EFFECT OF AEROBIC TRAINING ON CARDIO-RESPIRATORY FITNESS OF TUBERCULLSIS PATIENTS

BY

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DECEMBER, 1997

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN EXERCISE AND SPORTS SCIENCE

DEPARTMENT OF PHYSICAL AND HEALTH EDUCATION

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AHMADU BELLO UNIVERSITY,

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DECLARATION

The researcher hereby declares; that this thesis was written by him and that it is a record of his own research work. It has not been submitted in any previous research work for a higher degree. All quotations and sources of information consulted have been duly acknowledge.

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This thesis entittled, "Effect of Aerobic Training on Cardio-respiratory fitness of Tuberculosis Patients;" by Adamu Mundi Ugya meets the regulations governing the award of the degree of Master of Science in Exercise and Sports Science, Ahmadu Bello University, Zaria; and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

To all Nurses, Health Workers, Sports Scientists and all men and women of Goodwill.

ACKNOWLEDGEMENT

Jesus is Lord, may the Grace of God that saw the investigator through the research and that passes all understanding be with all (Amen).

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ABSTRACT

The effect of regular aerobic exercise training programme on cardio-respiratory fitness of tuberculosis patients was the focus of this study. Gomez (1983) found out that about two third 2/3 of all tuberculosis patients survived with drugs and ambulatory treatment. If treatment was started late and victims rested too long, many abnormalities and complications resulted, because tuberculosis destroys the lungs. This gave way to the physical fitness need for tuberculosis patients admitted to the hospitals for months without exercise. When the diseased lungs are not exercised, lungs collapse could occur.

The subjects for the study were tuberculosis patients In ward four (4) of Jos University Teaching Hospital. Out of twenty (20) patients on admission in ward four (1) of JUTH, Five (5) were selected based on their abilities to undergo the test. Permission was sought from the thoracologist, and the thoracic nursing officers incharge of the chest ward four (4) of JUTH for research an all tuberculosis patients

The subjects took part in regular aerobic exercise training on bench step at a prescribed Intensity of 40% - 60% maximal heart rate for 20 - 30 minutesper training session, for three alternate days a week for eight weeks. Measures of body weight, resting heart rate, blood pressure, temperature respiration and physical fitness index were taken:

l Before training commenced

2. Four weeks after commencement of training and

3. at the end of eight weeks.

The data collected were statistically analysed using ANOVA, Scheffe's Test, and t. - test statistics. Based on the results of the analysis, it was found that the body weight, diastolic blood pressure, heart rate, and physical fitness index were statistically significant ($p<0.05$). For body temperate, respiration, and systolic blood pressure were however found to be Insignificant ($p < .05$).

The data from this study show that there was no significant effect of aerobic bench step exerciseon systolic blood pressure, and respiration of pulmonary tuberculosis patients. However, it waw observed that eight weeks aerobic training on bench step significantly improved the cardio-respiratory fitness of the tuber-culosis patients as supported by a decline in heart rate, diastolic blood pressure, and increase in physical fitness index.

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CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

The field of exercise and sports science has been expanding very rapidly from mere understanding of the reactions and response of human body to designing new techniques of enhancing its immune response to diverse stimuli (Mackinnon, 1992). In other words, unprecedented progress has been made in this field, not only in making it a more reliable prophylactic discipline but also in making it an acceptable profession of rehabilitation. In this rapid progress, one of the most exciting areas that attracted the attention of its scientists is the immune response of trained as against untrained subjects to exercise and exercise training.

This unprecedented interest and progress, the prophylactic and curative aspects of exercise and sports sciences has been attributed to two primary reasons. Firstly, the primary, secondary and tertiary consumers of sports are interested in maintaining the health of atheletes during training and after the competitions. Venkateswarlu, 1996, explained that athletes are more susceptitable to illness during intense training and major competitions that effects their ability to training

as well as their health, especially when train or compete during illness.

Secondly, the increasing interest in community health promotions to regular participation in exercise programme has drawn the attention to the immunological responses to exercise test. This has an added advantage in the field of rehabilitation, where the interest of the allied health professions is to make the ambulatory patients, a bread winner to the family, by improving his ability to do gainful work. (Mackinnon, 1992; Venkateswarlu 1996).

This view is based on the fact that systematic and moderate exercises performed on a regular basis constitute an important factor in the prevention and cure of different degenerative and debilitating like cardiac insufficiency, artherosclerosis, hypertension, non-insuline dependent diabetes, asteoporosis, and tuberculosis. At present such focus is directed towards other diseases that are associated with life factors like cancer and Acquired Immune difficiency syndrome (AIDS).

Exercise training is now recognized as an urgent therapy for certain diseases, primary to counter-act the debilitating responses to illness and treatment, and to improve the psycho-biological state of the patient. The earlier investigation in this direction revealed significant relationship between intense exercise and susceptibility to illness (Bailui, 1925; Cowles, 1918; Nichonles, Spaeth, 1922; Oppenheimer and spaeth, 1922). Thirty years later, Horstmenn, (1950), reported a significant positive association between the severity of acute poliomylitis and intensive exercise. This early stimulate the research activity on the haemotological responses to different modes of on the incidences of upper respiratory illness among athletes tend to support the view that athletes in prolonged and high intensive training and competitions are more susceptible to this illness than those exposed to Low intensive volume of exercise with Low intensity (Neiman, 1989; 1992; Peter and Bateman, 1993).

However athletes engaged in less strenous training and low intense competition don't seem to be prone to this susceptible illness than that of non-training counterparts. This study also suggest that low intese exercise improves recovery rate and functional capacity of the patient.

This investigation was conducted to find out whether exercise training can produce beneficial effects in tuberculosis patients.

Tuberculosis is mostly a disease of the lungs. It affects joints bones, intestines, brain and other parts of the body. Extra-pulmonary tuberculosis affects other organs of the body outside the lungs. Tuberculosis is commonly called Cox, that is named after the discoverer. Tuberculosis is the infection of the lungs joints, spine, brain, intestines, and other parts of the body by the organism called tuberculosis bacilli.

Patients with tuberculosis are often isolated and given chemotherapy in the form of antibiotics and anti- tuberculosis drugs. Patients are encouraged to rest for a considerable period of time. The purpose is to reduce the stress on the lungs which are diseased.

The lungs are essential organs for sustaining life as they are responsible for oxygen intake and carbon-dioxide elimination of the body. The tuberculosis patients, though encouraged to rest still make use of the lungs with minimal stress. However, it is not clear whether structured aerobic exercise programme affect the rate of recovery from the deadly disease, tuberculosis.

In this situation the patients with prounced tuberculosis are generally admitted for about eight months or more and kept on anti-tuberculosis drugs for about eighteen months. During this period of treatment in the hospital, no exercise programme is engaged on. Rest has been the predominant treatment.

Primo (1993) associated most respiratory disease drugs to enhance work and exercise performance. That is why many patients suffering from asthma, and victims of cattarh, when given their treatment just before exercise show in their urine traces of dope drugs. This suggests that if patients engaged in exercise as they take their drugs, they will recover faster.

Any physical educator who comes across a tuberculosis patient may say exercise may be countra-indicated since all exercise involve the lungs which are already diseased. It was observed by Parker (1988) that when a tuberculosis patient was advised to have complete rest, the organ mostly concerned which are lungs were not rested. This is because one must continue to breath so as to get air despite the injury to the lungs. Moreover, the moment the lungs stop to work, life ceases. That is why there is the need to stress

the concern for exercise in tuberculosis patients to save the patient from disuse and depletion of the body.

Parker (1988) treated tuberculosis patients at home and in some infectious disease hospital (IDH). The segregated patients isolated from their house hold contacts had marked weight loss due to fear, loneliness and inactivity, while those at home recovered fast with rapid resumption to their normal life. This was the effect of active participattion method of treatment and chemotherapy. Active life as confirmed above reduces frequent cough; and infectivity in patients with pulmonary tuberculosis. The number of tuberculosis particles nucled declined rapidly following treatment with exercise and drugs than with drugs and rest (Parker, 1988). The cough rapidly diappeared. There was also a decline in malaise, fever, cough, and bacilli count in sputum smear. These indications occured within two weeks after the start of drugs and exercise treatment. Exercise should be done under the sun and exposed airy area since rays from the sum kill tubercule bacillus organism and reduce the struggle for air (oxygen) between the patient and the bacteria. It is worth noting that tuberculosis organism uses oxygen as man and is fifty percent waxy. That is why it affects the uppermost part of the lungs

more than any other area. On the basis of these findings and suggestings, this study was conducted to find out the effect of exercise training on cardio-respiratory fitness of tuberculosis patients.

