mean value	Test mean value (good range value)	t-calculated	df	Sig. (2-tailed)=p	Mean Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Cluster	41024.08	50250	-10.231	39	.00	-9225.92500	-11049.8365	-7402.0135
Linear	40093.9	50250	-9.628	39	.00	-10156.10000	-12289.6769	-8022.5231

t-critical=2.021 ,with level of significance=0.05

As it can be seen in the above table-10, the cluster has significance difference in cardio vascular endurance in comparison of the group with good range mean value of 50250 micro second by single sample t-test with the level of significance 0.05 and degree of freedom 39, and two tail hypothesis test, because the obtained t-value  $|-10.231| = 10.231$  is greater than the critical value of t-critical 2.021 and  $p=0.00 < 0.05$ , therefore; the null hypothesis ( $H_0$  6) is rejected and the alternative hypotheses ( $H_1$  6) is accepted by statistical t-test. And also the linear group has significance difference in cardio vascular endurance in compression of the mean of the group with the standard good range mean value 50250 by one sample t-test with the level of significance 0.05 and degree of freedom 39, and two tail hypothesis test, because the obtained t-value  $|-9.628| = 9.628$  is greater than the critical value of t-critical (2.021) and  $p=0.00 < 0.05$ , therefore; the null hypothesis ( $H_0$  5) is rejected and the alternative hypothesis ( $H_1$  5) is accepted by statistical t-test, when we compare the two group mean with standard mean, the two group have relatively better performance bur thee linear group smaller mean difference than the cluster

group relative to the standard good range mean value. Therefore; the linear group has better performance in cardio vascular endurance than the cluster

**Table-11.Single-Sample t-Test of curl up of cluster and linear groups.**

Group	Group mean value	Standard good range Test mean value	t-calculated	Df	Sig. (2-tailed)=p	Mean difference	95% Confidence Interval of the Difference	
							Lower	Upper
Cluster	13.1	31	-11.595	39	.00	-17.90	-21.0225	-14.2225
Linear	11.15	31	-13.42	39	0.00	-19.85	-22.842	-16.8581

t-critical= 2.021,with level of significance=0.05

Based on the above table-11, the cluster group has significant difference in curl up in comparison of the mean of the group with standard good range mean value of 31 by one sample t-test with level of significance 0.05 and degree of free dam 39, and two tail hypothesis test ,because the obtained t-value  $-11.595/9.595$  is greater than the critical value of t-critical(2.021) and  $p=0.00<0.05$ , therefore; the null hypothesis ( $H_0$  6)is rejected and the alternative hypothesis is accepted by statistical t-test. And also the linear group has significant difference in curl up in comparison of the mean of the group with standard good range mean value 31 by one sample t-test with level of significance 0.05 and degree of free dam 39, and two tail hypothesis test ,because the obtained t-value  $-11.595/11.595$  is greater than the critical value of t-critical(2.021) and  $p=0.00<0.05$ , therefore; the null hypothesis ( $H_0$  5) is rejected and the alternative hypothesis is accepted by statistical t-test .when we compeer the two groups mean with standard parameter mean, the cluster mean difference is less than linear group this shows

that relatively the cluster group better performance than linear group. Therefore; the cluster group has better performance in curl up than linear.

**Table12. single-Sample t-Test of trunk lift of linear and cluster**

Group	Group mean value	Test mean value	t-calculated	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
							Lower	Upper
cluster	9.475	12	-5.558	39	.00	-2.525	-3.4439	-1.6061
linear	10.925	12	-2.022	39	0.05	-1.075	-2.1502	0.0002

