ASSESSMENT OF PHYSICAL AND PHYSIOLOGICAL CHARACTERISTICS OF MALE NIGERIAN UNIVERSITY ATHLETES

By

RICHARD OGUNLEYE

DEPARTMENT OF PHYSICAL AND HEALH EDUCATION,
AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA

JANUARY, 2013

ASSESSMENT OF PHYSICAL AND PHYSIOLOGICAL CHARACTERISTICS OF MALE NIGERIAN UNIVERSITY ATHLETES

By

RICHARD OGUNLEYE

B.sc. Physical and Health Education (ABU, Zaria), M.Sc. Exercise and Sports Science (ABU. 2006).

Ph.D /EDUC/01597/2006-2007

A DISSERTATION SUBMITTED TO
THE POST-GRADUATE SCHOOL.
AHMADU BELLO UNIVERSITY, ZARIA
NIGERIA

IN PARTIAL FULFILLMENT OF THE REQUIRMENT FOR THE AWARD OF DOCTOR OF PHILOSOPHY(Ph.D) IN EXERCISE & SPORTS SCIENCE

DEPARTMENT OF PHYSICAL & HEALTH EDUCATION
FACULTY OF EDUCATION
AHMADU BELLO UNIVERSITY
ZARIA, NIGERIA

JANAURY, 2013

DECLARATION

I hereby declare that this dissertation entitled 'Assessment of Physical and Physiological Characteristics of Male Nigerian University Athletes' has been written by me in the Department of Physical and Health Education under the supervision of Prof. C.E. Dikki, Prof. K. Venkateswarlu and Prof. J.A. Gwani.

The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this Dissertation was previously presented for any other degree at any university.

RICHARD OGUNLEYE **DATE**

CERTIFICATION

This dissertation entitled "Assessment of Physical and Physiological characteristics of Male Nigerian University Athletes" by Richard Ogunleye meets the regulations governing the award of the degree of Doctor of Philosophy in Exercise and Sports Science of Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

---------- ----------

PROF. C.E. DIKKI **DATE**
CHAIRMAN, SUPERVISORY COMMITTEE

---------- ----------

PROF. VENKATESWARLU K. **DATE**
MEMBER, SUPERVISORY COMMITTEE

---------- ----------

PROF. J.A. GWANI **DATE**
MEMBER, SUPERVISORY COMMITTEE

---------- ----------

PROF. C.E. DIKKI **DATE**
HEAD OF DEPARTMENT

---------- ----------

PROF. ADEBAYO A. JOSHUA **DATE**
DEAN, POSTGRADUATE SCHOOL

DEDICATION

This Dissertation is dedicated to the Almighty God for his love and His infinite mercy, and to the memory of my late humble father James Ojeagbase Ogunleye who slept in the bossom of the Lord on the 22/12/1987. And to the entire family of James Ojeagbase Ogunleye.

ACKNOWLEDGEMENTS

The researcher would like to thank the almighty God for His grace benevolence, for a Doctor of Philosophy in Exercise and Sports Science. But divine provisions made the achievement of this feat relatively easy. The researcher therefore wishes to express unreserved thanks to the Supervisory team of the research in the persons of Professor C.E Dikki for his professional and academic guidance and constructive criticisms and suggestions, and for creating the paternal ambience that has made it possible for one to bring out the best of one's capabilities. Similar appreciation goes to Prof. Venkateswarlu Kankanala and Prof. J.A Gwani (members of the supervisory. Committee) for their encouragement, constructive guidance and suggestions during the course of the research. Also express profound gratitude to Dr. E.A Gunnen. Prof. (Mrs.) M.A Suleiman, Prof. M.A Chado, Dr. E. J. Chom, Prof. (Mrs.) T. N. Ogwu, Prof. (Mrs.) C.O. Adegbite and the entire members of staff of the Department of Physical and Health Education, Ahmadu Bello University Zaria are graciously acknowledged for their interest and valuable contributions.

I am grateful to my family members and friends and also Mr. John Obemeata who has in one way or the other contributed immensely to the success of this work. Also deeply appreciate Mr. Augustine Braimoh and Mr. Nse Dickson who were responsible for the typesetting of this work.

TABLE OF CONTENT

Title Page ……..…….i
Declaration ……...ii
Certification ……..……..……iii
Dedication ……iv
Acknowledgement ……v
Contents ……..……vi
List of Tables ……..xi
Abbreviations ……xiii
Definition of Terms ……..xiv
Abstract ……...xv

CHAPTER ONE

1.1 Background of the Study…….…….....1
1.2 Statement of the Problem …….……...…...2
1.3 Purpose of the Study ……...……...……...4
1.4 Research Questions ……4
1.5 Basic Assumption ……..….5
1.6 Major Hypothesis …….……...……...6
1.7 Sub-Hypothesis ……..……..…..…6
1.8 Significance of the Study ……..……..……..…7
1.9 Delimitation of the Study …….....8
1.10 Limitation of the Study ……...……...8

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction ……..…...10

2.1 Characteristics of physical Fitness for Field Based Team Sports Players in Terms of Energy Supply During Intermittent sprint Exercise Test ……..12

2.2 Physiological Characteristics of Elite Short and Long Distance Triathletes ……...14

2.3 Analysis of Anthropometry, Body Composition And Performance Variables of Young Indian Athletes in Southern Region ……15

2.4 Physiological Characteristics of Male Ultra Endurance Runners ……...16

2.5 Training and Bioenergetics Characteristics In Elite Male Kenyan Runners ..……...18

2.6 Differences in Aerobic and Anthropometric Characteristics between Peribubertal Swimmers and non-Swimmers ……..…...21

2.7 The Differences is Some Anthropometric Characteristics between top Football Players and Recreational Players ……..…22

2.8 Analysis of the Characteristics of Competitive Badminton Players ……..23

2.9 Comparison of some Anthropometric Characteristics of Elite Badminton and Tennis Players ……24

2.10 Physique Traits of Lightweight Rowers and their Relationship to Competitive Success …..……25

2.11 Anthropometric Characteristics, Somatotyping and Body Composition of Volley Ball and Basketball Players …..……26

2.12 Physiological Characteristics of Junior and Senior Rugby League Players ……..…..……27

2.13 Physiological and Metabolic Characteristics of Elite Tug of War Athletes ……28

2.14 Anthropometric, Gait and Strength Characteristics of Kenyan Distance Runners ……..……..…….....28

2.15 Anthropometric Comparism of World-Class Sprinters and Normal Populations ……..……29

2.6 Summary …….……...……..30

CHAPTER THREE

3.0 Research Methodology ……...…….....32

3.1 Introduction ...……..….32

3.2 Research Design ……...……33

3.3 Population of Subjects ……..……....33

3.4 Sample and Sampling Technique ……..……..….....33

3.5 The Text Items Used ……....…35

3.6 Testing Procedure ……..…….……..…37

3.6.1 Cooper 12 Minutes Run Test …….……..38

3.6.2 50 Meter for Speed ……...39

3.6.3 20 Meter Shuttle Run (Agility) …….…...40

3.6.4 Muscular Power (Standing Broad Jump) …….....40

3.6.5 Calf Circumference Measurement …….……...…41

3.6.6 Height and Weight Measurement ……..…….....41

3.6.7 Total Leg Length Measurement ……..…….....42

3.6.8 Total Arm Length Measurement ……..……42

3.7 Instrumentation ……42

3.8 Study Conditions and Control ..……..…..44

3.9 Test Assistance ……..……..……44

3.10 Statistical Analysis ……..…..……..……..……44

CHAPTER FOUR

4.0 Results and Discussion ……...……..46

4.1 Introduction ……..……..…...46

4.2 Results …….....46

Hypothesis Testing ……..……..…..47

Sub-Hypothesis One (I) ……..……..……....47

Sub-Hypothesis Two (II) ……..……..……...49

Sub-Hypothesis Three (III) ……..……..…..…...51

Sub-Hypothesis Four (IV) …….....…..53

Sub-Hypothesis five (V) ……..……..54

Sub-Hypothesis Six (VI) ……...56

4.3 Discussion ……..……..…….57

CHAPTER FIVE

5.0 Summary, Conclusions and Recommendation ……..…..…64

5.1 Summary……..……..……64

5.2 Conclusion ……..…….....65

5.3 Recommendations ...……...…….……....66

5.4 Recommendation for Further Research ……..……..…67

References ……...……..……..…..68

Appendix ……..……...74

LIST 0F TABLES

Table 4.2.1: Means and standard deviation of the stature and body mass of male university male athletes used for this study characteristics of subjects ……...36

Table 4.2.2a: The mean, standard deviation and standard error of 12 minutes run test ...……..……...37

Table 4.2.2b: One way Analysis of variance in 12 minutes run by groups of sports ……..38

Table 4.2.3a: The mean, standard deviation and standard error of 50meter speed run test ……...……..39

Table 4.2.3a: Analysis of variance (ANOVA) for differences between 50 meter speed run test ……..39

Table 4.2.4a: The mean, standard deviation and standard error of 20 meter shuttle run test ……..……..40

Table 4.2.4b: Analysis of variance (ANOVA) for differences in 20 meter agility test between individual sport, ball game, racket game, speed endurance sport and combat sport of male Nigerian university athletes ……..……....41

Table 4.2.5a: The mean, standard deviation and standard error of standing broad jump test ……..……..41

Table 4.2.5a: Analysis of variance (ANOVA) for differences between standing broad jump test …..……,,,,……..…42

Table 4.2.6a: The mean, standard deviation and standard error of total arm length measured …...……..……..…43

Table 4.2.6b: Analysis of variance (ANOVA) for differences in total arm length measured ……..……..…43

Table 4.2.7a: The mean, standard deviation and standard error of total leg length measured ……..……..……..44

Table 4.2.7b: Analysis of variance (ANOVA)for differences in total leg length measures……..……..45

ABREVIATIONS

AAPHERD: American Alliance for Health Physical Education Recreation

V_{02} MAX: Volume of Oxygen Uptake

BF: Body Fat Percent

NUGA: Nigeria University Games Association

WAUG: West African University Games

ANOVA: Analysis Of Variance

IWKG: International Working Group on Kinanthropometry

KG: Kilogram

CM: Centimeter

MM: Millimeter

MD: Middle Distance

SPSS: Statistical Packages for Social Sciences

OPERATIONAL DEFINITION OF TERMS

PHYSIOLOGICAL MEASURES: Variables such as volume of oxygen up take (v_{02} max) and maximal heart rate.

ANTHROPOMETRIC MEASURES: Variables such as the measurement of body segment i.e. leg length, arm length calf circumference.

PROPORTIONALITY: The different sizes of the human body in terms of weight, height, body dimensions etc.

PHYSICAL MEASURES: Variables such as speed, agility, broad jump, 50 meter shuttle run, height and weight measurement.

ATHLETES: Group of players in regular contentions for the medal positions at the highest levels of competition.

ABSTRACT

Application of modern scientific technological principles to the selection and training of athletes in different sports disciplines has been responsible for the incredible high sporting standards registered in modern competitions. Moreover, frequent changes in officiating rules of different sports discipline necessitate the development of new equipment of new training technologies and methodologies. Available research evidence indicates specific physical and physiological characteristics relevance to certain sports. This research was therefore conducted to assess the physical and physiological characteristics of Nigerian Male University Athletes under the following group of sports, individual speed, speed endurance sports, combat sports, racket sports and ball games. To achieve the purpose of this study, four universities from each of the seven administrative zones of Nigerian Universities were selected, eight athletes from each university were selected. The groups are, individual sports, speed endurance sports, combat sports, racket sports and ball games, totaling 32 athletes were selected from each zone, multiplied by 7 administrative zones, totaling 225 athletes respectively, representing their various universities at the NUGA championships. The athletes thus selected were tested in the 12 minute run to determine their volume of oxygen uptake (V_{02} max), 20 meter shuttle run for agility, 50 meter dash to determine speed, anthropometric measurement were also taken such as height, weight, calf circumference, total arm length and total leg length to determine their upper and lower limb lengths. The data thus collected were statistically analysed. Descriptive statistics of mean, standard deviation and standard error, one ways analysis of variance (ANOVA) were used to determine if there was any significant difference among the selected groups of sports.

