ASSESSMENT OF HEALTH RELATED PHYSICAL FITNESS STATUS OF PLATEAU STATE PROFESSIONAL FOOTBALL LEAGUE PLAYERS

BY

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FEBRUARY, 2011

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M.Sc/EDUC/31241/2001 – 2002 (Old Number)
M.Sc/EDUC/01475/2008 – 2009 (New Number)

**A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL AHMADU BELLO UNIVERSITY, ZARIA,
NIGERIA**

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF MASTERS OF SCIENCE (M.Sc) IN EXERCISE AND SPORT SCIENCE

**DEPARTMENT OF PHYSICAL AND HEALTH EDUCATION, FACULTY OF EDUCATION, AHMADU BELLO UNIVERSITY, ZARIA,
NIGERIA.**

FEBRUARY, 2011

DECLARATION

I hereby declare that this thesis entitled "Assessment of Health Related Physical Fitness Status of Plateau State Professional Football League Players" has been written by me and that it is a record of my own research work and that it has not been submitted in any previous research work for a higher degree. All quotations and sources of information have been duly acknowledged in the text and references.

Longchi Ayuba Emmanuel	**Date**

CERTIFICATION

This thesis entitled "Assessment of Health Related Physical Fitness status of Plateau State Professional football League Players" meets the regulations governing the award of Degree of Master's of Science in Exercise and Sports Science, Department of Physical and Health Education, Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation

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DEDICATION

This work is dedicated with all sense of appreciation to my late Father Pa, Emmanuel Ngusakal Longchi, my mother Mama Naomi, my wife Mrs. Helen, sons and daughter Emlong, Miret, Ngusakal, (Junior) and Kangret for their unflinching support and prayers.

ACKNOWLEDGEMENT

The researcher would like to first and foremost express his profound gratitude to God Almighty for the abundant grace, love, protection and good health enjoyed throughout the period of this course and thesis.

The researcher wants to express his heart felt appreciation and indebtedness to his supervisor Professor M. A. Chado for giving this research topic a theoretical frame and academic focus. His constructive criticisms, comments and suggestions at different levels of the research work are indeed immeasurable.

The researcher is also highly indebted to Prof. C. E. Dikki, who is also my supervisor and Head of Department Physical and Health Education Department, Ahmadu Bello University Zaria, for attending to this project work despite his tight schedules. His contributions to this research are highly appreciated.

The researcher's thanks also go to Prof. A. I. Kabido the Head of Department of Physical and Health Education, Ahmadu Bello University Zaria, for his encouragement and leadership style, which has facilitated the completion of this research work.

The researcher would also like to express his happiness to Dr. Ngunen Ezra for his advice and encouragement. The researcher wishes to acknowledge the team spirit of his course mates, Jacob Gajere, Mr. Balami a PhD student and others too numerous to mention.

Other lecturers and support staff in the department have been of wonderful assistance to the researcher. In conclusion, the researcher is thankful to Mr. and Mrs. Tolla of Hill Crest College Jos and my typist.

ABSTRACT

This study was conducted to assess the health-related fitness status of Professional Football League Players in Plateau State. Relevant literatures were received in related headlines as muscular endurance, cardio-respiratory endurance, flexibility, muscular strength and body composition. In the study, a total of 102 players were used from three Professional Football League Clubs thus, Plateau United, Jersey Raiders, and Mighty Jet to constitute the population. The seventy (70) research selected by purposive sampling techniques were administered physical fitness tests. The test items determined the differences between muscular endurance, cardio-respiratory endurance, flexibility, muscular strength and body composition and international fitness norms. The muscular endurance was determined by the number of sit – ups, the cardio-respiratory endurance was determined from performance of the subjects in 12 minutes distance run walk. Flexibility was determined from sit and reach test. Muscular strength was determined from standing broad jump which measures explosive power but there is element of muscular strength in explosive power. Body composition was determined from the sum of skinfolds measurement at the chest, abdomen and thigh. The descriptive statistics of mean, standard deviation and the students' two-tailed t-test were used to analyze the data collected. The findings of this study revealed significant differences between the test results of the research sample and international fitness norm in muscular endurance, cardio-respiratory endurance and percent body fat, while there was no significant difference in flexibility and muscular strength. The study recommended the development of a national physical fitness norm for armature, Professional and premier League Football Players in Plateau State and Nigeria at large. Some areas for further study were suggested. The study was summarized and concluded.

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CHAPTER ONE: BACKGROUND OF THE STUDY

1.0 Introduction

The human body could be described as a machine. A machine is of course a device that could be used to ease the performance or execution of work. The human machine is therefore more wonderfully structured than a human-made machine. It functions efficiently and effectively under "normal" use (Adeniran, 1990). The biological creation of the human body is quite suited for diverse forms of physical activities. Right from historical times when man had to run, hunt, throw missiles and wage wars in order to keep alive and survive, he required a body fit to make effective use of each physical ability (Klats *et al.,* 1981).

The stresses to which the human machine is sometimes subjected to cannot be described as being optimum and thus the human machine does not function under normal condition at all times. Participation in sporting activities accounts for some of these stresses. Exposure to stresses will usually cause breakdown and in some cases sudden death. Emiola (2004), emphasized that the ancient Olympic coaches noted that Paleologos 1970 were very scientific in their approaches in training sports men and women, they knew details about the needs for certain types of physique for some sports. They were well knowledgeable in the science of the body. Football in particular has gone scientific today, so all physiological parameters that influence sports performance negatively or

positively should be experimented. The components of general fitness and physical fitness particularly, are central in the performance of sports. For sports men and women to perform effectively and purposefully, they must develop a high level of general fitness to be able to cope with mental, psychological, physiological and tactical challenges of sports. A Football player, apart from the goaltender, would require sufficient cardio-respiratory endurance (CVE) in addition to adequate playing skills, tactics and strategies of the game (Agbonjinmi, 1990).

Gwani (1990) posited that Football is a game that posses a lot of mental challenges and other complex physiological parameters, which demands substantial physical demands on the player. He further stressed that the performance of a Football team is also dependent on the physical and mental qualities of the individual player. This implies that the development and maintenance of an optimum level of fitness by anyone wishing to make the most of himself as a Football player and of his life is a task that must be done (Adelakmn, 1990). During Football matches, players are subjected to aerobic and anaerobic exercises of varied length and intensity, alternated with short rest periods. Consequent upon these, a training programme must include endurance, strength, speed, agility flexibility and muscular coordination, because, for every position of play in Football, there is usually a physical demand placed on the individual players commensurate with its importance in assisting the team to achieve

objectives of winning. This shows that players' positions in a team should be based on evidence of the health related fitness components coupled with coordination and psychological factors (Gwani, 1990).

The word physical means different things to different people. Some people look at the term "physical" as simply everything related to anatomy and others believe that "physical" corresponds with wellness, although all of these definitions fit physical. The most popular view is that of wellness. The word also refers to the bodily characteristic such as physical strength, physical development, physical skill or performance, physical health and physical appearance (Insel *et al.*, 1996, Bucher 1979).

Physical fitness is an individual's matter and it is better defined with due considerations for the general health, the occupation, vocational activities, interests, needs and capabilities of the individual. This submission was corroborated by Olusegun *et al* (1998). He asserted that physical fitness is the ability of the individual to endure exertion and stressful physical activity due to his normal daily occupational requirements.

Physical fitness, according to skinner *et al.* (1990), is characterized by the ability to perform work satisfactorily and to live a full and balanced life. Pollock *et al.* (1988) stressed that physical fitness encompasses a wide variety of characteristics in the broad categories of cardiovascular respiratory fitness, body composition, muscular strength,

endurance and flexibility. Physical fitness, in own opinion is the physical abilities possessed by an individual to perform specific physical activities and still have some energy left to participate in general activities.

Nwanko (1997) also defined physical fitness as a reflection of the ability to work with vigor and pleasure, without undue fatigue with energy left for enjoying hobbies and recreational activities and for meeting unforeseen emergencies. Physical fitness is categorized into two general areas, thus, the health-related and performance related fitness components (Anyanwu, 1982). However, being physically fit does not necessarily mean being totally healthy or being able to perform all highly skilled events as (Tukur, 1995). Performance related fitness has different elements from health-related fitness. Health related fitness, Williams (2007) describes it as those components of physical fitness whose improvement have health benefits, such as cardiovascular fitness, body composition, flexibility muscular strength and endurance.

The basic components of health-related physical fitness are:

1. Cardio-respiratory endurance
2. Muscular-skeletal fitness: Muscular strength, Muscular endurance and Flexibility
3. Body composition

Tukur (1995), posited that these components relate to the development of health and increase in the functional capacity of the

individual. He further stressed that these components offer the individual some protection against degenerative diseases such as low back pain, coronary heart disease, obesity and musculoskeletal disorders and results in looking good and feeling well. This research study is therefore, meant to assess the health-related physical fitness status of Plateau State Professional Football League players.

1.1 Statement of the Problem

Sports scientists, Team managers, coaches and/or trainers the world over, are today searching and exploring through researches, the best ways to improve the performances of their athletes, man and women. Talented Amateur sportsmen and women have been failing selection fitness test into professional football clubs due to their low level of Health related and performance fitness status. Most Football players and handlers globally are experimenting with different training principles towards finding scientific bases for improving the low level of fitness status of their players. Football is the most popular team game in the world today. It's popularity has motivated researchers through out the world to conduct research in the game (Amusa *et al.,* 1990).

Most sports scientists, Team managers and coaches train sportsmen and women, Football players most importantly on the assumption that they are improving their performances without monitoring players' level

of physical fitness through practical physical fitness test which enable sports trainers say with certainty the scientific reasons for the improvement of player's performance. Most players are not willing to follow scientific training procedures designed by their coaches and still hope to perform well. Most professional football teams in Plateau State have been finding it difficult to qualify to play in the premier league competition in recent time. This challenged the researcher to investigate possible, reasons for this.

A review of literature on Football indicates that some works have been done particularly in the area of the physical characteristics of the players, Amusa *et al.* (1985). However little has been done to determine the health related physical fitness of professional football league players of Plateau State in particular. Health related physical fitness components can affect the performance of Football players negatively or positively hence there is the need for sports scientists to prove that by conducting researches. This will enable Football handlers to monitor the level of health related physical fitness status of National Football Players in Plateau State vis-à-vis their performance. This will also enable the national teams in Plateau State to select and train players in accordance with their health related physical fitness status. This research work was therefore conducted to determine the health related physical fitness status of Professional Football League Players in Plateau State.

1.2 Research Objectives

The objectives of this study are:

i. To assess the health related physical fitness status of professional football league players in Plateau State.

ii. To compare the health related physical fitness status of professional football league players in Plateau State with standard fitness norm

iii. To provide a basis for assessing future physical fitness status of footballers and other sports men and women.

1.3 Significance of the Study

For National Football Players to perform with optimum prowess in their Professional Football League Competition, football they players must be physically fit, because football is an endurance sport, which continuously supply energy to the human body. This therefore shows that developing the physical fitness components generally and the health-related fitness components particularly would go along way in improving the performance of professional football players. The outcome of this research would therefore contribute data that would be used in the course of establishing the Nigeria norms on health related fitness components of national Football players.

The findings of this study would help the Plateau State Football Associations (P. F. A) to know the current health-related fitness status of their Professional Football League Players, hence work towards improving and maintaining their fitness status. It would assist coaches and Team managers in selecting new physically fit Football players and drop old players who cannot meet the team's health related fitness standards norms.

This study would motivate physical educators, coaches, exercise and sport scientists in Plateau State and Nigeria at large to research more in the area of health related fitness components. This research would also assist them towards designing appropriate Nigeria based tests and standards to evaluate the health related fitness components. This study would also contribute to the current body of knowledge in the area of physical education in general and health related physical fitness in particular.

1.4 Hypothesis

Major Hypotesis: There are no significant differences amongst the health related physical fitness status of professional football league players in Plateau state and international fitness norms.

Sub-Hypotheses

i. There is no significant difference between muscular endurance of Professional Football League Players in Plateau state and standard fitness norm.

ii. There is no significant difference between cardio-respiratory endurance of Professional Football League Players in Plateau state and standard fitness norm.

iii. There is no significant difference between flexibility of Professional Football League Players In Plateau State and standard fitness norm.

iv. There is no significant difference between muscular strength of Professional Football League Players in Plateau State and standard fitness norm.

v. There is no significant difference between body composition of Professional Football League Players in Plateau state and international fitness standard.

1.6 Delimitation

This study was delimited to the health related physical fitness components which are cardio-respiratory endurance, muscular strength, muscular endurance, flexibility and body composition of Professional Football League players in Plateau State.

The study was also delimited to the male Professional Football League players in Plateau State. This is, because, health-related physical fitness components are very important to sportsmen and women particularly national league football players who are required to compete throughout the football season.

1.7 Limitations

This study was constrained by the non-availability of Nigerian based physical fitness norms to assess and interpret the physical fitness status of the Professional Football League players. It is also limited by the tight schedules of the Professional Football League competitions in Nigeria, un-cooperative attitude of the players and lack of standard fitness norms for Nigerian football league players.

The researcher used the team officials to encourage the subjects to participate in the test. The researcher also used international fitness norms values to interpret the test results.

1.8 Definition of Terms

Health Related Physical Fitness: This is referred to as physical fitness components, which improve well-being and the optimum physiological function of the body. They include cardiovascular endurance, flexibility, muscular strength, muscular endurance and body composition.

Health Related Physical Fitness Components: This is the level of physical fitness in cardio-respiratory endurance, muscular fitness (muscular endurance, muscular strength, flexibility) and body composition.

Professional Footballer: People who earn their live through playing football.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

The review of literature related in this study was done under the following subheadings

ii. Concepts of fitness and physical fitness

iii. Components of physical fitness

iv Health related physical fitness components

v. Methods of assessing health related fitness components

vi. Summary of Review of Related Literature

2.2 Concept of Fitness

Before delving into the concept of physical fitness, it's imperative to define fitness and or total fitness to enable this discussion flow. Dimka, (2002) understands fitness from two perspectives aerobic and muscular fitness. He further explained that aerobic fitness refers to the ability of the human body to take in, transport and utilize oxygen. On the other hand, muscular fitness includes strength endurance and flexibility.

Dimka (2002) also defined total fitness as an "individual's capacity to survive and live effectively in his environment". To him, it involves the whole person, the spiritual, mental, emotional, social and cultural as well as physical. Fitness is therefore "that state, which characterizes the

degree to which the person is able to function" in other words, the ability to function depends on the physical, mental social emotional and spiritual components of fitness, all of which are related to each other and mutually interdependent.

The American Association for Health, Physical Education and Recreation (AAHPER) in May, 1964, in the Journal of the American Medical Association (JMA) stressed that the term fitness implies freedom from diseases, enough strength, agility, endurance and skill to meet the demands of daily living, sufficient reserve to withstand ordinary stresses without causing harmful strains, and mental development and emotional adjustment appropriate to the maturity of the individual.

American association for Health Physical Education and Recreation as quoted by Bucher (1975) defined fitness as "that state which characterizes the degree to which the person is able to function. It implies the capacity to live most vigorously and effectively within one's own physical resources, such as resisting fatigue, performing with an acceptable degree of motor ability and being able to adopt to muscular stress. The term aerobic refers to energetic physical activity that requires high levels of oxygen consumption for a long period of time, e.g. up to half an hour. (Dimka 2002) He further explained that aerobic activities generally involve rhythmical actions that move the body over a distance or against gravity as in fast dancing, jogging, bicycling, swimming or

certain calisthenics. He also noted that performing aerobic activity with sufficient intensity and duration on a regular basis increases the body's ability to extract oxygen from the blood and burn fatty acids and glucose efficiently, thus improving aerobic fitness. Exercise scientists view fitness from two perspectives:

i. Aerobic fitness (cardio-respiratory)

ii. Muscular fitness

Aerobic fitness is the phrase used to describe the physical working capacity (PWC) of an individual who performs successive work bouts of between 3-6 minutes duration and of increasing intensity with adequate rest periods between successive bouts ('Devries, 1978). An individual aerobic fitness refers to his ability to take in oxygen, transport it to the parts that needs it and it's subsequent effective utilization by the muscles of the body at work (Chado 1991)

Chado (1991), further emphasized that a person's aerobic fitness is largely dependent on the condition(s) of the heart. This is because when the heart beats slowly and ejects considerable volumes of blood into the blood stream, more blood is oxygenated. Hence, contracting muscles through peripheral circulation receive more oxygenated blood thereby providing the necessary 0_2 for all the working muscles engaged in that particular physical activity.

Muscular fitness, according to Chado (1991), refers to "the degree to which muscles adopt to physiological demands of a task in order to bring about improved movement. Among the variables to consider are muscle strength, local endurance and flexibility of joints. He further posited that very often, the percentage of body fat in terms of body composition, considering the individual's age and sex, forms part of the fitness level because it is unhealthy to have too much fat. Muscular fitness is affected to a large extent by the amount of fat content of the body and/or sex and age of the person.