t-critical= 2.021, with level of significance=0.05

As it indicated in the above table-12, the cluster group has / no significant difference in trunk lift in comparison of the mean of the group with standard fixed maximum range mean value of 12 inch by one sample t-test with level of significance 0.05 and degree of free dam 39, and two tail hypothesis test ,because the obtained t-value /-5.558/=5.558 is greater than the critical value of t-critical(2.021) and  $p=0.00 < 0.05$ , therefore; the null hypothesis ( $H_0$  6) is rejected and the alternative hypothesis( $H_1$  6) is accepted by statistical t-test. And also the linear group has significant difference in trunk lift in comparison of the mean of the group with standard maximum range mean value of 12 inch by one sample t-test with level of significance 0.05 and degree of free dam 39, and two tail hypothesis test ,because the obtained t-value /-2.022/=2.022 is greater/ than the critical value of t-critical(2.021) and  $p=0.05=0.05$ , therefore; the null hypothesis ( $H_0$  5) is rejected and the alternative hypothesis ( $H_1$  5) is accepted by statistical t-test .when we compeer the two groups mean with standard mean, the linear group has smaller mean difference than cluster group ;this shows that relatively linear group has better performance than cluster group in trunk lift.

**Table 13 Single-Sample t-Test of sit and reach of cluster and linear**

Group	Group mean value	Test mean value	t-calculated	Df	Sig. (2-tailed)=p	Mean Difference	95% Confidence Interval of the Difference	
							Lower	Upper
Cluster	4.75	6.5	-2.795	39	0.008	-1.75	-3.0164	0.4836
Linear	5.225	6.5	-2.271	39	0.029	-1.275	-2.4104	-1.396

t-critical= 2.021, with level of significance=0.05

According to the above table-13, the cluster group has significant difference in sit and reach test in comparison of the mean of the group with standard good range mean value 6.5 by one sample t-test with level of significance 0.05 and degree of free dam 39, and two tail hypothesis test ,because the obtained t-value  $|-2.795|=2.795$  is greater than the critical value of t-critical(2.021) and  $p=.008<0.05$ , therefore; the null hypothesis ( $H_0$  6) is rejected and the alternative hypothesis ( $H_1$  6) is accepted by statistical t-test. And also the linear group has significant difference in sit and reach test in comparison of the mean of the group with standard good range mean value of 6.5 by one sample t-test with level of significance 0.05 and degree of free dam 39, and two tail hypothesis test ,because the obtained t-value  $|-2.271|=2.271$  is greater than the critical value of t-critical(2.021) and  $p=0.029<0.05$ , therefore; the null hypothesis( $H_0$  5) is rejected and the alternative hypothesis( $H_1$  5) is accepted by statistical t-test .when we compeer the two groups mean with standard mean, the linear group has relatively better performance than cluster group because the mean difference of linear is approach to the standard mean value.

## **Finding from group physical fitness measurements comparison by single/one sample t-test**

When the two groups measured mean value for a given physical fitness compared independently with the standard good range mean value for a given physical fitness parameter they had shown the same character to one/single sample t- test. According to physical fitness measurements such as: aerobic cardio vascular endurance, curl-up, flexibility(sit and reach) both groups have shown significance difference in one sample t-test in all fitness parameters in comparison with standard good range value. But linear group has better performance in all fitness when we compare the two groups' mean value with standard good range than cluster group, because their mean value for each fitness parameters has equivalent value with the good range value of standard . May be due to this the cluster and linear students has shown difference in practical work when they are assigned in schools and/or may be difference in motivational/interest or other external factors.

#### 4.4 .The independent sample t-test for male with male and female with female of linear and cluster groups.

##### 4.4.1 The independent sample t-test of male-male of linear and cluster groups.

Table-14. The independent sample t-test of male verses male of aerobic cardio vascular endurance, curl up, trunk lift, and sit and reach..