CHAPTER ONE
INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Physical and physiological characteristics have been shown to determining factors in the successful performance of many sports discipline (Kreighbuam and Bartheles, 1985, Venkarteswarlu, Gunen and Ameh, 2010).

It has also been shown that some physical measures like structure, weight, length, and arm length were more important for success in some sporting events than in others (Ireland and Ott, 2004). For example, basketball, volleyball, and track event like high jump have been reported as sports in which the absolutes height of the body was important to success. (Accurater, 1988) in order words the taller the better.

However, giving two performance of equal height, measurement could reveal quite different proportions or a little length of the segment making of the height. (Kreighbuam and Bartheles, 1985) recorded arms, leg and length measurement of 1968 Olympic athletes, the result of this study showed that basketball players, weight throwers and rowers had the greatest arm length. The shortest arm lengths were found on gymnast, divers and weight lifters, whereas, basketball players, weight throwers, rovers and athletes from field events had the

greatest leg length, similar findings were reported on trunk length; because of such differences among athletes of different disciplines, it was assumed that such characteristics can be used to identify athletic talents early in life (Hoare and Warr, 2000, Pitsiladi and Scott, 2005, Venkarteswarlu 1992). Early talent identification has been found to be advantageous in achieving higher performance level Australian Law Reform Commission, 1996).

However, there have been application of talent identification within sports requiring more decision making may not be very useful as success in this sports, depend more on decision making processes, Falks et al 2004, Hoare and Warr, 2000, Lindor et al 2005, Pinnah et al, 1995, Reilley, 2000, Gilbourn, 2003). It is the believe of this investigator that physical physiological characteristics identified among athletes of different sports discipline can be used to identify talents for different sports.

If such characteristics of Nigerian elites sports of men and women are known, they can be used to identify talents for different sports earlier in life.

1.2 STATEMENT OF THE PROBLEM

The recruitment process within the Nigerian universities calls for coaches to identify prospective students-athletes who would be most successful in their institution. Humara, (2005) argues that while coaches are expert in the identification of physical attributes needed for success, they may lack the ability

to identify psychological skills. In addition, Niednagel, (2004) would contend that environmental factors also contribute to the athletes likelihood of success in sport. Also physical performance efficiency and effectiveness in different sports depend on a large extent on the size, weight and proportion of the physique of the athlete. Every year, the coaches in the Nigerian university embark on the monumental task of trying to select athletes that will be successful at the Nigerian University Games Association, the West Africa University Games (WAUG) and the World University Games (FISU); coaches may examine an athlete from many perspectives in order to determine if they will be successful in their programme.

This initial assessment most often include an examination of physical ability as coaches often attribute athletic success to talent and physical characteristics. The field of sports psychology is based on the idea that psychological attributes and mental skills also contribute to athletic success. Still, many questions on how much of an athlete's success stems from physical attributes, and how much stems from psychological attributes. Coaches have often relied on informal judgments of psychological factors to determine potential to succeed. Can athletic success at the university level be predicted using psychological traits in conjunction with their physical abilities?

1.3 PURPOSE OF THE STUDY

The purpose of this study was to assess the physical and psychological characteristics of male Nigerian university athletes on the selected group of sports namely:

a. Individual sports
b. Racket game
c. Combat sports
d. Speed endurance sports
e. Ball game
f. Individual sports which comprises track and field and swimming.
g. Racket game which comprises tennis and badminton.
h. Combat sports which comprises taekwondo and judo.
i. Speed endurance sports which comprises soccer and hockey
j. Ball game which comprises of volley ball and basketball.

1.4 RESEARCH QUESTIONS

i. Are there significant differences among individual sports which included swimming, track and field groups in their physical characteristics which included height, weight, 20 meter shuttle run, 50 meter speed, run, standing broad jump and calf circumference measurement?

ii. Are there significant differences in the physiological characteristics among the groups of sports which is 12 minutes cooper test run?

iii. Are there significant differences among individual sports, racket game, ball game, speed endurance sports, and combat sports in their physical characteristics?

iv. Are there significant differences among individual sports, racket game, track and field events in their physical characteristics?

v. Are there significant differences among the speed endurance sports i.e hockey and soccer in their physiological characteristics?

1.5 BASIC ASSUMPTIONS

a. It is assumed that individual with talent for sports respond better to training than those who chose sports without consideration of the talent for that sport.

b. That individual identified for talent for a particular sports shows greater and faster improvement in the sports performance.

c. Physical physiological and social characteristics of individual athletes are used to select sport that is more suitable to an individual.

d. The interaction of environment determines the maximal performance that one can achieve in any sports.

e. It is also assumed that individual athletes that performs better in sports depend to a large extent on the size, weight, and proportion of the physique of the athlete.

1.6 MAJOR HYPOTHESIS

On the basis of the research questions, the following hypothesis were formulated for the purpose of the study.

There are no significant differences among selected athletic groups in their physical and psychological characteristic.

1.7 SUB-HYPOTHESIS

a. There are no significant differences among selected athletic groups in their physical characteristics which included height, weight, calf circumference, standing broad jump, 20 meter agility, 50 meter speed, total leg length and total arm length measures.

b. There are no significance differences among selected athletic groups in their physiological characteristic which included cardio-respiratory endurance as assessed by 12 minutes cooper test run.

c. There are no significance differences among selected physical and physiological characteristic of athletes.

1.8 SIGNIFICANCE OF THE STUDY

This study is justified on the following basis:

a. There has been a rapid increase in the intensity and frequency of participation in national and international sports competitions such as the Nigerian University Games Association (NUGA) West Africa University Games (WAUG) World University Games (FISU), All African Games and the Olympic Games respectively. On the basis of the physical and physiological characteristics of this study, information as regards to the Nigerian male university athletes will be established. Such information can be used to select athletes for sports that are more suitable to them.

b. Physical performance efficiency and effectiveness in different sports depend to a large extent on the size, weight, and proportion of the physique of the athletes. Several kin anthropometric studies have shown significant association between anthropometric characteristics of athletes and the chosen sports. However, the result of this study would establish the differences among the selected athletic groups in such physical and physiological characteristics.

c. This investigation will bring to light a new area of research relating to talent detection and identification in sports.

1.9 DELIMITATIONS OF THE STUDY

The study was delimited to the following:

a. Research was conducted to assess the physical and physiological characteristics of male Nigerian university athletes.

b. The physical characteristics included as assessed by 20 meter shuttle run, 50 meters speed, lower limb explosive strength as assessed by standing broad jump, height, weight, calf circumference, total arm length, total leg length measures.

c. The physiological characteristic included only cardio-respiratory endurance as assessed by 12 minutes cooper test run.

d. The university male athletic groups studied were.

e. Individual sports which included track and field and swimming.

f. Speed endurance sports which included soccer and hockey.

g. Ball game which included basketball and volleyball.

h. Combat sports which included judo and taekwondo.

i. Racket sports which included tennis and badminton.

1.10 LIMITATION OF THE STUDY

The study had the following limitation which will be taken into consideration while interpreting the results.

The physical and physiological characteristics could have been studied by using more sensitive and sophisticated instruments, but because of the unavailability of such instruments, only field test was conducted to assess those characteristics which might not be as accurate as laboratory procedures.

CHAPTER TWO

2.0 INTRODUCTION

The purpose of this study was assess the physical and physiological characteristics of male Nigerian university athlete, talent identification programmes have traditionally focus on individual sports with discrete physical and physiological characteristics, the measure of an anthropometric attribute, such as the upper and total leg length of a player, has a limited value in predicting performance in team and individual sports. Such as judo, taekwondo, track, swimming, basketball, volley ball, badminton, tennis, soccer and hockey (Berg and bell, 2001). The differences in anthropometric variables counted for a significant proportion of variance in playing performance.

Because of the lucrative nature of sports in both the amateur and professional, high performing athletes are highly sought and valued. Most universities in Nigeria also have athletes who represent the country at various international outing (competition) because of the recognition to be earned by such institution, it is beneficial to be able to identify higher performing athletes earlier on.

To achieve this purpose, available related literature has been critically reviewed and discussed under the following sub-headings in this chapter:

2.1 Characteristics of Physical Fitness for Field based Team Sports Players in terms of Energy Supply during Intermittent Sprint Exercise Test.

2.2 Physiological Characteristics of Elite Short and Long Distance Tri-athletes.

2.3 Analysis of Anthropometry, Body Composition and Performance Variables of Young Indian Athletes in Southern Region.

2.4 Physiological Characteristics of Male Ultra Endurance Runners.

2.5 Training and Bioenergetics Characteristics in Elite Male Kenyan Runners.

2.6 Differences in Aerobic and Anthropometric Characteristics between Peribubertal Swimmers and Non-Swimmers.

2.7 The Differences is Some Anthropometric Characteristics between Top Football Players and Recreational Players.

2.8 Analysis of the Characteristics of Competitive Badminton Players.

2.9 Comparison of Some Anthropometric Characteristics of Elite Badminton and Tennis Players.

2.10 Physique Traits of Lightweight Rowers and Their Relationship to Competitive Success.

2.11 Anthropometric Characteristics, Somatotyping and Body Composition of Volleyball and Basketball players.

2. 12 Physiological Characteristics of Junior and Senior Rugby League Players.

2.13 Physiological and Metabolic Characteristics of Elite Tug of War Athletes.

2.14 Anthropometric, Gait and Strength Characteristics of Kenyan Distance Runners.

2.15 Anthropometric Comparism of World-Class Sprinters and Normal Populations.

2.1 CHARACTERISTICS OF PHYSICAL FITNESS FOR FIELD BASED TEAM SPORTS PLAYERS IN TERMS OF ENERGY SUPPLY DURING INTERMITTENT SPRINT EXERCISE TEST

According to Toshiyuki et al, (2010), reported on the activity profiles of field-based team sports players (e.g. soccer, handball, and basketball) fluctuate randomly depending on game situation, from brief periods of maximal or near maximal intensity to longer periods of low-intensity activity. On the other hand, the activity patterns of track athletes are nearly constant. The purpose of this study was to compare the characteristics of physical fitness for field-based team sports players, endurance runners and sprinters from the view point of energy supply during intermittent sprint exercise. Twenty-four university-trained males (field-based team sports players: F:n =8, endurance runners: E:n = 8 and sprinters: S: n =8) completed an intermittent sprint exercise test. The test consisted of three 5 x 30m (every 40s) repeated sprints, with sprints separated by a 4-min rest period. Sprint times were recorded during intermittent sprint exercise test from

0-15m, 15-30m, and 0-30m by electronic photo cells. Oxygen uptake (VO_2), minute ventilation (VE), heart rate (HR), and blood lactate concentration (La) were also measured during the test. An incremental treadmill rest and a 40s anaerobic power test were also performed to determine maximal aerobic and anaerobic capacities.

The F group had a significantly faster 0-15m sprint time than E ($P < 0.05$), but not when compared with the S group; while, the F group had a significantly slower 15-30m sprint time than the S group ($P<0.05$). The F group had a significantly lower La during intermittent sprint exercise test than the S group also had a significantly ($P<0.05$), but not when compared with the E group. In contrast, VO_2, during intermittent sprint exercise test in the interval phase showed no significant differences among the groups. Although no significant differences were observed, lower La indicated a sufficient phospocreatine resynthesis in the interval phase in the F and E groups.

These findings showed that the F group performed the repeated-sprint as fast as the S group from 0-15m with lower anaerobic energy supply. Further more, the results suggested the need for regular implementation of repeated-sprints in the F group. In conclusion, field-based team sports players have superior repeated-sprint ability than sprinters, especially over short distances such as 15m.

