CARDIORESPIRATORY ADAPTATIONS TO TWELVE WEEK PROGRAMME OF JOGGING AMONG MALE STUDENTS OF JIGAWA STATE COLLEGE OF EDUCATION, GUMEL

BY

UMAR MUHAMMAD

SUBMITTED TO:
THE POSTGRADUATE SCHOOL,
AHMADU BELLO UNIVERSITY, ZARIA.

A THESIS IN PARTIAL FULFI LMENT OF REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE (EXERCISE AND SPORTS SCIENCE) DEPARTMENT OF PHYSICAL AND HEALTH EDUCATION, FACULTY OF EDUCATION, AHMADU BELLO UNIVERSITY, ZARIA.

2005

DECLARATION

I hereby declare and affirm that this thesis has been written by me and that it is a record of my own research work. This work has not been presented in any previous applications for higher degree. All sources consulted for information have been acknowledged by means of references.

Umar Muhammad

Date ……..2005

CERTIFICATION

This thesis entitled "cardio respiratory adaptations to twelve week programme of jogging among male students of Jigawa state college of education Gumel," by Umar Muhammad meets the regulations governing, the award of the degree of master of science (exercise and sports sciences) of the Department of Physical and Health Education, Ahmadu Bello university, Zaria, and is approved for its contribution to knowledge and literary presentation.

Sign ……..

Date.....……...

Dr. J.A. Gwani

Chairman Supervisory Committee

Sign ……..

Date……..

Dr. F.R. Haruna

Member Supervisory Committee

Sign ……..

Date…….

Dr. J.A. Gwani

Head of Department

Sign ……..

Date…….

Prof. J.U. Umoh

Dean Postgraduate School

ACKNOWLEDGEMENT

For the successful completion of this research work, the researcher is indebted to the members of his supervisory committee especially the Chairman Dr.J.A Gwani, Dr F.R. Haruna and late Dr. I. I. Gamba (may his soul rest in peace) for sparing their precious time in going through the manuscripts for correction in every detail. He is also grateful to Professors M.A. Chado and K. Venkateswarlu for most of the materials used in this research work.

The researcher also thanks his brothers Muhammad Hurdi ACP, Haruna Abbas, Garba Ahmed, Jibrin Abdullahi, Habibu Tahir and Abdulkadir Abbas for their financial and moral support. Furthermore his friends and colleagues Dr. Tukur I.T., Dahiru Abdulkadir, J.F. John, Hamisu Dodo, Usman A. Danzamo, Usman A. Hadejia, Umar A. Musa, Kabirun Musa for their professional advise and encouragement.

Finally he is grateful to Baffa A. Dodo for all his patience in typing this work.

Umar Muhammad

ABSTRACT

Tasks of daily life no longer provide sufficient regular vigorous exercise to develop and maintain adequate levels of physical fitness. For that reason, in recent years, Jogging has become popular as away of keeping physically fit.

In this study, a 12 week jogging programme of one hour, three alternate days a week (Tuesday, Thursday and Saturday) was conducted involving forty two male students of Jigawa State College of Education Gumel.

$V0_2$max, resting heart rate and resting systolic and diastolic blood pressure were taken at pretraining, after 4 weeks of training, after 8 weeks of training and post training (after 12 weeks of training) respectively. The Cooper 12 minute run test for used to infer $V0_2$max, the resting heart rate and resting blood pressure were determined through the use of a sinex digital; sphygmomanometer. These values were analyzed using the SPSS package. The statistics used was the one-way repeated measure ANOVA, at probability level of P <.0005.

The study found significant effect of the training programme on $V0_2$max, resting heart rate, resting systolic blood pressure and resting diastolic blood pressure.

The changes observed due to the training programme are evidence of cardio respiratory adaptations.

TABLE OF CONTENTS

METHODOLOGY

CHAPTER FOUR

CHAPTER FIVE

LIST OF TABLES

4:5c Paired sample t-test on resting diastolic blood pressure through the training period.

31

LIST OF APPENDICES

DEDICATION

This Work Is Dedicated to My Family, My Wife Hajiya Khadija and Children Mika'il, Aisha, Hussaina and Muhammad Mubarak for their patience and understanding.

Umar Muhammad

CHAPTER ONE

1.1 INTRODUCTION

One of the greatest problems of the present day that faces man in his highly civilized and technologically advanced society is how to be successful in life without sacrificing his health. Success in ones area of endeavour will elude if he cannot concentrate, always nervous, indecisive and dragging a tired body around, where zeal and energy are called for.

Tasks of daily life no longer provide sufficient regular vigorous exercise to develop and maintain adequate levels of physical fitness. Mechanization of work and of many domestic chores has, for the most part eliminated obligatory physical activity from modern life. Lack of this regular physical activity has been associated with certain degenerative diseases such as high rate of heart related diseases, high blood pressure (hypertension), obesity. Increased anxiety and different types of depression (Chado, 1992). On the other hand, studies have shown that a physically active lifestyle has many benefits, including reduced risk of coronary heart diseases, hypertension, colorectal cancer, obesity and osteoporosis (Blair, Kampert, Kohl, Barlow & Macera 1996; Bouchard, Shepard & Stephens, 1994). Other benefits include reduced stress and depression and increased emotional well-being, energy level, self-confidence and satisfaction with social activity (Gauvin & Spence 1996). Therefore, the need for regular exercise in maintaining an organically sound body from birth through old age cannot be over—emphasised.

With the above observations in mind, it is believed that the best way to achieve the desired goal of health and leading a productive life today is to participate in regular physical fitness programme. Physical fitness has been

1

described by Clarke (1967) quoted by Nieman (1998) as the ability to last, to bear up and to persevere under difficult circumstances where an unfit person would give up. It reduces being fatigued from ordinary efforts, to lacking the energy to enter zestfully into life's activities and to becoming exhausted from unexpected, demanding physical exertion, he concluded that the maintenance of an adequate level of physical fitness is essential for any one wishing to be useful to himself and his life.

The concept of physical fitness has evolved from a primary focus on its motor and strength components (performance-related fitness) to more emphasis on its health-related aspects. Health-related physical fitness is often operationalized in three components: cardio respiratory fitness, muscular skeletal function of the lower trunk (abdominal strength and lower back flexibility) and body composition -specifically subcutaneous fat (Malina 2001). Health related fitness has been defined as the ability to perform daily activities with vigour and to demonstrate capacities that are associated with a lower risk of premature development of hypo kinetic

diseases (Philippaerts, Lefeure, Thomas, Vanreusel, Evynde, Claessens et al., 1999).

Among the components of the health related fitness is the cardio respiratory fitness, which is the ability of the circulatory and respiratory systems to adjust to and recover from the effects of exercise or work. It is considered the single most indicative measure of a person's physical condition (Fox, Bowers & Foss, 1993).

Cardio respiratory endurance or aerobic fitness is enhanced when large muscle masses of the body are involved in continuous and rhythmic activity for at least three to five exercise sessions a week 20-60 minutes a session, at an intensity of 50-85 percent maximum oxygen uptake (Vo_2 max). Typical aerobic activities include jogging, swimming, cycling, brisk walking and various vigorous sports (Nieman, 1998).

Today, many private and public sponsored agencies encourage reluctant spectators to join the fun of exercise. In Germany, for example, the German sports federation launched an aggressive media campaign called "Trimming - 130". The programme encourages people to boost their pulse to a rate of 130 beats per minute, three times a week for duration of 10 minutes. In Britain about 1.5 million dollar was spent on "look after yourself" campaign which aimed at getting the public to exercise more, smoking less and eating more nutritional meals. Brazil embarked on "move-it" strategy which enjoins people to use stairs instead of' elevators, to walk instead of' driving and to work-out instead of snack-out. In

Nigeria, we hear slogans like "keep fit" and "jogging for survival" all aimed at encouraging people to take to regular exercises for development of physical fitness and health.

In recent years, jogging, which are a combination of walking and slow running, has become popular as a way to keeping physically fit. Jogging begins when a person moves at a speed and forms those results in a period of flight between foot strikes (Powers & Howley, 1997). Regular jogging forces the body to become conditioned to an increased need for oxygen. When the body reaches the level of fitness that meet this need, the cardio—respiratory system becomes more efficient (Cooper, 1968).

1.2 STATEMENT OF THE PROBLEM

Improved standard of living and changes in life styles brought about by the modern technology of automation has significantly affected the lives of the people in this 21st century. Today, we use automobiles for going to the shortest distance from our homes and places of work; we have tractors and other farm machines to do most of our farm work. At home, the housewife has an electric washing machine for laundry and dishes, electric yam pounder, carpet cleaner etc. for our leisure time we watch television, play computer games or play cards; all these suggest a sedentary life style. With the change in life style, there is a consequent increase in the prevalence of degenerative diseases at an alarming rate. Such diseases as coronary heart diseases, hypertension, obesity, cancer etc are all on the increase.

At the turn of the 21st century, attention was paid more to the preventive health rather than the curative. Exercise has been found to be an effective non-pharmacological intervention against such diseases because it is easy, less expensive and an effective means of controlling and preventing such diseases. Exercise has been found to increase physical fitness and an increased physical fitness play a major role in preventing the prevalence of degenerative diseases.