1.2 STATEMENT OF THE PROBLEM

Medical opinion has been inconsistent about the engagement of patients suffering from tuberculosis and other respiratory disorders in aerobic exercise training (Loudon, 1969). This investigator was therefore interested to find out the effect of aerobic exercise training on cardio-respiratory fitness as determined by bench step exercise, resting heart rate response, number of bench step per minute, physical fitness index, thermal responses to exercise and blood pressure.

Cardio-respiratory fitness was tested to find out if participation in exercise training could improve the capacity of tuberculosis patient to work. Body temperature and blood pressure were tested to find out their adaptability of tuberculosis patient to exercise training.

1.3 PURPOSE OF THE STUDY

The purpose of this study were to determine the effects of exercis on patients of pulmonary tuberculosis undergoing chemotherapy in their recovery from tuberculosis as indicated by the cardio-respiratory frequenby and body weight. Distinctively from this study we shall find out if exercise enhanced anti-tuberculosis drugs.

It is therefore the intention of this researcher to enlighten reseachers on the new awarness and the magnitude of problems facing tuberculosis patients and the result of the evaluation will help in the solution to the research problem, then suggest unlimited prospects in ambulatory treatment of tuberculosis.

1.4 BASIC ASSUMPTIONS

Based on the available information, this investigation was conducted on the following assumptions:

Blood haemoglobin count, new lung tissues and period of discharge from hospital of tuberculosis patients would differ significantly as a result of regular aerobic bench stepping exercise due to the gains in physical fitness index.

Responses to drugs received for the treatment of tuberculosis would be enhanced by regular exercise, bringing about quick recovery and early resumption to normal working life.

1.5 HYPOTHESIS

On the basis of the assumption of this study and available research evidence, the following major hypothesis was made for the purpose of this study:

(A) There are no significant effect of training bench stepping exercise on patients of tuberculosis in their cardio-respiratory fitness, blood pressure, and body weight.

From this major hypothesis the following sub-hypotheses were generated:

1.5.1 There is no significant effect of training in bench stepping exercise on heart rate, number of bench step, and physical fitness index.

1.5.2 There is no significant effect of bench stepping exercise training on blood pressure, body temperature, and respiratory frequency of tuberculosis patients.

1.5.3 There is no significant effect of bench stepping exercise training on body weight of tuberculosis patients.

(B) MAJOR HYPOTHESIS TWO:

There is no significant change in the direction of the effect of eight weeks training in bench stepping exercise on cardio-respiratory fitness, blood pressure, body temperature and body weight of patients of pulmonary tuberculosis.

The following sub-hypothesis were generated:

1.5.4 There is no significant change in the bench step exercise on cardio-respieratory fitness of tuberculosis patients as indicated by changes in resting heart rate and physical fitness index.

1.5.5 There is no significant change in the direction and magnitude of the effect of eight week training in bench step exercise on diastolic blood pressure of tuberculosis patients.

1.5.6 There is no significant change in the direction and magnitude of the effect of eight week training in bench step exercise on body weight of tuberculosis patients.

1.6 SIGNIFICANCE OF THE STUDY

This study is justified on the following basis:

(1) Medical opinions and scientific evidences have been inconsistent on the prophylactic and curative effects of aerobic training, through some studies suggested beneficial effect of aerobic training on patients suffering from hypertension and diabetes no such evidence has been reported to the knowledge of this investigator on patients suffering from tuberculosis. As this study was conducted to find out the effects of bench stepping exercise on cardio respiratory fitness, body weight, thermal response, and blood pressure. It-s findings would have immense value for the understanding of the effects of aerobic training on the working capacity and recovery of tuberculosis patients.

(2) One of the main problems associated with improvement of tuberculosis patients in given exercise training programme is to understand their adaptive capacity for the training. As this study involved the measurement of thermal response to exercise, blood pressure and respiratory frequency on patients who underwent an eight week programme of bench stepping exercise training. This finding would reveal whether patients suffering from pulmonary tuberculosis can adapt to an aerobic exercise training programme.

(3) Another of the controversial issues in the treatment of tuberculosis patient is the effect of therapy on the regenerative effects of the cells and tissues. As exercise training was used as an adjunctive therapy in this study. The findings would reveal whether the regenerative capacity of the tissues affected by pulmonary tuberculosis, as indicated by changes in body weight, would improve due to aerobic training.

1.7 DELIMITATION

This study was delimited to the following:

This study was conducted to find out the effect of eight weeks bench stepping exercise on cardio-respiratory endurance, blood pressure, thermal, response, respiratory frequency and body weight of patients of pulmonary tuberculosis.

The subjects for this study were selected from Jos University Teaching Hospital, who were on chemo-therapy. They all led sedentary life style before admission into the hospital.

1.8 LIMITATIONS

The study has the following limitations which will be considered while interpreting the results:

(1) One of the most important factors affecting recovery of patients suffering from any disease is diet. As the diets of the patients selected for this study were prepared at home. However, every possible attempts was made to convince the subjects on the importance of diet for their recovery.

(2) The subjects used in the study were directly under the control of the medical doctor incharge of the tuberculosis ward, therefore, the investigator did not have direct control of the activities of the subjects. However, he sought the co-operation of the concerned doctors and nurses to control the movement of the subjects so that the results of this study were not affected.

(3) After starting the study, the nurses in the hospital from which the subjects were selected went on strike during which period, the subjects were discharged from the hospital and therefore the training was discontinued. However immediately after three weeks of this strike period, when the nurses resumed their duties, the exercise training was conducted on the patients continuously for eight weeks. Therefore it was assumed that the possible effects of one week training given before the strike action on the cardio-respiratory fitness and body weight of the subjects were normalized during the three weeks strike period, and thus had no influence on the effect of subsequent eight weeks training.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

2.1 INTRODUCTION TO LITERATURE REVIEW

Annabel (1993) accentuated that in developing countries, like Nigeria, tuberculosis is one of the communicable disease that could be treated with drugs and ambulative exercise. There is no evidence that incidence of tuberculosis is declining. Even in America, Germany, and Great Britain, the incidence of extra-pulmonary tuberculosis remains constant, often presented in unexpected ways. In an attempt to bring to light the information related to the incidence, spread, and cure of tuberculosis, available textbook literature, research evidence, and exercise protocols on different aspects of tuberculosis have been reviewed and presented in this chapter under the following sub-titles:

(a) How tuberculosis is contracted
(b) Patho-physiology of tuberculosis
(c) Signs and symptoms of tuberculosis
(d) Diagnostic tests for tuber culosis
(e) Treatment and management of tuberculosis
(f) Prevention of tuberculosis
(g) Side-effects of anti-tuberculosis drugs and their effects on exercise performance.

(h) Exercise prescription for tuberculosis patients

(i) Current trends in Bench stepping exercise for tuberculosis patients.

(j) Breathing exercises for tuberculosis patients

(k) Precautions during exercise for the tuberculosis patients.

(1) Summary:

2.2 HOW TUBERCULOSIS IS CONTACTED

Tuberculosis is a disease acquired by inhalation of infected droplet nuclei from sputum of persons with active cavitory tuberculosis. Personal contact with large number of bacilli are necessary for infection to take place. Most patients cease being within several weeks after treatment is started with drugs, even though smears and cultures of the patient's wastes for tuberculosis bacilli remain positive. This is the period when sports scientist can approach the patient safely to introduce exercise programme.

Tuberculosis infected patients are indicated by a positive skin test, x-ray of the chest, findings from the history, and signs or symptoms. Loudon (1969) showed that all persons are highly susceptible to infection of tuberculosis, but relatively resistant in varied degrees.

If exercise is engaged in regularly it raise the body's resistance level to tuberculosis, (Loudon, 1969). Tuberculosis is common in infancy and old age due to week body's defences.

The severity of tuberculosis as explained by Crofton (1992), depends on the size of infecting micro organism quantity (dose), that is, how many tubercle bacilli are inhaled; and the infestation depends on the body's defence mechanism of the person infected, that is, host's resistance. Tubercle bacilli are of two main types: the human mycobacterium tuberculosis and the cow mycobacterium bovine (Cow). The human type is contacted usually through inhalation, whereas, the bovine type is ingested from untreated cow milk. It is commonly observed that some people suck milk directly from animals, making them prone to tuberculosis. To prevent this urgly incidence, cow milk must be boiled before drinking.

Hugh (1990) observed that tuberculosis organism thrives under poor socio-economic conditions, which bring about over-crowdedness, poor ventilation in houses and poor diet. All these facilitate the transmission of the disease. The closer the contact

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with infected person the higher the risk of infection with tuberculosis.