There are several aspects of the total fitness which the Football coaches, team managers and sports scientists generally should know if they are to succeed, such as, the neuromuscular, sociological, psychological, Cardiovascular, aerobic and organic fitness. All these phases of the individual must be fit if a person is to be regarded as totally fit. To be precise, most discussion on physical fitness tends to focus on muscular fitness, which to many is physical fitness.

2.3 Physical Fitness

The phrase physical fitness is ascribed different meanings and explanations. However, it is an aspect of the total fitness. Physical fitness is multifaceted and involves both skill-related and health-related component. The skill-related component of physical fitness such as

speed, power, agility, balance, reaction time and coordination are primarily important in achieving success in athletics and are not crucial for the development of better health. The health-related components of physical fitness are cardiovascular endurance, muscular strength, muscular endurance, flexibility and body composition. Nwanko (1997) stressed that physical fitness is defined differently depending on whether it is defined by a physical educator, a physiologists, a cardiologists, a military recruitment officer etc. For this research study, physical fitness is defined by Nwanko (1997) as a reflection of one's ability to work with vigor and pleasure, without undue fatigue, with energy left for enjoying hobbies and recreational activities, and for meeting unforeseen emergencies. Physical fitness is to the human body what fine-tuning is to an engine. It enables us to perform up to our potential fitness. It can be described as a condition that helps us look and do our best. More specifically it is the ability of the heart, lungs, blood vessel and muscles to perform at optimal efficiency and since what we do with our bodies also affect what we do with our mind, fitness influences to some degree qualities such as mental alertness and emotional stability.

Lorin (1978) opines that physical fitness does not imply bulging muscles, Herculean strength, or incredible acrobatic skill. Nor can it be measured by ability to perform a single specific act or exercise. Rather, physical fitness is that condition of the body which will permit the

youngster to maintain good health, respond favourably to physical effort and physical stress, enjoy the sensations of his or her own body, and function at an optimal mental and physical level. Physical fitness for a child involves the following characteristics, relative resistance to disease and injury, strength and power, endurance and stamina, speed, agility, coordination and balance. For purpose of clarity and conceptual comprehension, the following definitions of physical fitness have been proposed both by individuals and groups. According to Kennedy, a one time President of the United States of America, as quoted by Dimka (2002)"Physical fitness is not only one of the most important keys to healthy body, it is the basis of dynamic and creative intellectual activity. The relationship between the soundness of the body and the activities of the mind is subtle and complex such that intelligence and skill can only function at the peak of their capacity when the body is healthy and strong. That hardy spirits and tough minds usually inhabit sound bodies"

Dimka (2002) maintained that physical fitness is "the development and maintenance of optimal individual muscular strength, muscular endurance, and cardiovascular endurance. The term include such factors as flexibility, balance, agility, power and speed"

Hockey as quoted by Tukur (1995), defined physical fitness as "the ability to carry out daily task with vigour and alertness, without undue fatigue, and with ample energy to enjoy leisure time pursuits and to meet

unforeseen emergencies" He further reported that physical fitness is the ability to last, to bear up and to persevere under difficult circumstances where an unfit person would give up. It is the opposite to being fatigued from ordinary efforts, to lacking the energy to enter zestfully into life's activities and becoming exhausted from physical exertion (Tukur, 1995).

Tukur (1995), further defined physical fitness as the quality of the whole body in terms of its state of adjustment to physical demands. A physically fit person is not overly fat, but has a strong skeleton, neuromuscular strength, strong connective tissues, and has good circulatory endurance.

Pollock (1988) viewed physical fitness as "composed of a wide variety of characteristics included in the broad categories of cardio-respiratory fitness, body composition, muscular strength, endurance and flexibility".

Bwai (1988) posited that a physically fit person tends to exhibit some appreciable and often acceptable behavioural patterns in other facets of his life such as sociological, emotional, psychological, cultural, spiritual, etc. Literature on the importance of exercise to the human machine has shown that a physically fit person is more socially outgoing, emotionally balanced, physiologically strong, psychologically stable, culturally flexible and spiritually strong.

Nwankwo (1997) noted that a high degree of physical fitness increases the individual's physical efficiency or ability to work effectively and the preparedness to meet the demands of daily living with vigor and also respond effectively in emergencies without undue fatigue or exhaustion. In other words, we should perform our daily or routine chosen tasks (domestic, professional and social responsibilities) with sufficient energy and enthusiasm and also be able to meet any emergencies without undue fatigue (muscle ache palpation of the heart, depression, etc). Physical fitness fluctuates and may be maintained at optimum levels of exercising regularly.

Chado (1993) stated that physical fitness is the capacity of the body to function at the optimal level of efficiency in doing daily activities and still capable of handling other physical activities either in the form of exercise or sport participation planned or unplanned without undue fatigue.

Olusegun (1998), asserted that physical fitness is an individual matter and is better defined with due considerations for the general health, occupation, vocational activities, interest, needs and capabilities of the individual. To him physical fitness is the ability of the individual to persevere or endure physical exertion and stressful physical engagement beyond his routine daily occupational demands.

Amusa (1985), maintained that physical fitness could, operationally, be defined by the types of tests used to evaluate it. He further stressed that some people's claim of physical fitness implies maximal functional capacity of all systems of the body, especially the cardiovascular and musculoskeletal systems. This concept implies that individuals should seriously concentrate on building their endurance, strength, flexibility and muscles endurance to their maximal levels. Astrand *et al* (1986) as quoted by Amusa (1985), defined physical fitness broadly as the "capacity for energy output, neuromuscular function and in terms of psychological factors".

2.4 Components of Physical Fitness

Today, the struggles of man on earth are so herculean that the squeezes and strains in our daily life, require optimum physical fitness to contend with the rigours of living. This implies that physical exercise is inevitable, due to the fact that physical and organic fitness does not only increase life expectancy but it also makes life worth living. However, whether exercise contributes to the promotion of fitness, health and performance or not depends on a number of variables such as heredity, environment, habits, etc.

Tukur (1995) asserted that physical fitness is not a quality acquired by chance, but it is acquired via the medium of muscular effort and

maintained and improved upon through regular participation in a well designed programme of physical exercise. The law of use and disuse states that the functional efficiency of an organism, man inclusive, improves with use and regresses with disuse (Devries, 1978).

Olusegun *et al* (1998) categorized physical fitness elements into two general areas, namely, the health-related and performance -related physical fitness components. According to Gwani (1990), the components of performance-related physical fitness are agility, balance, speed, aerobic and anaerobic capacity, visuomotor coordination, rapidity of muscular contraction, coordination, skill and technique. These elements are necessary for skillful performance, hence should be classified as motor ability components and not physical fitness components.

Chado (1993) and Insel *et al* (1996) corroborated that by asserting that the motor performance related fitness elements include speed, agility, coordination, balance, reaction time, playing strategies and power.

Olusegun (1998) and Insel (1996) posited that cardio-respiratory endurance, muscular strength and endurance, flexibility, body composition, relaxation and emotional stability and risk factors reduction are the components that encompass health-related fitness which is the main focus of this study. Allsen *et al* (1980) claimed that physical fitness is built upon the foundation of four major factors such as cardiovascular endurance, strength, flexibility and proper body weight. Chado (1993)

corroborated Allsen *et al* (1980) by stating that health-related fitness involves development and maintenance of muscular strength, local muscular endurance, joint flexibility, cardio-respiratory endurance and having an appropriate body composition between the percentage of body fat deposit and the total body weight. These health-related physical fitness components are considered vital quantitative elements of physical fitness. This is so, due to the fact that they are directly linked to the physiological functions of the body. These components improved health by reducing significantly the incidences of degenerative or cardiovascular diseases.

In a research carried out by Larson and Yocom as stated by Bucher (1978) that ten components were identified as benefits of physical fitness, thus, resistance to diseases, muscular strength and endurance, cardiovascular and respiratory endurance, muscular power, flexibility, speed, agility, coordination, balance and accuracy. These fitness components are perceived from the perspective of physique and organic efficiency, which connotes anatomical, physiological soundness and motor fitness which is newly added to the list (Duhu, 1978). He further expatiated that motor fitness includes endurance, power, strength, agility, flexibility and balance. Any player who possesses this component learns motor skills with ease including the ability to fully, dodge, fall, climb, swim, ride, carry heavy loads and the ability of muscles to perform an

activity or series of activities over a relatively long period of time or long hours of continuous work (Umedum *et al.,* 1986).

For effective performance, Football players are supposed to be physically fit, for the game generally and probably for a specific position on the team. Results of recent kinethropometric studies have suggested that besides endurance motivation and skill, athletes morphological characteristics also contribute to successful sports performance. The performance or skill-related component is dependent upon the effectiveness with which the player's organs and systems support the effort which shows that health and fitness are two very much interdependent factors in athlete sports performance Football players inclusive (Amusa, 1985). From the foregoing literature, it's crystal clear that the performance or motor fitness components and the health-related fitness components are undoubtedly complimentary to athletes' sports performance and healthful living.

2.5 Health-Related Physical Fitness Components

Health is explained primarily in the context of physical fitness and selected indicators of health status e.g. obesity or bone mineral measurements. The concept of physical fitness has evolved from a primary focus on its motor and strength components (performance - related fitness) to more emphasis on its health-related aspects (Malina,

2001). Health-related physical fitness is often operationalised in three components, thus: cardio-respiratory fitness, musculoskeletal fitness (strength and lower back flexibility) and body composition. Specifically subcutaneous fatness (AAHPERD: 1984) More related definitions include physical and physiological fitness operationalized in morphological, muscular, motor, cardio-respiratory and metabolic components (Bouchard *et al.,* 1994). Hence, the term metabolic fitness, which includes measures of serum lipids, blood pressures, blood glucose and other parameters, is being used more frequently (Katzmarzryk *et al.,* 1998).

Malina (2001) asserted that health-related physical fitness is presumably indicative of some aspects of an individual's health. In 6 -9 year old children in second national children and youth fitness survey in the United States, for example, 28 indicators of physical activity, age and sex account for only 21 % of the variance in the run-walk and 18% of the variance in the fatness (Pate *et al.,* 1990). A similar analysis relating habitual activity to the health-related fitness of fourth grade children shows weak relationship. After controlling for gender, physical activity accounts for only 3 - 11 % of the variance in health related fitness items (Sallis *et al.,* 1993).

Among Taiwanese youths, 12 - 14 years of age, estimated daily energy expenditure and energy expenditure in moderate to vigorous

physical activity (MVP A) is significantly related to the 1 mile run and sit and reach, but is not related to sit-ups and the sum of skinfolds. Partial correlations controlling for age, sex, socio-economic status and area of residence, though significant, are low (0.12 - 0.19) and account for less than 5% of the variance in health-related fitness items (Hoeger *et al.,* 1992). Similarly, there is a weak association between estimated daily energy expenditure in moderate to vigorous physical activity (MVPA) and health-related fitness of Quebec youths 9 - 18 years of age. The variance shared by activity and fitness varieties ranges from 11 to 21% (Katzmarzyk *et al.,* 1998).

Since a large portion of the variability (80-90%) in health -related fitness is not accounted for by physical activity as measured in the studies, the general pattern of results suggests that factors other than physical activity exert more influence on the health-related fitness of children and youths. Malina (2001) stressed that these factors are probably rooted in the biological and behavioural dimensions of changes that occur with normal growth, maturation and development from childhood through adolescence.

Health-related fitness is a state of being. It is transient. Unlike motor skill related fitness which has a high retention, health-related cannot be reserved for prolonged periods, but requires constant development and maintenance through regular development and

maintenance through regular programme of physical activity (Tukur, 1995).

The health-related fitness components as outlined by AAHPERD (1986) and the American Academy of Pediatrics are

- Cardiovascular or aerobic endurance
- Flexibility at joints
- Muscular strength
- Local muscular endurance and
- Body composition (Chado, 1993)

The benefits of health related fitness result in looking good physically and feeling well, having a high capacity for physical work and protects one against cardio-respiratory diseases and other ailments due to sedentary life style.

2.6 Cardiovascular/Respiratory Endurance

The heart, lungs, blood and various cells are interdependent parts, making up the cardio respiratory system (Tukur, 1995). Insel *et al* (1996) stated that cardio-respiratory endurance is the most important fitness component. It is the ability to deliver essential nutrients, especially oxygen, to working muscle of the body and to remove waste products during prolonged physical exertion. They further stressed that it involves the efficient functioning of the heart, blood vessels and lungs.

This health related physical fitness parameter is also referred to as circulatory or circulo-respiratory fitness. It is also referred to as the cardiovascular endurance. The circulo-respiratory capacity or endurance is conceived by Dimka (2002) as "the ability of the lungs and heart to take in and transport adequate amounts of oxygen to working muscles allowing activities that involve large muscle to be performed over long period of time". It is also referred to as the capacity of the circulatory system to supply oxygen to the cells to sustain the oxidative and enzymatic energy demands of the body and the removal of metabolic waste. Chado (1991) refers to cardiovascular and respiratory endurance as aerobic fitness, which implies the ability of oxygen uptake, transportation, and utilization by an individual during work, which exceeds three minutes continuously as it involves large muscle groups of the body. He further stressed that this ability is related to the condition of the individual's heart. When the heart beats slowly and powerfully and emptied large volumes of blood to be circulated. There is improved supply of oxygenated blood to the working muscle, hence the peripheral circulation receives and utilizes oxygen more efficiently (Chado 1991).

Cardio-respiratory endurance refers to how well the heart and lungs work to supply the body with oxygen during work out for a relatively long period of time. Cardio-respiratory endurance is the ability to perform dynamic exercise involving large muscle groups at moderate to high

intensity for prolonged periods (American College of Sports Medicine 1995).

Cardiovascular fitness is often viewed in the context of VO_2 Max. A Football player, apart from the goal tender, would require sufficient cardiovascular endurance (CVE) in addition to adequate skills and tactics and strategies of the game. The physiological variables that affect cardiovascular endurance in Agbonjinmi *et al* (1990) are ventilation, cardiac output (Q) the amount of hemoglobin (Hb). He further stressed that a positive linear relationship between CVE and Hb has been reported in many studies by scientists e.g. (Hockey, 1977).

Oxygen delivery capacity of the blood is dependent on the amount of circulating blood, Hb which has implication for post-exercise O_2 debts. Several cardio-respiratory changes that negatively affect aerobic capacity have been identified in the anaemic state. Kjellbery *et al* (1949) cited by Agbonjinmi *et al* (1990) reported a very close relationship (0.82 ± 0.037, 90 ± 0.01) between the amount of the Hb and stroke volume during work. They observed that the pulse rate at different load revealed an inverse correlation to the amount of Hb. They concluded that the greater the amount of Hb the greater the amount of work performed per pulse rate. They also noted increase in resting and exercise pulmonary ventilation in the aneamic state and higher values for Respiratory Minute Volume (RMV) at either sub-max or maximum 0_2 consumption in aneamic

individuals. They also observed that ventilation equivalent of oxygen was pronounced with increase severity of aneamia. Responses to aneamia include increase in cardiac output (Q) and increase velocity of blood flow, in order to compensate for the reduced oxygen carrying capacity of blood (WHO 1974) The increase in cardiac output (Q) was shown to have resulted from tachycardia compensatory resting haemodynamics in aneamia and blood was selectively shunted to vital organs were reported. All these cardiovascular and respiratory adjustments-limit physical fitness and endurance.

Williams (1999) asserted that the highest rate of oxygen consumption is called peak or maximum oxygen uptake (VO_2 Max) He further stressed that any Level of activity can be described in terms of its oxygen cost as a proportion of an individuals maximum oxygen uptake. According to American college of sports medicine (1995) Exercise physiologists consider directly measured maximum oxygen uptake (VO_2, max) or peak VO_2 max to be the most valid measure of functional capacity of cardiorespiratory system.

Heyward (1998) added that the maximal and sub-maximal VO_2 is expressed in absolute or relative terms. Absolute VO_2 is measured in litters per-minute (Lmin) or milliliters per-minute (m1.Min-1) and provides a measure of energy cost for non-weight-bearing activities such as Leg or arm cycle ergometry. Absolute VO_2 max is directly related to

body size, thus men typically have a Larger absolute VO_2 Max than women. To compare individuals who differ in body size, VO_2 max is expressed relative to body weight, that is, ml. Kgl. Min-l. Cardio-respiratory health related fitness component is all-inclusive because it's the basis of the total fitness to the various health benefits associated with the development of optimum physical fitness. Cardio-respiratory endurance. Hockey (1977) enumerated some of the benefits to include increased efficiency in supplying oxygen, increased fat tolerance, increased blood supply and capillarization, enhanced development of collateral circulation, reduction of hypokinetic ailments etc.