Tested fitness	Group	N	Mean	SD	t-calculated	df	Sig. (2-tailed)= p	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
										Lower	Upper
Cardio vascular	Linear	30	37028.63	3792.253	-1.884	58	0.065	-2203.36667	1169.77227	-4544.92027	138.18694
	Cluster	30	39232.00	5164.284							
Curl up	Linear	30	13.5333	9.27634	-0.129	58	0.898	-.33333	2.57685	-5.49146	4.82479
	Cluster	30	13.8667	10.63739							
Trunk lift	Linear	30	11.4667	3.33976	-1.179	58	0.243	-2.40000	2.03558	-6.47466	1.67466
	Cluster	30	13.8667	10.63739							
Sit and reach	Linear	30	4.7800	3.88502	.621	58	0.537	.64667	1.04121	-1.43753	2.73087
	Cluster	30	4.1333	4.17491							

t-critical= 2.00 , with level of significance 0.05

As it can be seen in the above table-14,in male verses male comparison of linear and cluster in fitness(aerobic cardiovascular, curl up , trunk lift, and sit and reach) parameters by using independent sample t- test with .05 level of significance, 58 degree of freedom, and two tail hypothesis test, there is no significance difference in males in aerobic cardiovascular endurance , curl up , trunk lift, and in sit and reach test, because the calculated t-value (1.884,0.129,and 1.179,0.621 respectively for aerobic cardiovascular curl up , trunk lift, and sit and reach ) are less than the t-critical value(2.00) and  $P>0.05$  for each case ,therefore; null hypothesis( $H_0$ ) is accepted ,and alternative hypothesis ( $H_1$ )is rejected, but when we compare their mean value linear group males have better performance than cluster male groups in cardio vascular and in sit and reach ,but in the other cases cluster male groups better perform than linear male groups.

#### 4.4.2 The independent sample t-test of female-female of linear and cluster groups.

Table-15. The independent sample t-test of female verses female of aerobic cardio vascular endurance, curl up, trunk lift, and sit and reach..

Tested fitness	Group	N	Mean	SD	t-obtained	Df	Sig. (2-tailed) =p	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
										Lower	Upper
CVE	Linear	10	49289.70	4608.83873	1.580	18	.131	2889.40	1828.21293	-951.53285	6730.33285
	Cluster	10	46400.30	3490.30527							
Curl up	Linear	10	4.0000	5.12076	-2.630	18	.017	-6.80000	2.58543	-12.23179	-1.36821
	Cluster	10	10.8000	6.37356							
Trunk lift	Linear	10	9.3000	3.02030	.398	18	.695	.40000	1.00554	-1.71256	2.51256
	cluster	10	8.9000	.99443							
Sit and reach	linear	10	6.5600	1.82708	-.040	18	.969	-.04000	1.00246	-2.14610	2.06610
	cluster	10	6.6000	2.59058							
t-critical=2.101,with level of significance 0.05											

As it indicated on the above table-15, in female verses female comparison of linear and cluster in fitness (aerobic cardiovascular, curl up, trunk lift, and sit and reach) parameters by using independent sample t-test with .05 level of significance, 18 degree of freedom, and two tail hypothesis test, there is no significance difference in females in aerobic cardiovascular endurance, trunk lift, and in sit and reach test, because the calculated t-value (1.58, 0.398, and -0.04 respectively for aerobic cardiovascular, trunk lift, and sit and reach) are less than the t-critical value (2.101) and  $P > 0.05$  for each case, therefore; null hypothesis ( $H_0$ ) is accepted, but there is significance difference in curl up because  $t_{\text{calculated}} = 2.63 > t_{\text{critical}} = 2.101$ ,  $p = 0.017 < 0.05$ , therefore; null hypothesis ( $H_0$ ) is rejected and alternative hypothesis ( $H_1$ ) is accepted, but when we compare their mean value linear group females have better performance than cluster female groups only in trunk lift, but in the other cases cluster female groups better perform than linear female groups.

## **Findings from male to male and female to female comparison of the two groups.**

In two sex ( male with male and female with female) comparison of the two groups (linear and cluster) in aerobic cardio vascular endurance , curl up, trunk lift, and sit and reach there is no significance difference in independent t-test between males, and in case of females with females comparison ,except curl up , also females have not shown significance difference in aerobic cardio vascular endurance , trunk lift, and sit and reach test.