As the awareness of getting physically fit increase so also the means of getting it multiplied; for instance, the laboratory method was used to develop physical fitness using complicated and expensive machines to scientifically improve and assess the level of improvement in physical fitness status of individuals. However, the laboratory techniques were both expensive and complicated for use. Therefore, the researcher was motivated to choose jogging because of its popularity and easy administration particularly among adults. For example, in a study reported by Pollock (1978) a group of men trained in interval training and jogging on alternate days, at the end of the study 90% of this group preferred continuous jogging training to interval training.

The purpose of this research was therefore, to investigate the cardio respiratory adaptations to 12week jogging programme among college students. Specifically the research seeks to answer the following questions:

i.) Does the jogging Programme have any significant effect on the VO_2 max of the subjects'?

ii.) Does the 12-week jogging programme have any significant effect on the resting heart rate of the subjects'?

iii.) Does the 12-week jogging programme have any significant effect on?

a) Resting systolic blood pressure and

b) Resting diastolic blood pressure of the subjects?

1.3 BASIC ASSUMPTIONS

Based on the research evidence available and professional opinions, the following assumptions were put forward for the purpose of this study:

i.) Cardio-respiratory fitness can be improved through regular moderate physical activity such as jogging.

ii.) Regular moderate aerobic activities can bring about a decrease in resting heart rate.

iii.) Regular moderate aerobic activities can bring about a modification in resting blood pressure.

1.4 HYPOTHESES

In this study, the Null hypotheses were used to test the significance of difference between groups at pre and post-training performance in the 12-minutes run test as a measure of cardio-respiratory fitness, resting heart rate and resting systolic and diastolic blood pressure.

i.) *The twelve-week jogging programme has no significant effect on the VO_2 max of the subjects.*

ii.) *The twelve-week jogging programme has no significant effect on the resting heart rate of the subjects.*

iii.) *The 12-week jogging programme has no significant effect on (a) resting systolic blood pressure and (b) resting diastolic blood pressure.*

1.5 SIGNIFICANCE OF THE STUDY

Jogging has become popular as an aid to the development of cardio-respiratory fitness, the world over. It is expected that the findings in this research would: Motivate the entire student population of the college to participate in regular jogging that develop cardio-respiratory fitness after they see the result of this research. This could lead to the development of a jogging programme for all members of the college community.

i.) *The result of the study could serve as a standard for reference by other students to compare their own performance in health related fitness.*

ii.) *Finally, the study will be a useful contribution to the growing literature in exercise and sports sciences in particular and physical and health education in general.*

1.6 DELIMITATIONS

This study was delimited to the male students of Jigawa State College of Education, Gumel. The training duration was 12-weeks of regular jogging programme in which the Cooper 12 minutes run field test

was administered in both the pre and post training periods to assess the effect of the training.

Other indices considered in this study were the effect of the training on resting heart rate, resting systolic blood pressure and resting diastolic blood pressure.

1.7 LIMITATIONS

The study was for a period of twelve weeks thus, it was not easy to randomize the selection of subjects, therefore, volunteers were used. However this was noted in the data interpretations.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.O INTRODUCTION

The purpose of this research was to determine the effects of regular jogging program on cardio respiratory fitness based on the following variables; VO_2 max, resting heart rate and resting blood pressure of college students. To accomplish the task, available literature was critically reviewed, which is presented and discussed in this chapter under the following sub—headings:

2. 1 The concept of cardio respiratory fitness/Benefits.

2.2 Measurement of cardio respiratory fitness.

2.3 Jogging and cardio respiratory fitness.

2.4 Training guidelines for cardio respiratory fitness.

2.5 Cardio respiratory training effects

2.6 Summary.

THE CONCEPT OF CARDIORESTORY FITNESS

Cardio respiratory fitness refers to the body's ability to sustain prolonged rhythmical exercise. It includes activities such as cycling, jogging or endurance swimming (Wilmore & Costill, 1999). It is also the ability to perform dynamic exercise involving large muscle groups at moderate to high intensity for prolonged periods (Heyward, 1998). Winsley & Armstrong (2005) defined it as a quantifiable physiological variable that

reflects the ability of the individual's cardiopulmonary and muscular systems to use oxygen to produce energy for movement. Nieman (1998) stated that cardio respiratory endurance or aerobic fitness is enhanced when large muscle masses of the body are involved in continuous and rhythmic activity for at least twenty to sixty minutes on regular basis. He further stressed that, typical aerobic activities include jogging, swimming, cycling, brisk walking and vigorous sports. In the same vein, Bruce (1999) expressed that brisk walking, riding a bike, swimming, golfing, aerobic dancing; jogging, square and social dancing, volleyball etc are fun. They enrich life; give physical and social variety and stimulation. Being in good condition also reduces the stress and effort required to do daily activities, these are the attributes of cardio respiratory fitness he concluded. Deveries (1980) summarised the attributes of cardio respiratory fitness as lower resting heart rate, lower heart rate for any sub maximal workload, greater maximal cardiac output, greater maximal oxygen uptake (VO_2 max) and capacity for greater oxygen debt. From the foregoing, we can understand that cardio respiratory fitness is essential for every individual, to be able to meet up the challenges of our daily living. Sharkey (1984) stated the benefits of cardio respiratory fitness as: improved circulation and respiration, reduced risks of heart disease, improved fat metabolism, reduced body weight, strengthened bones, ligaments and tendons, reduced tension and stress, improved vitality, reduced fatigue, personality changes, enhanced self- confidence and body image and emotional

stability. In the same vein, Billman (2002) found that regular jogging and long walk can favorably alter many known risk factors for cardiovascular disease including reducing obesity, lowering incidence of non-insulin dependent diabetes (NIDD), lowering arterial blood pressure and altering blood lipid profile by increasing high-density lipoprotein cholesterol and decreasing low-density Lipoprotein cholesterol.

Numerous studies have shown that regular jogging program improves scores on cardio respiratory fitness tests. Regular aerobic exercises such as jogging brings health benefits - better vigour, improved eating, sleep and rest habits, reduced risk of variety of disorders including low back pain and cardiovascular diseases and reduced reaction to stress. It also improves the quality of life. The Bucknell University student health service magazine (2001) reported a group of 135 College students who exercise regularly were found to be better equipped to handle life's hassles than less active students and therefore suffered fewer physical symptoms of stress.

A more direct method of evaluating cardio respiratory improvement is through heart rate measurement. Heart rate is closely related to work output, the rate that is measured immediately following work indicates how hard the individual is working (Kadiri, 1989). The speed with which the individual recover from activity and even the resting heart rate are indicators of the ability of the cardio respiratory system endurance (Bruce, 1999). Cardio respiratory improvements include reduced blood pressure,

reduced blood serum triglyceride and cholesterol, reduced weight, reduced emotional stress reaction, concluded (Bruce, 1999).

Research evidence also reveals that the oxygen consumption to a given exercise is decreased due to training. This has been attributed mainly to the improved muscle efficiency, neuromuscular coordination and decreased respiratory frequency (Fox et al 1993). Furthermore, Venkateswarlu (1971) attributed the improvements in cardio respiratory efficiency resulting from regular training to improved vagal tone and peripheral circulation. Bucher (1979) also contributed that a person with high degree of cardio respiratory fitness has improved physical fitness. Pulse rate was slower and blood pressure was lower, the lungs had larger surface area, allowing for the absorption of more oxygen by the blood, the supply of red corpuscles is larger, which also aids in increasing the oxygen supply and susceptibility to fatigue is decreased.

The benefits of cardio respiratory fitness are numerous, people who are involved in regular aerobic exercises such as jogging and aerobic dance, report benefits which fall into two broad categories each of which has substantial confirmation by research evidence. First, a fit cardio respiratory system is more resilient to coronary heart diseases (CHD) and other circulatory problems such as hypertension, stroke and varicose veins (Brown, Dengel, Hogikyan, Supaino 2002; Warchman, Wong, Hennings, Mitchel, Rennie, Cruickshank & Day, 2000). The protective benefits of exercise are two fold. Large-scale studies of whole communities have

shown that with regular activity there is reduction in the coronary heart disease risk factors such as improved blood fat profile, lowered diastolic blood pressure (among those with hypertension) and reduced stress levels (Malina 2001). In addition, a lifestyle of regular aerobic exercise such as jogging contributes to more efficient function of various systems, weight maintenance, and reduced risk of mortality and overall improvement of quality of life (Bouchard et al, 1994). Furthermore, muscle cells become more active users of oxygen and there is increased capillarisation in the working muscles. This is particularly significant in the heart muscle itself where it is known as coronary collateral circulation. The second benefit of cardio respiratory exercises lies in the effect it has on helping people to look better. For example, few regular joggers are over fat even though many start out that way. Cardio respiratory exercises typically involve large muscle groups, which burn up lots of calories, and the accompanying fat loss, muscle firmness, and an overall look of health and vitality are frequently reported by aerobic exercisers' (Jackson, Morrow, Hill & Dishman, 1999).