Sparks *et al* (1997), emphasized that cardio-respiratory endurance is considered the most important component of health-related physical fitness because the functioning of the heart and lungs is so essential to overall wellness. They further noted that a person simply cannot live very long or very well without a healthy heart and lungs. The capacity for heavy prolonged muscular work such as football depends on the body's ability to supply oxygen to the working muscles. The more oxygen the body is able to take in and utilize, the more work the body should be capable of performing. The heart, circulatory and respiratory systems must function efficiently, if a high degree of cardiovascular endurance is to be achieved in the game of football (Adelakun 1990) He further noted, that with cardiovascular endurance above average level, such benefits as

maximal oxygen intake etc. can be derived. Cardiovascular ability is linked very closely to skill, since skill result only from the practice on a particular activity. When the demands for oxygen increase within the body as in football players, the ability of the body to take in and deliver oxygen to the working muscles will be an important factor in determining how much work can be performed. The more oxygen the circulatory and respiratory systems are able to deliver, the longer the person will be able to exercise before fatigue or exhaustion set in (Toriola *et al*., 1992). Fatigue and/or exhaustion resulting from exercise diminish physical performance due to reduced muscular strength, co-ordination, timing speed of movement, reaction time and alertness. Increased cardio-respiratory endurance enhances physical performance.

Sarafino (1994) advanced that in the early childhood years, aerobic exercise improves agility and cardiovascular function and Buchner *et al* (1992) also stressed that at the other end of the life span, adults generally show a gradual decline in their physical work capacity as reflected in their muscle flexibility, strength and endurance.

Relative VO_2 max is used to estimate the energy cost of weight-bearing activities such as walking, running, aerobic dancing stair climbing and bench stepping. He further explained that VO_2 max is expressed relative to the individuals fat- free mass, that is ml/kg fat free mass (FFM-1 Min-I) For example, your clients improvement in relative

VO_2 max following a 16- week aerobic exercise programme may reflect both improved capacity of the cardio-respiratory system (increase in absolute VO_2 max) and weight loss (increase in relative VO_2 max expressed as ml. Kg-1 Min-1 due to a decrease in body weight Thus, expressing VO_2 max relative to fat free mass (FFM) instead of body weight, provides you with an estimate of cardio-respiratory endurance that is Independent of changes in body weight.

Cardio-respiratory status is measured or evaluated in diverse ways by different scientists. It is measured in the Laboratory by determining aerobic capacity or the amount of oxygen used during a maximum work bout. The Laboratory test is usually performed on a motor- driver treadmill or bicycle ergo-meter. Cardio-respiratory function is measured in the Laboratory by determining aerobic capacity or the amount of oxygen used during a maximum work bout. (AAHPERD, 1986) This test is usually performed on a motor -driven treadmill or bicycle ergo-meter However; this approach is not practicable in schools.

Fitness test batteries used in the past and at present, employ field test for the measurement of cardiovascular fitness or endurance. The distance run tests e.g. One -mile run test and the twelve-minutes run, correlate well with the Laboratory test and are therefore recommended as field tests (Golding *et al.,* 1987) Although these field tests do not give

accurate results, but with careful administration of the test, worth while results can be obtained.

Chado (1991) and power *et al* (1997) cited that the coopers' twelve-minute run test is widely used in place of the Laboratory test because of its ease of administration and cost. Kenneth Cooper did intensive research on which to base a rating scale for evaluating circula-respiratory conditioning. The test involves running as Long distance as practicable in nine or twelve- minutes. A standard 400m track can be used for this purpose by employing an odiometer or by carrying a pedometer (Tukur, 1995) He further stressed that the results of the test indicated that nine or twelve-minute run test appeared to be a good measure of the cardiovascular fitness and comparable to the results obtained from the laboratory tests. A validity coefficient of 0.90 had been reported when V02 max was used as indices. Gwani (1986) Burke, (1976) Jackson *et al* (1976) Corroborated the above Claim.

2.7 Problems Common to Cardiovascular Fitness Testing

As any other Test, cardiovascular fitness Testing is affected by several problems depending on the purposes of the Test. These problems affect the physiological parameters and also the test results. The factors include Nervousness, tension and other psychological imbalance (McArdle (1991) and Nelson (1979). So also, temperature, time of the

day, changes in body position, altitude, humidity, and state of health affect cardiovascular and other physiological parameter's measurement; hence reduce the reliability and objectivity coefficient (Devries, 1978).

2.8 Flexibility

Heyward (1998) defined flexibility as the ability of a joint, or series of joints, to move freely through a full range of motion. Although flexibility is generally considered as one of the five components of health related fitness, its exact contribution to general health according to Maud (1995), is even less clearly defined than its importance to athletic performance.

Brynteson *et al* (2001) posited that flexibility has traditionally been the most neglected of the health-related components of physical fitness. However, increased range of motion is thought to aid in the prevention of injuries associated with loss of mobility. As a health related physical fitness component, Flexibility is also used to connote, the range of movements and or motions in one or more joints. It is also referred to as the ability of an individual to move the body and its parts through a wide range of motion without undue strain to the articulating surfaces and muscle attachments (Maud, 1995, and Nelson 1979). A flexible body is therefore that which the joints can move easily, thereby allowing movements and performs a wide variety of physical activities.

Flexibility, according to Singer *et al* (1976) depends on the structure of the bone at the joint, the amount of mass surrounding the joint, and the capacity of Ligaments, tendons, muscles skin they cut across or traverse the joints. Sparks *et al* (1997) in the same vein stated that the three tissues that affect flexibility are muscles, tendons and ligaments. They also added that the range of movement in a joint is determined by the bone structure. He further explained that motion scientists point to the fact that effective and efficient engagement in any form of physical activity is influenced to a great extend by the specific joints. A Football player needs to be flexible to be able to align his body quickly for dribbling and change of direction. He also needs speed and endurance to ran after the ball and opponents around, strength and power for mobilizing appropriate muscular contractions for quick and sudden action and to overcome resistance. All these actions demand particular physical physiological and motor performance characteristics from players. These performance attributes are referred to as human performance factors, which are basic and form the framework on which skills are built and which enable a Football player to execute his skills efficiently, economically and gracefully.

Bartect (1998) mentioned, the most important demonstrable benefits of flexibility to include improved cartilage's nutrition, it looses

up the whole connective tissues, their by enhancing physical mobility and they have a relaxing effect and improve bodily awareness.

Maud (1995) confirmed that within the realm of sport there are many activities where high degree of flexibility in specific joints are desirable for enhanced performance in both quantitative and qualitative athletic activities. This implies that inflexibility could predispose sports men and women to muscle strains and tendon injuries. Hyper-flexibility or extensibility might lead to joint dislocations and ligamentous sprains. It optimizes the efficiency of movement and inflexibility results in a reduction of movement efficiency and may increase the chances of injury in some sports.

2.9 Factors Affecting Flexibility

Flexibility is related to the Body Type, Age Sex and Physical Activity

Body Type: People with well developed muscles or excessive amount of subcutaneous fat may score poorly on range of motion (ROM) test, because adjacent body parts contact each other quickly than for those with smaller limb and trunk girths. This is not true in all cases. For example some body builders and obese people who always stretch their muscles have adequate level of flexibility (Heyward, 1998 and Maud (1995) posited that flexibility is affected by joint congruence, tendons, Ligaments, fascia, joint capsules and adipose tissue in addition to muscle

Age: Flexibility progressively decreases with aging because of changes in the elasticity of the soft tissues and a decrease in the physical activity level. Giround *et al*. (1995) reported significant improvements in shoulder and hip Range of movement (ROM) of older men (50-69years) following 10 weeks of flexibility training. Hence older persons can benefit from flexibility training and should be encouraged to perform stretching exercises at least three times a week to counteract, age-related decreases in range of motion (ROM).

Gender: Alter (1996) reported that some evidences suggest that females generally are more flexible than their male counterparts at all ages. This, he attributed to gender difference in pelvic structure and to hormones that may affect the laxity of connective tissues. Nevertheless, the effect of gender on flexibility seems to be joint-and motion-specific. Females tend to have more hip flexion and spinal Lateral flexion compared to males of the same age, conversely, males have greater range of motion in hip extension and spinal flexion and extension in the thorax region (Norkin *et al.,* 1995).

Activity and Inactivity: Lack of physical activity is a major cause of inflexibility than gender, age and body type. Hartley (1980) reported that it is documented that inactive persons tend to be less flexible than active persons and that exercise increases flexibility. Disuse, due to lack of physical exercise or immobilization produces contraction and shortening

of the connective tissue which, in effect, restricts joint mobility. Mobilizing the joints and muscle in a repetitive pattern or maintaining habitual body postures also may restrict range of motion (ROM) due to the tightening and shortening of the muscle tissue. For instance, joggers and people who sit behind a desk for long periods need to stretch the hamstrings and low back muscles to counteract the tautness developed in these muscle groups. The arrangement of muscles in an agonist and antagonist relationship would tend to suggest that an imbalance of strength or flexibility would predispose an athlete to injury (Maud, 1995).

Warm-Up: Heyward (1998) reported that warming the joints (113.F) produces a 20% increase in range of motion (ROM) whereas cooling the joint (65.F) results in a 10 to 20% decrease in flexibility. When flexibility tests are administered, it required that:

a. the client performs some type of warm-up activity to increase circulation and internal body temperature and

b. multiple trials of each test items is administered. Excessive amounts of stretching and flexibility training may lead to hypermobility, or an increased Range of motion of joints beyond normal, acceptable values. It leads to joints laxity (looseness or instability) and may increase the risk of musculoskeletal injuries. Chado (1991) also posited that inflexibility has been found to contribute to postural

problems, because the muscles become weak due to physical in-activity.

2.10 General Guidelines for Flexibility Testing

In order to assess a client's flexibility, should select a number of test items, due to the highly specific nature of flexibility (Heyward 1998). Heyward (1998) further stated that, direct tests that measure the range of joint rotation in degrees are usually more useful than indirect tests that measure static flexibility in linear units. He then advanced that when administering these tests, consider the following guidelines.

- Have the Client perform a short warm -up prior to the test and avoid fast, jerky movements and stretching beyond the pain -free range of joint motion. Administer three trials of each test item.
- Compare the Clients best score to norms in order to obtain a flexibility rating for each test item and use the test results to identity joints and muscles group in need of improvement.

Direct Methods of Measuring Static Flexibility

To assess static flexibility directly, measure the amount of joint rotation in degrees using a universal goniometer, flexometer, or inclinometer. Research shows high agreement between Range of motion

(ROM) measured by radiographs and universal goniometers for the hip and knee joints

Mayer *et al* (1984) reported no difference between radiography and the double- inclinometer technique for assessing spinal range of motion in patients with low back pain. Measurements of upper-extremity joints are generally more reliable than range of motion measurements of lower extremity joints (Norkin *et al.,* 1995). The inter-tester reliability of inclinometer measurements is variable and joint specific. Studies reported reliability coefficients ranging from 0.48 for Lumber extension to 0.96 for subtalar joint position (Heyward, 1998). The knowledge of anatomy and standardized testing procedures, as well as training and practice to develop your measurement techniques are very important, in obtaining accurate and reliable range of motion (ROM) measurement.

Indirect Methods of Measuring Static Flexibility

Maud *et al* (1995) and Heyward (1998) explained that static flexibility can be assessed indirectly using Linear measurements of the range of motion for this purpose you use a tape measure, Yardstick, and sit-and -reach box to measure flexibility in inches or centimeters rather than degrees of joint motion. A major weakness of some flexibility field test is that, the length or width of the body segments may affect the performance.

Maud *et al* (1995) stated that recent studies by Jackson et al (1986) and Jackson *et al* (1989) have found that although the sit -and reach test appeared to be a valid measure of flexibility in hamstring area, it was not necessarily a valid measure of Low-back flexibility. They reported that for both young and adult females, the sit-and reach test correlated moderately well with passive hamstring flexion, r=,64 and r=,70 in that order, but poorly with low-back flexibility, r=.28 and, r =.12.

On the other hand, they reported that for adult males, the sit -and-reach test correlation was, r = .89 for hamstring r = .59 for low-back flexibility. They further advanced that a more valid description of the sit-and-reach test would be that it assesses the flexibility of the posterior muscles, that is the hamstring and the lower middle and upper para-spinal and calf muscles. This means that the tightness of any of these muscles can limit the subject's ability to reach forward. To eliminate problems associated with varied arm and leg lengths, Hoeger (1991) developed a modified sit -and-reach test that standardized the finger-to-box distance to give room for proportional differences between arms and legs. This was demonstrated by Hoeger *et al* (1992) hence recommended that when a sit-and-reach test protocol is deemed appropriate, the modified procedure of Hoeger (1991) be utilized.

2.11 Modifiedsit-And-Reach Test

Brynteson (2001) reported that, the sit and reach test measures the flexibility of the lower back and hamstrings. The subject sits on the floor with buttocks, shoulders, and head in contact with the wall. The legs are extended with knees straight and the soles of the feet against a box of 12cm high. The hands are placed one on top of the other, with neither set of fingers extending beyond the other. A yardstick is placed on top of the box with the zero ends toward the subject. The subject reached forward as far as possible without allowing either head or shoulders to loose contact with the wall, and the yardstick is positioned and held so that the zero end touches the extended fingers. The yardstick must now be held firmly in place until after completion of the test.

The subject then leans forward gradually, allowing the head and shoulders to move away from the wall and the fingers to slide along the top of the yardstick. Three slow, forward movement trials are made, on the third forward motion, the subject leans as far forward as possible, holding this position for a minimum of 2 seconds. Reading is taken from the distance covered by the fingers along the yardstick. Two separate trials are made, and the mean of the two is recorded as the sit-and-reach score of each subject. Skin, connective tissue and condition within joints restrict the range of motion so also excessive body fat (Sharkey, 1990). Flexibility is limited by structural components which differ so much

among joints. (Heyward, 1998). He further stated that these structural components include the bone structure at each joint that controls the movement of the joint and in some cases impede movement while the muscles tissues, ligaments hold the skeletal frame together. Injuries occur when the ligaments are stretched beyond their anatomical elasticity. Optimal flexibility rest on the duration and intensity of the exercises for full range of motion to occur.

The relevance of flexibility to sports performance and physical exercise are many. For example, a person's ability to move depends largely on his general and specific flexibility. It's therefore undoubted that a high level of flexibility helps an individual to perform physical activities including Football efficiently. Flexibility is very important in diving, hurdling, swimming, jumps, gymnastics and other sports. (Nelson *et al.,* 1972). They further stressed that Football, American Football and basketball need average flexibility, which is an indication that, it is not a general component rather, specific to each joint and the sports engaged in.

Cabin *et al* (1985) asserted that a certain amount of threshold level of flexibility is necessary for most sports, though it varies from sports to sports. They further expatiated that many daily activities need threshold amount of flexibility. Nevertheless, some people may need less flexibility to perform recreational and daily activities than others. However all

people need maximal amount of flexibility to prevent muscle pain, soreness and injury.

Stanford (1984) and Singer *et al* (1976) have conducted a study and identified two types of flexibility:

a. Static flexibility which implies range of motion when a joint is moved slowly, in other words range of motion about a joint.

b. Dynamic flexibility refers to the resistance to movement produced by a joint.

Flexibility as an important component of health related fitness parameter plays vital role in the health status and performance level of sportsmen. The benefits of having good flexibility according to Sparks *et al* (1997) are many and increase the quality of life for many people especially the elderly. It reduces the incidence of low-back pain, muscle and joint injuries because lack of flexibility affects the degree of extension and flexion of joints Bwai (1986) and Chado (1991) also added that lack of flexibility has been found to contribute to postural problems, because muscles become weak due to physical inactivity. There is a saying that goes thus, "use it or lose it". If an individual wants to reduce injury, inhibit lower back pain, prevent post exercise pain, and relieve emotional tension that person should work on attaining adequate flexibility.

Heyward (1998) also reported that static flexibility is a measure of the total range of motion (ROM) at the joint, while dynamic flexibility is a measure of the resistance to movement. Both types of flexibility are important in performance of sports skills as well as activities of daily living, such as bending to pick up the newspaper or getting out of the back of a two-door car. Range of motion (ROM) is highly specific to joint and depends on morphological factors such as the joint geometry, joint capsule, ligament, tendons, and muscle spanning of the joint. The joint structure determines the planes of motion and may limit the range of motion (ROM) at a given joint. Triaxial joints (e.g. ball and socket joints of the hip and shoulder) afford a greater range of movement in more directions than either the uniaxial or biaxial joints.

There are no universally adopted flexibility test batteries because it is evaluated in different ways by individuals or groups. However Johnson *et al* (1979) reported that flexibility tests can be grouped into two as follows:

1. Relative flexibility tests. These are designed to be relative to the length or width of a specific body part. That is, it measures the movement, length and width of an influencing body part.
2. Absolute flexibility tests. They measure only the movement in relation to an absolute performance goal. For example, on

the splits you determine the distance between the floor (which is the goal) and the performer's sit.

There are many scientific devices for evaluating flexibility among which are goniometers for measuring angles, flexiometers to ascertain degree of flexion, anthrometers or anthropometers for measuring joints. Recent sophisticated devices include electrogoniometers and radiogoniometers (Corbin *et al.,* 1985). These devices are costly and complex to operate for self-testing at home and school. Nevertheless they remain the best instruments and or method for the evaluation of joint flexibility. However, the sit-and-reach test is widely employed by sports scientists as field test to evaluate flexibility.