Jengenta (1986) observed that some people could get tuberculosis (Cox) through feeding equipment, like cups, spoons, and from dust. The tubercule bacilli could remain enveloped in cracks, in dried sputum, saliva, vomitus, faeces or urine of the victim. At the rise of dust and inhaled by any person infection results.

Croften (1992) and Jentgenta (1986) agreed that immuno-suppression from any cause, be it debilitating diseases, mal-nutrition (under feeding), increased tobacco and alcohol consumption, lack of B.C&G. to stimulate immunity, steroid therapy or acute intercurrent infection, could increase the risk of tuberculosis, since it lowers the body's resistance.

2.3 PATHO-PHYSIOLOGY OF TUBERCULOSIS

There is a continual turnover of the components of connective tissue breakdown and replacement, and by organisation of the attachments of the various components. The connective tissue of the lungs provides the connection between all cells and those around them.

The alveoli, as explained by Crofton (1992), are made of reticuli and collagen which are elastic and enables repairs. There is considerable information regarding the rapid response to alveoli connective tissue in areas where trauma has occured, for example tuberculosis cavity in the lungs, Newly formed collagen fibres are abundant around prolifering fibroblasts within five days of exercise. Recent studies by Horne (1992) and Fred (1993) indicated that in exercise, small percentage of collagen is turned over rapidly while the remainder of the collagen fibres showed a very slow rate of metabolic change due to lack of exercise. Weight increase therefore is indication of new tissue development tuberculosis patients.

When a patient is infected with tuberculosis, the host macrophage activation is started (that is, body's oxygen. Jentgenta (1986) explained that the organism can remain dormant for many years before reactivation again; if the body's defence becomes low. He also stated that the bacillus has 50% waxy covering, making it resistant to drugs.

As Gomez (1982) puts it, a person infected with tuberculosis has a lesion from slow inflammation at site of infection and the regional lymph-glands. The lymphocytes and other cells surrounding the

infected area form small swelling called tubercle (Primary Complex or Langhan's Giant Cell). A tubercle is a gray translucent lession which is short and thick, produced by tubercle bacilli. The tubercle consists of dead cells and tissues which are cheese - like in appearance, surrounded by phargocytic (scavenger) cells. This liquid necrosis is called caseation (Gomez, 1982).

Gomez)(1982) and Jentgenta (1986) further explained that when the tubercle erodes its wall and splashes out to the walls of a bronchus it will result in exudations, bleeding and coughing out of blood and so on, leaving the wounds (lesions) affecting a lobe or a segment of lungs. When tubercle bacilli enters the blood, it moves to the brain to cause maningitis military. Military is a tubercle resembling a millet seed in the brain or blood. Patients may have severe lung damage and the residual cavities become the seat of aspergillus fungus infection. This later results in lung aspergilloma, which is a ball like material of fungus within the cavity, which may give rise to fever and recurrent haemoptysis (coughing out of blood).

Obioma (1991) tried to answer why some people suffer repeatedly from tuberculosis infection while others are free from tuberculosis. The answer given was that it was due to interaction between the people, infectious agents and the environment. The host persons are poor, with low body defence and poor food. Agents of infection are viruses, bacteria, fungi and parasitic worms. The environment including the families, schools, smokers, drunkerds and cold weather.

2.4 SIGNS AND SYMPTOMS (IDENTIFICATION) OF TUBERCULOSIS

Tuberculosis is normally associated with physical signs in which patient may be obviously ill. He becomes very thin, with loss of weight. The tuberculosis patient may be pale or have a flush due to fever. The fever becomes more severe in the evening. Pulse is raised in proportion to fever. Finger clubbing occurs due to extensive lung disease and Iron loss through coughing off of blood. Chest has fine crepitations (Crackles) in upper part of lungs during deep breath after coughing. There is dullness with localized wheeze due to local tuberculosis bronchitis and pressure by a lymph node on a bronchus. With fibrosis (scarring), the trachea or the heart may be pulled

over to one side (annabel, 1993).

Many victims of tuberculosis fail to go to the hospital early due to the taboo that "Fuka" which is tuberculosis is to be hidden, since the exposed victim is considered as an outcast. The patient uses silently at home certain concoctions from native doctors without any improvement, acute coughing out of blood makes the tuberculosis patients run to the hospital. The mouth becomes filled with sputum. There is cough, fatigue and loss of appettite, usually as a result of active body defence mechanism. Marked wasting (weight loss), anaemia, mal-nutrition, clubbed fingers, and others may be due to the effusion or blood and serum from the lungs to other areas. Other causes are escape of excess sputum and vomitus, excess perspiration with sweating, and to a large extent struggle between the body cells and bacilli to share the air (oxygen).

The tubercule bacilli and human body cells all use oxygen and carbohydrate (Hugh, 1990). Tuberculosis patients develop high temperature in the evenings and sweat profusely at nights. According to Gomez (1982), ladies develop irregular periods and male patients potency is drastically reduced; breathing difficulties

result and one can easily die of toxicity and exhaustion.

2.5 COMPLICATION OF TUBERCULOSIS

Untreated or poorly treated pulmonary tuberculosis leads to coughing out of blood (haemoptysis). In all severe cases, the coughing out of blood is in large amount, leading to anaemia, and spontaneous pneumothorax (collapse of the lung through damages caused by tuberculosis organism).

Gomez (1982) and Nen (1988) explained that there is pleural effusion which is fluid in the covering sack of the lungs which soon causes the collapse of lungs, cardio-respiratory insufficiency (heart and lungs diseases) results in co-pulmonale. Bronchiectasis, fibrosis of the lungs are the consequences of extensive tuberculosis diseases and only symptomatic therapy is possible.

2.6 DIAGNOSTIC TESTS FOR TUBERCULOSIS

Bloom and Toohey (1991), explained that all suspected pulmonary tuberculosis patients must be sent for sputum culture and microscopy. The urine is also checked for tuberculosis bacilli. Skin test must be done to measure the hypersensitivity to tubercule protein. Tuberculin Mantoux test is a purified protein derived from attenuated tubercle bacilli organism. The tuberculin is injected under skin. For those who have not previously been injected, a red raised area appears at site of injections. This is tuberculin positive. For those who do not react in this way are tuberculin negative. This means that the injection site has no localized area of unduration of five millimeter eruption found forty-eight (48) hours after testing. These patients on admission are tested positive to the bacilli.

B.C.G. (Bacillus Calmette - Guerin) Vaccine is a freezed, dried, attenuated, harmless, live bovine strain tubercule bacilli given in 0.1ml to those found to be tuberculin negative risk or children newly born to protect them from infection for 15 years.

Another method of detection of tuberculosis is through mass x-ray film that shows a "snow storm" appearance which indicates destruction of lungs by tuberculosis.

2.7 TREATMENT, MANAGEMENT AND PREVENTION OF TUBERCULOSIS

Bloom and Toohey (1991) stressed that tuberculosis is curable provided the diagnosis is made early, and appropriate therapy instituted. For those who fail to exercise, rest enough and who have poor diet, or those who live in dirty environment have poor tuberculosis prognosis. It was also found by Bloom (1991) that stress, worry, and very light clothing during cold periods predisposes one to tuberculosis.

Pearce (1988) emphasized that nearly all of us have had tuberculosis infection without symptoms or obvious illness, and the immunity acquired protects. Moderate exercise or ambulation was found to support the normal function of lungs, exercise therapy reduces internal tension during impaired health, bringing about energy for healing. She recommended that tuberculosis patient should continue their chemotherapy (drugs), and are adviced that the use of Isoniazid (INH), Para - Amino - Salicylic Acid (PAS), streptomycin,

Rifampamycin, Pyrazinamide and ethambutol which are anti-tuberculosis drungs should be importantly continued. These drugs are used in combinations, because tubercle bacilli organism easily grows resistant to drugs due to their hard lipid cell cover. The treatment with drugs must continue without break for eighteen (18) months.

Jentgenta (1986) used anti-tuberculosis drugs on tuberculosis patients in order to control the infection and to avoid the later development of tuberculosis elsewhere in the body. Corticosteroids administered to patients with tuberculosis is in order to minimize the risk of adhesions and for the improvement of healing.

Bronchuscopy is a treatment used to aspirate (suck out) the material discharges from the lungs or bronchus. The last method is thoracotomy, which is the surgical intervention where by certain parts of the lungs are removed to prevent the spreading of infection.