2.2 MEASUREMENT OF CARDIORISPIRATORY FITNESS

The measurement of maximal oxygen consumption (VO2 Max) was found to be the best measure of an individual's cardio respiratory fitness. Unfortunately, the most accurate way to determine one's maximal oxygen uptake is to test a person in a laboratory setting with a treadmill or cycle ergometer. The inspired and expired gases are usually collected and

analysed to determine oxygen consumption. However, this is not always practicable to administer due to either problem of time or equipment. Since, it involves much time and expensive equipment to administer. Attempts have therefore been made to devise other methods found also to be valid and reliable means of estimating maximal oxygen uptake and which could also be administered to a large group of subjects with minimum cost in duration and money (Ezra, 1986). Thus field tests were therefore devised to predict VO_2 max. The tests can be used to classify the cardio respiratory fitness level of healthy men ≤ 40 years and women ≤ 50 years (Heyward, 1998)

Evidences from research findings indicated that a reliable estimate of maximal oxygen consumption may be obtained from the performance during the 12 minutes run test. The result of this test correlate very highly (r 0.90) with laboratory VO_2 Max(Ward, Ebbeling, Ahlquist, 1995). This test is therefore, considered to predict a person's maximal oxygen uptake (Maud & Foster, 1995). Other studies conducted on the relationship between the laboratory assessment and the 12 minutes run test reported significant correlation (Jackson & Coleman, 1976; Gwani 1986; & Ezra 1986). The 12-minutes run test was found to be a valid measure of cardio respiratory fitness because it was more accurate test for measuring cardio respiratory fitness than Astrand's Rhyming test which consistently underestimates maximal oxygen consumption (Ezra 1986; Gwani 1986).

In his contribution, Chado (1991) -stated that the 12-minutes run test as suggested by Cooper 1968 has since gained worldwide recognition. It is used to measure the extent of an individual's ability to respond adequately and safely to endurance related work. It indicates the functions of the heart, blood and oxygen consumption. Similarly, previous research findings substantiated the administrative feasibility and reliability of the 12- minute run test for young adolescent boys and girls (Gwani. 1986).

2.3 JOGGING AND CARDIORESPIRATORY FITNESS

Roby and Davis (1970) defined jogging as a term that used to include all speeds of running. But it now refers to slow, continuous running. However one person's jogging may be another person's running, depending on the exercise habits and goals of the participants. In their own opinion Bowerman and Harris (1967) saw jogging as a graduated programme of moderate exercise which can be adapted to men and women of varying ages and levels of fitness. It is a simple type of exercise, requiring no highly developed motor skills. They further concluded that jogging is an exercise programme of relaxed walking and running that will improve the level of physical fitness of nearly everyone from 7 to 70 years. It is the easiest and most effective way of applying the aerobic principles of exercise. Jogging is probably one of the safest forms of physical exercise for the over-weight and under-exercised with special benefit for the elderly, the middle-aged and the young.

Jogging is different from most popular physical fitness programmes, unlike weight lifting, isometric exercises and callisthenics with their emphasis on muscle building, jogging works to improve the heart, lungs and circulatory system. Jogging is free, it is convenient and enjoyable. It is safe, and requires no special motor skills or equipment. And it can benefit nearly everyone who is not ill or disabled. At the same time it has special benefits for the 'over 30' and the 'well over 30' groups who do not exercise regularly. Through jogging they can recapture a level of physical fitness they thought they had lost (Bowerman & Harris 1967).

Several research findings have revealed a lot of cardio respiratory benefits that can be derived through jogging. Adeniran & Adeniji (1988) reported after an 8 week of regular jogging, three days a week for a distance of 4.8km per session that although boys had better cardio respiratory endurance, both sexes showed improved cardio respiratory endurance post-training. In another study conducted by Pollock (1978), showed that the drop out rate in a high intensity interval training programme was twice that of a continuous jogging programme. The physiological effects of the training programmes were equal, both groups improved significantly in aerobic capacity. In the same study, by Pollock another group of men trained in interval training and jogging on alternate days, at the end of the study 90% of this group preferred continuous jogging training to interval training. Also, more injuries were recorded with the interval training groups.

Studies have shown that Jogging can be done anytime, any where and involves only one person. It has all the benefits of walking it conditions the heart, improves muscle tone and strength, relieves stress and can help with a variety of health problems, such as osteoporosis, heart diseases and arthritis. Other measurable rewards of jogging include improvement in time, distance, endurance and strength (Acquaviva, 2003).

Cantly & Hoffman (1981) summarized the physiological effects of jogging as, thus: the Heart; similar to all muscles, the heart's reaction to stressful activity is to increase in size during the activity. This increase results in a stronger contractions which in turn increase the amount of blood pumped out with each stroke. Because more blood is now available with each beat, the resting heart rate lowers. The heart, like any other machine can certainly be expected to last longer. Lungs: As a result of regular programme of various exercises (e.g. jogging) the individual's lungs will increase their level of strength, endurance and capacity for work. The internal lung volume will increase, creating greater surface areas for gas exchange. These increases the number of alveoli utilized, and a greater efficiency of exchange of oxygen and carbon dioxide. There will be reduction in the breathing rate during rest and smaller increases during exercise. Capillaries; oxygen is unloaded in the capillary beds in the muscles. Long, slow running such as jogging results in the increase in number and size of these capillary beds in both the lungs and

musculature. This further improves the exchange of gases. Blood, regular training such as jogging increases the blood volume along with the number of red blood cells per unit of whole blood. This in turn increases the oxygen carrying capacity of the body. And finally the muscle glycogen stores increase their capacity as a result of regular aerobic training such as jogging.

2.4 TRAINING GUIDELINES FOR CARDIORESPIRATORY FITNESS

Aerobic exercise is an activity that can be sustained for an extended period of time without building oxygen debt in the muscles. It is a type of exercise that overloads the heart and lungs and causes them to work harder than they do when a person is at rest (Bucher 1979). From the foregoing, it is understood that for an activity to elicit the required response in cardio respiratory fitness it needs to be for a period enough to task the circulatory and respiratory systems, and that for adaptations to take place the frequency must be enough to allow for them to take place. In this regard Laursen & Jenkins (2002) stressed that a long period of training 3 to 5 times per week 12 to 38 days is required for increases in maximal oxygen uptake to occur. Milesis (1976) measured the effects of 15, 30 and 40 minutes of conditioning on cardio respiratory fitness variables, body composition. Pulmonary function and serum lipids. Improvements in Tread-mill performance time, VO_2 max and diastolic blood pressure were in proportion to duration of the training session.

Moffat, Byrant & Robert 1977, found significant improvement in aerobic capacity in college men who trained 3 days a week for 10 weeks. In another study by Crews & Roberts (1976), on the effects of 5, 3 and 1 day week training, found both 5 and 3 days per week groups had significantly greater gains in work capacity scores than the one day group. No difference was found between 5 and 3 day per week groups. This has been substantiated by Powers & Howley (1997) who stated that an exercise programme conducted three to five times per week, for twenty to sixty minutes session, at an intensity of about 50 to 85% VO_2, max brings about improvement in cardio respiratory fitness. Other studies show that higher intensity and frequency are required to increase cardio respiratory efficiency than to maintain it and that as low as one to two times per week training can help to maintain cardio respiratory gains (Hickson & Rosenkoeter, 1981). In their research, Blair, Kow, Gordon, Peffenbarger Jr. (1992) stated that as few as 6 to 10 training sessions, lasting as low as 5 to 10 minutes per session could result in improved aerobic capacity, although programmes of shorter duration show significantly lower training effect than do programmes of as long as 30 to 60 minutes duration.

In conclusion, Cantly & Hoffman (1981) pointed out that for improvement to occur, a demand must be placed on the body, for a sufficient period of time, and on regular basis.' The demand generally should approximate 75-80% of an individual's maximum heart rate.

Generally speaking 15 to 20 consecutive minutes is considered sufficient for the 'training effect' to occur. A 'regular basis' consists of 3 to 4 times per week.

2.5 CARDIORESPIRATORY TRAINING EFFECTS

The current trend in scientific research indicates a decrease in resting heart rate and a compensatory increase in stroke volume due to training. Various reasons have been advanced for this heart rate response to a given exercise. While some have attributed decrease in heart rate from training to morphological and structural changes taking place in the heart during training, others have viewed it as a result of muscle efficiency, neuromuscular coordination and improved peripheral circulation (Kadiri 1989). Bruce (1999) pointed that as fitness status improves the heart rate decrease. This shows that the body can now perform the same work with less effort from the heart and blood vessels as well as other systems of the body. Billman (2002) expounded that a resting bradycardia is a well established consequence of exercise training and is, in fact, used as a marker that the exercise-trained state has been achieved. In a study reported by Hockey (1977), using untrained subjects on the treadmill daily for half-hour bouts for 4 weeks, he found an increased exercise tolerance which was elicited by reduced pulse rate at a given work load. He attributed this to improved peripheral circulation rather than to the heart itself. Wilmore & Costill (1999) reported that the mechanism responsible for the exercise induced reduction in resting heart

rate could be attributed to an increase in parasympathetic activity and a decrease in sympathetic activity. An important factor in the decrease in resting heart rate is the sensitivity of the heart muscle to the sympathetic transmitters; adrenalin and noradrenalin (Fox et al, 1993).

Studies have also shown that the longer the athlete's distance, the more the effect of the activity on decreased heart rate. Bramwell & Ellis (1965), found that 10 days prior to competition, the longer the athlete's distance the lower the pulse rate of their 202 Olympic athletes. Several other studies have consistently supported this finding (Bloom field & Singerset, 1965, Wilmore, Royce, Girandola, Katch & Katch 1970; Venkateswarlu, 1971 and Wilson, Fardy & Flowlioher 1981).

Research evidences consistently showed that resting heart rate is almost always reduced by 5to 10 beats per minutes with at least a few weeks of endurance training (Shepherd & Astrand, 1992, Venkateswarlu, 1974). Most studies seem to support the idea that blood pressure rises during physical activity, however, there is no consensus on what happened to resting systolic and or diastolic blood pressure as a result of regular exercise training (Kadiri, 1989). Bramwell & Ellis (1965) studied 202 Olympic athletes and found blood pressure measured 10 days preceding their competition to be within the range common to healthy people of their age group. This suggests that their long training had not significantly changed their blood pressure level.