Chado (1991) explained that this test is popular with AAPHERD, used for measuring the extent of the students' joint flexibility particularly around the trunk and the areas of the posterior thigh. Corbin et al (1985) corroborated the statement above because they stressed that, this test (Sit-and-reach) provide good assessment for flexibility and requires only a ruler or measuring stick and a box or chair.

They further expatiated that other field test include the arm and shoulder reach, the prone trunk lift, and various tests for assessing the length of different muscle groups of the lower limbs. To conduct the sit-and-reach test, the measurement is performed on the test apparatus, consisting of a specially designed box with a measuring scale on the top

level of feet (Hoeger 1991). The measuring stick is fixed with a tape to a box with the stick's end overlapping. After a warm up, the subject reaches as far as possible recording the distance reached with the stick. The knees are kept straight and the two hands overlapped. The position of the maximum reach is recorded after taking the average of the three trials or record the farthest of the trials. The sit-and-reach is the test battery used to evaluate the flexibility (extensibility) of the low back and posterior thighs. To assume the starting position, clients remove their shoes and sit down at the test apparatus with their knees fully extended and the feet shoulder width apart. The feet should be flat against the end board. The arms are extended forward with the hands placed on top of each other to perform the test. The testee reaches directly forward, palms down, along the measuring scale four times and holds the position of maximum reach on the fourth trial for one second. The score is the most distant point reached on the fourth trial measured to the nearest centimeter.

The test administrator should remain close to the scale and note the most distant line touched by the fingertips of both hands. The tester should place one hand on the subject's knee to ensure that they remain extended (AAHPER & D, 1986). The flexibility tests are used in physical fitness to determine potentials in certain sports. It is also employed to determine achievement, skill grade and the cause of poor posture.

2.12 Muscular Strength

Strength is the amount of force a muscle or group of muscles can exert in one maximum effort. Put differently, it is the ability of a muscle or group of muscles to exert force. It is also defined as the ability of a group of muscles to exert enough contractile force against resistance or load. It also refers to the ability of muscles to generate force and the ability of the body to release or apply that force. Howley *et al.,* (1997), Lorin (1978), Heyward (1998) & Jackson et al (1999). It is regarded as the symbol of physical fitness and most of the physical fitness tests were strength tests.

Hockey (1977) considers strength as the maximal one-effort that can be exerted against a given resistance, while Johnson *et al* (1997) defined it as the muscular force exerted against movable and immovable objects and can best be measured using one-maximum effort on a given movement or position. Acquiring greater strength is a necessary part of developing fitness for most sports. Although the ability to lift heavier weights is unquestionably a measure of improved strength, the method does not allow the strength gains of individual groups of muscle to be assessed precisely. A certain amount of strength is needed to carry out the tasks that are performed everyday, without which, it would be impossible to carry out daily tasks because all human movements depend on a

minimal level of strength. Muscular strength is needed by all animals to overcome gravitational pull so that an upright posture is maintained.

Maud et al (1995) defined strength as "the ability to develop force against an unyielding resistance in a simple contraction of unlimited duration" while Gwani (1990) also defined muscular strength as the contraction force of muscle. He emphasised that it is needed for muscle movement. Most components of motor performance rely on some degree of strength since they all need some degree of muscle contraction. He further stressed that the greater the contraction of muscle the greater the force exerted and the greater the strength. Muscle strength is generally viewed as the maximal force that can be generated by a muscle or groups of muscle. It is the peak output of energy measured over a relatively brief period of time. For example, lifting a heavy weight, such a performance is determined by the mass of muscle (size and number of muscle fibers) and is not limited by the ability of the body to provide oxygen to the muscles in action. In this regards, muscle strength perse is relatively independent of the function of the heart and lungs (Lorin, 1978)

Getchell *et al* (1982) stressed that strength is fundamental to all sports and most day-to-day activities. They further explained that lack of reasonable strength cause poor performance in sports and daily tasks. It is a major factor in the cause of back pain in many adults. Dimka (2002) stated that at any given moment of an individual's life his emotional state

is a major factor that affects his muscular strength. He further explained that a state of excitement does intensify the excretion of the adrenal gland, which increases the strength and endurance of muscles by epinephrine which speed up your heart, raise your blood pressure to help you acquire more strength. Other factors that influence the amount of strength, which muscles can exert, are their mechanical advantages (attachments of muscle to levers) and the extent to which they are stretched.

Nelson *et al* (1976) stressed that strength is an element in power, increased strength results in the ability to apply more force, hence strength leads to power. They further noted that it is a factor in muscular endurance, agility and running speed. There are two forms of strength. Static (isometric) and dynamic (isotonic). The former is the ability to apply force at a particular position without moving through the range of motion. It involves the isometric muscle contractions involved in exerting force against a fixed or stationary object. While the later, dynamic strength is the capacity to apply force through the range of motion. It concerns isotonic muscle contractions as experienced in pull-up or dip on the parallel bars. This type of strength is made use of largely in athletic activities. However the two strengths are closely linked (Heyward 1998; Maud *et al.,* 1995).

Fitness in Football is not based on physique only but also on functional capacity of the individual to perform work and to supply the necessary energy. Adelakun (1990) asserted that a minimal level of strength is important for without this, it would be impossible to carry out the tasks that are necessary in Football game. He further maintained that all movements are to a degree dependent on a certain minimal level of strength. A person who is engaged in hard physical work such as Football match requires a much higher degree of strength than a person engaged in an office job and who spends much of his time sitting behind the desk.

Muscular strength must be developed by either isometric exercise such as elbow push, hand push, sit up etc or isotonic exercise (weight lifting exercising for strength and muscular endurance) or a combination of both. It is important because it provides the power behind every movement and it plays the role of protecting or preventing injury in Football game.

Jackson *et al* (1999) discovered the following benefits of strength

- Strength can improve physical performance in sports and leisure time activities. Players need sufficient strength to be professional Footballers.
- Having adequate strength can help minimize the risk of injury by making participation less stressful on their body.

- By building muscular strength, players do not lose bone mineral density, muscle mass or at least postpone or minimize these losses.
- Sports men and women experience an improved sense of well-being through the physical effects of improving strength; and the more subtle psychological effects.
- Strength increase people resting metabolic rate, and helps you look and feel good boast your psychological and physical preparation, hence improves physical performance.
- It improves self-concept and self-esteem for both athletic and patient population. Stronger muscles also allow the athletes to run faster and move efficiently in the game of Football. It also provides increased joint flexibility. (Adelakun 1990).

Skinner *et al* (1990) explained that isometric and isotonic strength increases from 10 and 14 years to 20 and 29 years, remain unchanged until 40 to 49 years and then decline. They further explained that lower strength in children is due to their smaller muscle fibres and reduced strength at old age is due to muscle atrophy (fast twitch fibres specifically), reduced number of muscles fibres and decreased ability to recruit fast twitch fibres. They added that strength training in older men has increased their fibre size and number, the same way as that of

younger men. However strength was still less, indicating that depreciation with age is neurological. Sufficient muscular strength enables sports men and women perform better with greater ease and control. Recent developments in equipment for measuring isokinetic strength, however, provide the opportunity to make dynamic and precise movement on a wide range of muscle groups during exercise of different intensities, despite the fact that the quantification of the total body strength is very difficult due to numbers of muscles and muscle groups (Williams 1999).

Hockey (1997) posited that strength is measured precisely by asserting the maximal force that a muscle or muscle group can exert once and for all. Similarly, Chado (1991) advanced that the standing broad jump or standing long jump is used to measure the ability of muscle or group of muscles to exert maximum force within a short period. Muscular strength can be measured by using grip dynamometer and cable tensionmeter while electromyography is the laboratory method for assessing muscular strength (Gwani 1990). Heyward (1998) added that load cells, barbells and dumbells and isokinetic machines are used to assess dynamic strength and strength. He further noted that to evaluate strength, many tests must be administered due to the fact that its not a general component, rather it is specific to a particular muscle or group of muscles known as the principles of specificity.

Williams (1999) claimed that testing the functional strength of the quadriceps for example requires angular velocities that are close to those experienced during free exercise. The functional angular velocity of the knee during walking have been reported to be about 233%, whereas during running the value increase to 1200%. The angular velocities used to test muscle performance of athletes should therefore be in the fast range, namely 300-400%. New versions of isokinetic muscle testing equipment can test in that range of movements. Repeated contractions provide an insight into the fatiguability of muscle groups and how training alters this particular aspect of muscle function. There are unfortunately no universally agreed isokinetic testing procedures for muscle function mainly because in many laboratories the tests used are dictated by the design of isokinetic dynamometer (William 1999).

McArdle *et al* (1991) and McArdle *et al* (1981) advanced that muscular strength is measured by the followings:

1. Dynamometry;
2. Tensionmetry;
3. One-repetition maximum or I-RM and the newest approach; and
4. Computer assisted force and work output determinations

Power *et al* (1997) Mathew *et al* (1976) mentioned that strength is measured in pounds or kilograms using a dynamometer, tensionmeter or manometer. They demonstrated that sometimes strength is as well

measured as maximal amount of weight that can be lifted once by a group of muscle through the range of motion.

Malina (1996) showed that lower extremity strength tends to be more stable than upper extremity strength, which may be related to the weight bearing and locomotor functions of the lower extremities. He further indicated correlations for indicators of functional strength: flexed arm hang, pull-ups, sit -ups and leg lifts are generally similar to those for static dynamometric and cable tensionmetric measures.

He advanced that the long jump and medicine ball throw were chosen to reflect explosive muscular strength of the lower and upper limbs respectively. Muscular fitness "muscle strength and endurance" were measured by sit-ups (sup). The vertical jump (VTJ), explosive strength of the legs, the hand grip (HGR) or static strength (but corrected for body weight) were measured.

Power *et al* (1997) and Hockey (1977) stated that grip strength is the most commonly used measurement of muscular strength. This involves the subject squeezing hand dynamometer and exerting a maximal force once only, as the muscle contracts forcefully and the force produced is recorded on the dial. It has the reliability coefficients of 0.96 as reported by Johnson *et al* (1979). Professional footballers by the nature of their profession require the ability to exert maximum energy in one

explosive movement. The standing broad jump was used in this study. It assessed the explosive strength of the lower extremities. Professional Football League players require the capacity to exert maximum energy in a one effort explosive movement. The muscles of the lower limbs provide this power. The reliability coefficients have been ascertained to be 0.96 (Nelson *et al* (1972)) and Johnson *et al* (1979). However, Polluck *et al* (1984) suggested that validity of the jump might be improved by standardizing the direction for executing the jump.

Heyward (1998) recommended using the relative strength scores. The relative strength score is the amount of additional weight divided by the body weight. For example, if a 150-pound (68.2kg) man successfully performs one pull-up with a 30-pound (13.6kg) weight attached to the waist belt, his relative strength score is 0.20 (30ib/150ib)

McArdle *et al* (1991) also advanced that strengthening muscles for use in a specific activity such as Football, requires more than just identifying and overloading muscles involved III the movement with regards to the exact movements involved.

Blair (1989) in the same vain posited that maximum strength of men and women is generally achieved between the ages of 20 and 30 years at a time when muscular sectional area is usually the largest. Thereafter, there is a progressive decline in strength for most muscular group. He further explained that there is a decline of at least 16.5% in

muscular strength after the third decade of life - 30 and above years. The strength loss is directly related to limited mobility and physical performance as well as to increase in the incidence of accidents suffered by those with muscular weakness. The loss of handgrip strength in males by age 65 is about 20% compared to 20 years old. Other data from individual beyond age 65 suggest that the loss of strength further accelerates with aging, with the overall age-related strength loss ranging from 24 to 45%.

Power *et al* (1997) asserted that many years back, test such as the standing long jump or sergeant jump and reach have been used as field-tests to evaluate an individual's explosive anaerobic power or muscular strength. The standing long jump is the distance covered in a horizontal leap from a crouched position, while the sergeant's jump-and-reach test is the difference between the standing reach height and the maximum jump and touch height. They further noted that the 40-yard dash has been a popular test to evaluate power output in Football players for many years.

2.13 Muscular Endurance

There is close link between muscular endurance and strength. It also depends on the number of capillaries within the working muscles. Corbin (1985) classified the two (muscular strength and endurance) as a component referred to as muscle fitness. Muscular fitness (endurance) is

the ability of a muscle to repeat identical movements or sustain certain pressures, maintain degree of tension over a period of time (Johnson *et al.,* 1979). Muscular endurance is the ability to persist; it is also the repetition of sub-maximal contractions or sub-maximal holding time. Endurance is achieved by prolonged repetitive contractions of a portion of the contracting fibres. The repetitive muscular contraction requires a continuous supply of energy to muscle fibres with aerobic slow oxidative capacities, fast oxidative glycolytic are ideally suitable for the work. These fibres have a good oxygen supply, numerous mitochondria and the aerobic enzymes needed to supply ATP for extended periods of effort. Muscular endurance implies that there is longer period of muscular contraction or repetitions without fatigue. The major difference between strength and endurance rest on the level of tension or resistance applied to a muscle and the number of repetitions. A weight that is more than 66% of maximum strength places a high degree of tension on the muscle fibre and cannot be lifted many times. The lifting of such weight develops muscular strength. Conversely, when lighter weights are lifted many times, muscular endurance develops instead of strength.

From the view point of sports science, it has been shown by Astrand *et al* (1986) that people need endurance or stamina to perform well in prolonged physical activities. Ajiduah (1990) believes that a good football team that has trained sufficiently for endurance stands a better

chance of winning a prolonged match. For example, the Nigerian Golden Eaglets lost to the Soviet Unions under 17 national team during the finals of JVC cup in Canada probably because they lacked endurance. The match lasted for over 110 minutes and ended in a penalty shoot-out. Most of the golden eaglets players, were fatigued during the second half of the extra time hence poor penalty shots at the goal. A similar thing again happened to the Golden Eagles in Scotland in 1989 when the team, lost to Saudi Arabia during the quarter-finals. This shows apparently that the boys did not train well for endurance. Muscular fitness includes muscle strength and endurance. Trunk muscle strength and endurance were measured by sit-up (SUP). The vertical jump (VTJ), explosive strength of the legs and hand grip (HGR) or static strength (but corrected for body weight) were measured. Upper body muscular endurance was measured by the bent arm hang test (BAH) (Tuxworth, 1995).

Johnson *et al* (1979) and Skinner *et al* (1990) indicated that there are three types of muscular endurance tests and each of these may be expressed in absolute (lifting the same load) and relative (lifting the same percent maximal voluntary contraction) terms. They further stressed that absolute values correlate closely with the strength, but relative value does not. The American College of Sports Medicine (ACSM) (1995) recommended using a push up test to assess endurance of the upper body musculature. For women, modify the standing push-up position by

making the client assume a kneeling position with the knees flexed at 90° and the ankle crossed. Golding *et al* (1989) recommended that using a bench press test to assess dynamic endurance of the upper body. For the absolute endurance test, use a flat bench and barbell. The client performs as many repetitions as possible at a set cadence of 3 repetitions per minute.

Dynamic muscular endurance can be assessed by measuring the maximum number of repetitions for each calisthenics-type exercise. Test protocols and norms for some commonly used muscular endurance test are, sit-up, pull-ups and dips. Because many women and children are unable to perform even one pull-up, the timed flexed arm hang is commonly used for these groups.

Johnson *et al* (1979) suggested the use of relative endurance tests, which are dependent upon a proportional amount of weight of the body. Since maximum strength is know to fluctuate and dependent upon many parameters, conversely, body weight is more constant. They further outlined three categories of endurance tests:

1. Dynamic test of muscular endurance: This is where the performer executes similar repetitions of a movement through a designated distance and over an unlimited amount of time. The test is scored in terms of the number of correctly executed repetitions, such as barbell exercises with

sub-maximal loads and the frequently used push-ups, pull-ups and sit-ups. Heyward (1998) developed a modified pull up test that uses an inclined board. (300 angle to floor) with a pull-up bar at the top.

2. A scooter board was modified to slide along garage door tracks attached to the inclined board. While lying prone on the scooter board, grasp the pull up bar, then pull up the chin over the pull up bar.

3. Repetitive static tests of muscular endurance: the testee executes repetitions of force against a static measuring device, and test is scored in terms of the number of times he registers a force equal to a certain percent, either the maximum strength of the muscles involved or of body weight. A good example of this would be the number of times the testee can squeeze eighty pounds or more on a grip strength dynamometer. The test ends when the testee either fails to squeeze the prescribed load or when he falls behind the desired cadence (Heyward 1998)

Timed Static Test of Muscular Endurance

The performer maintains one continuous muscle contraction rather than a series of repetitive bouts, and the test is scored in terms of the amount of time the weight was held. The flexed - arm hang test for girls

is a good example (Johnson *et al*., 1979). Muscular endurance test differs from strength test because the score is based on the number of repetitions executed (or the duration of time a set tension is maintained) and not the maximum amount of weight lifted or force exerted as is the case for measuring strength.

Ajiduah (1990) mentioned that Footballers need the following types of endurance:

- General endurance
- Specific endurance
- Strength endurance
- Speed endurance

He further stated that general endurance is usually aerobic in nature and specific endurance can be aerobic or anaerobic. For instance, at the beginning of all training seasons e.g. during the preparatory seasons the Footballers should be made to do 2 -3 kilometers of jogging or running at 50 - 60 percent of the maximal speed.