2.2 PHYSIOLOGICAL CHARACTERISTICS OF ELITE SHORT AND LONG DISTANCE TRIATHLETES

According to Gregorie P. Millet et al, (2002), compare the physiological Reponses in cycling and running of elite short-distance (ShD) and long-distance (LD) tri-athletes. Fifteen elite male tri-athletes participating in the world Championships were divided into two groups (ShD and LD) and performed a laboratory trial that comprised sub-maximal treadmill running, maximal then sub-maximal ergometry cycling and then an additional sub-maximal ergometry cycling and then an additional sub-maximal run. "In Situ' best ShD triathlon performances were also analysed for each athletes. ShD demonstrated a significantly faster swim time than LD whereas VO_{2max} (Ml kg^{-1}), cycling economy ($W1^{-1}$ min^{-1}), peak power output (W_{peak}, W) and ventilator threshold (%VO_{2max}) were all similar between ShD and LD>. Moreover, there were no differences between the two groups in the change (%) in running economy from the first to the second running bout. Swimming time was correlated to W_{peak} (r = - 0.76; P< 0.05) and economy (r =- 0.89; P <0.01) in the ShD athletes. Also, cycling time in the triathlon was correlated to W_{peak} (r = -0.83; P < 0.05) in LD. In conclusion, ShD traithletes had a faster swimming time but did not exhibit different maximal or sub-maximal physiological characteristics measured in cycling and running than LD tri-athletes).

2.3 ANALYSIS OF ANTHROPOMETRY, BODY COMPOSITION AND PERFORMANCE VARIABLES OF YOUNG INDIAN ATHLETES IN SOUTHERN REGION

According to George Abraham, (2010), the purpose of this study to analyze the anthropometry and body composition associated with performance of university level male track and field athletes of south India. This study was conducted on 93 track and field athletes from South India, comprised of 22 sprinters (100 and 200 mts), mean age 19.5 years, height 172.1cm and weight 68.2kg, 20 middle distance runners (800 and 1500mts), mean age 19years, height 166.8cm and weight 62.1kg, 20 throwers, (shot, discus and hammer throw) mean age 19 years, height 170.8cm and weight 72.6kg and jumpers (High, long and triple jump), mean age 18.3years, height 169.9cm and weight 64.1kg. Besides height and weight 64.1kg. Besides height and weight, six skin folds (triceps, Chest, subscapular, adomen, suprailiac and calf), two bicondyklar breadths (humerus and femur) and two girths (biceps and calf) were measured. Sometotype evaluations were made according to carter and Heath (1990) method. BMI was calculated as body mass divided by square of height (Kg/M^2). The somatochart indicated that sprinters and middle distance runners are ectomorphic mesomorphs, long distance runners are mesomprph ectomorphs while throwers are endomorphic mesomorphs. The jumers fell into the somatotype category of balanced mesomprhhs. Among all groups body fat percent is lowest in sprinters

(6.23 ± 0.835) and highest in throwers (7.38± 0.85%)> This was reflected in their endomorphic components which is lowest in sprinters (2.53±0.45) and height in throwers 93.39±0.65). Ectomorphic component is highly marked in long distance runners (3.56 ± 0.65) while mesomophy was highest in sprinters (4.31±0.91). Throwers have significantly higher values of skin fold than other groups. Compared to their overseas counterparts, the athletes of both track and filed events in the represent study exhibited greater endomorphic values. The present data will serve as a reference standard for the anthropometry and body composition of south Indian track and filed athletes.

Keywords: Body composition, soomatotype, Endomorphic, ectomorphic, mesomorphic, anthropometric.

2.4 PHYSIOLOGICAL CHARACTERISTICS OF MALE ULTRA ENDURANCE RUNNERS

According to Paul Murgatroyd et al (2007), that when a group of 44 ultra runners completed a questionnaire devised to collect information on the athlete's participation in ultra-racing, history of competition in single and multi-stage events, training schedules, perceived strengths and weaknesses of preparation for events, technical aids used in training and history of injury. A number of research questions were raised through analysis of the results of these questionnaire and this gave rise to the establishment of a comprehensive research programme, involving both laboratory and field data collection. The first stage in this research

programme, completed in late 2008, focused on building a detailed physiological profile of the ultra-running community, from completers to "elite". Physical characteristics of endurance athletes from a range of disciplines, including swimming cycling, triathlon and running, has been reported in detail by various sources (Noake et al., 1990; Sleivert and Rowlands, 1996) and Billat et al., 2001) and, more specifically, within ultra-endurance running in a more limited fashion.

Yeung and Yeng (2006), for instance, complied data on cardiopulmonary fitness, flexibility, muscular strength and endurance and body composition of participants in a 100km ultra-endurance team event, and Hoffman (2008) reported the anthropometric characteristics of competitors in the 2007 western states endurance run, but many questions still remain about this particular athletic population. With this issue in mind, then, around 100 runners were invited to participate in the study, through email correspondence, following advertisement of the study within the ultra-running community. Selection of the final sample group of 40 runners (30 males and 10 females) was based on the criteria that: (a) They were engaged in regular training (>3 sessions per week); (b) they had competed in ultra-distance races during the previous twelve months and (c) they were available for laboratory testing.

Not surprisingly, the final group's ultra-endurance experience was highly varied, with the spectrum of participants covering beginners' (<5 ultra-races)

through to ‘veterans’ (>30 ultra-races). In terms of ultra-running ability, both the male and female sub-groups were diverse in their composition, including several competitors who would frequently appear at the head of race results (to 10%). One male, for example, was part of the national UK ultra-running squad and currently holds a number of ultra-race records. These higher ability subjects would be expected to average around 10-12km-1 for an event, dependent on race terrain and distance. At the other end of the spectrum, there were a number of male and female participants whose primary aim was to complete each event they participated in and would be regarded as ‘back of the pack’ runners. The average speeds of these runners would be around 4-6km h-1, again dependent on race terrain and distance.

The runners had a number of physiological tests administered when they came to the labs at Lincoln, firstly, anthropometric data was collected, including simple measures of mass, height, BMI and the sum of four skin fold sites, the latter in order to calculate percentage body fat. Secondly, treadmill testing was then used to ascertain a variety of maximal and sub-maximal physiological characteristics. After a fingertip blood sample was taken, to determine resting blood lactate, and a 10-15min warm-up administered, the first of the two treadmill tests was conducted. This stage of assessment was aimed at determining the physiological measures of running economy, lactate threshold and lactate turn-

point, all deemed important variables in long-distance running. The lactate threshold is useful for athletes as it defines the transition between 'easy' and 'steady' running, and is an indicator of marathon speed, whereas the lactate turn-point indicates the transition between "steady and 'tempo' running, and is a useful predictor of 10mile to half marathon performance.

Once this test had been completed, the runners were given around 10 minutes to recover until they indicated they were ready to undertake the second and final running assessment, the aim of which was to assess peak aerobic capacity and maximum heart rate and lactate production. The runners were then given a 10miuntes warm-down on the treadmill.

The anthropometric characteristics of the male and female athletes studied are presented in table 1. The range of age (24-59years) and the mean (39.4years reflects the diversity of the group. The male participants recorded means of 178.0cm for height, 58.0kg for mass and 22.3kg-m^{-2} for BMI. The females recorded means of 161.3cm for height, 58.0kg for mass and 22.4kg-m-2 for BMI. Similar values for both genders were observed in the body fat percentages (♂ mean 14.4%; ♀ mean 16.3) and the sum of the skin fold measurements (♂ mean 31.5mm; ♀ mean 39.2mm), indicating a certain level of homogeneity and percentage fat levels.

2.5 TRAINING AND BIOENERGETICS CHARACTERISTICS IN ELITE MALE KENYAN RUNNERS

According Vernique Billkat et al (2003) compares the training characteristics and the physical profiles of top-class male and female Kenyan long distance runners. The subjects were 20 elite Kenyan runners: 13 men)10km performance time: 10km performance time of 28min, 36s 18s) and 7 women (32min, 32s 65s). The male runners were separated into high-speed training runners (HST: N = 6) and low speed training runners (LST: N = 7) depending on whether they train at speeds equal or higher than those associated with the maximal oxygen uptake (vV_{omax}). All but one woman were high-speed training at speeds equal or higher than those associated with an incremental test on a 400m track to determine Vo_{2max}, vVo_{2mx} and the velocity at the lactate threshold (vLT). Within each gender among the HST group, 10km performance time was inversely correlated with vVo_{2max} (rho= -0.86, p = 0.05, and rho = -0.95, p = 0.03, for men and women, respectively). HST male runners had a higher Vo_{2max}, a lower (but not significantly) fraction of vVo_{2max} ($FV0_{2max}$) at the lactate threshold, and a higher energy coast of running (ECR) . Among men, the weekly training distance at vVo_{2max} explained 59% of the variance of vV_{o2max} and vVo_{2max} explained 52% of the variance of 10km performance time. Kenyan women had a high Vo_{2max} and FV_{o2max} at vLT that was lower than their male HST counterparts. ECR was not significantly different between genders; the velocity at the VO_{2max} is the main

factor predicating the variance of the 10km performance both in men and women, and high-intensively training contributes to this higher VO_{2max} among men. Key words: Africa, Vo_{2max}, Oxygen uptake, running, performance.

2.6 DIFFERENCES IN AEROBIC AND ANTHROPOMETRIC CHARACTERISTICS BETWEEN PERIBUBERTAL SWIMMERS AND NON-SWIMMERS

Benefice et al (1990) said, in order to judge the effect of moderate sports training on the anthropometric characteristics and aerobic capacity of boys before and during puberty, a comparative study was conducted of 140 athletes, 94 of whom were not undergoing any specific training and 45 of whom were spending more 3 hours a week practicing swimming. The boys were divided into three maturity groups according to pubic hair status: prepubertal, and end of puberty.

The study shows greater maximal oxygen uptake in absolute terms, body weight, lean body mass, chest circumference, arm circumference, and arm muscle area for the swimmers and non-swimmers concern physical characteristics generally involved in swimming. The difference in aerobic capacity, however, may be in part due to the morphological changes engendered by training; a longitude study would confirm this. It is suggested that anthropometric indicators of arm muscles may be used in the biological supervision of swimming training.

Keywords: Anthropometry, maximal aerobic uptake, swimming and training.

2.7 THE DIFFERENCES IS SOME AUTHROPOMETRIC CHARACTERISTICS BETWEEN TOP FOOTBALL PLAYERS AND RECREATIONAL PLAYERS

Popovic, S. Masanovic (2007), observed, in gaining relevant knowledge about important differences with respect to some anthropometric characteristics of the best football players and their peers who play football on a recreational basis. The sample included 56 respondents, aged 28 (1year) divided into two subsample groups. The first subsample group was comprised of 26 respondents who practice football at a football club "vojvodina" from Novi Sad, while the other subsample included 30 respondents who play football recreationally. The sample of variables contained 20 anthropometric measures that defined longitudinal and transversal dimensionality of the skeleton, then, then the body mass and body volume as well as the subcutaneous adipose tissue. The results of the measuring were analyzed by means of a statistical procedure labeled a significance test of two arithmetic means conducted on independent samples or popularity known a t-test. Based on the results it was concluded that significant differences occur in the case of all the variables used to assess the subcutaneous adipose tissue, as well as in the case of most of most variables for assessing the body mass and body volume at a significance level of p = 05.

Key Words: Anthropometric characteristics, top football players, recreational players.

2.8 ANALYSIS OF THE CHARACTERISTICS OF COMPETITIVE BADMINTON PLAYERS

According to D. Cabello Manrique, (2003) to describe the characteristics of badminton in order to determine the energy requirements, temporal structure, and movements in the game that indicate performance level. To use the findings to plan training with greater precision. Eleven badminton players (Mean (SD) age 21.8 (3.260 years) with international experience from four different countries (France, Italy, Spain, and Portugal) were studied. Two of the Spanish players were monitored in several matches, giving a total of 14 samples, all during the 1999 Spanish International Tournament. Blood lactate concentration was measured with a reflective photometer. Maximum and average heart rates were recorded with a heat rate monitor. Temporal structure and actions during the matches were determined from video recordings. All variables were measured during and after the game and later analyzed using a descriptive study. The results confirmed the high demands of the sport, with a maximum heart rate of 190.5 beats/min and an average of 173.5 beasts/min during matches over 28minutes long and performance intervals of 6.4 seconds and rest time of 12.9 seconds between exchanges.

The results suggest that badminton is characterized by repetitive efforts of galactic nature and great intensity which are continuously performed throughout the match an awareness of these characteristics, together with data on the correlations between certain actions such as unforced errors and winning shots

and the final result of the match, will aid in more appropriate planning and monitoring of specific training.