However, Henry (1954) found inconsistent changes in systolic blood pressure of his 33 subjects due to training. Boyer & Kasch (1970) also found little change in blood pressure as a result of training on healthy subjects. Mellorwiez (1964), found the mean systolic blood pressure of 107 highly trained athletes to be lower (117 mm Hg) than that of the general population. He also found that diastolic pressure to be significantly different between trained and untrained individuals, which he attributed to lessened elastic peripheral resistance with increased cardiac output, a feature of superior circulatory status of athletes. Brown et al. (2002) explained that exercise training has been shown to improve aerobic capacity and lower body fat, each of which could also contribute to a reduction in blood pressure. Brown et al, (2002) concluded that other factors such as changes in insulin sensitivity and sympathetic nervous system activity also contribute to the exercise induced changes in blood pressure.

However, Nieman (1998) expounded that exercise training can lower the resting systolic and diastolic blood pressure of people with normal blood pressure by an average of 4mmHg and 3mmHg respectively. Conversely, Powers & Howley (1997) explained that endurance exercise has been found to cause a 10 mm Hg reduction in resting blood pressure of hypertensive. Further more, Gaeddert (1999) found moderate exercise (jogging 2 miles a day), controlled hypertension very well that more than half the patients stopped taking medication. Winsley & Armstrong (2005)

further illustrated that, an exercise training programme has no significant effect on lowering either systolic blood pressure or diastolic blood pressure of normotensive individuals. However, they stressed that endurance type exercise has been found to bring about a reduction in both systolic and diastolic blood pressure of hypertensive. In another study, Venkateswarlu (1971) found mean resting systolic pressure of Indian gymnasts. , footballers, swimmers, volleyballers, track and field athletes and basketballers after 8 months training in these sports to decrease by 10.0, 14.0, 17.2, 9.2, 14 and 13.4 mm Hg respectively.

2.6 SUMMARY

From the available literature at the disposal of the researcher, jogging was found to be the most effective way of applying the aerobic principles of exercises. Regular jogging brings an improvement in cardio respiratory endurance even to the heart attack victims, because it increases the flow of blood to the damaged heart.

In cardio respiratory testing, a number of studies show that a reliable estimate of maximal performance can be obtained during the 12 minutes run test, and that a strong correlation was found between the 12 minute run test and the laboratory tests as measures of maximal oxygen uptake.

Finally, the changes observed in blood pressure as a result of exercise are not consistent as those in heart rate. This may be as a result of the dynamic nature of the human body. Several factors affect the relative

equilibrium of the human body, such factors as psychological state, body position during measurement, physiological condition to mention a few.

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

The purpose of this research was to investigate the cardio respiratory adaptations to twelve weeks programme of jogging among male college students.

3. 1 POPULATION

The population for this study were all the one thousand, two hundred and five (1,205) male students of Jigawa State College of Education, Gumel.

3.2 SAMPLE AND SAMPLING TECHNIQUE

For this research, the purposive sampling technique was employed to select the subjects. Subjects were encouraged to participate due to the fact that not all students may be ready to undergo a programme of twelve-weeks. Thus, forty two male volunteers from the college constitute the subjects who participated in the programme.

3.3 RESEARCH DESIGN

For this study, the one group pre-test-post test design was used. In the study, measurements taken during pre training were compared with those taken at post training to assess the training effects, using the repeated measure analysis of variance.

3.4.0 TEST PROCEDURE

All the subjects assembled at the college exercise science laboratory on the morning the pre-training tests were to be administered. They were then informed about the nature of the training program, the risks and benefits that could accrue as a result of participation in the training.

Then, each subject was given an informed consent form to fill, indicating their willingness to participate in the program. (Appendix F).

The resting heart rate and resting blood pressure of the subjects was then taken in the morning before they leave the laboratory. In the evening of the same day between the hours of 4.30p.m. And 6.30 p.m., the 12 minute run test was conducted for VO_2 max. All these tests were conducted on Monday and training began the next day (Tuesday).

In the first 4 weeks, the subjects participated in the jogging program. The program entailed a jogging of one hour (between the hours of 4.30pm and 6.30pm) for three days a week (Tuesdays, Thursdays and Saturdays). Then at the end of week 4, the test (resting heart rate, resting systolic and diastolic blood pressure and 12 minute run test) was administered to assess the training effects. This was repeated for week 8 and week 12.

3.4.1 RESTING BLOOD PRESSURE AND HEART RATE

Resting blood pressure and heart rate were taken in the morning of each day the tests were conducted. That is, the morning of the day the pre-

test (0-week) was conducted and repeated each morning of the subsequent tests (week-4, week 8 and week 12)

Before the test, the subjects were asked to rest in supine position for 15 minutes to take care of any increase or anxiety of tracking to the place where the measurements were taken. Thus, when the subject was fully rested, the resting blood pressure was measured, with a sinex automatic sphygmomanometer.

The subject was then made to sit on a chair with the bare left arm resting on a table so that the middle of the arm is at the level of the heart.

The depleted rubber cuff is then wrapped around the upper arm so that the mid line of the cuff is over the brachial artery.

As the automatic sphygmomanometer gives the reading for Blood pressure, the pulse rate was also given, thus recorded.

The average of 3 readings taken at one minute interval as suggested by Warchman et al, (2000), was recorded for each subject, for both blood pressure and heart rate.

3.4.2: 12 MINUTE RUN TEST ($V0_2$ MAX)

The cardio respiratory fitness of the subjects (VO_2 max) in this study was determined through the use of the Cooper's 12 minutes-run test.

The test conducted in a standard 400m track. At the beginning of the test, the subjects were grouped in to 7 groups of 6 persons each. Each

subject was assigned a lap scorer who recorded the number of laps covered.

All the subjects assembled at the starting point and each group took turn to run for twelve minute. The subjects were instructed to 'run', 'jog' or walk for 12 minutes, but they should not stop entirely, they were also instructed to stop at the sound of a whistle. The number of laps covered by each subject was recorded to the nearest meter and then American College of Sports Medicine (ACSM) formula in Powers & Howley (1997) was used to convert the distance in to individual's assessment of maximal aerobic power.

$$Vo2\ max = \frac{Distance\ (m) \times 0.2 + 3.5\ ml.\ kg.\ min^{-1}}{Time\ (min).}$$

3.5 TRAINING PROTOCOL

The jogging programme adopted for this research was for one hour, three alternate days (Tuesday, Thursday and Saturday) for twelve weeks (Cantly &Hoffman 1981).

The time for the programme was late afternoons between 4.30p.m. and 6.30 p.m. A participant was given the liberty to come at any period within the span of two hours. However, he was required to jog for one hour

3.6 RESEARCH ASSISTANTS

Ten assistants were used in this research two of which were lecturers in the Department of PHE, Jigawa State College of Education Gumel while the rest were students of the PHE department. The student

assistants were trained to record time and number of laps covered by each subject while the lecturers assist the researcher in recording the heart rate and blood pressure of the subjects.

3.7 INSTRUMENTATION

The following instruments were used for the purpose of this research:

I. Sinex automatic sphygmomanometer was used to measure the blood pressure and heart rate of the subjects.

ii. Stop watches; three stop watches (Sport timer alarm, Digital) were used in this study. They were used in the course of the 12 minutes run test.

3.8 STATISTICAL TECHNIQUES

i. *The repeated measure analysis of variance was employed to test the significance of difference that occurs at different stages of training.*

ii. *Descriptive statistics was used to find the mean scores and standard deviation for the different stages of training.*

iii. *A paired sample t-test was employed to find significance of differences between pairs of scores at different stages of the research.*

iv. *An alpha level of $P \leq 0.0005$ was used to retain or reject a hypothesis.*

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

The purpose of this research was to investigate the cardio respiratory adaptations to12 week jogging programme among college students. To this end, the data collected during this investigation were analyzed statistically and results were discussed and presented in this chapter.

4.1 RESULTS

Information on the physical characteristics (age, weight and height) of the subjects used in this study was shown in the table 4.1 below:

Table 4.1 Physical characteristics

Age (yrs)	*Weight (kg)*	*Height cm*
27.095+3.68	*61.785+5.76*	*167.000+5.96*

HYPOTHESIS ONE

The twelve –week jogging programme has no significant effect on $V0_2$ max of the subjects.

Table 4:2 a, b, c summary of repeated measure ANOVA, (b) Means and standard deviation and (2c) paired samples t-test.