Strength endurance is a must for all Footballers. Running about on the Football pitch demands strength in the legs and for a Footballer to run about on the field for over 120 minutes, he needs strength and endurance. Exercises such as series of squat jumps, with or without barbell on the shoulder, skipping and jumping over series of hurdles or platforms, running uphill and running on sand will help to develop strength

endurance in Footballers. Practice matches lasting between 120 and 150 minutes are recommended also for the development of strength endurance in Footballers.

Speed endurance training is also a must for Footballers. A good Footballer should be able to run 100m race easily in at least 11.0 seconds. Some strikers and defenders can run faster than that and they do spring so many times in a match when chasing a ball or when moving with the ball towards the goal area of the opponents. Ajiduah (1990), further specified that most of the work-outs suitable for the development of speed endurance in sprinters can be used for developing speed endurance in Footballers. Exercises like pair running, series of short sprints, series of 200m races at about 80 percent of their maximal speed, running with the ball repeatedly from one end of the field to the other (shuttle relay sprint races with the ball) are some of the activities that can be used by Football coaches to develop speed endurance in Footballers.

The bent-knee sit up is one of the most commonly used measures of local muscular endurance of the abdominal muscle, which are very important muscles in maintaining good posture. The test requires counting the number of times the individual comes to a sit-up position from the spine position with fingers clasped behind the head and knee flexed or hands crossed on the chest with palms placed on the shoulder.

The validity and reliability of strength and muscular endurance measures are affected by client's factors, equipment, technical staff and environmental factors. They must be controlled to ensure the accuracy and precision of muscular fitness score (Heyward 1998).

2.14 Body Composition

Body composition refers to the amount of lean body weight and fatness, which constitute body weight. It can be divided into fat-free mass (FFM) and body fat. Healthy body composition involves a high proportion of lean body tissue and acceptable low level of body fat adjusted for age and gender (Sparks *et al.,* 1997).

The assessment of body composition is within the realm of anthropometry, which is defined as the science that deals with the measurement, and quantification of size, weight and proportions of the human body. Anthropometric techniques e.g. skinfold circumference and diameter measurements are popular, inexpensive and require little space in measuring body composition in the field setting (Maud 1995).

The determination and assessment of body composition can provide important information about a wide variety of populations including the diseased, the apparently healthy, the obese and the athletic. Individuals suffering from muscle wasting disease (e.g. HIV, anorexia, Nerosa) or who are battling against obesity may be assisted through

therapeutic interventions by changes in percent body fat. (Vescovi *et al.,* 2001).

Howley *et al* (1997) advanced that, approximately one third of American adults are obese. They further defined obesity as a condition in which a person is over fat (i.e. has an excess of adipose, or fat, tissue) and is typically defined as a body fat percentage of greater than 32% for females and greater than 25% for male.

Classification	Women	Men
Essential fat	11.0-14.0	3.0-5.0
Athletes	12.0-22.0	5.0-13.0
Fitness	16.0-25.0	12.0-18.0
Potential risk	26.0-31.0	19.0-24.0
Obese	32.0 and higher	25.0 and higher

According to Sparks *et al* (1997) "Healthy body composition involves a high proportion of lean body tissue and acceptable low level of body fat adjusted for age and gender. A person with excessive body fat is more likely to experience a variety of health problems"

In order to make a valid assessment of the body composition for clients. Heyward (1998) advanced that; it is necessary to understand the underlying theoretical models. He further reported that it is worthy of note that, the body is composed of water, protein, minerals and fat. These two component models of body composition, divides the body into fat

component and fat free body (FFB) component. The fat free body consists of all residual chemicals and tissues including water, muscle, (protein) and bone (mineral).

The two component models of body composition consist of the following assumptions.

1. The density of fat is 0.901gcc-1
2. The density of FFB is 1.100g cc-1
3. The density of fat and fat free body components (water, protein, mineral) are the same for all individuals.
4. The densities of the various tissues comprising the FFB are constant within an individual and their proportional contributions to the lean component remain constant.
5. The individual being measured differs from the reference body only in the amount of fat. The FFB of the reference body is assumed to be 73.8% water, 19.4% protein and 6.8% mineral (Heyward 1998).

Sarafino (1994) reported that people add fat to their bodies because they consume more calories than they burn up through metabolism. He also advanced that the body stores excess calories as fat in adipose tissue, which consists of cells that vary in number and size. According to researcher Margaret Straw, the growth of adipose tissue through childhood and adolescence involve both increase in cell size and in

number. He further noted that the major reason why adults tend to gain weight as they get older is that metabolism and physical activity decline with age. Hence, to maintain their younger weight levels, people need to exercise and take in fewer calories as they get older. Both biological and psychosocial factors affect weight control.

Howley *et al* (1997) advanced numerous negative health consequences of obesity to include coronary artery diseases, hypertension, stroke, non-insulin dependent diabetes mellitus, increase risk of various cancers, osteoarthritis, degenerative joint diseases, abnormal blood lipid profile menstrual irregularities, and psychological burden for many individuals.

Wilmore *et al* (1992) evaluated Football players to demonstrate the problem with using the term' overweight to describe body composition (Leanness-fatness). In their research, Football players were shown to be over-weight according to the Body Mass Index (BMI), but when body composition was determined by hydrostatic weighing they were not considered over fat. They were overweighed as a result of having excessive amount of Fat-Free Mass (FFM) not fat weight.

Pullock in Maud *et al* (1995) advanced that, more recently, various techniques to measure body composition use models that differentiate fat from fat free mass (FFM). They further mentioned that there are two compartment models as proposed by Brozek *et al* (1963) which assumes

that the body composition is made up of fat and fat free body compartments. The fat-free body (FFM) includes the muscles, bone and other non-fatty tissues. There are several attempts made by scientists to measure or quantify the components parts of the human body. Over the years sports men and women body type or build were studied to determine the unique physical features of their structures and their compatibility to various sports activity (Nelson *et al.,* 1972). The extent of muscular development, the percent body fat and the dimensions of body structure are factors used in evaluating physique and body somato-type. The body composition may be regarded as being composed of basically two fractions, thus:

i. Body fat and fat free (weight lean body mass) (Fox, 1979) and Maud (1975).

   Maud et al (1995) further stressed that the amount of body fat (adipose tissue) that is stored is determined by two factors

   a. The number of fat-storing cells, or adipocytes

ii. The size, or capacity of the adipocytes

It has been shown that the number of fat cells cannot be effectively decreased by exercise or dietary restrictions once adulthood is reached. During weight reduction involving fat loss in adults, it is the size but not the number of adipocytes that decreases. The body composition is the

proportion of fat compared to bone and muscle, which is having a healthy percentage of muscle and fat in your body. For instance in non-athletic college-age males, body fat accounts for approximately 15% of the total body weight, while the corresponding figure for females is approximately 26 percent. Body composition is a component of health-related fitness, and the focus is almost exclusively on fatness (Roland *et al* (1989), Guo *et al* (1994) and McArdle *et al* (1991) recommended that, the desirable body mass range for professional Football players who are 188cm tall and weight 116kg is 78 to 88kg. They stressed that the average weight for young adult males who are 188cm tall is 85kg. Using either set of criteria, the player is clearly "overweight" and by conventional standard should reduce his body mass at least 28kg just to achieve the upper limit of the desirable weight range for professional Football players. They also reported that a player must reduce an additional 3kg to match his 'average' American male counterpart.

McArdle *et al* (1991) also discovered that the total fat content of the Football player was only 12.7% of his body weight compared with 15% body fat typically reported for young male non athletes. They further mentioned that this player's fat was below that normally found in the general population, even though he weight much more than the average.

Such observations were first noted by Navy physician Dr. Albert Behnke in the early 1940s on 25 Football players. 17 of whom were

found unfit for military service because they were overweight and presumably too fat or obese. He carefully evaluated each player's body composition and discovered that the so-called excess weight was due primarily to muscular hypertrophy.

Blair (1989) stated that after age 35, men and women tend to progressively add until the fifth or sixth decade of life and after age 60, total body mass is reduced despite increasing body fat. Also lean body does tend to decrease with age. This is largely due to aging skeleton that become demineralised and porous concurrently, there is reduction in total muscle mass (Beun 1992).

Body fat is stored around the main organs of the body and within the muscles, but half is stored a layer just beneath the skin, making over fatness a visible phenomenon. (Tukur 1985). There are two sites of the total amount of body fat known as fat depots or storage:

1. Essential fat depot. This is the fat stored in the bone marrow, the heart, the lungs, kidneys, liver, spleen, intestines, muscles and lipid rich tissue throughout the central nervous system and the breast in the case of females
2. The second fat deposits consist of fat accumulated in adipose tissue known as nutritional reserve. It includes the fatty tissues that protect the various internal organs from impact and the subcutaneous fat volume beneath the skin.

According to Sports Fitness Adviser (2005), excess body fat is related to injury; non-adherence to training and overall reduced athletic performance. A body fat percentage act against performance "dead weight" reducing speed and efficiency of movement. It is also detrimental to jumping, agility and endurance activities.

Sedentary life style and high caloric intake enhance high percentage of fat storage resulting in obesity amongst adult and children despite the fact that there is no existing record supporting the above claim for the Nigeria population. Nevertheless, in the United States of America at least one-third of adults are obese (Curbin *et al.,* 1985).

Bouchard *et al.,* (1994) posited that a life style of regular physical activity presumably contributes to more efficient function of various systems, weight maintenance, reduced risk of several degenerative tissues, reduced risk of mortality, overall improvement of quality of life and enhanced physical work capacity.

Mathews *et al* (1976) advanced that physically active or fit people posses less body fat than their inactive counterparts. They further noted that differences in performances do manifest between males and females due largely to greater percentage of fat contained in the female body. They further noted that the body weight of adult male average 15 percent fat, while female has about 23 percent fat. Optimum level changes from

individual to individual are due to a variety of genetic factors McArdle *et al* (1981).

Pollock in Maud (1995) asserted that, in most athletic events, Football particularly, participants must move their body mass quickly and efficiently; thus, the accumulation of body fat can deter training speed and jumping ability as well as endurance performance. Power (1997) asserted that the body composition can be measured in terms of total body water (isotope dilution, bioelectric impedance analysis) bone density (photon absorptiometry), lean tissue mass (potassium-40), density (underwater weighing) and thickness of various tissues (ultrasound, radiography and skinfolds).

2.15 Measurement of Body Composition

McArdle *et al* (1991) stated that there are several methods advanced by scientists to evaluate and quantify the body composition, where the major structural components of the body e.g. muscle, bone and fat are estimated Willet *et al* (1999) stated that the measurement of body fat, which is composed mainly of adipose in the form of triglyceride, represents a challenge to researchers and clinicians. He further stressed that the main stores of fat are subcutaneous and intra-abdominal, and considerable amounts of fat can also reside within muscles, particularly in elderly persons. The body composition could be best determined through

the dissection and chemical analysis of the animal carcass and human cadaver. Johnson *et al* (1979). However, other methods include radiography in which bone, muscle, fat and skin are estimated through x-ray analysis, the potassium-40 method, which employs the measurement of gamma radiation, from the body and requires a chamber and elaborate equipment, the helium dilution method, in which volume differences between volume in a special chamber and subject volume are analyzed (Tukur, 1995). Traditionally, the gold standard for estimating body fat has been hydro densitometry (under water weighing). However it's limited by its methodological requirements. This is based on the principle that fat tissue is less dense than muscle and bone (Willet *et al.,* 1999). They further explained that dual-energy x-ray absorptiometry is now replacing densitometry as a standard because of its high precision and its simplicity for the subject.

Skinner *et al* (1990) also stated that the body composition could be determined through body density which according to them is a function of the densities of the various body components and other proportions each represents relative to the entire body mass. They further explained that the major reason for using the body density to estimate body fat is because the young and old population tends to be underestimated. Another error may be the assumptions that the density of fat is fairly constant with age, gender and location, muscle and bone densities vary

markedly. They noted further that bone elasticity increase up to age 20 and decline after age 50. All of these methods are used primarily for research purposes and are not available for routine clinical care, but they can be used to validate other methods of measuring body fat McArdle *et al* (1981) mentioned that there are two general procedures used to evaluate body composition:

1. Direct. This refers to the chemical analysis of the animal carcass and human cadaver and
2. Indirect which is the hydrostatic weight, skin fold and circumference measurement otherwise known as hydrostatic weighing and skin fold and girth measurement. (McArdle *et al.,* 1991). It requires significant amounts of technical expertise and is difficult or impossible to administer on some special populations e.g. obese elderly children etc (Vescovi, 2001 and Maud, 1995).

Body Composition Estimation

Maud *et al* (1995) reported that the hydrostatic technique has been found to be highly reliable with pearson-product correlation coefficients >.95. The percent body fat can be estimated from bioelectrical impedance (McArdle *et al.,* 1991 and Claessens *et al* 1990). One of the most valid or gold standard of estimating body fat has been hydrodensitometry (underwater weighing). This is based on the principle that fat tissue is less

dense than muscle and bone. That is, fat floats whereas lean body tissue sinks, and fat weight is determined by immersing the subject in water to see how well they float. It is an indirect method based on the Achimede' s principle of floatation, which states that the loss of weight of the body in water is equal to the weight of the water displaced by the body. This method is expensive, time wasting and requires expertise and subjects full cooperation. (Mc Ardle *et al* (1991), Willet *et al* (1999) and Maud *et al* (1995). They further discussed that the dual-energy x-ray absorptiometry is replacing densitometry as a standard method due to its high precision and simplicity for the subject.

In clinical practice and epidemiologic studies, the body fat is often estimated by using a formula that combines weight and height. The underlying assumption is that most of the differences in weight for persons of the same height is due to fatness. The ratio between body fat and lean body tissue is a better gauge of fatness than the body weight measured by use of a scale or height/weight chard method. For instance, a height/weight chard may label a 6-foot, 210 pound Football player as over weight, when in reality he has only 10% body fat as measured with skinfold calipers (Donatelle *et al.,* 1994). The formula used most times in epidemiologic studies is the body-mass index, also referred to as the quetelet index, which is the weight in kilograms divided by the square of the height in meters. In the 19th century, this index observed empirically

that in adults, this index is minimally correlated with height and hence provides an appropriate measure of weight adjusted for height. Among middle aged adults, body mass index is strongly correlated with fat mass measured densitometrically and adjusted for height (Heyward, 1998). It has an approximate correlation of r = 0.90 for both men and women (Willett *et al.,* 1999).

The body mass index (BMI) and skin fold are routinely used in fatness surveys as indicators of fatness (Rolland *et al*., 1989 and Guo *et al.,* 1994). The underwater weighing and measurement of lung residual volume enable one to readily assess the body fat percent or body composition with considerable degree of accuracy, but obviously not for ease of measurement. (Maud 1995). He further stated that the body fat and composition may be reasonably estimated from measurements of subcutaneous fat as reflected by skin fold thickness. He also pointed that such measurements which are relatively uncomplicated, have been adopted by physicians, trainers, coaches and physical educators as a means of assessing the body composition of different persons, sports men and women inclusive. The skin fold measurements are taken with an instrument called a skin fold caliper meant to measure folds of skin only without muscle tissues (Heyward, 1998).

Measurement of body fat with the skin fold caliper has methodological problems such as the caliper pressure, inter-observer

error, difficulty of obtaining accurate measures on obese people and the expertise required to obtain accurate measurements (Skinner *et al.,* 1990). Heyward (1998) and Claessens *et al* (1990) added that the skinfolds are measured on biceps, sub-scapular, suprailiac, medial calf, calpopliteal front thigh; chest, midaxillary and abdomen.

Accumulation of intra-abdominal fat is of most concern for long-term health consequences (Van Loan 1996). He also advanced that the waist-to-hip rate (WHR) is used to estimate abdominal adipose tissue distribution and is a risk factor for cardiovascular diseases and diabetes. The waist circumferences by itself has also been proposed as a measure of abdominal fat.

$$C = \frac{\text{waist circumference}}{0.1091N0 + (kg)/h+(m)}$$

A higher value of circumference indicates more percent body fat.

The Procedure for Measuring Skinfolds

In a number of regions of the body, the subcutaneous adipose (fat) is lifted with the fingers to form a skinfold. The skinfold fat measures consist of a double Layer of subcutaneous fat and skin, the thickness of which is measured with a skin fold fat caliper AAPHERD (1986) Health relate physical fitness test items Brozek *et al* (1963) advanced five skinfolds sites (SFS) for measuring skinfolds thus: biceps, triceps, sub-scapular, abdominal and suprailiac. The skinfold sites are better assessed

in the morning, so as to eliminate error that could result from vascular tissue vasodilatation (MacArdle *et al.,* 1991).