## CHAPTER FIVE

### SUMMARY, CONCLUSION AND RECOMMENDATION

#### 5.1 Summary

Good physical fitness is one of the most important key to sound and solid foundation of good health and living one's life to fullest. The human body is created to function well when it is in active condition. Physical fitness avoids an individual from being infected or suffers from illness; stay healthy both mentally and physically throughout their lives. In order to live quality of life, an individual should develop overall fitness aspects(physical, psychological, social, spiritual...etc) and all-round fitness is a key to quality of life. A physically fit person looks better, feels better and thinks better and also lives better. Physical fitness, especially health-related physical fitness is one aspects closely associated with good health. Regular physical activity, in addition to healthy lifestyle is a critical means with no alternatives to keep the body fit sustainably. Physical fitness is required not only by athletes for better performance, but also by non-athletes for maintenance of a healthy body and healthy mind

Participation in regular physical activities is rapidly decreased specially in the college education because academic education in the collage focuses on the specialization in preferred fields. In collage level professional physical education courses were offered for both linear physical education and cluster Aesthetics group students so that attention should be given to physical fitness promotion and active style of life for those students through identifying their fitness level. Therefore,

- This research aimed to assess and compare in some selected physical fitness of physical education verses Aesthetics students in Arbaminch collage of teachers' education.
- To test the null hypothesis whether there is significant difference between physical education and aesthetics group students by deciding the variables which cause the effect on some behavior of research subjects as independent variables (different health and physical education courses given to both groups in practice or theory ).
- And dependant variables of physical fitness such as aerobic cardio vascular endurance ( one mile run or walk), muscular strength and endurance(Curl-up, trunk lift),and flexibility(sit and reach) measured values, and control variables' such as age, weight,

height, attitude/ interest, academic achievement, balanced diet , and other external factors.

- The research select 80 students from third year linear and cluster group students as the subject of the research from total population of college students both by simple random ( lottery ) and purposive sampling method from the population of the research area and collect the data through measure the dependant variables by their respective measuring device and procedures.
- In this research physical fitness of the two groups are compared with each other and with standard average independently and with the comparison of standard value test by quasi-experimental designing and using statistical tool of independent sample t-test and one/ single sample t-testwith 5% error ,two tail hypothesis test and equal variance assumption.
- By using the test values generally there is no significance difference between two groups in selected physical fatnesses variables; this may be due to not considering of control variable as factor and other hidden factors, but practically the two groups have shown difference.

## 5.2 Conclusion.

Academic education in the college students focuses on the specialization of different fields which does not consider physical fitness development. The only specialization that give great contribution to the improvement of physical fitness is physical education department. The main means to transmit knowledge and skill in physical education is physical exercise; this physical exercise also has the way that improve physical fitness components, therefore; it is mandatory to participate in regular physical activity for physical education and aesthetics students in order to increase their physical fitness level and to be active and competent in their profession. Arbaminch collage physical education and Aesthetics stream students devote most of their time for academic and theoretical oriented tasks instead of participating in regular physical activity that help them to develop their fitness level high. Due to these and other related factors the two groups have shown difference in practical session and theoretical class. They are effective in theoretical aspect of physical education lesson but they were not actively perform or engage in practical aspect of physical education session ; as well as in practical aspect of the fulfillment of practicum course .

- Based on these difference this research is designed in quasi -experimental form to compeer the two groups in the some selected physical fitness variables.
- To compeer the two groups with each other and male with male, and female with female independent sample t-test was used and to compeer the group average with the standard parameter average value single sample t-test was used.
- The findings are :except trunk lift measurement , two groups in other physical fitness measurements(aerobic cardio vascular endurance), curl-up, flexibility(sit and reach ) statistically have no significance difference in independent sample t-test.
- But when we compeer the two groups' mean value, there is difference between two group and in most mean value comparison linear group has relatively better performance than cluster group and when the two groups measured mean value for a given physical fitness compeered independently with the standard good range mean value for a given physical fitness parameter. And also they had shown the same character to one or single sample t-test.