PREVENTION OF TUBERCULOSIS

Relapse of further tuberculosis Infection was found uncommon in patients who have good periods of chemotherapy and ambulatory exercise and no relapse for those who had less contact with persons or materials (formltes). That is why Jindani et al. (1995) affirmed that sending tuberculosis patients to a sea-side exercise for * fresh air and sum bath hastened recovery. Adequate diets are important for faster tissue growth. They also advocated that exercise should be engaged in so as to cut wasting due to disuse. Such exercise should be'fcwwpc where it is well ventilated with enough fresh airt and patients wearing light clothing only during exercise*

Campbell (1988) maintained that rest for tuberculosis patients is important. He later advised that a graduated re-education of gradual return to outdoor exercise would be helpful in recovery. Further, he explained that the rise in body temperature above the normal during exercise destroys tuberculosis bacteria. If the tuberculosis patient is allowed to move around (ambulation) or run about, he

will be likely to cough out the material exudating or oozing from the lymph glands into the bronchus, which may also encourage postural coughing out.

Rose (1987) and Campbell (1988) are of the view that teaching resistive breathing to the tuberculosis patient makes the diaphragm breath deeper and shift over-dependence on intercoastal muscles for breathing.

Hugh (1984) believed that prevention is the best treatment for tuberculosis and recommended some preventive measures to include improved living standard, health and environmental education, identification of tuberculosis patients and isolation. Increased milk diet helps to increase body's resistance to tuberculosis. Immunization, using B.C.G. vaccination is essential. During therapy, tuberculosis patients should be informed about the side-effects of anti-tuberculosis drugs and dangers of stopping the drugs before the full course of eighteen (18) months. There is need for regular follow-up to chest clinic. Regular blood count, urine analysis and observation of vital signs are other areas of concern.

2.7.1 SIDE EFFECTS OF ANTI-TUBERCULOSIS DRUGS AND THEIR EFFECTS ON EXERCISE.

Side effects of anti-tuberculosis drugs could be minor or major with serious health hazards. Jentgenta (1986) affirmed that anti-tuberculosis drugs have discomfort. This discomfort could persist for the duration of drug therapy. This has a significant effect on the working or exercising capacity of tuberculosis patients.

CORTICOIDS

These drugs are derived from adreanalin. Such drugs are prednisolone, ephedrine, and others. During exercise, these drugs increase heart beat and are anabolic in origin, which enhance performance in exercise. The aceeleration of the functions of the body are vital in diseased lung recovery.

ETHAMBUTOL

The side effect of this drug is the impairment of vision, a decrease in visual acuity, blurred vision and red colour blindness. These ocular toxicity affects balance, thereby affecting exercise.

ISONIAZID (INH)

The side-effects of the drug that affect exercise performance are muscle pains, confusion and dizziness.

PARA-AMINO- SALICYLIC ACID (PAS)

This has the side effect of thyroid suppression and hypotassemia (Low Potassium (K^+) in the blood). These side effects affect heart to rest for longer periods in diastole, which affects exercise performance.

2.8 EXERCISE PRESCRIPTION FOR TUBERCULOSIS PATIENTS

Jindani et al (1993) believes that "Fresh air" treatment is the best for treating respiratory diseases, especially tuberculosis. Proper ventilation of the living rooms, exercising in fresh air and sun-bath would assist the lungs take more oxygen. This is because tuberculosis organism is also aerobic in nature, competing to use the air in the body.

Lea (1980) suggests that tuberculosis patients, who are known to suffer from cardio-respiratory diseases may be allowed to participate in category 'E' exercise. The category 'E' exercise involves bench stepping at low intensity, exercising on bicycle argometer, long walks low grade tred mill and other mild exercises. This grade of exercises are for those patients who are physically active persons and stable with tuberculosis for one to three months in the chest ward of hospital or out patient department, which is

to say that they don't show any signs of coughing, haemoptysis (bloody sputum); noctunal pyrexia (night fever), exercise weight loss and severe chest pains.

2.9 CURRENT TRENTS IN BENCH STEPPING AND TUBERCULOSIS

Braucha and Darling (1942) must be credited for having started the Harvard Fitness Laboratory in Harvard University. They developed what has come to be know as the Harvard step Test (HST) which the recovery pulse count is used to determine indices of physical fitness. Harvard step test was modified from Master's Nine inches step test of 1914 as recorded in Encyclopedia Britanica (1990). When one runs, he lifts up his legs (high knees) reaching nine inches and above.

In Harvard step test the subject steps up and down a twenty inche high bench, thirty times a minutes in tune with a metronome, for a maximum of five minute. The subject is allowed to lead off with either foot and to change the step if he wishes to do so. Immediately after the exercise, the subject is sitted and his pulse rate is recorded in beats; in one to one and a half, two to two and a half, and three to three and a half minutes, after the exercise.

...Library, ...llo University, Nigeria.

The fitness index of the subject is calculated by using the following formula:-

$$\text{Physical fitness index} = \frac{\text{Duration of exercise}}{\text{Two x sum of three half minutes of count.}} \times 100$$

In this test, the lower the number of heart beats during the recovery, and the longer the work time, the higher the score (Johnson et al, 1990). Though there are different versions of Harvard step test, the investigator used the test described above with the exception that only one pulse count was used, that is, from one to one and half minutes after exercise, was used. The pulse count thus recorded was to determine physical fitness index by using the following formula:

$$\text{P.F.I.} = \frac{\text{DURATION OF EXERCISE IN SECONDS}}{\text{Recovery pulse x 5.6.}} \times 100$$

This Harvard step test was not used by tuberculosis patients before as to the knowledge of this investigator or on subjects suffering from infections diseases. Most of the previous studies were on body dysfunctions, not as a result of direct micro-organism, such as tubercle bacilli, but as a result of life style. Common examples of such infirmities and disabilities are hypertension, obesity, diabetes, haemophiliasis, sickle cell and coronary heart disease.

According to Guyton (1970) the human body is made of seventy-five (75) trillion cells. The brain cells are fragile. Once they die, they will remain functionless but not decayed; mostly their work or functions may be taken up by those cells around the dead brain cells. But certain organs increase in size and reproduce (growth and development) to replace the damaged ones. Example given by Guyton (1970) was that the liver cells can regenerate the dead or weaker cells. This is in line with the concept according to which exercise helps regerate new vigor. This is because liver (the largest organ in the body) is vital in meeting energy requirement in providing body's resistance to infection and in providing better blood nourishment to brain and muscle cells for vigorous activities. Exercise in tuberculosis patients improves blood flow to the brain and the injured lungs, sending vital materials to all tissues.

Spencer (1987) explained that exercise hastens the passage of blood lymphocytes from blood stream onto lymph nodes faster, that makes it possible to have cellular immunity and white blood cells migrate to foreign antigens as tuberculosis lesions.

Exercise activates cells (immunoblasts) into plasma cells (immunocytes) and secrete immunoglobulins by lymphocytes (immune process).

2.10 BREATHING EXERCISE IN TUBERCULOSIS PATIENTS

Donna (1978) threw light on the need to teach breathing exercise to tuberculosis patients. Increased work out put increases breathing. Breathing exercise increases work output tolerance and relaxation. Tachypnea is the increased frequency observed in breathing exercise. He advised that any person with chest pains, asthma, gas in stomach (flatulence), peptic ulcer, indigestion, tuberculosis and others should be involved in either active or passive exercise for treatment. A tuberculosis patient in stepping will increase his work output and work output tolerance increases breathing.

2.11 PRECUATIONS IN BENCH STEPPING AND BREATHING EXERCISE OF TUBERCULOSIS PATIENTS.

Donna (1975) and Bailey (1192) suggested some precuations to be taken during breathing exercise and bench stepping of tuberculosis patients. These include the following:-

i) There should be no forced expiration during exercise so as to prevent airway collapse in tuberculosis patients.

ii) No prolonged expiration should be encouraged since the mycobactarium tuberculosis organism tries to squeeze every bit of air from the lungs for use, depriving the body of exygen resulting to gasping.

iii) There should be no trunk hyper-extending to the back so as to push abdomen out, because abdominal respiration assists the diseased lungs in respiration.

iv) Bloating out lower abdomen excessively should be avoided, this is because high pressure is created in the chest causing the week diseased lungs to collapse.

v) The upper chest should be relaxed (not to be over used) by rhythmic arm movements.

vi) Concentrate on breathing should be for only short periods to avoid hyperventilation. Hyperventilation is noticed by dizziness and tingling in the fingers.

2.12 SUMMARY OF LITERATURE REVIEW

If the tuberculosis patients have been smoking for very many years, the periods taken to exercise will make them give up smoking, reduce their incidence of tuberculosis and make them healthy.

The tuberculosis patient who moves around gets satisfaction from treatment with drugs and exercise and will have several solutions to his problems than the dormant and inactive patient. Certain combinations of rest, exercise and drugs may indicate that exercise will be less difficult. Those who walk around and exercise have reduction of negative feelings.