2.9 COMPARISON OF SOME ANTHROPOMETRIC CHARACTERISTICS OF ELITE BADMINTON AND TENNIS PLAYERS

Arsan Yasin et al (2008) investigate the comparison of anthropometric parameters of elite badmininton and tennis players. The sample of this study is consisting from 30 elite tennis and badmininton players who participate in the study voluntary. As a result of this study, a significant statistical difference between badminton and tennis players is observed only in terms of calf variable which is one of the circumference width variables. In terms of length measurers. A significant difference is not observed between the mean values of badminton and tennis players at the significance level of 0.05. However, a significant difference is observed in terms of bust and forearm lengths at the levels of 0.10. a statistically significant difference is found between the mean values of the players in terms of biacromical, bitrochanteric and feral epiconduler diameters which and diameter measure variables, it also observed that tennis players have larger mean values in biacronical and femoral epiconduler diameter and badmininton players have target mean values in men values in biacromical diameter measures. As a result, it can be said that the wider hip and calf breadths of badminton players results from the excess of jumping movements in badminton game and the continual movements of badminton players by toe tips in a close area. The wider

biacromial diameter and longer whole arm length in tennis players can be associated with reaching actions in tennis game due to the wide court. We may also claim that, due to frequent forearm activities in badminton, the players have shorter forcarm lengths than tennis players and this gives an advantage of better working lever for the amount of strength spent. Keywords: Anthropometry, Badminton, tennis.

2.10 PHYSIQUE TRAITS OF LIGHTWEIGHT ROWERS AND THEIR RELATIONSHIP TO COMPETITIVE SUCCESS

G.J. Slater et al (2005) observed that the physique traits and their relationship to competitive success were assessed amongst lightweight rowers competing at the 2003 Australian rowing championships. Full anthropometric profiles were collected from 107 lightweight rowers (n = 65 males, n = 45 females) competing in the under 23 and open age categories. Performance assessments were obtained for 66 of these rowers based on results in the single scull events. The relationship between physique traits and competitive success and then determined.

Lower body fat (heat time estimate – 8.4s Kg-1, P <0.01), greater total body mass (heat time estimate -4.4s kg-1, P = 0.03), and muscle mass (heat time estimate – 10.3 s kg-1, P <0.01) were associated with faster 2000m heat times.

The more successful lightweight rowers were those who had lower body fat and greater total muscle mass.

2.11 ANTHROPOMETRIC CHARACTERISTICS, SOMATOTYPING AND BODY COMPOSITION OF VOLLEY BALL AND BASKETBALL PLAYERS

According to Vishaw Gaurav et al (2010), compare the anthropometric characteristics and somatotype of the Guru Nanak Dev University, Amritsar's male basketball players and volleyball players. Sixty three sports persons (Volleyball = 36 and basketball = 27) of age group 18-25 years were selected form different colleges affiliated to Guru Nanak Dev University, Amritsar, Punjab, India. All the participants were assessed for height, weight, breadths, girths and skin fold thickness. An independent samples t-test revealed that basketball players had significantly higher height ($P<0.01$), weight ($P<0.01$) and body surface area ($P<0.01$) as compared to volleyball players. The basketball players were also found to have significantly greater biceps ($P<0.01$) and suprailliac ($P<0.01$) skin fold thicknesses, calf circumference ($P<0.05$), percent body fat ($P<0.01$), total body fat ($p<0.01$), fat free mass ($P<0.05$) and endomorphic component ($P < 0.05$) as compared to volleyball players. Volleyball players had significantly greater body density ($P<0.01$) as compared to basketball players. The basketball and volleyball players of this study were found to have higher percentage body fat with lower body height and body weight than their international counterparts. Further investigations are needed on the above studied

variables along with fitness and physiological variables assess relationships among them and with performances in volleyball and basketball.

Keywords: Anthropometric characteristics, basketball, body composition, somatotying, volleyball.

2.12 PHYSIOLOGICAL CHARACTERISTICS OF JUNIOR AND SENIOR RUGBY LEAGUE PLAYERS

According to T. J. Gabbett (2002), investigate the physiological characteristics of sub-elite junior and Senior rugby league players and establish performance standards for these athletes.

A total of 159 junior (under 16, 15, 14, and 13, n = 88) and senior (first grade, second grade, and under 19, n = 71) rugby league players (forward, n= 80, backs, n = 79), competing at a subelite level, underwent measurements of body mass, muscular power (vertical jump), speed (10m, 20m, and 40m sprint), agility (Illinois agility run), and estimated maximal aerobic power (multistage fitness test). Data were also collected on match and training frequency and playing experience. The result shows that there was a significant effect ($P<0.05$) of age and playing level on playing experience, body mass, muscular power, speed, agility, and estimated maximal aerobic power, with the physiological capacities of players increasing as the playing level increased. Forwards were heavier than backs for all junior and senior teams. The results show that there is a progressive improvement in the physiological capacities of rugby league players as the

playing level increases. These findings provide normative data and performance standards for subelite junior and senior rugby league players. Further studies on the sociological, physical, psychological, and personal predictors of talent in rugby league are warranted.

2.13 PHYSIOLOGICAL AND METABOLIC CHARACTERISTICS OF ELITE TUG OF WAR ATHLETES

Warrington et al (2001) determine the aerobic power, body composition, strength, muscular power, flexibility, and biochemical profile of an elite international squad of tug of war athletes. The data provide reference standards for the sport and may be useful for monitoring and evaluating current and future participants.

2.14 ANTHROPOMETRIC AND STRENGTH CHARACTERISTICS OF KENYAN DISTANCE RUNNERS

According Pui .W. Kong et al (2008), observed that anthropometric, gait and lower extremity strength characteristics of six elite Kenyan distance runners were analysed. Stride frequency, relative stride length and ground contact time were measured at five running speeds (3.5-5.4m/s) using a motion capture system. Isomemetric knee extension and flexion torques were measured at six angles and hamstrings and quadriceps (H:Q) ratios at three angular velocities were determined using an isokinetic dynamometer. These runners were characterized by a low body mass index (20.1± 1.8kg-m^{-2}), low percentage body fat (5.1±1.6%)

and small calf circumference (34.5 ± 2.3cm). At all running speeds, the ground contact time was shorter ($P<0.05$) during right (170-212ms) compared to left (177-220ms) foot contacts. No bilateral difference was observed in other gait or strength variables. Their maximal isometric strength was lower than other runners (Knee extension: 14-26 nm-kg-1, knee flexion: 1.0-1.4 Nm-kg-1) but their H;Q ration were higher than athletes in other sports (1.03 ± 0.51 at 60^0/s, 1.44 ± 0.46 at 120^0/s, 1.59 ± 0.66 at 180^0/s). The slim limbs of Kenyan distance runners may positively contribute to performance by having a low moment of inertia and thus requiring less muscular effort in leg swing. The short ground contact time observed may be related to good running economy since there is less time for the braking force to decelerate forward motion of the body. These runners displayed minor gait asymmetry, though the difference may be too small to be practically significant. Further investigations are needed to confirm whether the bilateral symmetry in strength and high H:Q ratios are related to genetics, training or the lack of injuries in these runners.

Key Words: Stride length, stride frequency, ground contact time, isometric torque, hamstrings to quadriceps ratio, asymmetry.

2.15: ANTHROPOMETRIC COMPARISM OF WORLD-CLASS SPRINTERS AND NORMAL POPULATIONS

According to Young (2005), observed the height and Body Mass (BM) distribution of sprinters (42 men and 44 women) were statistically compared to the

distributions of American and Danish normal populations. The main results showed that there was significantly less BM and height variability (measured as standard deviation) among male sprinters than among the normal male population (US and Danish), while female sprinters showed less BM variability than the US and Danish normal female populations. On average the American normal population was shorter than the sprinters. There was no height difference between the sprinters and the Danish normal population, all female groups has similar height variability. Both male and female sprinters had lower body mass index (BMI) than the normal populations. It is likely that there is no single optimal height for sprinters, but instead there is an optimum range that differs for male and females. This range in height appears to accuse people who are very tall or very short in stature. Sprinters are generally lighter in BM than normal populations.

These anthropometric characteristics typical of sprinters might be explained in part, by the influence the anthropometric characteristics have on relative muscle strength and step length.

2.16 SUMMARY

In this chapter extensive review work on related issues concerning the study has been done. It delved into expert opinion theories, and research findings related to physiological and anthropometric characteristics of national, internationals and

university athletics group such as individual sport, racket games, combat sport, speed endurance sports and finally team sport.

An introduction was made followed by some opinion on the physiological and anthropometric characteristics of athletes of the various groups of sports. Athletes of various sports elicit different physical, physiological and anthropometric characteristics and skills which are useful at their various areas of sport and performance.

One of the most essential requirements for performance excellence in competitive sports is the selection of the most suitable sport for an individual on the basis of his peculiar characteristics.

Available research evidence indicates specific physical and physiological characteristic favourable to certain sport. This research was therefore conducted to assess the physical and physiological characteristics of Nigerian male university athletes of individual sport, combat sport, racket game, speed endurance sport and ball game respectively.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 INTRODUCTION

The purpose of this study was to assess the physical and physiological characteristics of Male Nigerian university athletic groups that is, combat sport, individual sports, ball games, racket games and speed endurance sport. To achieve this purpose, the research design, the population and the sample, the procedure, instruments and statistical analysis used in this study are described in this chapter under the following sub- titles:

3.2 Research Design

3.3 Population and Description of Population

3.4 Sample and Sampling Technique

3.5 Test items used

3.6 Testing Procedure

3.7 Instrumentation

3.8 Study Condition and Control

3.9 Research Assistants

3.10 Statistical technique

3.2 RESEARCH DESIGN

The research design adopted in this study was the one- shot research design. According to (Thomas & Nelson, 1996) in this design, the subjects were tested for their physical physiological and anthropometric measures without giving any treatment. The treatment was their participation in training and competitions in their various fields of sport before they were tested.

3.3 POPULATION OF SUBJECTS

The population for this study consisted of male athletes from the Nigerian universities and within the seven Nigerian university administrative zones of the 6 geo-political zones of Nigeria.

3.4 SAMPLE AND SAMPLING TECHNIQUE

The sample for this study was selected by using stratified random sampling technique, in this technique, the male Nigerian University athletes were stratified into 5 groups of sports namely; individual sport, speed endurance sport, ball game, racket game and combat sport. Individual sport consisted of track and field and swimming; speed endurance sport consisted of soccer, hockey and rugby; ball game consisted of basketball and volleyball and handball, racket game consisted of tennis and badminton, table tennis, and squash; combat sport consisted of judo and taekwondo and karate and kick boxing. Because this study was primarily concerned with Nigerian University male athlete, from each of these 5 groups of

sports, track and swimming were selected under the individual sport, hockey and soccer were selected under speed endurance sport, volleyball and basketball were selected under ball game, badminton and tennis were selected under racket sport and finally judo and taekwondo were selected under combat sport at random by using dip and pick method, in this method, the names of all the groups of sports were neatly written on a piece of paper and thus track and swimming were picked under the individual sport, hockey and soccer were also picked under speed endurance sport, tennis and badminton were also picked under racket game, basketball and volleyball were also picked under ball game and finally judo and taekwondo were also picked under combat sport.

The 5 chosen groups of sport serves as strata for this study. Using the same method, 8 athletes from each of the university representing each zone of the Nigerian university administrative zones were selected, 4 universities were selected from each zone of Zone A to G within the Nigerian university administrative zone. Thus, the sample for this study consisted of 225 athletes from the 5 male groups of the Nigerian university administrative zone. (Start K. B. and Gelencross D.J. 1996) used the cup and dip method in simple random selection, when they investigated power, speed, and strength in the lower limbs of male college athletes. They further explained that this method ensures that the different characteristics that exist within the population are taken care of.

3.5. THE TEST ITEMS ADMINISTERED

Nine (9) different test items in all were administered on each subject throughout the duration of this study. All the tests were administered with the help of 20 testers. The tests included under physical characteristics are shown below:

A. Physical Characteristics

1. 20 meters agility test
2. 50 meters speed test
3. Standing broad jump
4. Height in meters
5. Weight in kilogram
6. Calf circumference
7. Total arm length measures
8. Total leg length measures

B. Physiological Characteristics

Cooper 12 minutes run test to determine cardio-respiratory endurance

All measurements were taken in centimeters, and kilograms. The length measurements were taken using manual tape rule in line with Behinke and Wilmore's procedure's (1974) procedure. The 12 minute run test as suggested by cooper (1968) and also as used by Guthel, (1987), was used as an indicator of cardio-respiratory endurance. Pollock, (1978), reported that the 12 minute run test is one of the best and most widely used field tests to measure cardio- respiratory

fitness. Turkur, (1995), Gwani (1986) and Burke (1976), also reported the reliability of the 12 minutes run test as having correlation of 0.91.