The recommended testing procedure by AAPHERD Health related physical fitness test items (1986) and Heyward (1998) are:

1. Locate the site of measurement and mark with wash-felt tip pen.
2. Grasp the skinfolds between the thumb and forefinger ensure the fold is large as possible and it contains all the subcutaneous fat at the site.
3. Place the contact surfaces of the caliper 1cm (1/2 inch) above or below the finger.
4. Slowly release the grip on the calipers enabling them to exert their full tension on the skinfold.
5. Read skinfold to the nearest 0.5 millimeter after needle stops (1 – 5 seconds after releasing the grip on caliper). In a similar way, Watson (1983) recommended the following procedure for skinfold measurement.
6. Take the reading 1 - 5 seconds after the application of the Measurements are taken on the right side of the body in standing position.

Behnke *et al* (1974) recommended, the following equations for estimating body composition

1. Lean body weight (LBW) in kg, calculated from four skeletal diameters -bi-acrominal, bitrochanter, wrist and ankle.
2. Body density (Db) as estimated from Sinning (1974) equation for college athletes; Db = 1.1080 - $0.00168X_I$ - $0.00127X_2$ where X_l is the subcapular site fold (SF) and X_2 is abdominal SF. This equation has reliability coefficient of 0.975
3. The percentage of the body fat in the body can be determined from a simple equation that incorporates density. The simplified equation is obtained by substituting 0.90 gcc- and 1.10gcc-1 for densities of fat and lean tissue respectively (McArdle *et al.,* 1991).
4. Percent body (% fat) is also calculated from the equation of Brozek et al (1963) with a reliability coefficient of 0.99
   % fat = (4.510/DB - 4.142) x 100.
5. Fat weight is also estimated from Behnke et al (1974) equation.

Using the Durnin and Rahaman procedure as advanced by Tukur (1995), in the skin folds thickness conversion into estimated fat percent, there are two steps:

1. Skinfolds thickness - estimate of body density,

2. Body density - estimate of percent fat

He further explained that the conversion of the skin-folds thickness to estimate body density is found out after adding all the measurements of all the skin fold sites and substituted in one of the following equations.

1. Men: body density = 1.161 - 0.0632 Log_{10} (total skin)

2. Women: body density = 1.158 - 0.0732 Log_{10} (total skinfolds)

3. Boys: body density = 1.1533 - 0.0643 Log_{10} (total skinfolds)

5. Girls: body density = 1.1369 - 0.598 Log_{10} (total skinfolds)

Body density for white athletes or men(18-61 yrs) = 1.1120 - 0.0043499 ($\sum$7skf) + 0.00000055($\sum$7skf)^2 - 0.00028826 (age) Jackson *et al* (1978) For the body density to be converted to estimate body fat, the following equation are used and is the same for all subjects.

$$\text{Percentage fat} - \frac{(4.95)}{\text{Body density}} - 4.5 \times 100$$

or percent body fat formula as derived by Berkeley Scientist Dr William Seri (1989)

$$= \frac{495}{\text{Density}} - 450$$

$$\text{Body Mass Index (BMI)} = \frac{\text{Current weight}}{\text{Body height (m}^2\text{)}}$$

2.16 Summary of Review of Related Literature

From the discussion made in chapter two, it is crystal clear that the most fundamental attribute of all living organisms is physical survival. This point to the fact that physical survival is central to an individual's existence which implies that physical survival is predicated on good health achieved through physical fitness.

Sports evolved from the prevailing circumstances of the Stone Age man. The primitive or ancient men had to survive through hunting and looking for means of livelihood as well as defending themselves against their enemies, diseases, threat from natural forces around them, hence physical fitness was a most for the survival of the primitive man.

Even though there is increased enthusiasm and concern by the general public in physical fitness and the various researches on it, there are still divergent views among physical education professionals and those in allied professions as to the general consensus on the meaning and constituents of physical fitness. Some argued that it concerns the performance related fitness only e.g. agility coordination, while another school of thought says it encompasses both the health related physical fitness components (cardiovascular endurance, muscular endurance, muscular strength flexibility and body composition) and the performance related physical fitness elements.

Nevertheless, conceptual definitions are matters of individuals' perspectives. However for the purpose of this research work, physical fitness was discussed under two components; the health related and skill or performance related physical fitness. The health related components, which is the focus of this research include, cardiovascular endurance, muscular endurance, strength, flexibility and body composition. These components were discussed extensively in chapter two. The performance or skill related components were just mentioned e.g. agility, balance, coordination speed and reaction time. The former components enhance physical fitness and good health while the later enhance motor skill learning and performance.

CHAPTERTHREE

METHODOLOGY

3.1 Introduction

The purpose of this study was to assess the health-related physical fitness status of Plateau State male professional Football League Players.

The chapter describes the procedures for conducting this research under the following sub-headings:

3.2. Research design

3.3 Population

3.4 Sample and sampling procedures

3.5 Test Instruments

3.6 Testing Procedures

3.7 Test Description

3.8 Research Assistants

3.9 Test Conditions

3.10 Statistical techniques

3.2 Research Design

The research designed adopted in the conduct of this study was the Ex-Post facto design as adopted by Dikko (1991), because no independent variable was manipulated. In this design, the dependent variables of muscular endurance, cardio-respiratory endurance,

flexibility, muscular strength, and body composition of the subjects were measured, using field tests such as sit-ups, 12 minutes distance run walk, sit and reach, standing broad jump and skinfold measurement respectively. The subject performances were compared with International Health-related physical fitness norms to determining the level of significance of Professional Footballers and norms.

3.3 Population

The population for this research comprised of the 102 players of the three teams that participated in the Professional Football League competitions during the 2005 seasons: Plateau United Football Club, Mighty Jet Football Club and Jersey Raiders Football Club.

3.4 Sample and Sampling Procedures

The sample used for this study was made up of seventy (70) male Professional Football League Players from three Football clubs namely, Plateau United Football Club (34 players), Mighty Jet Football club (34 players) and Jersey Raiders Football Club (34 players) during the 2005 league season of Plateau State.

The purposive sampling technique was used to select the three Football clubs as the sample of this research because their officials and players gave the researcher maximum cooperation.

The research made use of 25 players of Plateau United, 23 players of Jersey Raiders and 22 players of Mighty Football Clubs who were present on the first day of the test to constitute the 70 research subjects.

3.5 Test Instruments

The instruments and facilities used by the researcher in measuring the physical fitness status of the professional Football league players for this study were:

i. Stop watch: this was used for timing subjects in 12 minutes run, on 400m track and sit ups.

ii. Bathroom scale (Hana model) to measure the subjects weight

iii. Sixty centimeter (60cm) ruler for measuring the distance covered in sit and reach test

iv. A specially constructed box with a flat surface area where the subject can place the sole of his foot against it and slide his two arms on top of the ruler with finger tips together to measure flexibility on sixty centimeter (60cm) ruler

v. Whistle, this was used to start and stop subjects in twelve minutes Run/walk and sit-ups

vi. Mats: they were used for Sit-ups

vii. Skin fold calipers (Lange Skin Fild Coliper No. Part. No. 3008239 Beta Technology Incorporated Cambridge, Maryland): used for skin fold measurement.

viii. A standard four hundred meters (400m): track at the Rwang Pam township stadium Jos for the evaluation of Vo_2max

ix. Measuring tape: to measure distance covered in standing broad jump, as a test of explosive power.

3.6 Test Procedures

Before the tests were administered, informed consent forms were given to all the subjects, which were completed and returned (see appendix A). The subjects were certified to be medically fit to undertake the tests by the medical officer of each team.

Detailed explanations and demonstrations of every test item preceded actual performance of the tests. Before the test started, subjects were allowed to inspect the instruments to be utilized during each test for familiarization and to avoid fright. The tests were administered on the players of the three Professional Football Clubs independently, between 730 – 830 am each day under similar conditions. The numbers were given to players of each club (Jersey Raiders, Mighty Jet, and Plateau United) were alphabetically arranged to give every one fair treatment. Out of the five test items- 12-minutes distance run/walk-test, sit-up test, sit and

reach test, standing broad jump and skin fold measurement, the researcher grouped the players of each club into five and administered the five tests on each group for five days, after morning warm-up exercises. Each of the five test items were administered as described below.

3.7 Test Descriptions

The purpose of this study was to assess the health-related physical fitness status of Plateau State Male Professional Football League Players.

Cooper's Twelve Minute Distance Run/Walk Test

To administer the 12-minute distance run/walk test a standard 400-meter track of the Plateau State Sports Council Rwang Pam township stadium was used. Markers were placed on the track to divide the course into quarters, so that the exact distance covered in 12 minutes can be determined quickly and correctly. The subjects were instructed to run as fast as possible. Walking/jogging was allowed, as long as much distance as possible was covered in 12 minutes each. The distance covered by each subject at the end of 12 minutes was calculated by multiplying the number of Laps by 400m and the product was converted to kilometers to know the distance covered in kilometers (Km) recorded against the subject code numbers. The researcher used some students of PHE Department College of Education Gindiri that reside in Jos North, Jos East, Jos South and Bassa LGA as Research Assistants. A student was

assigned to each subject to count the number of Laps covered. The research assistants were given thorough orientation before the tests.

The researcher used the American College sport medicine formular for converting the 12 minutes distance run walk covered to VO_2 max by multiplying it by 0.2 and add 3.5.

The distance covered in the 12 minutes distance run walk test was converted in metres first per minutes.

Example: A subject covered 7 laps in 12 minutes run, the VO_2 max will be calculated as follows:

$$VO_2 \text{ max} = \frac{\text{(distance)}}{\text{Time (12m)}} \text{ x } 0.2 + 3.5$$

$$VO_2 \text{ max} \quad \frac{2800 \text{ metres}}{12 \text{ minutes}} \quad \text{x} \quad 0.2 + 3.5$$

VO_2 max = 50.17ml/kg (ACSM 1997)

Sit- Up Test

The subjects were told to assume the starting position by lying on their backs with knees flexed, feet on the floor with heels between 30-45cm from the buttocks, with the fingers interlocked behind the neck. The subject's feet were held firmly by a research assistant who also counted the number of sit-ups.

The exercise was repeated as many times as possible in one minute. The total number of repetitions in one minute was recorded as each subject's score. Instructions were given to the subjects in respect of the position of the fingers, which must remain interlocked behind the neck throughout the test. The research assistants gave the signal "ready" "go" and the sit-up performance stopped on the command "stop". The number of correctly executed sit-ups performed in 60 seconds were recorded as the scores of the subjects for muscular endurance.

Sit and Reach Test

The Hoeger (1989) modified sit -and -reach test, which takes into account the distance between the end of the fingers and the sit-and - reach box and uses the finger-to -box distance as the relative zero point was used. A 30cm high box or a sit -and reach box was used. The subjects sit on the floor with buttocks, shoulders and heads in contact with the wall, extends (but do not lock) their knees, and place the soles of the feet against the box. A 60cm ruler placed on top of the box with the zero end toward the subject. Keeping the head and shoulders in contact with the wall, each subject reach forward with one hand on top of the other and the 60cm ruler is positioned so that it touches their finger tips to serve as the Zero point for each subject. The 60cm ruler is firmly held in place then each subject reaches, forward slowly, sliding his Fingers along the top of the 60cm ruler Heyward (1998).

The score in (cm) is the most distant point on the 60cm ruler contacted by the fingertips. Three slow, forward movement trials were made, and on the third forward motion the subject's leans as far forward as possible holding this position for a minimum of two (2) seconds. The furthest distance reached of the three trials is recorded as each subject sit-and - reach score. The ensured that each subject followed instructions before taking the records.

Standing Broad Jump

A take-off Line on a jump-off-board with the feet several centimeters apart and toes just behind the take-off line. In preparation for the jump, the subject flexed the knees; both hands were swung backward, forward and upwards and jumped up double footed as far forward as possible using the arm and the legs to lift the body and propel it further. The tester emphasized the double take-off with the knees extended.

Three trials were allowed and each distance was measured from the nearest break on the sand to take-off board. The average of distance covered was computed for each subject to assess their muscular strength with International norms (see appendix G).

Skinfolds Measurement

The skin-folds (SKF) estimation using the skin-folds Caliper (Harpenden Lange) made was used.

The skin-folds were taken from the three sites, below as recommended in Brynteson Brynteson and Huber (2001):

a. Chest

b. Thigh

c. Abdomen

Skin Fold Sites

In taking the skin-fold measurement of all the subjects, the researcher followed Mcardle, *et al* (1991) procedures which stated that the most common areas for taking fat fold measurements are at the triceps, sub-scapular, the suprailiac, abdominal, the chest and upper thigh site for men. The standardized procedures for skin-folds measurements in these sites are as follows.

1. Take all the skin-fold (SKF) measurements on the right side of the body as stated by Brynteson; Brynteson and Huber (2001).
2. Carefully identity, measure, and mark the skin-folds (SKF) site, especially if are a novice SKF technician
3. Grasp the skin-fold firmly between the thumb and index finger of left hand. Lift the fold I cm above the site to be measured.
4. Lift the fold by placing your thumb and index finger 8cm (-3 inches) apart on a line that is perpendicular to the long axis

of the skin-fold. The long axis is parallel to the natural cleavage lines of the skin. For individuals with extremely large skin-folds, you will need to separate your thumb and finger more than 8cm in order to lift the fold.

5. Keep the fold elevated while the measurement is taken.
6. Place the jaws of the caliper perpendicular to the fold, approximately 1cm below the thumb and index finger, and release the jaw's preserve slowly
7. Take the SKF measurement 4 seconds after pressure is released
8. Open the jaws of the caliper to remove it from the site. Close the jaws slowly to prevent damage or loss of calibration.

The measurements were recorded in millimeter (mm)

The percent body fat was calculated using Brozek et al (1963) equation formular below, with a reliability co-efficient of 0.99

$$\% \text{ body fat} = \frac{(4.510 - 4.142)}{BD} \times 100$$

3.8 Research Assistants

Some students of the Department of physical and Health Education, College of Education, Gindiri residing in Jos North, Jos South, Bassa and Jos East Local Government Areas assisted the researcher

throughout the conduct of the tests as recorders. They received training on the timing of subjects and other test procedures to enable them assess the subjects.

3.9 Test Conditions

1. The testers made sure the tests took place on the same course and field to ensure similar test conditions for all the subjects.
2. The procedures and reasons for each test item were explained to the subjects before the commencement of the tests.
3. The time for the commencement of the tests lasted between 7:30 and 8:30 am each day.
4. The subjects were at test venue at least 30 minutes, before the commencement of tests.
5. All the subjects wore sports outfit appropriate for the test conditions.

3.10 Statistical Techniques

Descriptive statistics of mean, standard deviation, standard error of means were used to analyze the data. Therefore, the statistical techniques used for this study was the inferential statistics of student-t-test used to determine whether there is any significant difference between the subject scores and the international fitness standards (norms) by age groups.

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION

4.1 Introduction

This research was carried out to assess the health related fitness status of Professional Football League Players in Plateau State. To attain this objective, five different test items for evaluating health related physical fitness components were used in collecting the data. The test items included 12-minute distance run/walk test, sit and reach, standing broad jump, though it measures explosive power, there is element of muscular strength in explosive power, sit-up and skin fold measurement. These tests assessed cardio-respiratory endurance, flexibility, muscular strength, local muscular endurance of the abdomen and body composition. The results of the tests were statistically analyzed. The performance of the subjects was compared with standard international fitness norms to determine the significant differences. The t-test was used to analyze the data.

4.2 Results

The results of the statistical analysis are shown in tables as follows.

Table 1: Physical Characteristics of the Subjects

Item	**Minimum**	**Maximum**	**N**	$\overline{X}$	**SE** $\overline{X}$	Std. Dev
Age	14yrs	30yrs	70	18Yrs	14.8 ±	4.714
Height	1.48m	1.98m	70	1.74m	0.09 ±	0.10407
Weight	57kg	85kg	70	78.75	5.52 ±	6. 367

The age of the subjects ranged from 14years to 30 years with a mean age of 18±14.89 years. Their heights ranged from 1.48m to 1.98m with a mean height of 1.74± 0.09m and the weight of the subjects had a minimum of 57kg and maximum of 85kg with a mean of 70.57± 5.52kg. The data on table one (1) above indicates that most of the subject were young and were of moderate height and weight.

Table 2: **Comparison of Health Related Physical Fitness Components of Professional Football League Players in Plateau State (N=70)**

ITEMS		$\bar{X}$	$\overline{SEX}$	t_{cal}	df	t_{cri}	Remarks
Sit – ups	Prof. FC	51	.79	6.62*	68	1.980	Footballers have higher muscular endurance
	Norms	45					
Vo_2 max	Prof. FC	53.9	.47	2.66*	68	1.980	Footballer have higher cardio respiratory endurance
	Norms	52.6					
Sit and Reach	Prof. FC	43	.35	4.27**	68	1.980	Footballers have lower flexibility
	Norms	44					
Standing broad jump	Prof. FC	2.31	.00	3.53**	68	1.980	Footballers have higher muscular strength
	Norms	3.28					
% Body fat.	Prof. FC	10.39	.11	11.85*	68	1.980	Footballers have higher % body fat
	Norms	9.12					

t (68) =1.980 (P≤ 0.5) *Significant **Not Significant

Table 2 shows the results of t-test comparison for the professional football league players of Plateau State for difference between the health-related fitness components and international fitness norm.