(a)

Source of variation	*DF*	*SS*	*MS*	
Trials (Btw measures)	*3*	*1296.936*	*432.312*	

Subjects (Btw people)	*41*	*1065.971*	*25.999*	*284.516*
Residual (Error)	*123*	*186.894*	*1.519*	
Total	*167*	*2549.800*		

(b)

Measures	*N*	*Mean*	*SDS*
Time 1 (pre training)	*42*	*27.381*	*2.939*
Time 2 (4 weeks)	*42*	*30.701*	*2.564*
Time 3 (8 weeks)	*42*	*32.732*	*2.707*
Time 4 (Post train)	*42*	*34.931*	*2.831*

2c

		Mean	*SD*	
Pair 1	*$V0_2$max 1- $V0_2$max2*	*3.32*	*2.00*	*10.78*
Pair 2	*$V0_2$max1- $V0_2$max3*	*5.35*	*2.09*	*16.59*
Pair 3	*$V0_2$max1- $V0_2$max4*	*7.55*	*2.10*	*23.33*
Pair 4	*$V0_2$max2- $V0_2$max3*	*2.03*	*1.34*	*9.82*
Pair 5	*$V0_2$max2- $V0_2$max4*	*4.23*	*1.60*	*17.16*
Pair 6	*$V0_2$max3- $V0_2$max4*	*2.20*	*1.07*	*13.37*

In order to test the hypothesis that the twelve week jogging programme has no significant effect on the subjects' $V0_2$max, a one-way repeated measure ANOVA was conducted to compare their $V0_2$max at Time 1 (pretraning), Time 2 (4 weeks of training) Time 3 (after 8 weeks training) and Time 4 (after 12 weeks training). The result shows a

significant effect of F (3,41) = 284.516 P<.0005. Furthermore, follow-up paired t-tests indicated that $V0_2$max increased from pretraining to 4th week (t=10.78, P<.0005), pretraining to week 8 (t=16.59, P<.005), pretraining to post training (t=23.32, P<.0005) week 4 to week 8 (t=9.82, P<.0005), week 4 to post training (t=13.37, P<.0005). Thus, there was significant differece between the different training periods.

Therefore, based on the data above, the hypothesis which states that the 12-week jogging programme has no significant effect on $V0_2$max of the subjects was rejected.

HYPOTHESIS

The twelve-week jogging programme has no significant effect on resting heart rate of the subjects.

Table 4:3a, summary of repeated measure ANOVA for resting heart rate, (3b) means and standard deviation as well as (3c) paired samples t-test.

3a

Source of variation	*DF*	*SS*	*MS*	*F*
Trials	*3*	*3743.541*	*1247.847*	
Subjects	*41*	*8323.529*	*203.012*	*85.831*
Residual	*123*	*1788.208*	*14.538*	
Total	*167*	*13,855.279*		

3b

Measures	*N*	*Mean*	*SD*
Time 1 (pretraining)	*42*	*71.90*	*10.2*
Time 2 (4 weeks)	*42*	*67.5 0*	*7.6*
Time 3 (8 weeks)	*42*	*63.90*	*6.5*
Time 4 (post training)	*42*	*59.000*	*6.6*

3c

Paired	*Samples*	*Mean*	*SD*	*T*
Pair 1	*HRI-HR2*	*4.33*	*5.31*	*5.29*
Pair 2	*HR1-HR3*	*8.00*	*5.68*	*9.12*
Pair 3	*HR1-HR4*	*12.83*	*6.77*	*12.29*
Pair 4	*HR2-HR3*	*3.67*	*4.42*	*5.38*
Pair 5	*HR2-HR4*	*8.50*	*6.11*	*9.02*
Pair 6	*HR3-HR4*	*4.83*	*3.37*	*9.29*

To test the hypothesis that the twelve-week jogging programme has no significant effect on the resting heart rate of the subject, one-way repeated measure. ANOVA was conducted to compare the scores on resting heart rate at Time 1 (pretraining) Time 2 (4 weeks following the pretraining), Time 3 (8 weeks) and Time 4 (after 12 weeks, training). The results indicated a significant effect for time, F (3,41) = 85.831, P<.0005. Thus, based on the data presented above, the hypothesis which states that the twelve-week jogging programme has no significant effect on resting rate of the subjects was rejected.

Follow-up paired t-test revealed that heart rate decreased from pretest to week 4 (t=5.290 P<.0005), pretraining to week 8 (t=9.124 P<.0005), pretraining to post training (t=12.289,P<.0005), week 4 to week 8 (t=5.382, P<.0005);week 4 to post training (t=9.016, P<.0005) and week 8 to post training (t=9.293, P<.0005). Thus there was significant difference between the different training periods.

HYPOTHESIS THREE (A)

The twelve-week jogging programme has no significant effect on the resting systolic blood pressure of the subjects.

Table 4:4a Summary of repeated measure ANOVA, (4b), Means and standard deviation and (4c), paired samples of t-test.

4a

Source of variation	*DF*	*SS*	*MS*	*F*
Trials	*3*	*34.714*	*11.57*	
Subjects	*41*	*10246.286*	*249.91*	*22.49*
Error	*123*	*63.286*	*0.515*	
Total	*167*	*10344.286*		

4b

Measures	*N*	*Mean*	*SD*
Time 1 (pretraining)	*42*	*120.214*	*8.17*
Time 2 (4 weeks)	*42*	*120.214*	*7.848*
Time 3 (8 weeks)	*42*	*119.571*	*7.933*
Time 4 (post training)	*42*	*119.143*	*7.814*

4c

Paired	*Samples*	*Mean*	*SD*	*T*
Pair 1	*SBP1-SBP2*	*.000*	*1.06*	*.000*
Pair 2	*SBP1-SBP3*	*.643*	*.93*	*4.468*
Pair 3	*SBP1-SBp4*	*1.071*	*1.16*	*6.007*
Pair 4	*SBP2-SBP3*	*.643*	*.91*	*4.599*
Pair 5	*SBP2-SBP4*	*1.197*	*.18*	*5.799*
Pair 6	*SBP3-SBP4*	*.429*	*.77*	*3.609*

To test the hypothesis that the twelve-week jogging programme has no significant effect on the resting systolic blood pressure of the subjects, a one-way repeated measure ANOVA was conducted to compare their resting systolic blood pressure at Time 1 (pretraining), Time 2 (after 4 weeks), Time 3 (after 8 weeks) and Time 4 (after 12 weeks). The result indicated a significant effect F (3,41)=22.49 P<.0005. Thus, the hypothesis which states that the twelve-week jogging programme has no significant effect on resting systolic blood pressure was rejected.

Further comparison with the paired samples t-test indicated a significant difference in resting systolic blood pressure between pertaining ands 8 weeks after training (t=4.47,P<.0005); pretraining and post training (t=5.01, P<.0005); 4 weeks and post training (t=3.61,P<.0005). Similarly, the test revealed no significant difference between pretraining and 4th week of training (t=.000, P<.0005).

HYPOTHESIS THREE (B)

The twelve-week jogging programme has no significant effect on the resting diastolic blood pressure of the subjects.

Table 4:5a, b, c. 5(a) Summary of repeated measure analysis of variance (b) means and standard deviation as well as (c) paired samples t-test.

5a

Source of variation	*DF*	*SS*	*MS*	*F*
Trials (Btw measures)	*3*	*15.970*	*5.32*	
Subjects (Btw people)	*41*	*4823.267*	*117.64*	*5.35*
Residual (Error)	*123*	*112.279*	*0.99*	
Total	*167*	*4961.517*		

5b

Measures	*N*	*Mean*	*SD*
Time 1 Pretraining)	*42*	*78.04*	*5.6*
Time 2 (4 weeks)	*42*	*77.90*	*5.5*
Time 3 (8 weeks)	*42*	*77.45*	*5.4*
Time 4 (post training)	*42*	*77.33*	*5.5*

Paired	*Samples*	*Mean*	*SD*	*T*
Pair 1	*DBP1-DBP2*	*9.524*	*0.62*	*1.00*
Pair 2	*DBP1-DBP3*	*0.595*	*0.99*	*3.90*
Pair 3	*DBP1-DBP4*	*0.714*	*1.77*	*2.61*

Pair 4	*DBP2-DBP3*	*0.500*	*0.89*	*3.64*
Pair 5	*DBP2-DBP4*	*0.619*	*1.75*	*2.29*
Pair 6	*DBP3-DBP4*	*0.119*	*1.89*	*0.48*

The one-way repeated measure ANOVA was employed to test the hypothesis that the twelve-week jogging programme has no significant effect on the resting diastolic blood pressure of the subjects.

In the ANOVA, comparisons on the scores of resting diastolic blood pressure at pretest, 4th week, of training, 8th week of training and post training were made. Result showed a significant effect F(3, 41) = 5.35 P<.0005. Thus based on the data above, the hypothesis which states that the 12 week jogging programme has no significant effect on resting diastolic blood pressure was rejected.

Follow-up paired t-tests indicated that resting diastolic blood pressure decreased from pretraining to 8th week of training (t = 3.90, P<.0005) pretraining to post training (t = 2.61, P<.0005) 4th week to 8th week of training (t= 3.64, P<.0005), and 4th week to post training (t= 2.29, P<.0005). However, there were no significant difference between pretraining and 4th week of training (t = 1.000, P<.005), and 8th week and post training (t =- 0.40, P<.0005).

4: 2 DISCUSSIONS

The result of this investigation shows significant effect of regular jogging of one hour, three days a week for twelve weeks on maximum oxygen uptake among college men. This is in agreement with Powers &Howley (1997) who found an exercise program conducted 3 – 5 times per week for 20 – 60 minutes per session at an intensity of 50% to 85% VO_2max to improve cardio respiratory fitness. This is also consistent with the findings of Laursen &Jenkins (2002) who found an increase in

VO2max after 38 days of training 3 times per week. Furthermore, Moffat et al (1977) found significant improvement in aerobic capacity on college men who trained three days a week for ten weeks. This was also supported by Pate & Ward (1990) who found a group of initially sedentary young and middle-aged adults to manifest a mean increase in VO_2max of 15% due to endurance training.