This therefore indicates that the 12minutes run test is a good measure of cardio- respiratory endurance. The 50 meter dash test as suggested by AAHPERD (1989) has been used by various researchers as a good indicator of speed, Duhu (1978) emphasized on the 50 meter dash test as the most effective measure of speed. This also confirmed the finding of Ecker (1971). And Arogbonlo (1993) that 50 meter dash is a reliable test item for speed. They reported reliability co-efficiently of 0.86 and 0.94. The American Alliance for Health, physical Education, Recreation and dance (AAHPERD), (1989) also recommended the use of this test as a good measure of speed.

The standing broad jump measures the leg power of the subject. Bucher, (1981) recoded reliability co-efficient of 0.93. The standing broad jump is a good measure of leg power.

The shuttle run teat measures speed and agility, Machol, (1981) and Barrow, (1979), recorded a reliability coefficient of 0.94 for boys and o.82 for girls. AAHPERD (1989) recommended the use of this item as a good indicator for agility. The test involves the subject running and swiftly changing direction.

3.6 TESTING PROCEDURE

Before the tests were administered, informed - consent forms were given to the male subject in all the groups which were completed and returned. The subjects were certified to be medically fit to undertake the test by the principal medical officer of the university, it was also made clear to them that an individual was free to quit the test whenever he or she become uncomfortable. Detailed explanation and demonstration of every test items preceded actual performance of tests. Before the test began, subjects were allowed to inspect the instruments utilized to avoid fright, though virtually all the subjects were used to these equipment and facilities since they were all active sportsmen and women of the Nigerian university athletes.

The test were administered independently on the five group of sport which were the judo, taekwondo, track and field, swimming, soccer and hockey, volleyball and basketball, badminton and tennis respectively, and each subject had its members names drawn alphabetically to avoid confusion and assign numbers for easy identification.

The 9 test items administered are as follows:

i. Cooper 12 minute run test

ii. 50 meter run

iii. 20 meter shuttle run

iv. Standing broad jump

v. Calf circumference measurement

vi. Height measurement

vii. Weight measurement

viii. Total leg length measurement

ix. Total arm length measurement

During the test, each subject was permitted rest for two minutes relaxation session, after which the test followed. A ten minute general and specific warm up exercise were taken before engaging in the test. The 9 different test items were administered as follows:

3.6.1 Cooper 12 Minutes Run Test

This test is used to estimate cardio- respiratory endurance (aerobic capacity). Subjects were told to run on the track from the starting line until they heard the sound of the whistle indicating them to start and the final indicating them to stop wherever they were. The subjects ran in groups of 5-10 to avoid confusion. They were told not to run as fast as possible but be sure to pace themselves during the run to prevent premature fatigue when they are getting tired they can slow down to a walking speed or even stop. The number of times the subject run round the track (lapses) was counted at the end of 12 minutes is

determined by multiplying the number of laps covered by 400 meters and recorded against the subject number.

The ACSM for the calculation of the vo2 max for the running is m/min x 0.2 + 3.5 mi/kgm/min for instance a subject covered 2400m in 12 minutes run the vo2 max will be as follows:

—— = 200

200 x 0.2 = 40

40 + 3.5m/kgm/min

=43.5m/kgm/min

3.6.2 50 Meters for Speed

Speed was tested by means 50 meters sprint (AAHPERD). The test measures the subjects speed ability, that is, the minimum time required for a subject to run 50 meters. The test was administered to five subjects at a time from one group of sport. Each subject took a crouch position behind the starting line. The starting command was "Go" command was given, the starter made a downward sweep of the arm to give a visual signal of the arm to give a visual signal to timers who stand at the finishing line. On the command "Go" the subjects run the entire 50 meters as fast as possible, passing through the plane of the finishing line. The score is the time elapse between the starter's signal and the

time he crossed the finish line. Time is recorded the finish line. Time is recorded in second to the nearest tenth of a second.

3.6.3 20 Meters Shuttle Run (Agility)

The test of agility is measured by measuring the subjects in running and changing positions (Machol, 1981). Five parallel lines were marked on the ground 20 meters apart, two blocks of wood, 2cm x 2cm x 4cm were placed behind one of the lines. The subjects start from behind the other line. On signal, the subject's runs as fast as they can to the block, pick up one, run back and pick up the second block which is carried in the hand back to the starting line. Five subjects ran at the same time alternatively, first from behind the other. Two trials were allowed with rest period between trials. Scoring is the record time of the best trial to the nearest tenth of a second.

3.6.4 Muscular Power (Standing Broad Jump)

The muscular power test was evaluated by means of standing broad jump test (Butcher, 1981). This test measures power and body co-ordinations. Subjects are asked to stand behind a drawn take off line with the feet several inches apart and the toe just behind the take off line. In preparation for the jump, the subject bends the knee, both hands are swung backwards and jumps as far forward as possible using the arm to propel the body forward to help him to go further, the

testers emphasized on taking off feet with the knee extended. Three trials are allowed, measuring each jump from the take off line to the heel or other parts of the body that touches the ground nearest the take off line. The best distance was recorded as the score.

3.6.5 Calf Circumference Measurement

Explosive strength is very important to vigorous performance. Body type plays a vital role in sporting activities; it has been observed that most distance runners do not have heavy built calf structure probably as a result of aerobic training schedule they engaged in. In the calf circumference, the subjects were also measured using non stretchable tape rule. (Baker et al, 2003).

3.6.6 Height and Weight Measurement

The standard anthropometric protocol of the international working group on kinanthropometry (1 WGK) has described by Ross, (1983) were used to measure height and weight, in this respect, due to unavailability of the equipment for the anthropometric protocol of the international working group, the measurement of weight and height was done using a calibrated standio-meter and a weighing scale. The height was taken meters and weight in kilograms, the subjects dressed in a minimum sportswear and without shoes.

3.6.7 Total Leg Length Measurement

The total leg length was measured from the end of the spinal column to the floor or taken in centimeters using a hand manual tape rule in the absence of broad blade anthropometer using the Behinke and Wilmore's (1974) procedure.

3.6.8 Total Arm Length Measurement

The total arm length was measured from the acromion process to the tip of the third finger. The measurement was taken in centimeter using a hand measuring tape rule in the absence of broad blade anthropometer in line with the Behinke and Wilmore's (1974) procedure.

3.7 INSTRUMENTATION

The main purpose of this study was to assess the subject physical, physiological and anthropometric characteristics as related to their various areas of sports in their universities. To achieve this objective, the following instruments were used in conducting the tests:

a. Electronic stopwatch (World Time WR 5 bar model Japan) for timing (Pollock, 1978).
b. The laboratory weighing scale was used to measure the subject weight (Muller, 1982).
c. Whistle to control exercise and test proceedings, especially for starting and stopping (Mathew, 1981).

d. A 30- meter measuring tape, used for measuring distance reached in broad jump (Butcher, 1981).

e. Standard athletic track for the 12 minute run, 50 meter for speed, 20 meter shuttle run, and the warm up exercise before the commencement of the test (Cooper, 1968).

f. An outdoor jumping pitch for broad jump test.

Reliability of Instruments

The reliability of all the instruments used was established by test-retest method, in this method, the measurement was recorded once, it was repeated again, if the correlation between the first and second measurement was 0.92 and above, the instrument was considered as reliable. When this was done by the individual, it was considered intra-tester reliability. When the first and second measurements were taken by two different individual the reliability was considered as inter-tested reliability

Validity

The phase validity of the instrument was established when experts in exercise physiology agreed that the instrument measures what it is purported to measure.

3.8 STUDY CONDITIONS AND CONTROL

The researcher makes sure the purpose and meaning of the test items were carefully explained to the subjects before the commencement of the test. The subjects were to be on their sports outfits including running shoes that they felt were appropriate for the test. The subjects took their meal at least two hours before the commencement of the exercise. Proper warm up was conducted to avoid injury. The subjects arrived 30 minutes before the commencement of the test.

3.9 TEST ASSISTANCE

Test team approach was used. A total of 20 test assistance, comprising of coaches and some sport men and women, they were taught the procedure, that is, how to keep time for the subjects, in essence this guide them on how to evaluate each subject. The starters kept close watch on the subject from a good position, where they could make a valid and reliable judgment. The team completed the testing in one time block and uniform testing procedures were used.

3.10 STATISTICAL TECHNIQUES

The data collected were analysed with the use of Statistical Package for Social Sciences (SPSS), (Norusis, 1988) at the Data processing unit, institute of Agricultural Research, Ahmadu Bello University, Zaria. Descriptive statistics of mean, standard deviation and Standard error (st) were computed, the data was also

subjected to a One- way analysis of variance (ANOVA) in order to determine the influence of the independent variables of groups. Judo, taekwondo, track, swimming, Basketball, volleyball, badminton, tennis, soccer and hockey male groups. On the differences in the dependent variables on physiological indices and anthropometric characteristics among selected athletic groups.

The data was also subjected to Scheffe post hoc test for the purpose of locating the significance and interpreting the results. Pearson product moment correlation coefficient (Awokeni, 2004, Osuala, 2001) was also computed for establishing correlation among physical, physiological and anthropometric characteristics of the selected athletic groups of this study. In all cases, the critical value for interpretation of significance will be 0.05.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 INTRODUCTION

The purpose of this study was to assess the physical and physiological characteristics of male Nigerian University athletes. To achieve this purpose, the data collected in this study were statistically analyzed, the results of which were presented and discussed according to the hypothesis in this chapter.

4.2 RESULTS

Before presenting the results according to the hypotheses raised for this study, information regarding the means and standard deviation of scores of the physical characteristics of the subjects by sport group of male Nigerian University athletes have been presented in table 4:2:1

Table 4:2:1: Means and Standard Deviation of the Stature and Body Mass of Male University Male Athletes used for this Study

Sport Groups	Height (meter)		Weight (kilogramme)	
	Mean	SD	Mean	SD
Speed endurance sport	1.7	0.5	67.1	8.9
Ball game	1.7	0.5	69.6	6.7
Individual sport	1.7	0.6	63.4	10.9
Combat sport	1.7	0.10	71.2	6.9
Racket game	1.7	0.6	65.9	10.4

Table 4:2:1 shows the means and standard deviation of the physical (stature) and body mass of the subjects. Observation of the table revealed that all the athletes did not vary much in stature. However, the combat sport athletes were heavier than all other groups followed by the ball game players.

Hypotheses Testing

The purpose was to assess the physical and physiological characteristics of male Nigerian University athletes. In order to achieve this purpose, a major hypothesis was formulated; which states that:

> *There are no significant differences among selected athletic groups in their physical and physiological characteristics which included height, weight, calf circumference, standing broad jump, agility, speed, total leg length and total arm length measures and VO_2 max.*

In order to find out the differences among the athletic groups in their physical and physiological characteristics, the data collected were analyzed according the sub-hypotheses.

Sub-Hypothesis 1: There are no Significance Differences among Selected athletic Groups in their 12-Minute Run/Walk Test

To test this sub-hypothesis, data collected on the performance of each athletic group is shown in table 4:2:1a.

Table 4:2:2a: **The Mean, Standard Deviation and Standard Error of Estimate of 12-Minute Run/Walk Test of the Different Athletic Groups**

Test	Sport Groups	N	Mean	SD	SEE
12-munite run/walk test	Speed endurance	45	5.782	1.31815	0.12455
	Ball game	45	5.03-2	1.16266	0.10986
	Track & Individual	45	6.0883	1.81933	0.17191
	Combat	45	5.2019	1.36724	0.12991
	Racket	45	4.8162	1.30463	0.12328
	Total	**225**	**5.3848**	**1.48508**	**0.6276**

An observation of the performance of the different sport groups in 12-minute run/walk test revealed that track and individual sport athletes had a higher mean performance (6.088±1.819) than the other sport groups. The Racket sport groups however had the lowest mean performance (4.816±1.304).