With exercise training new cells are produced to replace the dead and damaged cells so as to maintain the seventy-five (75) trillion in the human body. Isoniazid causes confusion, restlessess and discrien-tation, while para- Amino - Salicylic Acid causes depression and affects potassium metablism of the heart. All these affect exercising patients. Tuberculosis patients should try to exercise, but follow less hazardous substitute, and try to cut over resting.

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CHAPTER THREE

3. METHODOLOGY

3.1 INTRODUCTION

The purpose of this study was to find out the effect of training in bench stepping exercise on cardio-respiratory endurance of tuberculosis patients. The research design, the subjects, the instruments, the tests, the training protocol and the statistical techniques used to achieve this purpose are described in this chapter.

3.2 RESEARCH DESIGN

As the purpose of the study was to find out the effect of eight (8) weeks aerobic training on cardio-respiratory endurance of tuberculosis patients, a single group pre-test, post-test research design was used. In this design, five asymptomatic patients of pulmonary tuberculosis were selected purposefully by the medical doctor to serve as subjects in the study. Resting heart rate, blood pressure, body temperature, and body weight of the subjects thus selected were recorded. After this initial test the bench stepping exercise was conducted on the subjects; from which physical fitness index of the subjects were determined.

After this initial test, the subjects were given training in bench stepping exercise on alternate days (Mondays, Wednesday, and Friday) for training the above measurements of the subjects were taken. These test were then repeated at the end of eight weeks period of training in bench stepping exercise. The data thus collected were statistically analysed to test the hypothesis of this study.

3.3 POPULATION

The population for this study comprised of in-patients, suffering from tuberculosis bacilli infection of Jos University Teaching Hospital. These patients were suffering from pulmonary tuberculosis.

3.4 THE SAMPLE

Purposeful sampling technique was used in selecting the subjects for this study. A total of five subjects were selected by the medical Waker and the subjects were suffering from pulmonary tuberculosis on the basis of asymptomatic state of the disease. They did not have any symptoms of coughing out of blood, or noctunal pyrexia (night fever), but were on regular anti-tuberculosis medications.

The subjects thus selected were requested by the investigator to give their consent to participate in this study; the purpose of which was explained to them. They were all leading a sedentary life style before hospitalization and were between the ages of eighteen (18) and thirty (30) years. They did not have any contra-in-dications of swollen lymph nodes, haemothorax, fever with exercise sweathing and severe coughing out blood in this study.

3.5 TRAINING PROTOCOL

The training consisted of bench stepping exercise for a total period of twenty (20) minutes, inter-sparsed with two minutes of rest after every five minutes of bench stepping exercise. On the first training session, the investigator demonstrated the exercise to the subjects, after which the subjects performed the exercise. In every training session five minutes of warming up, consisting of walking around the area, was done by each subject before they exercised. This exercise was repeated every week on alternate days (Monday, Wednesday, and Friday) for Eight weeks.

3.5.1 BENCH STEPPING EXERCISE

This exercise consisted of taking the right foot onto the top of the bench at the count one. As the right foot is stabilized by straightening on the bench by the side of the right foot on the count-Two. As both legs are straightened on the top of the bench the right foot is brought back to the starting position on the floor on count three, which is followed by the return of the left foot to the starting position on count four. The subjects completed one cycle of stepping up and down in two to four seconds.

This exercise is performed in four stages. In the first stage, the subject completed twenty-four(24) to thirty (30) circles of stepping up and down the bench per minute for the period of five minutes, after which the subject was to rest in sitting position for two (2) minutes. After the first two (2) minutes rest period, the second stage of the exercise commenced; in which the subjects repeated the exercise for five minutes, immediately after they rested for two (2) minutes in sitting position. This was followed by third stage in which the subjects repeated the exercise for another five minutes.

Immediately after five minutes exercise they rested for another 2 minutes in sitting position, after which the stage four commenced; in which the subject repeated the whole procedure.

Thus, the subjects performed the bench stepping exercise in four stages in each training session for a total periods of twenty minutes inter-sparsed with a two minutes rest period after every five minutes of exercise. Thus each training session consisted of twenty minutes of bench stepping exercise and eight minutes of rest.

3.5.2 TRAINING INTENSITY

As the subjects were patients of pulmonary tuberculosis they could not initially complete one cycle of stepping up and down the bench in three seconds. However, as they progressed in training, they could improve this intensity to two seconds per circle and towards the later of the training period to one second per circle.

3.6 MEASUREMENTS AND TESTS

Some subjects when asked agreed that pains occured in the leg muscles and that they ate well and slept well. Vivid measures were made on pulse rate, blood pressure and respiratory frequeences, if they returned to normal after exercise.

3.6.1 BODY WEIGHT

To measure this variable, the subjects were instructed to remove their shoes, as suggested by Sharkey (1978). This was done during each testing session.

3.6.2 RESPIRATORY FREQUENCY

Respiratory rate was observed on patients by checking the pulmonary ventilation of inspiration and expiration. The researcher noted the rate, the character of depth and regularity. The researcher also noted as well any respiratory discomfort which might be apparent. To prevent voluntary respiratory control by the subjects, the investigator counted the inspiration and expiration when the subject was not aware by pretending to count the pulse with hands on the redial pulse, while in reality, respiratory rate was counted

3.6.3 PULSE RATE

Pulse rate is a measure of the heart beats (Pears, (1980). The radial pulse was commonly used. But the investigator used the carotid pulse. The investigator took the pulse rate by placing the third and fourth fingers over the subjects' carotid artery by the angle of the neck. The thumb was not used because it has pulse sensation. The researcher's fingers did not compress the carotid to cut off blood supply to the brain. The pulse rate was taken by employing a protocol of considering pulse rate for the next fifteen seconds which was multiplied by four to get the pulse rate in beats per minute. In every test, the pulse rate was recorded after the subject rested for about five minutes to avoid the influence of walking to the testing center.

3.6.4 BODY TEMPERATURE

The normal skin or body temperature is thirty seven degrees (37^{o}c) Celsius or 98.4 degrees Ferrenheit. The subject's temperature was taken by means of clinical thermometer, which was placed between the skin folds of the axilla (armpit) for

two minutes. This was in line with Bell (1975), who used exercise temperature of subjects by measuring with mercury thermometer, which was first shaken down forcefully before it was inserted into armpit for two minutes, after keeping the armpit dry. The temperature was recorded in degrees centigrade (Celsius).

3.6.5 BLOOD PRESSURES

To measure blood pressure an external pressure was applied, as suggested by Guyton (1971), around the upper arm by using a Cuff with rubber tube to the gauge of sphyg-momanometer in which Mercury was contained. The stethoscope was placed on brachial pulse as the inflator was released slowly to deflate the Cuff. The first sound the investigator heard was recorded as systolic and the last sound as diastolic. All values obtained were recorded in millimeters Mercury (mm Hg).

3.6.6 PHYSICAL FITNESS INDEX

Bench stepping exercise was used by More house and Miller (1980) to select men for hard work or for evaluating the progress of recovery from disease, who also emphasised on speed of bench stepping, simplicity and accuracy of bench test. In this case,

after completing full five minutes of exercise the researcher counted the time and had the patient seated qietly, after which the researcher began exactly one minute after the subject stopped the exercise and counted the number of heart beats for exactly thirty seconds. The base of the neck (carotid-artery) was used easily to find the pulse after exercise. The researcher recorded the duration of effort and the number of heart beat per minute.

The following formula was used to calculate the physical fitness index (Kadiri, 1989).

$$P.F.I. = \frac{\text{Exercise duration in seconds}}{\text{Recovery pulse} \times 5.6} \times 100$$

The following ready-made table was used to find out physical fitness index (PFI) from exercise duration and recovery pulse.

TABLE 3.1: READY-MADE TABLE FOR FINDING PHYSICAL FITNESS INDEX

EXERCISE DURATION IN SECONDS	RECOVERY PULSE PER MINUTE										
	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90 Above
0 - 59"	20	15	15	15	15	10	10	10	10	10	10
1'-1:59"	45	40	40	35	30	30	25	25	25	20	20
2'-2:59"	70	65	60	55	50	45	40	40	35	35	35
3'-3:59"	100	85	80	70	65	60	55	55	50	45	45
4'-4:59"	125	110	100	90	85	75	70	65	60	60	55
5'-	130	115	105	95	90	80	75	70	65	65	60

INSTRUCTION:- (1) Find the exercise duration (2) Find the pulse count (3) Read off score where line and column interact (4) PFI below 25 is poor, 25 to 40 is average, and above 30 is good general fitness for tuberculosis patients (Modified from Morehouse (1980).