- According to physical fitness measurements such as: aerobic cardio vascular endurance, curl-up, flexibility(sit and reach) both groups have shown significance difference in one sample t-test in all fitness parameters in comparison with standard good range value. But linear group has relatively better performance in all fitness when we compare the two groups' mean value with standard good range than cluster group, because their mean value for each fitness parameters has equivalent value with the good range value of standard .
- Also in two sex ( male with male and female with female) comparison of the two groups (linear and cluster) in aerobic cardio vascular endurance , curl up, trunk lift, and sit and reach there is no significance difference in independent t-test between males, and in case of females with females comparison ,except curl up , also females have not shown significance difference in aerobic cardio vascular endurance , trunk lift, and sit and reach test.
- In addition to this ; when we compare linear and cluster students with standard average value the two groups have above the good range in cardio vascular endurance but they are below the good standard average value in other measured variables. Therefore; in most case the null hypothesis are accepted for independent sample t-test and alternative hypothesis are accepted for single sample t-test

### 5.3 Recommendation

According to the finding of the research the following recommendations are forwarded

Even there is no statistically significance difference between two groups in t-tests there is mean difference in all measured variables between the linear and cluster group students, the linear group have perform relatively better than cluster groups and also when we compare both the linear and cluster group students with the average value of standard parameter of selected variables they score below the good range in muscular strength, endurance and flexibility therefore, the following recommendation forwarded for collage, students, instructors and curriculum designer

- The collage should fulfill different equipments and facilities in which students can have regular physical fitness activities in order to improve their fitness level.
- The students should practice muscular strength or endurance and flexibility exercises regularly to improve the whole components of health related physical fitness.
- The cluster group students result shown less mean value compare to linear group students in most of measured variables therefore they should practice more and regularly in order to perform linear group students and to approach the average value of good range of standard parameter of selected and measured physical fitness variables.
- Collage instructors should provide the activities according to the principle of variety for the two group during the practical session and they design additional practice session for cluster group in which students can improve their health related physical fitness level. In addition to this ;collage physical education instructors should follow up the progress of student's physical fitness by conducting fitness test throughout the year to motivate students participation in regular physical activities.
- Curriculum designers should consider physical fitness related courses when developing the curriculum for both linear and cluster students to minimize the gap between the two groups and with standard.

**N.B Further research areas recommended that can be derived from this research**

- ❖ What is the relationship between the weight and some selected physical fitness?
- ❖ What is the relationship between the height and some selected physical fitness?
- ❖ What is the relationship between the sex difference and some selected physical fitness?
- ❖ What is the relationship between the attitude and some selected health related physical fitness?
- ❖ What factors affect the development of physical fitness of linear physical education and cluster aesthetics students.

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## Appendix 1 Aesthetics and physical education students Field Test Data

Tester: - Mezgebe mena, -Eferem Kentiba -Tsegay Tsemi		College: Linear physical education					Date: Desmber 16 up to March 10/ 2014		
No	Name of the students	Age	Weight (kg)	Height (m)	Aerobic Cardiovascular Endurance		Muscular Strength/Endurance		Flexibility
					1mile(m in/sec)	Time in microsec.	Curl-Up # completed	Trunk Lift (Inch)	Sit and Reach (Inch)
1	HP1	19	52	1.56	7.24.97	44497	15	7	5
2	Hp2	22	62	1.68	5.46.22	34622	10	13	4
3	Hp3	20	60	1.67	5.58.13	35813	14	16	1.5
4	Hp4	25	63	1.52	7.68.53	48853	0	13	7.1
5	Hp5	20	55	1.56	9.29.75	56975	11	12	7
6	Hp6	20	55	1.57	6.56.51	41651	0	12	7.1
7	Hp7	20	53	1.66	7.22.82	44282	27	9	8
8	Hp8	22	60	1.66	6.52.41	41241	7	10	6
9	Hp9	20	56	1.58	7.47.60	46760	3	10	7
10	Hp10	22	66	1.7	6.51.85	31185	8	12	8
11	Hp11	22	60	1.84	5.62.15	36215	22	17	8
12	Hp12	22	61	1.71	5.53.59	35359	18	13	-1
13	Hp13	24	63	1.76	7.03.66	42366	20	18	4.5
14	Hp14	22	61	1.67	5.43.03	34303	17	12	5
15	Hp15	20	56	1.63	5.46.7	34670	0	17	7
16	Hp16	24	60	1.62	5.28.39	32839	4	17	5
17	Hp17	21	50	1.64	6.50.60	41060	16	12	8
18	Hp18	23	66	1.72	6.12.20	37220	21	14	8
19	Hp19	22	63	1.75	5.24.52	32452	20	9	6
20	Hp20	19	54	1.59	5.48.15	34815	1	12	9
21	Hp21	24	66	1.67	5.32.10	33210	15	14	4
22	Hp22	20	48	1.56	8.03.12	48312	5	5	7