This increase in VO_2max resulting from the training program could be attributed to an increase in the amount of oxidative enzymes which enable the muscle tissues to use the available oxygen and an increase in cardiac out put, blood volume and better perfusion of active muscles with blood due to a decrease in peripheral resistance (Wilmore & Costill 1999). The increase in stroke volume is a prerequisite for the increase in maximal oxygen uptake (VO_2max) resulting from training (Wernstedt et al, 2002). Laursen & Jenkins (2002) also reported that improvements in VO_2max and physical work capacity could be attributed to peripheral and central adaptations accruing from physical training. These are evidenced through an increased delivery of oxygen to the working muscles, an increase in blood and plasma volume (hypervolaemia) accompanied by a greater cardiac output and increased muscle and cutaneous blood flow during exercise.

Although the VO_2max of the subjects in this investigation both at the pre training and post training periods were lower than that of the fitness classification of their age range as reported in the literature, the

magnitude of the change observed after the training (27.67%) is within the range of improvement accruing from such training protocols as was supported by Pollock & Wilmore (1990) who found an increase in VO_2max of 20% following 6 months training program on previously untrained subjects.

A decrease in resting heart rate is a well established consequence of exercise training and is, infact used as a marker that the exercise trained state has been achieved (Billman 2002). The result of this study shows a significant effect of the training on resting heart rate of the subjects.

Research evidences have consistently indicated that resting heart rate is almost invariably reduced by 5 – 10 beats per minute with a few weeks of endurance training (Bruce 1999, Shepherd &Astrand 1992; Venkateswarlu 1974).

Some of the factors responsible for this exercise induced resting bradycardia include; an increase in parasympathetic activity (Wilmore &Costill, 1999) and an improved muscle efficiency, neuromuscular coordination and improved peripheral circulation (Kadiri, 1989).

The result of this investigation reveals a significant effect of the jogging programme on resting diastolic and systolic blood pressure of the subjects. The mechanisms responsible for the reduction in blood pressure as a result of aerobic training are many. Maximal oxygen consumption is the best overall index of cardio-respiratory fitness and high $V0_2$max levels are associated with lower blood pressure. Thus, improvements in cardio

respiratory fitness ($V0_2max$) with aerobic training could lead to aerobic exercise-induced reductions in blood pressure mediated indirectly through various blood pressure regulating mechanisms (Brown et al 2002). Similarly, aerobic exercise-induced improvements in insulin sensitivity may affect the blood pressure response through alterations in insulin effects on renal sodium handling and sympathetic nervous system activity (Raven, Potts & Shi 1997). Furthermore, Billman (2002) emphasized that endurance exercise training brings about an alteration in the automatic nervous about an activity resulting in an increase in cardiac parasympathetic tone.

Venkateswarlu (1977) found mean resting systolic blood pressure of Indian gymnasts, footballers, swimmers, volley ballers, track and field athletics and basket ballers after 8 months of training in these sports to decrease by 10.0,14.0, 17.2,19.4 and 13.4 mm Hg respectively. Similarly, he found a significant reproduction in the resting diastolic blood pressure of the subjects.

However, there are research evidences, which suggested that a decrease in resting blood pressure for normotensive individuals are inconsistent(Nieman,1998).Furthermore, Powers& Howley (1997) ,explained that endurance training causes significant reduction in blood pressure (up to 10mm Hg) of hypertensive individuals.

Finally, the result in this investigation indicated significant differences between the different training periods. This was revealed

through the paired sampled t-tests conducted. This was observed for all the variables except the blood pressure, which revealed insignificant difference between the pretraining and 4 weeks after the training.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY

This study was conducted to find out the cardio respiratory adaptations to twelve-week programme of jogging among male college students.

To this end, the purposive sampling technique was employed to select the subjects. This was due to the fact that not all students may be ready to participate in a programme lasting for twelve weeks. Thus, forty two male volunteers constitute the subjects for this research.

Maximum oxygen uptake (VO_2 weeks) was inferred from the Cooper 12 minute run test taken at pre-training, after 4 weeks, after 8 weeks, and at post training. The resting systolic and diastolic blood pressure and resting heart rate were determined through the use of a sinex automatic sphygmomanometer.

The training protocol was a jogging program of one hour, three alternate days (Tuesday, Thursday and Saturday) for 12 weeks. The period was between 4.30 pm and 6.30pm; a participant was free to come within the span of two hours. However, he has to jog for one hour.

The data collected were analyzed on the computer using the SPSS package to test the hypotheses of the study. A significant level of $P \leq 0.0005$ was used to retain or reject a hypothesis.

5.2 CONCLUSIONS

Within the limitations of this study, it was concluded,

(i) *That a 12-week programme of jogging improved VO_2 max in college men by 27.67%.*

(ii) *That a 12-week programme of jogging reduced the resting heart rate of college men by 17.86%.*

(iii) *That, the reduction is resting heart rate and improvement in VO_2 max following the 12-week programme suggest an improvement in cardio respiratory fitness of the subjects.*

(iv) *That, the resting systolic and diastolic blood pressure reduced by .89% and .91% respectively following the 12-week jogging programme.*

5.3. RECOMMENDATIONS

On the basis of the findings of this study, the following recommendations were made:

i.) *There is a need for the development of a Jogging program that can be used to improve the cardio respiratory fitness of the entire population. This will go along way in the improvement of their health.*

ii.) *There is a need for a study of this nature that will involve the female students in Jigawa State College of Education, Gumel.*

iii.) *Finally, there is a need for the development of Nigerian norms so as to avoid comparing performance of Nigerians with foreign standards.*

REFERENCES

Acquaviva, J (2003) "Jogging". Health A to Z http:// www. Health A to Z. Com/healthoz/A toZ/ hl/fit/card/jog. html

Adeniran S. A and Adeniji B.O. (1988) "Effect of an 8 week jogging program On the physical fitness level of adolescent boys and girls" Journal of Nigeria Association of sports Science and Medicine 2 (2) 187-198.

Billman G.E. (2002) Aerobic Exercise Conditioning: a Non-pharmacological antiarrhythmic intervention. Journal of apply physiology 92: 446-454

Blair, S. N, Kampert J B, kohl H. W, Barlow C.E and Macera C.A (1996) "Influences of cardio respiratory fitness and other precursors on cardiovascular disease and all cause mortality in men and women" Journal of American Medical Association 276 (3): 205-210.

Blair, SN, KOW, H.W., Gordon, N.F., Peffenbarger, R.S.Jr (1992) "How much Physical activity is good for health?" Annual review of public health 13: 99-126

Bloomfield, J. and Singerset P. O. (1965) "Anatomical and physiological

Differences between sprint and middle distance swimmers of university level" Journal of sports medicine and physical fitness 5:76

Bouchard, C., Shepherd, R. J. and Stephens, T. (Eds) (1994) physical activity,

Fitness and health: international proceedings and consensus statement. Human kinetics, Champaign, Illinois.

Boyer, J. L. and Kash, F. W. (1970) "Exercise therapy in hypertensive men."

Journal of American Medical Association 211: 1668.

Bowerman, W. J. and Harris, W. E (1967) Jogging: A physical fitness program

For all ages Corgi book, Tran world publisher's ltd.

Bramwell, C. and Ellis, R. (1965) "Clinical observation on Olympic athletes."

Arbeits physiologie 2:51

Brown, M.D. Dengel, D.R., Hogikyan, R. V., Supiano, M. A. (2002) "Sympathetic

Activity and the heterogeneous blood pressure response to exercise training in hypertensive" Journal of applied physl 92: 1434-1442.

Bruce, A.C. (1999) "Exercise for the order adult" Aging publication GG0003.

University of Missouri extension service p1.

Bucher, C.A (1979) Foundations of Physical Education C.V Mosby Company, St.

Louis.

Bucknell University Students Health Service Magazine (2001) "Exercise and

Fitness: a report of the surgeon General on physical Activity and health for adolescents and Young Adults" http://www.bucknell/edu/

Cantly. And Hoffman. (1981) running together: the family Book of jogging.

Leisure press, west point N.Y

Chado, M. A., (1991) Physiological basis of physical fitness and conditioning.

ABU press ltd Zaria

Chado, M. A., (1992) Physical fitness for productive health. ABU press ltd Zaria.

Cooper K. H. (1968) Aerobics. Bantam publications. New York.

Crews, T.R. and Roberts, J.A. (1976) "Effects of interaction of frequency and

Intensity of training" Research quarterly 47: 48-55

Deveries, H.A. (1980) "Aerobic Responses of female Distance Runners to

Sub-maximal and maximal exercise" Annual Journal of Cardiovascular Science NYA, 310: 726-733

Ezra, C.T. (1986) "The Relationship between Astrand's rhyming and coopers 12

Minutes run test as measures of cardiovascular fitness" Unpublished M. Ed thesis, A B U Zaria

Fox, E.L., Bowers, R. and Foss, M. (1993) Physiological basis of exercise and

Sport Pre-publication copy, W. C. Brown Com. Inc.

Fox, E. L., Bowers R.W. and Foss M., (1993) "Cardio respiratory adaptations to

Exercise training." The Physiological Basis for Exercise and Sport.

Gaeddart T. (1999) "Exercise" Wysiwyg: //Zoffsite bottom 64/http.

5th Edition Brown and Benchmark publishers Madison.