3.7 INSTRUMENTATION

INSTRUMENTAL CONTROLS:

The following intrumental controls were followed to obtain accurate results and to avoid the influence of extrenuous factors on test results:-

(1) In order to avoid the negative influence of the prevailing low temperature in Jos on the health of the patients, all training seassions were conducted in the chest ward four in Jos University Teaching Hospital. Jos recorded a metrological humidity of 60% and room temperature of 22°c. This precautions were taken because of the assumption that incidence of tuberculosis is more during the cold seasons (Crofton 1992).

(2) In another way to avoid the negative effect of exercise and digestion, all training sessions were conducted between eleven (11) A.M. and one (1) P.M., that is, 3 hours after the patients finished their eating.

(3) The investigator trained himself for three weeks prior to conducting the initial tests in recording all measurements, which made him produced test, re-test reliability of more than 0.92 for all measurement. This was done in

order to eliminate the influence of the inconsistency of measurement by the investigator on the test results.
In order to avoid the influence of one test or measurement over the results of other tests and measurements, the following sequence of measurement and test was followed:

(a) Immediately after five minutes of rest the heart rate of the subjects was recorded.

(b) This was followed by blood pressure and respiratory frequency.

(c) The measurement of the body temperature was then recorded after which body weight was measured.

(d) This was followed by bench stepping exercise. The sequence was followed to avoid the influence of stepping exercise or standing on other measurements.

3.7.1 STEPPING BENCH

A sixteen inches bench for stepping exercise was used. This bench was modified from twenty inches (20") bench stepping for normal as used in Harvard step,

which means a female sixteen inches (16") from male twenty (20") reduction in the height of the bench stepping apparatus. This was because Braucha and Darling (1992) found out that for the level of fitness of the subject and the height of subjects, bench step apparatus could be reduced. The subjects were patients and they did not require too much stress. Hence, the modified case of the bench to 16 inches. The bench was made of cast iron for firm grip.

3.7.2 STOP WATCH (DML '95)

This was a watch that has prominent seconds hands. It was used to measure the heart rate, respiratory frequency, and the duration of work done on bench stepping. The accuracy of the test was found to be as good as that of other stop instruments (Dasket, 1995).

3.7.3 SIHYGMOMANOMETER AND STETHOSCOPE (Exp '93)

These instruments were used for the measurement of blood pressure in milli-meters mercury (Mm Hg).

3.7.4 THERMOMETER (ZEAL HG ' 93) IN DEGREES CELSIUS

This was used to monitor the indirect body temperature through the armpit skin (axillary). The unit of measurement was degree celsius or centigrade.

3.7.5 WEIGH SCALE (SEC A S ' 93) IN KILOGRAMS

This instrument was used for measuring body weight of subjects in Kilograms (kg).

3.8 STATISTICAL TECHNIQUES

The date collected in the study as found in table 4.5 were statistically analysed to test its hypotheses by using the folowing test:

(a) t-test: This test was used to find out the significant level of the differences between pre-test means and post-test means of different measurements.

(b) Repeated Measures ANOVA: This was used to find out the significant level of the mean difference between the pre-test, mid-training test and post-training test in different measurements.

(c) Scheffe's Post-Hoc Test:

This was used when-ever the F-ratio was found significant in order to locate the place of significance.

CHAPTER FOUR

4. DATA ANALYSIS, RESULTS AND DISCUSSIONS

4.1 INTRODUCTION:

The data collected to achieve the purpose of this study were analysed statistically, the results of which are presented and discussed in this chapter. Before the result are presented to test the different hypotheses of this study, information regarding descriptive data of the subjects in the status of different variables is presented.

4.2 RESULTS

Descriptive statistical data of the subjects on different variables in pre, mid, and post training tests are shown in table four: One (4.1) which is to answer the first major hypothesis: There is no significant effects of training in bench stepping exercise on patients of tuberculosis in their cardio-respiratory endurance, blood pressure, body temperature and body weight.

TABLE 4.1: MEANS, STANDARD DEVIATIONS AND STANDARD ERRORS OF THE SUBJECTS' PHYSICAL CHARACTERISTICS (AGE, WEIGHT, AND HEIGHT)

VARIABLES	TESTS	X1	X2	X3	X4	X5	MEAN	S.D.	S.E.
Body weight (KG)	T_1	38	41.5	55	64	48	49.3	10.4	4.6
	T_2	41.5	43.8	57.2	66.5	53.5	52.4	10.3	4.55
	T_3	45	46	60	69	59	55.8	10.2	4.6
Age (Years)	-	25	30	27	20	21	24.6	4.2	1.9
Height (CM)	-	150	160	170	155	166	160.2	8.1	3.6
Lifesaving Duration in weeks	T_1	11	5	7	4	10	7.4	6.8	3.0
	T_2	16	14	9	10	18	13.4	5.2	2.4
	T_3	20	20	15	16	22	8.6	3.85	1.7

X = Subject, SD = Standard Deviation, SE = Standard error

T = test.

Examination of table four: One (4.1) shows that the mean age and the height of the subject for all the test were 24.6 ± 4.2 years and 160.2 ± 8.1 centimeters respectively. The mean disease duration of the subjects were 9 ± 6.8 weeks in the first test, 13.4 ± 5.2 weeks in the second test and 18.6 ± 3.85 weeks in the third test, as the subjects participated in the study for the period of about eight weeks. The mean body weight of the subjects increased from a pre-test mean of 49.3 ± 10.4 kilograms through mid-training test mean of 55.8 ± 10.2 kilograms. The high values in body weight in all the tests; as can be seen by the ranges from 38 to 64 kilograms in the first test, 41.5 to 66.5 kilograms in the second test and 45 to 69 kilograms in the third test.

In other words; all the subjects increased their weight gradually and progressively during the period of eight weeks aerobic exercise training programme.

4.3 SUB-HYPOTHESIS ONE

There is no significant effect of training in bench stepping exercise on cardio-respiratory fitness of tuberculosis patients as indicated by changes in resting heart rate, number of bench bench steps and physical fitness index.

This hypothesis was tested by finding out the significance of changes produced by eight weeks training bench stepping exercise in resulting heart rate, number of bench steps per minute and physical fitness index which are shown in table 4.2.

TABLE 4.2: STUDENT T-TEST VALUE FOR THE EFFECT OF EIGHT WEEK TRAINING IN BENCH STEPPING - EXERCISE ON CARDIO-RESPIRATORY FITNESS (HEART RATE AND P.F.I.)

VARIABLES	PRE TRAINING		POST-TRAINING		T-VALUE
	MEAN(X)	SD	MEAN(X)	SD	
HEART RATE	100.2	9.23	81.6	8.99	4.43
BENCH STEP	26	3.8	33	2.79	4.83
P.F.I	53.8	4.7	66.3	3.4	5.34

$T(3) = 2.776 < .05$

Table 4.2 shows significant improvement in cardio - respiratory endurance of the subjects as a result of eight week training in bench stepping exercise, as indicated by the significant decrease in heart rate ($t = 4.3 < .05$); a significant increase in the number of bench step per minute ($t = 4.83 < .05$), and significant improvement in physical fitness index ($t = 5.34 < .05$) of the subjects due to bench stepping exercise. These results therefore do not support the null-hypothesis of insignificant effect of training in bench stepping exercise on cardio-respiratory endurance.

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4.4 SUB-HYPOTHESIS TWO

There is no significant effect of bench stepping exercise training on blood pressure, body temperature and respiratory frequency of tuberculosis patients. The measurements of blood pressure, body temperature and respiratory frequency were included in this study purely as signs of adaptation of the subjects to the exercise training. To test this hypothesis, t-ratios for differences between pre-training and post-training values for blood pressure, body temperature and respiratory frequency were computed, the results for which are shown in table 4.3.

TABLE 4.3: t-test VALUE FOR PHYSIOLOGICAL EFFECT OF TRAINING IN BENCH STEPPING EXERCISE ADAPTATION TO THE EXERCISE

VARIABLE	PRE TRAINING		POST-TRAINING		t-VALUE
	MEAN ($\bar{x}$)	SD	MEAN ($\bar{x}$)	SD	
S.B.P.	124	5.48	116	11.4	1.92 N/S
D.B.P.	86	5.48	78	4.47	3.59
Temp ^{o}c	37.5	0.82	37.1	2.6	0.6 N/S
Resp. Freq.	30	9.96	27	2.97	1.1 N/S

t (3) = 2.776 .05

N.S = Not significant

S.B.P.= Systolic blood pressure

D.B.P.= Dystolic blood pressure.