To find out whether there are statistical significance differences in the performance of the different sport groups in 12-minute run/walk test, the data was analyzed with one way analysis of variance (ANOVA 1) and presented in table 4:2:1b.

Table 4:2:2b: One Way Analysis of Variance (ANOVA 1) for Differences in 12-Minute Run/Walk Test between Different Selected Athletic Groups of Male Nigeria University Athletes

Test	Source	SS	MS	DF	F
12-minute run test	Between Groups	126.106	31526	4	15.810*
	Within Groups	1106.742	1.994	555	
	Total	**1232.848**	**5.3848**	**1.48508**	

F (4,555) = 2.37, P = ≤ 0.05 *Significant

The findings revealed that 12minutes run test had significant main effect among the selected athletic groups. It was revealed that individual sport had greater significantly higher mean than other male athletic groups in their 12minutes run test. Therefore, it was concluded that they were significant different among selected male athletic groups in their 12minutes run test.

The null hypothesis of no significant difference was therefore rejected, scheffe post hoc results revealed that the five male athletic groups were different from each other in their physiological characteristics as indicated in table 4.2.1b

Sub Hypothesis 2: There is no Significant Difference in 50meter Run Test between Speed Endurance Sport, Ball Game, Individual Sport, Combat, and Racket Game of Male Nigerian University Athletes.

To test this sub-hypothesis, data collected on the performance of each athletic group is shown in table 4:2:2a.

Table 4:2:3a: Mean Standard Deviation and Standard Error of Estimate 50 Metres Speed Run Test of the Different Athletic Groups

Test	Groups	N	Mean	SD	SEE
50meter run test	Speed endurance	112	7.2438	1.07606	.10168
	Ball game	112	6.6334	1.73436	.06939
	Track & Individual	112	7.2021	1.19698	.11310
	Combat	112	7.2267	1.17460	.11099
	Racket	112	7.8724	1.22872	.11610
	Total	**560**	**7.2357**	**1.16165**	**.04909**

An observation of the performance of the different athletic groups in 50metre run test revealed that speed endurance, track and individual, combat and Racket athletic groups had higher mean performances (7.243±1.076, 7.202±1.196, 7.226±1.174, 7.872±1.228 and 7.235±1.161) respectively than the ball game sport group (6.633±1.734).

To find out whether there are statistical significance differences in the performance of the different sport groups in 50metres run test, the data was analyzed with one way analysis of variance (ANOVA 1) and presented in table 4:2:2b

Table 4:2:3b: Analysis of Variance (ANOVA) for Differences in 50 Meter Speed Run between Different Selected Athletic Groups of Male Nigerian University Athletes

Test	Source	SS	MS	DF	F
50metres run test	Between Groups	86.179	21.545	4	17.896*
	Within Groups	668.152	1.204	555	
	Total	**754.331**	**5.3848**	**559**	

F (4,555) =2.37, P = ≤ 0.0 *Significant

The findings revealed that 50meter speed had greater significant main effect on differences among selected athletic groups, it was revealed that individual sports had greater significantly higher mean than other male athletic groups in their 50meter speed run test; therefore it was concluded that there were significant differences among selected male athletic groups in their 50meter speed run test.

The null hypothesis of no significant difference is therefore rejected, post hoc result of scheffe test for difference of mean further shows that the five male athletic groups were different from each other in their 50meter run test as indicated in table 4.2.3.

Sub-Hypothesis 3: There are no Significant Differences in 20 Meters Shuttle Run Test between Individual Sport, Ball Game, Racket Game, Speed endurance Sport and Combat Sport of Male Nigerian University Athletes.

To test this sub-hypothesis, data collected on the performance of each athletic group is shown in table 4:2:3a.

Table 4:2:4a: The Mean Standard Deviation and Standard Error of 20 Metres Shuttle Run Test

Test	Sport Groups	N	Mean	SD	SEE
	Speed endurance	45	18.564	1.4128	.1335
20metre	Ball game	45	18.652	1.9091	.1504
run test	Track & Individual	45	18.919	1.9436	.1836
	Combat sport	45	18.729	1.2351	.11.67
	Racket game	45	19.285	1.6498	.1559
	Total	**225**	**18.830**	**1.6671**	**.0704**

An observation of the performance of the different athletic groups in 20metre shuttle run test revealed that racket athletic group had a higher performance mean (19.825±1.649) than all other athletic groups

To find out whether there are statistical significance differences in the performance of the different sport groups in 20metre shuttle run test, the data was analyzed with one way analysis of variance (ANOVA 1) and presented in table 4:2:3b

Table 4:2:3b: Analysis of Variance (Anova) for Differences in 20 Meters Agility Test between Individual Sport, Ball Game, Racket Game, Speed Endurance Sport and Combat Sport of Male Nigerian University Athletes

Test	Source	SS	MS	DF	F
	Between Groups	36.746	9.187	4	3.361**
20meter run	Within Groups	1516.855	2.733	555	
	Total	**1553.601**	**5.3848**	**559**	

$F(4, 555) = 2.37$, $P = \leq 0.05$ ** Not Significant

The finding revealed that 20meter shuttle run test had greater significant main effect on differences among selected athletic groups; it was revealed that speed endurance sports had higher mean than other male athletic groups in their 20meter shuttle run test.
The null hypothesis of no significant difference is therefore rejected, post hoc result of scheffe test for difference of mean further shows that the five male athletic groups were different from each other in their 20meter shuttle run test as indicated in table 4.2.5.

Sub-Hypothesis 4

There is no significant difference in standing broad jump between combat sport, individual sport, racket game, speed endurance sport and ball game of male Nigerian university athletes.

To test this sub-hypothesis, data collected on the performance of each athletic group is shown in table 4:2:5a.

Table 4:2:5a: Mean, Standard Deviation and Standard Error of Standing Broad Jump Test

Test	Groups	N	Mean	SD	SEE
Standing broad jump test	Speed endurance	45	2.4378	.8906	.00842
	Ball game	45	2.4484	.13768	.01301
	Track & Individual	45	2.4251	.08430	.00797
	Combat	45	2.4638	.15242	.01440
	Racket	45	2.3881	.41694	.03940
	Total	**225**	**2.4326**	**.21573**	**.00912**

An observation of the performance of the different athletic groups in standing broad jump test revealed that all the groups did not differed in their performances.

To find out whether there are statistical significance differences in the performance of the different sport groups in standing broad jump test, the data was analyzed with one way analysis of variance (ANOVA 1) and presented in table 4:2:5b

Table 4:2:5b: **Analysis of Variance (Anova) for Differences in Standing Broad Jump Between the Different Athletic Group of Male Nigeria University Athletes**

Test	Source	SS	MS	DF	F
Standing Broad Jump test	Between Groups	.368	.092	4	1.991**
	Within Groups	25.648	.046	555	
	Total	**26.016**		**559**	

F(4,555) = 2.37, P = ≤ 0.05 **Not Significant

The findings revealed that standing broad jump had significant main effect on differences among selected athletic groups, it was revealed that individual sport had greater significantly higher mean than other male athletic groups in their standing broad jump test. Therefore, it was concluded that there were significant differences among selected male athletic groups in their standing broad jump test.
The null hypothesis of no significant difference is therefore rejected, post hoc results of scheffe test for difference of mean further shows that the five male athletic groups performances were not different from each other in standing broad jump test

Sub-hypothesis 5: There are no Significant Differences in the Total Arm Length Between Ball Game, Speed Endurance Sport, Racket Game, Combat Sport, Individual Sport of Male Nigerian University Athletes.

To test this sub-hypothesis, data collected on the performance of each athletic group is shown in table 4:2:6a.

Table 4:2:6a: Mean Standard Deviation and Standard Error of Total Arm Length Measured

Test	Sport Groups	N	Mean	SD	S.EE
	Speed endurance	45	29.94	1.538	.145
Total Arm	Ball game	45	30.19	1.679	.159
Length	Track & Individual	45	30.11	1.783	.168
	Combat sport	54	30.07	1.393	.132
	Racket sport	45	30.01	1.580	.149
	Total	**225**		**1.597**	**.067**

An observation of the measured total arm length of the different athletic groups in showed that except for the shorter total arm length (29.94±1.538 of the speed endurance sport group, all the other group total arm length did not differ.

To find out whether there are statistical significance differences in the total arm length of the different sport groups, the data was analyzed with one way analysis of variance (ANOVA 1) and presented in table 4:2:6b

Table 4.2.6b: Analysis Of Variance (Anova) for Differences in Total Arm Length between Ball Game, Speed Endurance Sport, Racket Game Combat Sport and Individual Sport of Male Nigerian University Athletes

Test	Source	SS	MS	DF	F
Total Arm	Between Groups	4.054	1.013	4	.396**
Length	Within Groups	1420.759	2.560	555	
	Total	**1424.813**		**559**	

$F(4,555) = 2.37$, $P = \leq 0.05$ ** Not Significant

The findings revealed that total arm length measures had significant mean effect on differences among selected athletic groups, it was revealed that ball game had greater significantly higher mean than the other male athletic groups in their total arm length measures. Therefore, it was concluded that there were significant differences among selected male athletic groups in their total arm length measure as indicated in table 4.2.9.

The null hypothesis of no significant difference is therefore rejected, post hoc results of scheffe test for difference of mean further shows that the five male athletic groups were different from each other in their total arm length measures.

Sub-hypothesis 6: There is no Significant Difference in the Total Leg Length Measure between Speed Endurance Sport, Individual Sport, Racket Sport, Ball Game and Combat Sport of Male Nigerian University Athletes

To test this sub-hypothesis, data collected on the performance of each athletic group is shown in table 4:2:7a.

Table 4:2:7a: Mean Standard Deviation and Standard Error of Total Leg Length Measured

Test	Sport Groups	N	Mean	SD	SEE
	Speed endurance	45	40.15	1.928	.182
Total leg	Ball game	45	40.13	1.851	.175
length	Track & Individual	45	40.19	1.814	.171
	Combat sport group	45	41.43	1.412	.700
	Racket sport group	45	39.93	1.138	.202
	Total	**225**	**40.36**	**1.765**	**.159**

An observation of the measured total leg length of the different athletic groups in revealed that the combat sport group had longer mean average total leg length (41.43±1.412) than the speed endurance (40.15±1.928), ball game (40.13±1.851

and the track and individual sport group 940.19±1.814). However, the racket sport group had the shortest total leg length (39.93±1.138).

To find out whether there are statistical significance differences in the total leg length of the different sport groups, the data was analyzed with one way analysis of variance (ANOVA 1) and presented in table 4:2:7b

Table 4:2:7b: Analysis of Variance (ANOVA) for Differences in Total Leg Length Measured

Test	Source	SS	MS	DF	F
Total leg length	Between Groups	163.096	40.774	4	2.915**
	Within Groups	7762.589	13.987	555	
	Total	7925.686		559	

$F(4,555) = 2.37$, $P = \leq 0.05$ ** = Not Significant

The findings revealed that total leg length measure had significant main effect on differences among selected athletic groups, it was revealed that ball game specifically male basketballers had greater significantly higher mean than other athletic groups in their total length measures, therefore, it was concluded that there were significant differences among selected male athletic groups in the total arm length measures as indicated in table 4:2:7b
The null hypothesis of no significant difference is therefore rejected, post hoc results of scheffe test for difference of mean further shows that the five male athletic groups were different from each other in their total leg length measures

4:3 DISCUSSION

The results of this in table 4.23, 24 and 4.25, 26, 4.27, 28, 4.29, 210 and 4.211 and 4.212. Showed that the differences in the physical characteristics among

the group of male selected university athletes were affected by the various group of sports and probably their individual body make up.

Height

A Weish Statistician, Kholsa (2010) argued and produced graphs to illustrate that elite sports favour tall people. Team games are sports where height, shape and body composition and fitness play an important role in providing distinct advantage of specific playing positions, particularly at the highest level of performance where there is high degree of player specialization (Bale, 2000). But significantly higher means ± SE value for height than its male counterparts, although, there were significant differences in height among the other groups of the male groups.