23	Hp23	22	62	1.67	7.57.61	47761	1	10	5
24	Hp24	22	54	1.62	5.46.48	34648	32	9	2
25	Hp25	24	57	1.68	5.51.76	35176	31	11	8.5
26	Hp26	23	66	1.7	5.50.44	35044	23	7	5
27	Hp27	20	49	1.57	5.58.90	35890	0	13	8.5
28	Hp28	20	54	1.7	6.19.00	37900	15	9	1
29	Hp28	24	64	1.68	6.14.31	37431	13	11	5.4
30	Hp30	20	58	1.56	8.51.36	53136	2	10	3.4
31	Hp31	23	62	1.68	6.29.91	38991	8	10	4
32	Hp32	22	62	1.67	6.32.45	39245	2	8	7
33	Hp33	20	56	1.67	5.50.18	35018	12	12	5
34	Hp34	23	66	1.78	6.03.24	36324	15	10	8
35	Hp35	20	57	1.53	9.01.87	54187	2	6	6
36	Hp36	24	63	1.77	7.28.15	44815	1	5	-8
37	Hp37	20	62	1.61	7.47.66	46766	4	12	10
38	Hp38	19	63	1.62	8.27.59	50759	0	6	8
39	Hp39	29	54	1.62	5.59.18	35918	25	7	3
40	Hp40	20	62	1.63	6.00.47	36047	6	7	-4

Tester: - Mezgebe mena, - Eferem Kentiba - Tsegay Tsemiro		College: Cluster Aesthetics students				Date: Desmber 16 up to March 10/ 2014			
No	Name of the students	Age	Weight (kg)	Height (m)	Aerobic Cardiovascular Endurance		Muscular Strength/Endurance		Flexibility
					1mile(min/sec)	Time in micro sec.	Curl-Up # completed	Trunk Lift (Inch)	Sit and Reach (Inch)
1	As1	19	65	1.77	6.48.12	40812	18	12	9
2	As2	20	54	1.68	6.57.31	41731	8	10	6
3	As3	21	68	1.62	7.21.59	44159	14	10	8
4	As4	21	50	1.58	7.26.41	44641	21	8	7
5	As5	21	91	1.73	9.16.63	55663	0	5	-3
6	As6	20	47	1.53	7.24.97	44497	2	8	11
7	As7	24	53	1.68	6.50.15	41015	1	7	7
8	As8	19	50	1.59	7.41.43	46143	7	9	3
9	As9	21	62	1.62	7.28.91	44891	14	6	11
10	As10	24	52	1.59	9.16.63	55663	5	8	2
11	As11	26	74	1.82	5.51.50	35150	27	19	4
12	As12	23	63	1.71	6.21.31	38131	17	11	5
13	As13	21	55	1.67	6.56.07	41607	11	9	1
14	As14	21	50	1.68	6.12.08	37208	20	8	7
15	As15	23	60	1.71	6.53.15	41315	23	12	6
16	As16	20	58	1.57	7.47.60	46760	4	11	6
17	As17	23	52	1.7	6.31.07	39107	35	13	1
18	As18	20	54	1.5	7.00.88	42088	18	13	9
19	As19	20	61	1.66	5.18.57	31857	18	6	8
20	As20	22	64	1.68	6.45.33	40533	49	14	8
21	As21	21	54	1.6	7.32.13	45213	8	8	7