Table 4.3 shows significant decrease in diastolic blood pressure ($t = 3.59 < .05$) and insignificant change in systolic blood pressure, body temperature and respiratory frequency due to 8 weeks training in bench stepping exercise. This indicates that the subject adapted to the training given to them during the eight week period. The results support the null-hypothesis except for the effect of training on the diastolic blood pressure, which indicated that the patients were geting familiar.

4.5 SUB-HYPOTHESIS THREE

There is no significant effect of bench stepping exercise training on body weight of tuberculosis patients.

Change in body weight was used as indicator of rejuvination of the subjects from the pulmonary disease. To test this hypothesis, t-value was computed for the difference between pre-training and post-training mean values for body weight of the subjects, the results of which are shown in table four (4.4).

TABLE 4.4: t-TEST VALUE FOR EFFECT OF TRAINING BODY WEIGHT.

VARIABLES	PRE-TRAINING		POST-TRAINING		t-VALUE
	MEAN(X)	SD	MEAN(X)	SD	
Body Weight in Kilograms	49.5	10.35	55.8	10.18	2.196

$t\ (3) = 2.132 < .05$

Table 4.4. reveals significant increase in body weight of the subjects ($t = 2.196 < .05$) as a result of eight week training in bench stepping exercise. This is considered as a clear cut indication of hastening the process of recovery from the disease of the patients due to eight week exercise training.

4.6 SECOND MAJOR HYPOTHESIS

The second major hypothesis of the study was generated to find out if there were any change in the direction of the effect in the eight week training in bench stepping exercise on cardio-respiratory endurance and other variables of the subjects. Before the sub-hypothesis of the second major hypothesis are tested, the mean values of the subjects for the different variables in pre-during - and post training tests are shown in table 4.5.

TABLE 4.5: MEAN, STANDARD DEVIATION AND STANDARD ERROR OF CARDIO-RESPIRATIRY VARIABLES OF SUBJECTS BEFORE, DURING, AND AFTER TRAINING IN 16" BENCH STEPPING EXERCISE

VARIABLE		X_1	X_2	X_3	X_4	X_5	$\bar{X}$	SD	SE
Heart Rate	T_1	100	115	96	90	100	100.2	9.23	4.12
	T_2	94	100.6	85	80	95	90.9	9.11	4.066
	T_3	83	86	74	70	90	81.6	8.99	4.012
Systolic Blood Pressure	T_1	120	130	120	120	130	124	5.48	2.45
	T_2	110	125	125	115	125	120	8.44	4.18
	T_3	100	120	130	110	120	116	11.4	5.9
Diastolic Blood Pressure	T_1	80	80	90	90	90	86	5.48	2.45
	T_2	75	80	85	85	85	82	4.95	2.23
	T_3	70	80	80	80	80	78	4.42	2.00
Temperature	T_1	37.8	37.5	37.2	37	38	37.5	0.82	0.36
	T_2	37.4	37.25	37	37	37.5	37.3	1.71	0.78
	T_3	37	37	36	37.5	37	36.9	2.6	1.2
Respiratory Frequency	T_1	30	28	30	28	26	30	9.96	4.4
	T_2	32	25	29	28	26.5	28.1	6.47	2.85
	T_3	26	28	28	30	27	27	2.97	1.3
Bench Step	T_1	26	20	28	30	25	26	3.77	1.7
	T_2	28	26	31.5	33	27.5	29.2	3.28	1.45
	T_3	30	32	35	36	30	33	2.79	1.2

TABLE 4.5: (CONT'D)

VARIABLE		X_1	X_2	X_3	X_4	X_5	$\bar{X}$	SD	SE
Physical Fitness Index.	T_1	53.6	46.6	55.8	59.5	53.6	53.8	4.7	2.24
	T_2	57.3	54.5	64.1	68	56.6	60.1	6.2	2.83
	T_3	60.9	63.3	72.4	76.5	59.5	66.3	7.64	3.41
Body Weight in kg.	T_1	38.0	41.5	55.0	64.0	48.0	49.3	10.35	4.60
	T_2	41.0	43.0	57.0	66.0	50.0	51.4	10.22	4.46
	T_3	45.0	46.0	60.0	69.0	59.0	55.8	10.18	4.50

T_1 = Before Training;

T_2 = 4 Weeks Mid Training Test;

T_3 = Post Training;

SD = Standard Deviation;

SE = Standard Error;

$\bar{X}$ = MEAN.

Table 4.5 showed changes in the direction and magnitude of the effect of training on heart rate, blood pressure, respiratory frequency, bench steps, physical fitness index and body weight.

Heart rate, blood pressure and respiratory frequency showed a decline; whereas bench step, physical fitness index and body weight showed an increase due to training. But body temperature was not affected by training. These results, thus show an increase in cardio-respiratory endurance as shown by the decreased heart rate, blood pressure, and respiratory frequency and increase in Bench Step and physical fitness; and improved recuperation as indicated by increased body weight.

In order to find out whether the changes were due to chance or due to training repeated measures ANOVA was applied to the raw scores. The results of which were used to test the relevant hypotheses.

4.6.1 SUB-HYPOTHESIS TWO: ONE

There is no significant change in the direction the effect of eight week training in bench step exercise on cardio-respiratory endurance of tuberculosis patients as indicated by changes in resting heart rate and physical fitness index.

To test the sub-hypothesis, repeated measure ANOVA was used, the results of which are shown in table 4.6.

TABLE 4:6: REPEATED MEASURES ANOVA FOR DIFFERENCES BETWEEN TESTS IN HEART RATE AND PHYSICAL FITNESS INDEX (CARDIO-RESPIRATORY ENDURANCE)

VARIABLE	SOURCE OF VARIANCE	SUM OF SQUARES	DF	MEAN SQUARE	F
Heart Rate	Between groups	864.91	2	432.46	5.53
	within groups	938.13	12	78.18	
	Total	1803.04	14		
Physical Fitness Index	Between groups	390.63	2	195.34	5.45
	within groups	430.11	12	35.84	
	Total	820.74	14		

F (2,12) = 3.89 < .05) Scheffe's Post-hoc comparison different between test 1 vs 3 for both heart rate and physical fitness index.

Table 4.6 shows significant decline in heart rate ($F = 5.53 < .05$) and significant increase in physical fitness index ($F = 5.45 < .05$) due to eight week training in bench stepping exercise.

These responses of the subjects who were patients of pulmonary tuberculosis were not adequate to be significant within the first four weeks of training, because application of scheffe's post-hoc test reveal significant differences between the mean values of test one and three for both HR and physical fitness index. These results, thus show that show that the subjects showed significant improvement in cardio-respiratory endurance after eight weeks of training in bench stepping exercise, therefore these results fail to support sub-hypothesis two: one (2.1).

4.6.2 SUB-HYPOTHESIS TWO: TWO

There is no significant change in the direction and magnitude of the effect of eight week training in bench step exercise on diastolic blood pressure.

To find out the significant level of the differences between the mean values of test one, test two and test there, repeated measures ANOVA was applied. The result of which are shown in table 4.7.

TABLE 4: 7: REPEATED MEASURES ANOVA FOR DIFFERENCE BETWEEN MEAN VALUES OF TESTS ONE, TEST TWO AND TEST THERE-FOR DIASTOLIC BLOOD PRESSURE.

Source of Variance	Sum of Squares	df	Mean Square	F
Between groups	160	20	80	3.43
Within groups	280	12	23.33	
Total:	440	14		

F (2,12) = 3.89 < .05 Scheffe's Post-hoc comparison different between tests T1 vs T3 for diastolic blood pressure. (Not significant).

The analysis shown in table 4.7 changes in systolic blood pressure, respiratory frequency and body temperature were not included because t-test result showed insignificant effect of eight week training in bench stepping exercise on these variable. Examination of table 4.7 showed significant decline in diastolic blood pressure due to eight week training in bench stepping exercise. However, application of Scheffe's post-hoc test showed that the effect become significant after 8 week training and not after four week training therefore, this result has failed to support sub-hypothesis 2:2.

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4.6.3 SUB-HYPOTHESIS TWO: THREE

There is no significant change in the direction and magnitude of the effect of eight week training in bench step exercise on body weight of tuberculosis patients.

Changes in body weight was measured as indicator of recuperation of subjects from pulmonary tuberculosis to test this hypothesis, repeated measure ANOVA was used for difference between test one, test two, and test three in body weight, the results of which are shown in table 4.8.

TABLE 4.8: REPEATED MEASURES ANOVA FOR DIFFERENCES BETWEEN MEAN VALUES OF TEST ONE, TEST TWO AND TEST THREE FOR BODY WEIGHT.