Body Weight

Body weight is of important consideration especially in elite combat athletics as, quite often, competition had been based on different height categories (Encarta Encyclopedia Standard Edition, 2004). But male basketball players had significantly higher mean ± SE value for body weight than its male volleyball counterpart. The judo group also has a significant higher mean ± SE value than its taekwondo counterparts in body weight. An inherent problem existed, however, as body weight measurement alone might be inadequate because it did not present the full picture of the component that make up the body weight in terms of body

fat and or lean body mass (Stout et al 1996, Troiano et al, 1996. Walberg, Rankin et al, 1996). Athletic performance is also influenced by body physique, excessive amount of fat or Fat Free Weight (FFW) negatively affects long distance run performance, as the excess weight has to be transported by the lower extremities and this requires extra energy. Thus the excess fat weight causes the runner to be less efficient, since more leg power is needed during running.

Muscular Power

Muscular power, often called explosive strength is a combination of strength and speed. This is the ability to realize maximum force in the fastest possible time, it is also known as the ability to exert a maximum contraction in ones explosive act, according to Nelson and Jeinsen (1992).

It was observed that the individual sports specifically the track male group had significantly higher ± SE value for lower limb explosive strength than its male counterpart group. Thus, a significantly higher ± SE value for lower limb explosive strength implied not only that the group had comparative advantage over its counterparts interms of lower limbs explosive strengths, also that the individual sports engages in more leg explosive strength training.

Calf Circumference

Calf circumference had been reported to be a useful measure of strength for explosive power push, it was also observed that there were significant differences in the mean ± SE value for calf circumference among the male athletic groups.

Agility

The concept of agility is difficult to precisely define operationally, even though there is general agreement among coaches, athletes and researchers as what is meant by the term agility (Wilmore, 1974). Agility typically refers to the ability to move and change positions or directions rapidly without loosing balance or sacrificing speed. It was observed that individual groups has significantly higher mean the mean ± SE value for 20 meter shuttle run which is known as agility than other male athletic groups. This could be as a result of the training patter of the individual sports group such as the circuit training session.

50 Meters Speed Run

According to Nelson (1982), speed is the velocity of a body part of an object, that is, the rate of motion, speed is basically the result of rapid application of force to a mass. This force is caused by muscle contraction. If the force is greater than the resistance, the movement occurs as the force becomes proportionately greater, the speed with which the mass moves increases based on Newton's second law of motion. It was observed that the male individual sport

had significantly higher mean ± SE value for 50 meter speed run than their male counterparts.

Watson, (1983) pointed out that speed of contraction is apparently inherent in muscle tissue, because even when muscle receives constant artificial stimuli, they contract at varying rates.

Total body speed can be measured by timing the athletes over a set distance from 50-100meters. Running speed can be evaluated from 10meters, 20 meters, 40meters, 50 meters, to 100 meters sprint using electronic timing device. Individual sports are sports that requires speed since the events involved in it are more of anaerobic in nature.

VO2 Max

Cardio respiratory endurance is the most vital means of determining a person's maximal oxygen uptake (VO2 max) (Mathew 1981) maximal oxygen uptake, according to verducci (1980), indicates how well various physiological functions can be adjusted to increasing metabolic demand of work. It was observed that the male individual sports had significantly higher mean ± SE values for 12 minutes cooper test run. The significantly higher mean ± SE value recorded by the individual male groups meant that the male individual sports group during their training session are able to work at 90 to 100% of their Vo2 max up to 10 or 11 minutes while accumulating a high blood lactate level also from a study

conducted, reported that individual sports area able to work at a high percentage of Vo2 Max in the presence of a high lactate accumulation, lactate threshold and running economy do not appear to strongly influence the individual sports group(Cureton et al, 1992).

Total Leg Length

Stride length is the most mechanical variable at a run velocity; it is the mechanical variable that significantly limits performance in longer and middle distance races (Cureton, 1992). Clearly, stide length measured at pace contributes strongly to athletic performance (Ram's Botton, 2001) lower limb segment and thigh length, other body size and composition variables significantly related to performance run times are reflections of linearity as they correlated highly with height, and height is an important in morphological characteristics of successful players. It was observed in this study that the male basketball players had significantly higher mean ± SE value for total leg length measures; this is as a result of the fact that the game of basketball attracts tall people, tall man with long legs has the advantage in high jumps and other events that requires the use of legs to propel (Sheldon, 1998).

Total Arm Length

Total arm length measures played vital roles in most sports and games that require the use of hands. It was observed in this study that the ball game

specifically the Volley ball players had significantly higher mean ± SE value than their individual sport groups. This could be as a result of the fact that volley ball players make use of their hands during training sessions. It is expected that they have a longer arm length measures.

Significant Differences (ANOVA)

ANOVA

It was also observed that table 4.2.2, 4.2.4. 4.2.6, 4.2.8, 3.2.12, for analysis of variance (ANOVA) for differences among the groups of male Nigerian university athletes in their 12 minutes run test, 50 meters speed run, 20 minutes run test, 50 meters speed run, 20 meter agility test, standing broad jump test, total arm length, and total leg, length measures, height and weight measures were significantly difference from each other, in their physical characteristics among the selected male athletic groups.

Sports Variables	12min Seconds m/kgm/ min	50m Seconds	20m Seconds	Standard B/Jump Meter	Calf Circumference Meter	Height Meter	Weight Kilogram	Total Arm Meter	Total Leg Length Meter
Speed endurance sport	**5.8±1.3**	**7.2 + 1.2**	**18.6±1.4**	**2.4±0.089**	**13.3±1.2**	**1.7±0.5**	**67.1±8.9**	**29.1±1.5**	**40.1±1.9**
Ball game	**6.8±1.8**	**6.6±0.7**	**18.7±1.9**	**2.4±1.4**	**13.3±1.8**	**1.7±0.5**	**69.6±6.7**	**30.2±1.7**	**40.1±1.8**
Individual sport	**5.0±1.5**	**7.2±1.2**	**18.9±1.9**	**2.4±1.8**	**12.9±1.6**	**1.7±0.6**	**63.4±10.9**	**30.1±1.8**	**40.2±1.8**
Combat sport	**5.2±1.4**	**7.2±1.5**	**18.7±12.4**	**2.5+1.5**	**13.6±1.3**	**1.7±.1**	**71.2±6.9**	**30.1±1.4**	**40.1+1.3**
Racket game	**5.4±1.5**	**7.9+1.2**	**19.2±1.6**	**2.4±4.2**	**12.9±1.5**	**1.7±0.6**	**65.9±10.4**	**30.1±1.6**	**39.1±2.4**

M= Mean SD= Standard Deviation

CHAPTER FIVE

5.0 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY

There has been a rapid increase in the intensity and frequency of participation in national and international competitions. The recruitment process within the Nigerian universities calls for coaches to identify prospective students/athletes who would be most successful in their institutions.

Application of modern scientific technological principles to the selection and training of athlete in different sports disciplines has been responsible for the incredible high sporting standards registered in modern competitions, moreover, frequent changes in officiating rules of different sports disciplines necessitate the development of new equipment of training technologies and methodologies and above all necessitate to identify the most suitable individual for a particular sport.

Available research evidences indicates specific, physical and physiological characteristics favourable to certain sports. This research was therefore conducted to assess the physical and physiological characteristics of male Nigerian university athletes. To achieve this purpose, four universities were selected from the 7 administrative zones, 8 athletes from each university were selected totaling 32 athletes from each zone were selected. The athletes thus selected were tested in

the 12minutes cooper test run to determine their Volume of oxygen uptake (Vo_2 max), 50meters dash to determine speed, 20meter shuttle run for agility, anthropometric measurements were also taken such as height, weight, calf circumference, standing broad jump, total arm length and total leg length measures to determine their upper and lower limb length. The data thus collected were statistically analysed. Descriptive statistics of means, standard deviation and standard error was computed. One way analysis of variance (ANOVA) were used to see if there was any significance difference among the selected group of sports.

The result revealed that the basketball players were the tallest and heaviest and had longer limbs, individual sports were most agile and fast, whereas judo group recorded the least score in the 12minutes run, the racket game also recorded the least score in the 50meters speed, speed endurance sport also had a sound cardio respiratory endurance. On the basis of this result it was recommended that selection of a particular sport should be based on the physical and physiological characteristics.

5.2 CONCLUSION

On the basis of the findings and in light of the limitations of this study, the following conclusions were drawn.

The physical and physiological characteristics studied in this research work have been shown to be determining factors in the successful performance of many

sports discipline. It has also been shown that some physical measures like structure, weight, leg length and arm length were more important for success in some sporting events than in others.

In addition, physical performance efficiency and effectiveness in different sports depend on a large extent on the size, weight, and proportion of the physique of the athlete.

It was observed from the result recorded in this study that ball game recorded the highest score in height and weight measures, while the individual sports recorded the highest scores in the 50meter speed run and also the 12minutes cooper test also recorded the highest scores by the individual sport. The speed endurance sports recorded the highest scores in the 20 meter agility test.

Physical and physiological characteristics were significantly difference among the male Nigerian university athletes in this study.

5.3 RECOMMENDATION

This investigation has revealed areas relating to physical and physiological characteristics among Nigerian University Male Athletes. On the basis of the findings of this study the following recommendation are made:

a. People with better sprint endurance, medium height and agility are more suitable for speed endurance sports like soccer and hockey and therefore such people are to be selected when it comes to sport competition.

b. People with longer limbs and greater height are more suitable for basketball and volleyball and other sports that require the use of hands and leg such as javelin throw shot put, discuss and jumps.

c. People with better explosive strength e.g. speed; agility and medium height are more suitable for racket game and games like squash and table tennis.

d. People with greater sprint endurance, leg explosive strength and moderate in height are more suitable for combat sports such as judo, karate and taekwondo.

e. People with moderate height, better sprint endurance, and agility are more suitable for events like track and swimming.

5.4 RECOMMENDATION FOR FURTHER RESEARCH

a. Investigation may be conducted to find out the performance indices that can be used to select talent for different sport.

b. Research is also needed to find out among two groups of athletes of different height i.e. average and above average the effects of specific training strategies on each of the group.

REFERENCES

Acurater, A. E. and Ross W.D. (2005). *Biomechanics and the Male Athletes in Pull*, J. Brown, C.H, Vox, R.O. (Eds) Sports Perspective for Women. Champaign, I.L. Human Kinetics.

American Alliance for Health, Physical Education Recreation and Dance (AAPHERD) Instructor's Guide to Physical Education and Assessment, 1993.

Arogbonlo, S. (1993). A *Survey of Conditioning and Fitness Programme of First Division Professional Football Clubs in Nigeria*. Unpublished M.Sc Thesis Ahmadu Bello University, Zaria.

Astrand J.T. (1986). *Skeletal Muscles Adaptation in Adolescent Boys, Sprint and Endurance Training and Detraining*. Med. Sci. Sports Exercise 1986; 14 (6) 453 – 456.

Baldini and Loman G.M. (2002). *Genetics to Understanding Human Adaptation to Altitude in the Andes*. J. Exp Biol. (2001, 204, (pt 18) 3151 – 3160.

Bale P. (2004). *The Functional Performance of Children in Relation to Growth, Maturation and Exercise Sports Medicine*. 13.(3) 151-159.

Ball et al (1980). *Developing Talent in Young People*. New York.

Berg, K. (2005). *Aerobic Function in Male Athletes Clinics in Sports Medicine*, 3;779 Sport Medicine Journal 2005.

Billman (2002). *Human Performance*. A Role for the ACE Genotype? Exercise Sport Sci. Rev 2002, 30(4): 184-190.

Bonen S. and Carter M. O. (1983). *Genes and Human Elite Athletic Performance*. Hum. Genet 2005, 166 (5) 331-339.

Bouchard, S. and Secher N. H (2001). *Evaluation and Regulation of Body Build and Composition Eaglewood Cliffs*, N.J. Prentice Hall inc p,m152.

Brooks J. and Gabbett T. J. (2002). *Human Body Composition, New York.* Pergamon In. Lamb, M.W. and Harden, M.L (1973) Ib. Id.

Bucher and Gabbett T. J (1981). *Heredity and the Path to Overweight and Obesity Medicine and Science in Sports and Exercise.* 23; 285-291.

Bunt, S. and Lawrence S. (1990). *Human Gene for Physical Performance*. Nature 1998, 393 (6682) 221-222.