The above table showed significant difference in sit-up, VO_2 max and % body fat. This shows that professional footballers are not as required by international fitness norm values in muscular endurance, cardio respiratory endurance, and % body fat. Footballers performed higher in muscular endurance, cardio respiratory endurance and % body fat.

The major hypothesis of this research which states that "there is no significant differences amongst the health related physical fitness status of professional football league players of Plateau State and international fitness norm is therefore rejected".

However, no significant difference was observed in sit and reach and standing broad jump, but footballers performed higher in muscular strength and lower in flexibility.

The major hypothesis of this research which states that "there is no significant differences amongst the health related physical fitness status of professional football league players of Plateau State and international fitness norm" is therefore retained.

Table 3: Differences between the Health Related Components of the Professional Football League Players of Plateau and International Fitness Norm Values with reference to age groups (N=70)

ITEMS		$\overline{X}$	SE$\overline{X}$	t_{cal}	df	t_{cri}	Remarks
Sit – ups	Prof. FC	51	.79	6.62*	68	1.980	Footballers have higher muscular endurance
	Norms	45					
Vo_2 max	Prof. FC	53.9	.47	2.66*	68	1.980	Footballer have higher cardio respiratory endurance
	Norms	52.6					
Sit and Reach	Prof. FC	43	-.35	-4.27**	68	1.980	Footballers have lower flexibility
	Norms	44					
Standing broad jump	Prof. FC	2.31	.00	-3.53**	68	1.980	Footballers have higher muscular strength
	Norms	3.28					
% Body fat.	Prof. FC	10.39	.11	11.85*	68	1.980	Footballers have higher % body fat
	Norms	9.12					

t (68) =1.980 (P≤ 0.5) * Significant ** Not Significant

Table 3: shows the t-test results of differences between the health-related fitness components of the professional football league players of Plateau State and international fitness norm values.

Observation of this table showed significant difference in set-up (muscular endurance) of professional football league players and international fitness norm values.

However footballers performed higher than international fitness norm values in muscular endurance. The sub-hypotheses one of this research which states that "there is no significant difference between muscular endurance and international fitness norm is therefore rejected".

The age group analysis (see appendix 1-10) showed that footballers between ages 14-30 showed no significant difference except ages 14,16,18 and 20 that showed significant difference with international fitness norm values in muscular strength.

The null sub-hypotheses one of this research which states that "there is no significant difference between muscular endurance of professional football league players of Plateau State and international fitness norm values is therefore retained, since majority of the age groups showed no significant difference.

Table 3 above also showed significant differences in VO_2 max (cardio respiratory endurance) of professional football league players of Plateau State and international fitness norm values.

The null sub-hypotheses two of this research which states that "there is no significant difference between cardio respiratory endurance of professional football league players of Plateau and international fitness norm values" is therefore rejected.

However footballer performed higher than international fitness norm in cardio respiratory endurance.

The age group analysis (see appendix 1-10) indicated that ages between 14-30 years showed no significant difference between the cardio respiratory endurance of professional footballers and international fitness norm values except 18 years age group. The sub-hypotheses two of this research is therefore retained

Table 3 above also revealed no significant difference between sit and reach (flexibility) of the professional football league players of Plateau State and international fitness norm values.

The null sub-hypothesis three of this research which states that "there is no significant difference between flexibility of the professional football league players and international fitness norm values" is therefore retained. This indicates that the footballers are fit in flexibility. However the footballers performed lower in flexibility.

The age group analysis (see appendix 1-10) of difference between the health-related physical fitness components of the professional football league players of Plateau State revealed that the age groups between 14-30 years showed no significant difference with international fitness norm values. Hence the null sub-hypotheses three of this research is therefore retained.

However age group of 15years showed significant difference in flexibility between professional footballers and international norm values.

Table 3 above further showed no significant difference between standing broad jump (muscular strength) of the professional football league players of Plateau State and international fitness norm values.

The null sub-hypotheses four of this research which states that "there is no significant difference between muscular strength of the professional football league players and international fitness norm value" is therefore retained. This indicates that the footballers are fit in muscular strength.

However the footballers performed higher in muscular strength than international norm values. The age group analysis (see appendix 1-10) of difference between the health-related physical fitness components of the professional football league players of Plateau State showed that age groups between 14-30 years indicated no significant difference with international fitness norm values.

So, the null sub-hypotheses four of this research is therefore retained. This implies that all the age groups are also fit in muscular strength.

Table 3 also showed that there is significant difference between the % body fat of professional football league players of Plateau State and international fitness norm values.

The null sub-hypotheses five of this research which states that "there is no significant difference between % body fat of professional

football league players and international fitness norm values" is therefore rejected. This means that footballers % body fat is above norm value, which can affect their level of fitness and physical performance.

However footballers had higher % body fat than international fitness norm values. The age groups analysis (see appendix 1-10) of difference between the health-related physical fitness status of the professional football league players of Plateau State showed that age groups between 14-30 years indicated significant difference with international fitness norm values. The null sub-hypotheses five of this research is therefore rejected. The comparison of the health-related components of the Professional Football League Prayers in Plateau and International fitness norms is to ascertain differences in their fitness status.

4.3 Discussion

The purpose of this research was to assess the health related fitness status of professional football league players of Plateau State. To achieve this, the health related physical fitness test items as contained in AAHPERD (1986), Bryntenson (2001) and Robwood (2006) were used.

The findings of this study revealed significant difference between muscular endurance, cardio respiratory endurance and % body fat of the seventy professional football league players of Plateau State and international fitness norm values.

However, footballers showed no significance difference in flexibility and muscular strength with international fitness norm values. Running on football pitch demands strength of the legs of footballers. Ajiduah (1990) and Bartect (1998) emphasized that flexibility enhances footballer's physical mobility. The footballers were fit in flexibility and muscular strength but were not fit in muscular endurance, cardio respiratory endurance and % body fat. Training should be intensified to better level of fitness. Excess body fat affects muscular endurance cardio respiratory endurance and reduced overall athletic performance (Wood, 2006). Professional football league players of Plateau State showed significant difference in muscular endurance and international fitness norm values. However the age group analysis showed no significant difference amongst age groups 14-18 and significant difference amongst age groups 20-30 years in muscular endurance.

During football matches the amount of oxygen players consume increases proportionally (Williams, 1999). Football training programme must include the development of endurance, strength and flexibility exercises (Gwani, 1990). Ajiduah (1990) also supported this findings, that any good football team which has trained sufficiently for endurance has a better chance of wining a prolonged match. For instance the Nigeria, Golden eaglets lost to the Soviet Union under 17 national team during the

finals of J.V.C cup in Canada probably because they lacked endurance, since the match ended in penalty shoot-out.

A similar thing again happened to the Golden Eaglets in Scotland in 1989, when the team lost to Saudi Arabia during the quarter-finals. The match showed apparently that the boys did not train well for endurance.

Astrand *et al* (1977) stressed in line with the findings of this research that people need endurance or stamina to perform well in prolonged physical activities. For instance a football match that ends with penalty shoot out need muscular endurance by players. Ajiduah (1990) mentioned that footballers need the following types of endurances, general endurance, specific endurance, strength endurance and speed endurance. For instance, at the beginning of all training seasons, the footballers should be made to do 2-3 kilometers of jogging or running at 50-60 % of maximal speed.

The research results showed that the health related fitness status of professional football league players of Plateau State indicated significant difference between the Vo_2 max of footballers and international fitness norm values. However the age groups analysis showed no significant difference in cardio-respiratory endurance than international fitness norm among age groups 14-30 years.

A persons aerobic fitness is largely dependent on the condition of his heart, because strong cardiac muscles results in increased stroke

volume and cardiac out put and thereby providing sufficient oxygen to the skeletal muscles for physical activities. Cardio-respiratory endurance implies that there is improved supply of oxygenated blood to the working muscles, hence the peripheral circulation receives and utilizes oxygen efficiently (Chado, 1991).

Williams (1999) further supported this research findings by stressing that the highest rate of oxygen consumption is called peak or maximum oxygen uptake (Vo_2 max). He further emphasized that any level of activity can be described in terms of its oxygen cost as a proportion of an individual maximum oxygen uptake.

The more oxygen the circulatory and respiratory systems are able to deliver, the longer the person will be able to exercise before fatigue or exhaustion set in. (Toriola *et al.,* 1992). The heart, circulatory and respiratory systems must function efficiently, if a high degree of cardiovascular endurance is to be achieved in the game of football (Adelakun, 1990). He further noted that with cardiovascular endurance above average level, such benefits as maximal oxygen update can be derived.

The outcome of this research showed that there is no significance difference between the flexibility of the professional football league players and international fitness norm values. However the age groups analysis showed no significant and difference in flexibility among age

group 14-30 and international fitness norm value, except age group 15 years.

The relevance of flexibility to sports performance and physical exercises are many. A person's ability to move depends largely on his general and specific flexibility. A high level of flexibility helps an individual to perform efficiently in football. Flexibility is very important in diving, hurdling, swimming, jumps Gymnastics and other sports (Neilson *et al.,* 1972). They further stressed that America football and basketball needs average flexibility specific to each joint and the sports engaged in.

The result of this research reveals that all the professional football league players showed no significance difference in muscular strength and the international fitness norm values. This finding is supported by Getchell *et al* (1982). They stressed that strength is fundamental to all sports and most day-to-day activities. Johnson *et al* (1999) outlined the following benefits of strength to sports performance in line with the findings of this research.

- Strength can improve physical performance in sports, leisure time activities. Players need sufficient strength to be professional footballers.
- Having adequate strength can help minimize the risk of injury by making participation less stressful on the body.

- Sports men and women experience an improved sense of well being through the physical effects of improved strength and it improves self-confidence.

Maud (1995) confirmed that, within the realm of sports, there are many activities where high degree of flexibility in specific joints are desirable for enhanced performance in both quantitative and qualitative athletic activities, because inflexibility could predispose sports men and women to muscle strains, tendon and ligament sprains. Corbin *et al.,* (1985) asserted that a certain amount of threshold level of flexibility is necessary for most sports, though it varies from sports to sports.

This confirms the statement of Blair (1989) that maximum strength of men and women is generally achieved between the ages 20-30 years, a time when muscular sectional area is usually the largest. There after, there is a progressive decline in strength for most muscular groups. The decline 16.5% in muscular strength after the third decade of life, 30 and above years. Skinner et al (1990) explained that Isometric and isotonic strength increase from 10-14 years to 20-29 years and then decline gradually.

Adelakin (1990) asserted that a minimal level of strength is important, without this, it would be impossible to carry out the task that are necessary in football game.

The results of this research also indicated that the health related fitness status of Professional Football League Players of Plateau State showed significant difference with international fitness norm values in % body fat. However the age groups analysis also indicated difference between players % body fat and international fitness norm values amongst age groups 14-30 years in % body fat.

This difference may be due to inadequate training, Dietary pattern and physique of players Sarafino (1994) reported in line with the findings of this research, that people add fat to their bodies because they consume more calories than they burn up through metabolism.

According to sports fitness Adviser (2005) excess body fat is related to injury, non-adherence to training and overall reduced athletic performance.

Pollock in Maud (1995) asserted that in most athletic events, participants must move their body mass quickly ad efficiently, thus, the accumulation of body fat, can dater training speed, jumping ability as well as endurance performance.

The coaches of the Professional Football Clubs of Plateau State should step up the intensity and duration of the training programme of the players. They should also monitor the feeding pattern of the players to enable caloric intake to equal caloric expenditure.

This research also discovered significant difference between the % body fat of professional football league players of Plateau State and the international fitness norm values. Coaches should engage footballers in fat shading exercises to improve their fitness status and performance. Sarafino (1994) noted that the major reason why adults tend to gain fat/weight as they get older is that metabolism and physical activity decline with age. Hence to maintain their younger fat/weight levels, people need to exercise and take in fewer calories as they get older.

The results of this research indicated that the professional football league players of Plateau State showed no significant difference in muscular endurance with international fitness norm values among players in four age groups.

Mcardle *et al* (1991) also discovered that the total fat content of footballers was only 12.7% of his body weight compared with 15% body fat typically reported for young male athletes. Matthew *et al* (1976) advanced that physically active or fit people posses less body fat than their in active counterparts.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

Physical fitness is a means through which optimal health and physical performance can be achieved. Hence the need to assess the physical fitness status of professional football league players to prepare them for better performance. This study was assess the health related physical fitness status of professional football league players of Plateau State and to find out whether there differences between their health related fitness status and the international fitness norm values.

The subjects of this research were seventy (70) male professional football league players of Plateau State purposely picked from Plateau United, Jersey Club Raiders & Mighty Jet football clubs of Jos.

The subjects participated in all the health related physical fitness test items during 2005 league season, such as 12-minute distance ran/walk test, one minute flexed knee sit-up, sit and reach test, standing stand broad jump test and skin fold measurement as prescribed by AAHERD (1989), Brynteson *et al* (2001) and Robwood (2006). These test items were used to assess cardio respiratory endurance, muscular endurance, flexibility, muscular strength and percent body fat.

The data collected from the fitness tests were analyzed at the Data Processing Unit of the Institute of Agricultural Research (IAR), Ahmadu

Bello University, Samaru, Zaria. The descriptive and two-tailed t-test was the statistical method used to analyze the data.

5.2 Conclusion

In view of the limitations of this research and on the basis of its findings the following conclusions are drawn.

(1). The is significant difference between muscular endurance, cardio respiratory endurance and % body fat of the severity (70) professional football league players of Plateau State and international fitness norm values. However no significant difference is shown in flexibility and muscular strength.

(2). There is no significant difference in muscular endurance, however group analysis showed that there is no significant difference between the cardio-respiratory endurance, flexibility and muscular strength of the professional football league players of Plateau State ages 14-18 years and international fitness norm values.

(3). There is significant difference between the cardio respiratory endurance of footballers and international fitness norm values. However groups showed that there is significant difference between the % body fat and muscular endurance of the Professional Footballers of Plateau State 14-18 age group and international fitness norm values.

(4). There is no significant difference between the flexibility of footballers and international fitness norm values. However age groups showed there is no significant difference between the muscular endurance, cardio respiratory endurance, flexibility and muscular strength of the professional football league players of Plateau State 20-30 age group and international fitness norm values.

(6). There is no significant difference between the muscular strength of professional footballers and international fitness norm value. However age groups showed no significant difference.

(6). There is significant difference between the % body fat of the professional football league players of Plateau State and international fitness norm values. All age groups showed significant difference in % body fat too.

5.3 Recommendations

Based on the findings of this research the following recommendations are made.

- A national youth fitness Norm should be developed in Nigeria.

- All professional and premier league footballers in Nigeria should under go physical fitness test during pre season, in season and off-season.
- A national physical fitness norm for footballers should be developed.
- Physical fitness tests should be part of the recruitment exercise of amateurs, professional and premier football league players.
- Well-equipped physical fitness laboratories should be provided in all sports councils, tertiary institutions and national institute of sports.
- Technical staff in physical fitness evaluation should be trained abroad by the federal government.
- All applicants seeking admission and employment should be required to under go both medical and physical fitness test.
- Exercise should be integrated into our national health policies.
- Military, paramilitary and all security organizations should employ exercise scientists to conduct physical fitness test during their recruitment exercise.
- Plateau State professional football league players that performed below international fitness norm values, should

be subjected to relevant training programmes for improvement

5.4 Further Research

- Research on the relationship between the physical fitness status of defenders, midfielders and attackers should be conducted.
- Studies should be conducted to assess the Health-related fitness status of female national league players.
- Research should also be conducted on performance related fitness components of professional, premier and armature footballers.