22	As22	21	56	1.7	6.15.94	37594	0	11	7
23	As23	25	60	1.79	6.12.37	37237	1	12	5
24	As24	23	57	1.65	6.43.75	40375	7	12	8
25	As25	21	60	1.77	6.06.65	36665	14	11	3
26	As26	24	63	1.64	7.48.47	46847	15	9	6
27	As27	20	57	1.63	7.48.56	46856	16	9	8
28	As28	21	63	1.67	6.59.87	41987	22	8	2
29	As29	22	59	1.59	6.34.47	37447	1	9	-4
30	As30	21	50	1.61	7.12.24	43224	16	9	8
31	As31	22	60	1.7	6.20.16	38016	15	13	7
32	As32	22	64	1.58	5.59.18	35918	10	6	3
33	As33	20	63	1.78	6.14.81	37481	12	4	3
34	As34	20	55	1.65	5.01.02	30102	14	8	-1
35	As35	22	65	1.68	6.41.34	40134	5	6	2
36	As36	22	63.5	1.77	6.01.44	36144	7	8	5
37	As37	26	57	1.8	5.56.34	35634	8	10	4
38	As37	20	54	1.6	5.24.42	32442	12	7	4
39	As39	20	48	1.64	6.06.72	36672	11	12	5
40	As40	20	56	1.72	8.40.04	52004	18	8	-8

## Appendix 2 .Performance rang table for health related fitness

**Table 1. Sit and reach norm**

Sex	Male		Female	
Age	17-29	30-39	17-29	30-39
Under health	<-2.0- 0.9	<-3 -0.1	<1.0-3.9	<0
Good	4.0-7.0	3.0-6.0	6.5-8.5	0-2.9
Excellent	>8	>6	>8.5	>8
Mean of good rage for male and female age above 17= 6.75				

Gwen Robbins (2002).

**Table 2. One mile run/ walk norm**

Sex	Male		Female	
Age	15	Above 17	15	Above 17
Under health	> 9:00	>8:30	>10:30	>10:00
Good	7:00 - 9:000	7:0-8:30	8:00-10:30	8:00-10:00
Excellent	<7:00	<7:00	>8:00	<8:00
Mean of good rage for male and female age above 17=50250				

Larry E.craven (20011).

**Table 3. curl up norm**

Sex	Male		Female	
Age	15-17	Above 17	15	Above 17
Under health	<24	<24	<18	<18
Good	24-47	24-47	18-35	18-35
Excellent	>47	>47	>35	>35
Mean of good rage for male and female age above 17=31				

Larry E.craven (20011).

### Trunk-lift

For the trunk-lift the standard parameter that considered in this study is 12 inch

### Appendix 3 Model Figure of different field test taken from review literature

Figure 2: Starting Position for the Curl-Up Test (Cooper Institute, 2007)



Figure 3: Position of the student in the “up” position for the curl-up test (Cooper Institute, 2007)



**Figure 4: Measurement of trunk lifts(Cooper Institute, 2007)**



**Figure5: Back-Saver Sit and Reach(California Department of Education, 2012)**



**Figure6:Skinfold Measurement**

(Welk & Meredith, 2008)



**Figure7:Body Mass Index**

(California Department of Education, 2011)



## **Appendix 4 Evidence of some Pictures of field test during Data collection**

### **Warming up exercise before test administered**



### **One mile run or walk Test**





**Body mass index Test**





**Curl- up Test**





**Trunk Lift Test**



Sit and Reach Test



## Declaration

I, Mezgebe Mena the undersigned this theises declare that, this thesis is my original work, conducted under the supervision of Dr. solomon Teka, and has not been presented in any other university. If anyone who want to used this as source it is obligation to cite or acknowledge.

Name: Mezgebe Mena

Signature: \_\_\_\_\_

Place: Addis Ababa Ethiopia

Date of submission: April 30/2014

This thesis has been submitted for examination with our approval as University advisor.

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Dr. Solomon Teka  
Advisor