Burfoot D. (2005). *Relationship between Body Max Index and Body Fat in Black Population from Nigeria, Jamaica, and the United State of America.* America Journal of Epidemiology, 45; 620-628.

Chado M.A. (1990). *Physical Fitness for Productive Health,* Zaria ABU Press.

Contill S. (1999). *The Genetic Legacy of Western Bantu Migrations*. Hum. Genet 2005 117, (4) 366-375.

Cooper , (1968). *The Fitness Profile of who Train in jn-jitsu HTML, Document*.

Coylel and Johnson, (1979). *High-Altitude Adaptations*, Lancet, 2003, 362 (Suppl.) 14,15.

Danier and Ramsbotton R . (1986). *Human Performance.* A Role for the ACE Genotype? Exercise Sport sci Rev 2002, 30 (4) 184-190.

Davids, K. Genes (2005). *Training and other Constraints on Individual Performance*. A Role for Dynamic System Theory? Sport Science 5(2).

Dempsey and Ellis (1986). *Physiology of Exercise.* Dubuque, 10WA: William C. Brown C.O., 403, 04.

Drink Water, (1984). *Genotype is Associated with Human Elite Athletic Performance*. Am . J. Hum Genet, 2003, 73 (3) 627-631.

Duhu M. A. (1978). *Maximal Leg Force and Power Out during Short Term Dynamic Exercise*. Journal of Applied Physiology 51. 1175;1182.

Ecker T. (1971). *Track and Field Dynamic* California Taf News Press pp. 86-106.

Falk B. Lidor R, Lander Y. and Lang B. (2004). *Talent Identification and Early Development of Elite Water Polo Players.* A 2 Year Follow-Up Study Journal of Sport Sciences 22.347-355.

Fitts and Widrick (1996). *Mitochondrial DNA Lineages and Haplotype Diversity of Elite Kenyan Athletes' med*. Sci. Sports Exercise 2006.

Galbo S. (1983). *Elthopians and Khoisan shares the Deepest Clades of Human Y-Chromosomes Phylogeny,* Am J. Hum Genet 2002, 70 (1) 265- 268.

Grimby H. (1977). *Our Ancestral Physiological Phenotype*. *An Adaptation for Hypoxia Tolerance and for Endurance Performance,* proc. Natl. Acad. Sci USA, 12998, 95, (4) 1915-1920.

Gultin B. (2006). *Role of Exercise Intervention in Improving Body Fat Distribution and Risk Profile in Children.* American Journal of Human Biology 11. 237-247.

Guthel (1987). *Physiological Characteristics of Young and Senior Ring by League Players.* British Journal of Sports Medicine, 36. 334-339.

Harigaye S. (1969). *Mitochondrial DNA Analysis of Northwest African Populations Reveals Genetic Exchanges with European, N*ear Eastern and Sub-Saharan Populations Ann Hum Genet 1998, 62, (pt.6) 531-550.

Heyward A.V. (1998). *Advanced Fitness Assessment and Exercise Prescription,* Third Edition, Human Kinetics Champaign.

Hirronem. J, Rehunens S, Rusko H, Harkonen M. (1987) breakdown of high energy phosphate compounds and lactate accumulation during short supramaximal exercise. Eur J. Appl Physiol, 56. 253-359.

Hoare D. G. and Warr C.R. *Talent Identification and Men's Soccer. An Australian Experience.* Journal of Sport Sciences. 18. 751-758, 2000.

Ireland M.L. (2004). *Special Concern for Female Athletes.* In Fufu, Stone, D.A. (eds) , Sports Injuries, Mechanisms, Prevention and Treatment. Philadelphia, Lippincott Williams and Wilkins. 153-87.

Ireland, M.L. and Ott, S.M. (2004). *Special Concerns of the Female Athlete, Clinics in Sports Medicines*, 23(2) 1-3, W.B Saunders Company.

Jason R.K. (2004). *Human Performance.* A Role for the ACE genotype? Exercise Sport Sci. Rev 2008, 30,(4). 184-194.

Katzmarzyt P.T (2006). *Genetics of Abdominal Visceral Fat Levels*. American Journal of Human Biology, Wiley, Liss, inc, 11: 225-235.

Kippers and Ellis L. (2007). *High Altitude Adaptations,* Lancet 2007 High–Altitude Adaptations Lancet 2007, 362, (suppl). S.14-s.15.

Komi K (1979). *Glycogen Synthase Activation in Human Skeletal Muscle, Effects of Diet and Exercise.* American Journal of Physiology, 236. E660 –E666.

Kreighbaum and Barthels, (1985). *Biomechanics, a Qualitative Approach for Studying Human Movement and Education,* Macmillan 52-64.

Lambm, W (1999). *The Meaning of Human Nutrition,* Per Gammon Press inc, New York 53-56.

Lawole S. and Oyewole T. (1987). *Effect of Body Composition on Oxygen Uptake during Treadmill Exercise*. Body Builders Versus Weight, Matched Men. Research Quarterly for Exercise and Sport, 70 (2) 150-156.

Mac Arthur DG and North K. N. *Genes and Human Elite Athletic Performance Human Genetics* 116-339, 2005.

Machole S. (1981). *Influence of Age on the Hemo Dynamic Response to Exercise, Circulation,* 1981, vol, 36. P.22.

Mc Ardle. M. (1984). *Risk of Sudden Death Associated with Marathon Running.* Journal American College of Cardiology, 28. 428-31.

Mehta S. (2002). *Relationship between Measures of Fatness, Lipids and Ethnicity in a Cohort of Adolescent Boys*. Annals of Nutrition and Metabolism. 46, 5. Research Library. 192.

Milliken S. (1985). *Effect of Physical Activity on Thiamine, Riboflavin and Vitamin B-6 Requirements.* American Journal of Clinical Nutrition, 72. (supplement 5985.

Morehouse M. (1976). *Evaluation of Diets in Relation to Nutritional Status. Nutritional Problems in the Tropics.* Symposium, Proceedings of the Nutrition Society, 29, 191-197.

Nardone P. (1989). *Specific Aspect of Contemporary, Ion Implications for Physiological Analysis and Performance*. Sports Medicine 32, 345-359.

Nelson, P (1992). *Specific Aspect of Contemporary, Ion Implications for Physiological Analysis and Performance*. S. MED.

Norusis, M.J. (1988). SPSS/PC + V3D Base manual for IBM PC/XT and SP/2, B116 B129.

Nunneley and Millet G.P., (1974). *Dermal Excretion of Iron in Intensely Trained Athletes, Clinical Acts,* 127. 19-27.

Osuala, E.C. (2001). *Introduction to Research Methodology*. Third Edition Africana- FEP publishers Limited, Onitsha, Nigeria 109-113.

Petal D. R. and Graydanus, D. E. (2002). *Genes and Athletes*. Adolescent Medicine 13(2) 249-255

Pienaar A. E, Spamer. M. J. and Steyn Jr, H. S. (1998), *Identifying and Developing Ring by Talent among 10 Year-Old Boys.* A Practical Model. Journal of Sports Science 16-691-1998.

Pipes and Carter M. A.. (1994). *Training European Founder Lineages in the Near Eastern Mt DNA Landscape.* Am J. Hum. Genet 04.

Pollock, L.M. (1978). *Evaluation and Regulation of Body Build and Composition. New* Jersey Prenfice. Hall inc.

Rilly, T. Brigbo. J Franks. A (2000*). Anthropometric and Physiological Predisposition for Elite Soccer,* J. sports sci. 181-669-683.

Robinson, S.M. (2001). *Oxygen Supply and Muscle Metabolism in Physical Training, Acta, Physiological Scan Danavian.*

Roos, W.D. and O. Toole M.L. (1983). *Kinanthropometry.* In. Mc Dongall, J.D. Wenger (eds). The Physiological Testing Elites Athletes, New York Movement Publishers. New York.

Ruth, S.M. (2007). *Gender Comparison in Anthropometric Difference, Anaerobic Power Anaerobic Capacity Tests.* British Journal of Sports Medicine.

Sakai, K, Sheahan J. Takamats U. K. (1999). *The Relationship between High Power Output During Intermittent Exercise and Three Energy Delivery Systems.* Yan J. Phys Sports med. 48 453-466 (Japanese with English abstract).

Saltin B. (2006). *Morphology, Enzyme Activities and Buffer Capacity in Leg Muscles of Kenyan and Scandinavian Runners.* Scand J. med. Sci. Sports, 1995 -5 (4) 222-30.

schumacherY.O. (2003). *Haematological Indices in Cyclist.* Scandinavian Journal of Medicine Science and Sports, 12,301-308.

Sheldon S.F. (1988). *Weight, Size and Strength Unchanged with Steroids, Physician Sports med.* 1998, 2. 39-43.

Sheldon S.F. and Behnke A.R. (1998*). Weight Size and Strength Unchanged with Steroids, Physician Sports med* 1998, 2.39-43.

Sparkling F. (2006). *Why black Athletes Dominate Sports and why we're Afraid to Talk about it.* New York. Public Affairs, (2006).

Tarnopolsky M.A. (1990). *Effects of Rapid Weight Loss and Wrestling on Muscle Glycogen Concentration.* Clinical Journal of Sports Medicine, 6. 78-84

Thomas J.R. and Nelson, J.K. (2007). *Research Methods in Physical Activity.* Third Edition Human Kinetics. 343-363.

Venkanteswarlu, K. (1982). *Theory of Athletic Training.* Dept, of Physical and Health, ABU, Zaria.

Venkanteswarlu, K. *Theoretical Foundations of Training for Competitive Sports (In Press).*

Wardlaw, G.M. and Kessel, M. W. (2002). *Perspective in Nutrition, Fifth Edition,* Mc. Graw Hill, Boston, 198, 468, 469, 475, 423 and 719.

Willmore J.H. (2004). *Athletic Training and Physical Fitness, Boston Allyn and Bacon inc.*

Yamamoto M. (1994). *Capture of Exercise with Dual Nature of Anaerobics and Aerobics Jpn.* J. Sport sci-B-4, 607-615 (in Japanese)

Zasirsky. M.J, Wilson R.H. 91995*). Superior Fatigue Resistance of Elite Black South African Distance Runners. J.* Appl. Physio 11993. 75 94) 1822-1827

APPENDIX

SEVEN NIGERIA UNIVERSITY SPORTS ADMINISTRATIVE ZONES

ZONE (A)

1. Bayero University, Kano.
2. Ahmadu Bello University, Zaria
3. University of Abuja.
4. Usman Dan-Fodio University, Sokoto.
5. Kano University of Technology, Wudil
6. Nasarawa State University, Keffi
7. Federal University of Technology, Minna.

ZONE (B)

1. Obafemi Awolowo University Ile-Ife
2. Adekunle Ajasin University Akungba
3. University of Ilorin
4. University of Ado Ekiti
5. Ladoke Akintola University, Ogbomosho

ZONE (C)

1. University of Benin, Benin City.
2. Ambrose Ali University, Ekpoma

3. Bennson Idahosa University, Benin City
4. Igbinedion University, Okada, Benin City
5. Delta State University, Abraka
6. Kogi State University, Ayingba

ZONE (D)

1. Federal University of Technology, Owerri
2. University of Calabar, Calabar
3. Imo State University, Owerri
4. River State University of Science/Technology, Port Harcourt
5. University of Port-Harcourt, Port-Harcourt.
6. University of Uyo, Uyo.
7. Niger Delta University, Wilberforce Island

ZONE (E)

1. University of Maiduguri
2. Federal University of Technology, Yola
3. Tafawa Balewa University, Bauchi,
4. University of Jos, Jos
5. Adamawa State University, Mubi
6. University of Agriculture, Makurdi
7. Benue state University, Makurdi

ZONE (F)

1. Lagos State University, Lagos
2. University of Lagos, Akoka
3. Federal University of Agriculture Abeokuta
4. Ogun State University, Ago Iwoye
5. University of Ibadan, Ibadan
6. Olabisi Onabanjo University, Ago Iwoye

ZONE (G)

1. University of Nigeria, Nsukka
2. Abia State University, Uturu.
3. Ebonyi State University, Abakaliki
4. Enugu State University of Science and Technology, Enugu
5. Nnamdi Azikiwe University, Awka
6. Micheal Okpara University of Agriculture, Umudike