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APPENDIX I

Differences between the Health Related Components of the Professional Football League Players Ages 14 years in Plateau and International Fitness Norm Values (N=5)

ITEMS		$\overline{X}$	$S\overline{EX}$	T_{cal}	df	t_{cri}	Remarks
Sit – ups	Prof. FC	45	1.66	0.67**	4	2.776	Footballers have higher muscular endurance
	Norms	44					
Vo_2 max	Prof. FC	56.8	1.31	1.85**	4	2.776	Footballers have higher cardio respiratory endurance
	Norms	54.0					
Sit & Reach	Prof. FC	41	.58	-2.06**	4	2.776	Footballers have lower flexibility
	Norms	42					
Standing long jump	Prof. FC	2.0	0.39	-1.27**	4	2.776	Footballer have lower muscular strength
	Norms	2.3					
% Body fat.	Prof. FC	10.00	.26	3.23*	4	2.776	Footballers have higher % body fat
	Norms	9.00					

t (4)=2.776 $\leq$ 0.05

* = significant
** = not significant

APPENDIX 2

Difference between the Health Related Components of the Professional Football League Players Ages 15years in Plateau and Standard Norm (N=15)

ITEMS		$\bar{X}$	$SE\bar{X}$	t_{cal}	df	t_{cri}	Remarks
Sit – ups	Prof. FC	53	1.70	3.42*	14	2.145	Footballers have higher muscular endurance
	Norms	48					
Vo_2 max	Prof. FC	55.00	1.49	0.64**	14	2.145	Footballers have higher cardio respiratory endurance
	Norms	54.00					
Sit & Reach	Prof. FC	45	.85	4.61*	14	2.145	Footballers have lower flexibility
	Norms	49					
Standing long jump	Prof. FC	-2.28	-01	-2.01**	14	2.145	Footballers lower muscular strength
	Norms	2.29					
% Body fat.	Prof. FC	9.79	.87	7.69*	14	2.145	Footballers have higher % body fat
	Norms	9.12					

t (14)=2.145 $\leq$ 0.5

* = significant
** = not significant

APPENDIX 3

Differences between the Health Related Components of the Professional Football League Players Ages 16 years in Plateau and Standard Norm (N=9)

ITEMS		$\overline{X}$	$SE\overline{X}$	t_{cal}	df	t_{cri}	Remarks
Sit – ups	Prof. FC	52	1.16	3.75	8	2.306	Footballers have higher muscular endurance
	Norms	48					
Vo_2 max	Prof. FC	55.53	1.05	2.05	8	2.306	Footballers have higher cardio respiratory endurance
	Norms	53.45					
Sit & Reach	Prof. FC	42	.53	.17	8	2.306	Footballers have the some flexibility
	Norms	42					
Standing long jump	Prof. FC	2.36	.01	-1.36	8	2.306	Footballers have lower muscular strength
	Norms	2.37					
% Body fat.	Prof. FC	10.49	.26	5.32	8	2.306	Footballers have higher % body fat
	Norms	9.12					

t (8)= 2.306 $\leq$ 0.5

* = significant
** = not significant

APPENDIX 4

Differences between the Health Related Components of the Professional Football League Players Ages 17 years in Plateau and Standard Norm (N = 6)

ITEMS		$\bar{X}$	$SE_{\bar{X}}$	t_{Cal}	df	t_{cri}	Remarks
Sit – ups	Prof. FC	53	3.11	1.77**	5	2.571	Footballers have higher muscular endurance
	Norms	48					
Vo_2 max	Prof. FC	55.60	1.34	0.42**	5	2.571	Footballers have higher cardio respiratory endurance
	Norms	54.17					
Sit & Reach	Prof. FC	46	.89	-1.32**	5	2.571	Footballers have lower flexibility
	Norms	47					
Standing broad jump	Prof. FC	2.35	0.00	-1.00**	5	2.571	Footballers have the some muscular strength
	Norms	2.35					
% Body fat.	Prof. FC	9.92	22	3.68*	5	2.571	Footballers have higher % body fat
	Norms	9.12					

t (5)=2.571 $\leq$ 0.5

* = significant
** = not significant

APPENDIX 5

t-test of Differences between the Health Related Components of the Professional Football League Players Ages 18 years in Plateau and Standard Norm (N =10)

ITEMS		$\bar{X}$	$SE\bar{X}$	t_{cal}	df	t_{cri}	Remarks
Sit – ups	Prof. FC	51	2.06	2.40*	9	2.262	Footballers have higher muscular endurance
	Norms	46					
Vo_2 max	Prof. FC	56.75	1.02	2.99*	9	2.262	Footballers have higher cardio respiratory endurance
	Norms	53.70					
Sit & Reach	Prof. FC	57	1.53	0.52*	9	2.262	Footballers have higher flexibility
	Norms	51					
Standing long jump	Prof. FC	2.26	.01	-1.86**	9	2.262	Footballer have lower muscular strength
	Norms	2.28					
% Body fat.	Prof. FC	10.48	.21	6.41*	9	2.262	Footballers have higher % body fat
	Norms	9.12					

$t(5)=2.57 \leq 0.5$

* = significant
** = not significant

APPENDIX 6

Differences between the Health Related Fitness Components of the Professional Football League Players Ages 20 years in Plateau and Standard Norm (N=8)

ITEMS		$\overline{X}$	$SE\overline{X}$	T_{cal}	df	t_{cri}	Remarks
Sit – ups	Prof. FC	53	2.83	3.67*	7	2.369	Footballers have higher muscular endurance
	Norms	43					
Vo_2 max	Prof. FC	55.16	1.20	1.08**	7	2.369	Footballers have higher cardio respiratory endurance
	Norms	53.88					
Sit & Reach	Prof. FC	39	.35	0.32**	7	2.369	Footballer have lower flexibility
	Norms	40					
Standing long jump	Prof. FC	2.37	.01	-1.53**	7	2.369	Footballers have the some muscular strength
	Norms	2.37					
% Body fat.	Prof. FC	11.00	.59	3.16*	7	2.369	Footballers have higher % body fat
	Norms	9.12					

t (7)=2.369<0.5

* = significant
** = not significant

APPENDIX 7

Differences between the Health Related Fitness Components of the Professional Football League Players Ages 23 years in Plateau and Standard Norm (N =6)

ITEMS		$\overline{X}$	$SE\overline{X}$	t_{cal}	df	t_{cri}	Remarks
Sit – up	Prof. FC	43	1.40	.60**	5	2.571	Footballer have higher muscular endurance
	Norms	42					
Vo_2 max	Prof. FC	50.17	1.21	0.42**	5	2.571	Footballers have higher cardio respiratory endurance
	Norms	49.67					
Sit & Reach	Prof. FC	38	.22	-2.24*	5	2.571	Footballers have the some flexibility
	Norms	38					
Standing long jump	Prof. FC	2.35	.01	-1.00**	5	2.571	Footballers have lower muscular strength
	Norms	2.36					
% Body fat.	Prof. FC	11.22	.07	3.21*	5	2.571	Footballers have higher % body fat
	Norms	9.12					

t (5)=2.571 $\leq$ 0.05

* = significant
** = not significant

APPENDIX 8

Differences between the Health Related Fitness Components of the Professional Football League Players Ages 25 years in Plateau and Standard Norm (N=3)

ITEMS		$\bar{X}$	$SE\bar{X}$	t_{cal}	df	t_{cri}	Remarks
Sit-up	Prof. FC	54	7.97	1.42**	2	4.303	Footballers have higher muscular endurance
	Norms	43					
Vo_2 Max	Prof. FC	40	4.04	1.11**	2	4.303	Footballers have higher cardio respiratory endurance
	Norms	38					
Sit & reach	Prof. FC	41	1.86	-13**	2	4.303	Footballers have lower flexibility
	Norms	43					
Standing Long jump	Prof. FC	2.53	.01	-1.00**	2	4.303	Footballers have lower muscular strength
	Norms	2.54					
%body Fat	Prof. FC	11	.59	3.21**	2	4.303	Footballers have higher % body fat
	Norms	9.12					

t (2) = 4.303 $\leq$ 0.05

* = significant
** = not significant

APPENDIX 9

Differences between the Health Related Fitness Components of the Professional Football League Players Ages 27 years in Plateau and Standard Norm (N=4)

ITEMS		$\overline{X}$	SEX	$\overline{t}_{cal}$	Df	t_{cri} VALUE	Remarks
Sit – up	Prof. FC	49	2.29	2.51**	3	3.182	Footballers have higher muscular endurance
	Norms	43					
Vo_2 max	Prof. FC	51.85	1.65	-.70**	3	3.182	Footballers lower cardio respiratory endurance
	Norms	53.00					
Sit & Reach	Prof. FC	36	.50	-1.00**	3	3.182	Footballers have the some flexibility
	Norms	36					
Standing long jump	Prof. FC	2.23	.00	-1.00**	3	3.182	Footballers have the some muscular strength
	Norms	2.23					
% Body fat.	Prof. FC	10.10	.39	2.55**	3	3.182	Footballers have higher % body fat
	Norms	9.12					

t (3) = 3.182 $\leq$ 0.05

* = significant
** = not significant

APPENDIX 10

Differences between the Health Related Fitness Components of the Professional Football League Players Ages 30 years in Plateau and Standard Norm (N=4)

ITEMS		$\overline{X}$	$S\overline{EX}$	t_{cal}	df	t_{cri} VALUE	Remarks
Sit – up	Prof. FC	46	2.38	1.25**	3	3.182	Footballers have higher muscular endurance
	Norms	43					
Vo_2 max	Prof. FC	50.50	1.58	-21**	3	3.182	Footballers have higher cardio respiratory endurance
	Norms	41.63					
Sit & Reach	Prof. FC	2.32	.02	-1.00**	3	3.182	Footballers have lower flexibility
	Norms	2.34					
Standing long jump	Prof. FC	40	1.87	0.89**	3	3.182	Footballer lower muscular strength
	Norms	43					
% Body fat.	Prof. FC	10.85	0.67	2.82**	3	3.182	Footballers have higher % body fat
	Norms	9.7					

t (3)=3.182 $\leq$ 0.05

* = significant
** = not significant

APPENDIX A

Physical and Health Education Department,
Ahmadu Bello University, Zaria.

CONSENT FORM

I ---------- offer my consent to partake in the research to be carried out on the Assessment of the health physical fitness status of professional football league players in Plateau State.

I may fell some distress in the cause of participating in 12 minutes distance run walk test, sit ups test, sit and reach test, standing broad jump and skinfold caliper tests. However, I have been duly informed and advised to stop/slow down whenever I perceive any unusual pains or discomforts.

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Candidate	Signature	Date

APPENDIX B

PERCENTAGE FAT ESTIMATES FOR MEN CALCULATED FROM CHEST ABDOMEN AND THIGH SKINFOLD THICKNESS

Age range Sum of 3 Skmfold	19	220-22	23-25	26-28	29-31	32-34	35-37	38-40
14-16	29	3.3	3.6	3.9	4.3	4.6	5.0	5.3
17-19	3.9	4.2	4.6	4.9	5.3	5.6	6.0	6.3
20-22	4.8	5.2	5.5	5.9	6.2	6.6	6.9	7.3
23-25	5.8	6.2	6.5	6.8	7.2	7.5	7.9	8.2
26-28	6.8	7.1	7.5	7.8	8.1	8.5	8.8	9.2
29-31	7.7	8.0	8.4	8.7	9.1	9.4	9.8	10.1
32-34	8.6	9.0	9.3	9.7	10.0	10.4	10.7	11.1
35-37	9.5	9.9	10.2	10.6	10.9	11.3	11.6	12.0
38-40	10.5	10.8	11.2	11.5	11.8	12.2	12.5	12.9
41-43	11.4	11.7	12.1	12.4	12.7	13.1	13.4	13.8
44-46	12.2	12.6	12.9	13.3	13.6	14.0	14.8	14.7
47-49	13.1	13.5	13.8	14.2	14.5	14.9	15.2	15.5
50-52	14.0	14.3	14.7	15.0	15.4	15.7	16.0	16.4
53-55	14.8	15.2	15.5	15.9	16.2	16.6	16.9	17.3
56-58	15.7	16.0	16.4	16.7	17.1	17.4	17.8	18.1
59-61	16.5	16.9	17.2	17,6	17.9	18.3	18.6	19.0
62-64	17.4	17.7	18.1	18.4	18.8	19.1	19.4	19.8
65-67	18.2	18.5	18.9	19.2	19.6	19.9	20.3	20.6
68-70	19.0	19.3	19.7	20.0	20.4	20.7	21.1	21.4
71-73	19.8	20.1	20.5	20.8	21.2	21.5	21.9	22.2
74-76	20.6	20.9	21.6	21.6	22.0	22.2	22.7	23.0
77-79	21.4	21.7	22.1	22.4	22.8	23.1	23.4	23.8
80-82	22.1	22.5	22.8	23.2	23.5	23.9	24.2	24.6
83-85	22.9	23.2	23.6	23.9	24.3	24.6	25.0	25.3

86-88	23.6	24.0	24.3	24.7	25.0	25.4	25.7	26.1
89-91	24.4	24.7	25.1	25.4	25.8	26.1	26.5	26.8
92-94	25.1	25.5	25.8	26.2	26.5	26.9	27.2	27.5
95-97	25.8	26.2	26.5	26.9	27.2	27.6	27.9	28.3
98-100	26.6	26.9	27.3	27.6	27.9	28.3	28.6	29.0
101-103	27.8	27.6	29.0	28.8	28.6	29.0	29.3	29.7
104-106	27.9	28.3	28.6	29.0	29.3	29.7	30.0	30.4
107-109	28.6	29.0	29.3	29.7	30.0	30.4	30.7	31.1
110-112	29.3	29.6	30.0	30.3	30.7	31.0	31.4	31.7
113-115	30.0	30.3	30.7	31.0	31.3	31.7	32.0	32.4
116-118	30.6	31.0	31.3	31.6	32.0	32.3	32.7	33.0
119-121	31.3	31.6	32.0	32.3	32.6	33.0	33.3	33.7
122-124	31.9	32.2	32.6	32.9	33.3	33.6	34.0	34.3
125-127	32.5	32.9	33.2	33.5	33.9	34.2	34.6	34.9
128-130	33.1	33.5	33.8	34.2	34.5	34.9	35.2	35.5

Source: *Jackson and Pollock: Generalized equations for predicting body density of men. British Journal of Nutrition. 1978. In Brynteson P. Brynteson D & Huber F. (2001) Essential of Physical Activity Second Edition Eddie Bowes Publishing Inc.*

APPENDIX C

FITNESS STANDARDS FOR SIT-UP SIT-

PS STANDARDS

	15-19yrs		20-29yrs		30-39yrs		40-49yrs		50-59yrs		60-69yrs	
Fitness level	Male	female	Male	female	Male	female	Male	female	Male	female	Male	female
Excellent	>48	>42	>43	>36	>36	>29	>31	>25	>26	>19	>23	>16
Good	42-47	36-41	37-42	31-35	31-35	24-28	26-30	20-24	22-25	12-18	17-22	12-15
Average	38-41	32-35	33-36	25-30	27-30	20-23	22-25	15-19	18-21	5-11	12-16	4-11
Faire	33-37	27-31	29-39	21-24	22-26	15-19	17-21	7-14	13-17	3-4	7-11	2-3
Poor	>32	>26	> 28	> 20	>21	>14	>16	>6	>12	>2	>6	>1

APPENDIX D

AVERAGE BODY FAT PERCENTAGE OF ATHLETES					
Sport	Male	Female	Sport	Male	Female
Baseball	12-15%	12-18%	Rowing	6-14%	12-28%
Basketball	6-12%	20-27%	Shot putters	16-20%	20-28%
Body building	5-8%	10-15%	Skiing (x country)	7-12%	16-22%
Cycling	5-15%	15-20%	Sprinters	8-10%	12-20%
Football (backs)	9-12%	No date	Swimming	9-12%	14-24%
Football (linemen)	15-19%	No date	Tennis	12-16%	16-24%
Gymnastics	5-12%	10-16%	Triathlon	5-12%	10-15%
High/long jumpers	7-12%	10-18%	Volleyball	11-14%	16-25%
Ice/field hockey	8-15%	12-18%	Weightlifters	9-16%	No date
Racquetball	8-13%	15-22%	Wrestlers	5-16%	No date

Body Fat Percentage For The Average Population			
Age	Up to 30	30 – 50%	50+
Female	14 – 21%	15 -23 %	16 – 25
Male	9 – 15%	11 – 17%	12 – 19%

Htt://www. Sport-fitness-advisor. Com/body fat percentage. Html 5/23/2006

APPENDIX E

CARDIO-RESPIRATORY FITNESS STANDARDS ACCORDING TO MAXIMAL OXYGEN UPTAKE (ML/KG/MIN)

AGE									
Fitness Category	18-29		30-39		40-49		50-59		60-69	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Excellent	60	53	56	50	53	47	50	44	48	42
Very Good	53	46	49	43	45	39	43	47	41	35
Good	43	37	64	34	39	33	34	28	31	26
Fair	36	30	34	28	33	27	30	25	26	21
Poor	31	26	30	24	29	23	26	21	21	17
Very Poor	<31	<26	<30	<24	<29	<23	<26	<21	<21	<17

Adapted from cooper, ken. The Aerobics way, New York: M. Evans & Company, 1977, Pp. 280-281, and H Goeger, Werner and Hoeger, Sharon. Fitness and Wellness, Englewoo: Morton Publishing Company, 1990 P. 15 in Bynteson P. Brynteson D. & Huber F. (2001) Essential of physical Activity second edition eddie bowrs Publishing Inc. P. O. Box 130 Peasta, lona 52068-0130.

APPENDIX F

STANDARD LONG JUMP TEST STANDARD (BROAD JUMP)

Rating	Male (cm)	Female (cm)
Excellent	>250	>200
Very good	241-250	191-200
Above average	231-240	181-190
Average	221-230	171-180
Below average	211-230	161-170
Poor very Poor	191-210	141-160
	<191	<141

Rob Wood, R. J. (2006) Fitness: Standing Long Jump Test. www. To Pendsports. Com.

APPENDIX G

FLEXIBILITY STANDARD FOR SIT AND REACH

Fitness level	**Sit and Reach**
Excellent	59 cm
Very Good	53 – 58 cm
Good	40.5 -52 cm
Average	41 – 51 cm
Fair	34 – 40 cm
Poor	29 – 38 cm
Very Poor	28 cm

Bynteson P. Brynteson D & Huber F. (2001) Essential of Physical Activity Second Eddie Bowes Publishing Inc.