Gauvin, L. and Spence, J.C., (1996) "Physical activity and psychological well

Being: Knowledge base, current issues and caveats." Nutrition review 54 (4) 553-655

Gwani J.A. (1986) "Relationship between 6 minutes run and12 minutes run test

as measures of cardiovascular fitness" Unpublished M. Ed thesis, ABU Zaria.

Henry, F.M. (1954) "Influence of athletic training on the resting cardiovascular

System" Research quarterly 25: 28 -41.

Heyward, V. H., (1998) Advanced fitness assessment and exercise prescription.

3rd Edition. Human kinetics.

Hickson, R. C. and Rosenkoeter, M. A. (1981) "Reduced training frequencies

And maintenance of increased aerobic power". Journal of Medicine and Sciences in Sports and Exercise. 13:13-16.

Hockey, R. V. (1977) Physical fitness the pathway to healthful living. The C. V

Mosby comp St Louis, Missouri.

Jackson, A. W., Morrow, J.R. Hill, D.W. and Dishman R.K. (1999) Physical Activity for health and fitness: An individualized life time approach. Human Kinetics.

Jackson, A.S., and Coleman. (1976) "Validation of distance run test for Elementary school children" Research quarterly 47: 86-94

Johnson, B. L. and Nelson, J. K. (1979) Practical measurement for evaluation in

Physical education. Burgess publishing Co. Minneapolis 3rd Ed.

Kadiri, I. (1989) "Cadiorespiratory responses to stepping exercise as a mode of

Regular training" Unpublished M. Ed thesis ABU Zaria.

Laursen, P.B. and Jenkins, D.G. (2002) "The Scientific Basis for high-intensity interval training: optimizing training programs and maximizing performance in highly trained endurance athletes." Journal of Sports Medicine. 32(1)53.

Leonard A.; (1971) Encyclopedia of sport science American college of sport Medicine Macmillan publishers.

Malina R. M (2001) "Physical activity and fitness path way from childhood to Adulthood." American journal of Human biology. 13: 162-172.

Maud, P.J. and Foster, C., (1995) Physiological Assessment of Human Fitness. Human Kinetics.

Mellorwiez, H. (1964) "The effect of training on heart rate and circulation and Its importance in preventive cardiology" in Raab, W. (Ed) prevention of Ischemic heart disease. Spring Field, Illinois.

Milesis C.A., (1976) "Effects of different durations of physical training on Cardio respiratory function, body composition and serum lipids" Research quarterly 47: 716-125.

Moffat, R.J., Bryant A.S., and Robert D.N. (1977) "Placement of tri-weekly training sessions: importance regarding enhancement of aerobic capacity." Research Quarterly. 48:583-591

Nieman, D.C. ;(1998) the exercise health connection How to reduce your risk Of disease and other illness by making exercise your medicine. Human kinetics, Champaign U.S.A

Pate, R.R. and Ward, D.S. "Endurance Exercise Trainability in Children and Youth". In Grana L. and Sharkey S. (1990) Advances in Sports medicine and Fitness. Vol. 3 Year Book Medicine publishers Inc. Chicago.

Philappaerts, H.M., Lefeure, J., Thomas, M., Vanreusel, B., Evynde, R.V., Claessens, A.L., Lysens, R; and Beunen, G.; (1999) "Associations between daily physical activity and Physical fitness in Flemish Males: A Cross-sectional analysis". American Journal of Human Biology, 11: 587 – 597.

Pollock, M.L. (1978) "How much exercise is enough?" Journal of physiology and Sport medicine 6: 50-64.

Pollock. M. L., and Wilmore, J. H., (1990) Exercise in Health and Disease: Evaluation and prescription for prevention and

Rehabilitation. 2nd *Edition, Saunders publishers Philadelphia.*

Powers, S, K. and Howley, E.T. (1997) "Training Programs and changes in VO_2 *Max."* *Exercise Physiology: Theory and Application to Fitness and Performance. Brown and Benchmark, publishers.*

Powers, S.K. and Howley, E.T. (1997) "Exercise for Special Populations, *Exercise Physiology; Theory and Application to Fitness and Performance .Brown and Bench Mark.*

Raven B.P., Potts T.J. &Shi, X.;(1997) Baroreflex Regulation of blood pressure during dynamic exercise in: Exercise & Sport Sciences Reviews Vol.25. ACSM series. Williams & Wilkins.

Roby, F. and Davis, R. (1970) *Jogging for fitness and weight control. Philadelphia W.B., Saunders*

Sharkey, B.J. (1984) Physiology of fitness Human kinetics, publishers Inc Champaign 2nd Ed.

Shepherd, R. J., and Astrand, P. O. (Eds) (1992) *Endurance in sport. Blackwell Scientific publication, London.*

Sparks, Y. and Todd, M. (1997) "Physical development" Brilliant star /educational psychology interactive.

Venkateswarlu, K. (1974) "Cardiovascular adaptations to some training Methods." Research paper read in the international symposium On Exercise and sport physiology. Patiala, India.

Venkateswarlu, K (1971) "Comparative study of the effects of training in Certain physical activities on some cardiovascular, respiratory And renal functions." Doctoral Thesis, Punjabi University, Patiala, India.

Warchman, N.J., Wong, M. Hennings, S., Mitchel, T. Rennie, K., Cruickshank K. and Day, N.E. (2000) "Quantifying the association between habitual energy expenditure and blood pressure" International journal of Epidemiology; 29: 655-660.

Ward, A., Ebbeling, C.B., and Ahlquist, L.E. (1995) Indirect Methods for Estimation of Aerobic Power in Maud P.J. and Foster, C. (Eds) Physiological Assessment of Human Fitness. Human Kinetics.

Wernstedt, P., Sjorstedt, C., Ekran, I., Du, H., Thuomas, K. A.; Areskog, N. H. Nylander, E., (2002) "Adaptation of cardiac morphology and function to endurance and strength training." Journal of Medicine and Science in Sports 12; 17-25.

Wilmore. H. and Costill, D.L. (1999) "Cardio respiratory adaptations to Training" *Physiology of sport and exercise* *2nd Edition, Human kinetics.*

Wilmore, J.H, Royce, J, Girandola R.M. Katch F. I. and Katch V.L. (1970) "Physiology alternatives resulting from a 10 week programme of Jogging" *Journal of medicine and science in sport 2:7.*

Wilson, P.K, Fardy, P.S. and Flowlioher, V.F. (1981) *Cardio rehabilitation, Adult fitness and Exercise Testing. Lea and fabiger, Philadelphia.*

Winsley, R., and Armstrong, N. (2005) "Physical activity, Physical fitness, Health and Young people" in Green K; and Hardman, K. (Eds) *Physical Education: Essential Issues. SAGE Publications Inc. London.*

APPENDIX A

PHYSICAL CHARACTERISTICS OF THE SUBJECTS

Subject	*AGE (Yrs)*	*Weigh*	*Height (cm)*
1. AB	*25*	*56*	*164*
2. KU	*24*	*53*	*160*
3. IAI	*26*	*56*	*166*
4. IA	*28*	*62*	*170*
5. LY	*27*	*60*	*168*
6. MH	*30*	*68*	*172*
7. HMH	*32*	*70*	*174*
8. IS	*23*	*55*	*162*
9. AI	*34*	*68*	*170*
10. UU	*35*	*71*	*177*
11. MA	*23*	*62*	*166*
12. AH	*24*	*58*	*159*

13.BI *24* *61*
170
14.JMY *29* *66*
169
15.ASH *27* *69*
172
16.GM *22* *54*
156
17.MS *25* *63*
171
18.NM *30* *65*
174
19.JM *23* *60*
168
20.IA *22* *58*
160
21.YY *28* *63*
168
22.AA *26* *62*
173
23.MA *28* *70*
177
24.AM *28* *66*
175
25.IBJ *26* *59*
169
26.MS *32* *70*
174
27.MI *34* *69*
176

28.JA	*29*	*64*	*172*
29.HB	*29*	*65*	*168*
30.YA	*33*	*70*	*175*
31.SI	*30*	*65*	*170*
32.JS	*32*	*66*	*165*
33.MA	*31*	*65*	*159*
34.DD	*23*	*52*	*155*
35.AA	*25*	*55*	*158*
36.MA	*26*	*60*	*170*
37.DS	*25*	*61*	*166*
38.BM	*26*	*59*	*164*
39.AAI	*25*	*60*	*171*
40.YI	*22*	*51*	*160*
41.HA	*23*	*55*	*165*
42.ZA	*24*	*53*	*163*

APPENDIX B

RAW DATA OF VO_2 MAX OF THE SUBJECTS

SUBJECT	*T_1 (Pre-test)*	*T_2 (4 wks)*	*T_3 (8 wks)*	*T_4 (12 wks)*
1. AB	*27.33*	*33.50*	*36.66*	*39.66*
2. KU	*29.33*	*31.50*	*31.50*	*36.83*
3. IAI	*27.33*	*32.50*	*33.50*	*35.66*
4. IA	*30.33*	*34.50*	*36.66*	*39.66*
5. LY	*27.33*	*31.50*	*31.83*	*34.50*
6. MH	*28.33*	*31.50*	*33.50*	*36.83*
7. HMH	*23.16*	*26.33*	*29.33*	*32.50*
8. IS	*22.16*	*24.16*	*26.33*	*27.33*
9. AI	*23.16*	*26.33*	*28.33*	*31.50*
10. UU	*28.33*	*30.50*	*32.50*	*34.50*
11. MA	*35.50*	*36.66*	*38.66*	*39.66*
12. AH	*26.33*	*28.33*	*31.50*	*32.50*
13. BI	*28.33*	*32.50*	*32.50*	*34.50*

14. JMY 28.33 30.00 30.50 32.50

15. ASH 29.33 30.50 32.50 35.66

16. GM 27.33 29.33 32.50 35.66

17. MS 27.33 33.50 36.66 37.66

18. NM 23.16 25.16 27.33 30.50

19. JM 29.33 32.50 33.50 36.83

20. IA 27.33 32.50 32.50 35.56

21. YY 26.83 27.50 29.50 31.00

22. AA 29.33 30.50 33.50 36.83

23. MA 25.16 29.33 32.50 35.66

24. AM 27.33 31.50 34.50 37.66

25. IBJ 29.33 32.50 32.50 34.50

26. MS 27.33 30.50 33.50 33.50

27. MI 29.33 31.50 35.66 39.66

28. JA 25.16 30.50 31.50 32.50

29. HB 23.33 27.33 29.33 31.50

30. YA 28.33 31.50 34.50 35.66

31. SI 30.50 31.50 35.66 37.66

32. JS 24.16 29.33 30.50 32.50

33. MA 28.33 29.33 29.33 31.50

34. DD 23.16 31.50 31.50 32.50

35. AA 28.33 32.50 33.50 35.66

36. MA 29.33 29.33 32.66 34.50

37. DS 29.33 30.50 35.66 36.83

38. BM 24.16 31.50 34.50 35.66

39. AAI 24.16 29.33 32.66 33.50

40. YI 23.16 30.50 31.00 32.50

41. HA 30.50 32.50 35.66 36.83

42. ZA 34.33 35.66 36.83 39.00

APPENDIX C

RESTING HEART RATE OF THE SUBJECTS

SUBJECT	*T_1 (Pre-test)*	*T_2 (4 wks)*	*T_3 (8 wks)*	*T_4 (12 wks)*
1. AB	*70*	*70*	*60*	*52*
2. KU	*80*	*60*	*68*	*65*
3. IAI	*68*	*66*	*60*	*60*
4. IA	*66*	*66*	*64*	*62*
5. LY	*58*	*60*	*58*	*56*
6. MH	*68*	*65*	*60*	*52*
7. HMH	*72*	*68*	*66*	*62*
8. IS	*70*	*64*	*63*	*60*
9. AI	*82*	*76*	*75*	*70*
10. UU	*72*	*70*	*66*	*62*
11. MA	*60*	*62*	*59*	*60*
12. AH	*64*	*66*	*58*	*52*
13. BI	*62*	*60*	*59*	*56*
14. JMY	*64*	*64*	*62*	*54*
15. ASH	*68*	*68*	*68*	*60*
16. GM	*70*	*70*	*68*	*60*
17. MS	*72*	*70*	*68*	*60*
18. NM	*88*	*76*	*76*	*74*

19. JM	*60*	*58*	*60*	*52*
20. IA	*64*	*66*	*58*	*52*
21. YY	*58*	*60*	*58*	*56*
22. AA	*68*	*60*	*61*	*54*
23. MA	*76*	*64*	*60*	*52*
24. AM	*68*	*68*	*62*	*60*
25. IBJ	*72*	*60*	*56*	*56*
26. MS	*94*	*80*	*80*	*72*
27. MI	*84*	*72*	*70*	*68*
28. JA	*72*	*62*	*59*	*60*
29. HB	*64*	*60*	*56*	*50*
30. YA	*64*	*65*	*60*	*52*
31. SI	*73*	*68*	*62*	*56*
32. JS	*65*	*64*	*60*	*52*
33. MA	*64*	*66*	*58*	*54*
34. DD	*96*	*85*	*74*	*62*
35. AA	*92*	*89*	*70*	*64*
36. MA	*76*	*68*	*68*	*64*
37. DS	*84*	*75*	*68*	*64*
38. BM	*88*	*80*	*76*	*76*

39. AAI	*76*	*69*	*70*	*59*
40. YI	*84*	*80*	*68*	*60*
41. HA	*66*	*64*	*60*	*54*
42. ZA	*56*	*52*	*50*	*50*

Resting heart rate in beats per minute

APPENDIX D

RAW DATA OF RESTING SYSTOLIC PRESSURE OF THE SUBJECTS

SUBJECT	*T_1 (Pre-test)*	*T_2 (4 wks)*	*T_3 (8 wks)*	*T_4 (12 wks)*
1. AB	*120*	*122*	*120*	*120*
2. KU	*110*	*112*	*110*	*110*
3. IAB	*120*	*120*	*120*	*119*
4. IA	*120*	*121*	*120*	*120*
5. LY	*126*	*126*	*124*	*120*
6. MH	*121*	*120*	*120*	*119*
7. HMH	*120*	*120*	*118*	*118*
8. IS	*130*	*130*	*130*	*129*
9. AI	*131*	*130*	*130*	*130*
10. UU	*120*	*120*	*120*	*120*
11. MA	*120*	*119*	*119*	*119*
12. AH	*130*	*130*	*128*	*128*
13. BI	*110*	*110*	*110*	*110*

14.JMY 112 112 110 110

15.ASH 120 122 120 120

16.GM 110 110 110 110

17.MS 120 121 120 120

18.NM 119 120 119 118

19.JM 120 120 120 120

20.IA 112 112 110 110

21.YY 133 132 132 132

22.AA 120 121 120 118

23.MA 120 120 119 119

24.AM 110 110 111 110

25.IBJ 110 110 110 110

26.MS 130 130 128 128

27.MI 110 110 110 110

28.JA 130 130 130 129

29.HB 121 120 120

120

30.YA 112 112 110

110

31.SI 110 110 110

110

32.JS 110 113 111

110

33.MA 122 120 120

120

34.DD 110 110 110

110

35.AA 140 138 138

138

36.MA 130 130 130

129

37.DS 122 120 120

120

38.BM 120 120 120

119

39.AAI 113 111 111

110

40.YI 120 120 119

119

41.HA 130 130 130

129

42.ZA 135 135 135

134

Resting systolic blood pressure in mmHg

APPENDIX E

RAW DATA OF RESTING DIASTOLIC BP OF THE SUBJECTS

SUBJECT	*T_1 (Pre-test)*	*T_2 (4 wks)*	*T_3 (8 wks)*	*T_4 (12 wks)*
1. AB	*80*	*80*	*80*	*79*
2. KU	*70*	*70*	*69*	*69*
3. IAB	*80*	*80*	*80*	*80*
4. IA	*80*	*80*	*80*	*80*
5. LY	*82*	*82*	*80*	*80*
6. MH	*80*	*80*	*79*	*79*
7. HMH	*80*	*80*	*78*	*78*
8. IS	*85*	*85*	*84*	*84*
9. AI	*84*	*84*	*85*	*82*
10. UU	*80*	*79*	*79*	*79*
11. MA	*80*	*80*	*78*	*78*
12. AH	*86*	*86*	*82*	*82*
13. BI	*70*	*70*	*70*	*70*
14. JMY	*71*	*70*	*70*	*70*
15. ASH	*80*	*80*	*80*	*80*
16. GM	*71*	*71*	*71*	*70*
17. MS	*80*	*80*	*80*	*80*
18. NM	*78*	*80*	*80*	*79*

19.JM		*80*		*80*		*80*	
	79						
20.IA	*70*		*71*		*70*		*70*
21.YY	*86*		*86*		*85*		*85*
22.AA	*79*		*79*		*78*		*78*
23.MA		*80*		*80*		*80*	
	79						
24.AM		*70*		*70*		*70*	
	70						
25.IBJ		*71*		*70*		*70*	
	70						
26.MS		*82*		*82*		*80*	
	80						
27.MI	*71*		*71*		*70*		*70*
28.JA	*85*		*85*		*84*		*83*
29.HB		*80*		*80*		*80*	
	79						
30.YA	*71*		*70*		*70*		*70*
31.SI	*70*		*70*		*70*		*70*
32.JS	*70*		*70*		*70*		*70*
33.MA		*81*		*80*		*80*	
	80						
34.DD		*71*		*70*		*70*	
	70						
35.AA	*85*		*85*		*85*		*84*
36.MA		*82*		*82*		*82*	
	80						
37.DS	*78*		*78*		*78*		*76*
38.BM		*80*		*80*		*80*	
	79						

39. AAI 70 71 70 70

40. YI 80 80 80 80

41. HA 82 82 81 81

42. ZA 87 85 85 85

Resting Diastolic blood pressure in mmHg

APPENDIX F

INFORMED CONSENT FORM

DEPARTMENT OF PHYSICAL AND HEALTH EDUCATION

JIGAWA STATE COLLEGE OF EDUCATION, GUMEL

CONSENT FORM FOR PARTICIPATION IN 12 WEEKS JOGGING PROGRAM

I

.....

.....of the department of .....hereby consent to undergo a jogging program of 12 weeks, I hour, three alternate days a week (Tuesday, Thursday, and Saturday) for research purpose. The nature and effects of the program has been duly explained to me by the researcher.

I understand that this activity has been found to have very rare risk factors but a possibility that certain abnormal changes in heart rate or blood pressure may occur, this will be looked out for and avoided by proper supervision.

I am aware that I can withdraw from the program whenever I find that I cannot cope.

I also understand that the information gathered would be confidential and shall be used purely for research purpose and shall not be used for any other purpose without my prior approval.

Name..... sign.....

Date.....

Witness Name..... sign .....

Date.....