Source Variaance	Sum of Squares	df	Mean Square	F
Between groups	105.6	2	52.8	0.496
Within groups	1278.1	12	106.5	
Total	1383.1	14		

F (2,12) = 3.89 <.05 Scheffe's Post-hoc comparison different between tests, T1 vs T3 for body weights.

Table 4.8 shows significant increase in the body weight of the subject due to training in bench stepping exercise, though this increase in body weight was apparent even after four week of training; application of Scheffe's post-hoc test showed that this increase became significant only after eight weeks of training.

This result thus suggest that there was a gradual increase in body weight due to training which became significant after eight weeks of training, indicating a significant after eight weeks of training; indicating a significant progress in the recuperation of the subject from pulmonary tuberculosis. This result therefore fail to support sub-hypothesis 4.8.

4.7 DISCUSSION

The findings of this study revealed significant weight gain after eight weeks training in bench stepping exercise with diet and drugs. Chado (1991) agreed that exercise reduce excess body fat and weight. But, evidence from this study showed that tuberculosis patients, who had greatly lost weight due to tuberculosis gained their body weight after training in bench stepping exercise. Shryock (1990) associated weight changes in tuberculosis patients to factors, like nausea, vomiting and distorted dieting, which lower tuberculosis patients' weight, while overating aided weight gain. There were increased size of the intra-celluar fluid; increased blood volume, expansion of extracelluar fluid and fat deposition when the patient were on drug

treatment, dieting and ambulatory exercise. As the subjects of this study underwent treatment and exercise training their weight gain was experienced.

Shryock (1990) suggested that climatic changes, good home care, comfort and friendship and not isolation, aided weight gain. He then allowed sitting up in a chair as the first exercise allowed, followed by little walking, stepping exercise and light work without fatigue. This will allow salts to move round for water retention in extracellular space, causing above average weight gain. The weight gain observed in their study is attributed to these factors but not to any swallowing of sputum as an effort to gain weight (Shyrock, 1990).

Gomez (1982) maintained that body weight is an exact science to find the heaviness, and could be over heaviness. He also explained that weight gain is an evidence of convalacence, which means that the body utilizes more food, surplus was stored and enough left for long regular periods of exercise.

Above reason is associated with the gain in body weight observed in this study as the subjects were taking their drugs, diet, and ambulative exercise of bench stepping.

In contrast, Gomez (1982) found out that patients reading on beds (mental work), and moving around in sitting posture used no more fuel than lying in bed all day. Accepting the facts postulated by Gomez (1982), the bench stepping exercise changed the scene and activity of patients from resting state to ambulation, coupled with drugs and hospital diet that brought about weight gain.

Weight gain of about 0.35 to 0.45 kilogram per 2 weeks is normal (Lewis, 1993). The basal metabolic rate during exercise was increased by 10 - 25 percent. This aided in eating more, drinking more fluid and excreting less sugar from blood through renal threshold. (Venkaeswarlu, 1992). Exercise can both increase body weight or reduce excess body weight. Averagely desirable body weight is 50 - 57 kilograms at the height of 150 - 157 cm and within the age ranges of 25 to 30 years (Gomez, 1982).

Kafaru (1992) postulated that changes in body weight is highly significant in the evaluation of a person's state of health because it tells of the person's body mass. The mass is $\frac{1}{3}$ of body collagen protein in the skin, bone, tendon etc; and it is highly synthesisted in exercise. The findings of this research support this fact since after exercise training weight increased and without exercise collogen might have become rigid and staff, which decrease tissue permeability to nutrients, hormones and antibody molecules (Daskett, 1995).

However, this increase in body weight was not rapid but gradual, becoming significant only after eight week training in bench stepping exercise. This is attributed to the fact that all the subjects were sedentary before and during hospitalization, because of which they could not maintain the rate of 30 steps per minute bench stepping for the first few weeks. Once they adopted to the training, they started showing significant improvement in recovery from pulmonary tuberculosis as indicated by significant weight gains.

This study failed to show any significant change in the respiratory frequency of the subjects due to eight week training in bench stepping exercise. Normally, breathing is very inefficient in tuberculosis patients due to the block of the respiratory tract by mucus (Lewis, 1993). When a tuberculosis patient performs ambulatory exercise, more mucus that blocks the respiratory tract is expelled out making breathing work efficient with decreased frequency and deeper respiration, making more oxygen available to the body (Chado, 1991). The failure of this study to reveal this respiratory beneficial effect of training may be attributed to lower intensity and shorter duration of training in bench stepping exercise. Perhaps, with more intense and prolonged training, the benefits can be produced.

The body temperature before; mid, and after training had no significant difference. This was in agreement with Amusa and Veronica (1993), who maintained that exercise hastens thermoregulatory process of the body to normal temperature of 37 ^{o}c.

Frank (1992) affirmed that high fever in tuberculosis patients are toxic effects from the organism and associated anaemia. Exercise must be needed to make heat loss equal heat production in order for the body to remain in thermal balance. Changes in temperature affect cellular structures, enzyme systems and physiological processes. The use of drugs, diet and embullation exercise made body temperature run normal in this study.

The systolic blood pressure of pre-training was not significantly different from the mean post - training systolic blood pressure in this study. This is not in agreement with Amusa (1993), who postulated that exercise affects systolic pressure more than diastolic pressure. The post exercise systolic blood pressure can easily be affected by such things as emotion, stress, age, sex and temperature changes (Warbuton 1983). The instability of systolic blood pressure makes it unreliable as an indicator of training effect. The differences in diastolic pressure is a clear-cut, reliable and valid indication of training effect.

The findings of this study showed significant decline in the diastolic pressure of the subjects, only after eight week training in bench stepping exercise, suggesting significant improvement in cardiovascular efficiency of patients of pulmonary tuberculosis.

This study showed significant decline in heart rate, after eight week training in bench stepping exercise. Guyton (1979) attested that exercise heart rate and stroke volume are reduced by the recovery rate is faster in trained individuals, leading to reduced post-exercise heart rate. The research findings therefore are in agreement with Guyton (1979) for the reduced heart rate. The reduced heart rate may also be attributed to the increased pumping capacity of heart through training with the increase in stroke volume. This bradycardia at rest and after exercise was brought about only after eight weeks of training in bench stepping exercise; because the decreasing heart rate after four weeks of training was not significant. These changes are in a direction that improves the efficiency of cardiac pump.

Added to these factors responsible for bradycardia are the pychological benefits that the tuberculosis patient gets in training, like a feeling of emotional relaxation and well being, and to feeling of reduced stress during exercise caused by process of familiarization involving brain structures. That is related to a reduction in cortical hypothelamic impulse flow, or a shift in the celebral stimulation formation which controls and regulated cardiac performance through the stations in the brain stem. This results in either increased vagal stimulation or an inhibition of sympathetic drive on the myocardium. The mechanism for this bradycardia may also be provoked by peripheral factors like the decreased sensitivity of the excitory structures for nor-adrenalin or a reduced output of carticolamines from the adrenal cortex (Anderson, 1968).

Bench stepping exercise capacity was found to be increased after eight weeks of training in bench stepping in line with the findings of Venkateswarlu (1992), which affirmed that exercise training should fulfil the following practice requirements

to enhance the physiological benefits: For the frequency, the bench stepping exercise was followed regularly and frequently on a weekly basis of three times a week so as to maintain benefits. The intensity of bench stepping exercise was moderate at 28 - 30 steps per minutes which is equivalent to 70% of heart rate as could be seen in table four one. The duration of the bench stepping exercise session was for 20 - 30 minutes so as to produce beneficial effects. This continued for eight weeks.

The significant difference between pre-test and post-test showed much improvement, in bench stepping; which indicated a higher level of physiological fitness. The improvement was similar to those reported by Kadiri (1989) who posit that improvement in cardio-respiratory endurance was as a result of training.

Manipulated are the pre, mid, and post-test scores interactions of body weight, recovery heart rate, diastolic blood pressure, and physical fitness index. The study found that the interactional differences existed. The differences in recovery heart rate and physical fitness index were expected to be so because the recovery heart rate was used in calculating the physical fitness index.

Venkateswarlu (1971) studied similar groups at different types of regular exercise mode and suggested that bench stepping training can be used for diabetic patients and other patients, by doctors for short periods to determine the fit patients through heart rate.

Previous studies by American Lung Association (1992) showed that tuberculosis patients were concerned about weight gaining to go along with treatment. The research finding revealed that treating tuberculosis patients does not mean automatic weight gain. All that is involved is that the drug therapy and exercise made the patient eat more and drink more fluids. The well balanced diet with proper amounts of proteins, carbohydrates and fats was the diet given in the hospital. The American Lungs Association (1992) recommended that nutritous foods: fresh fruits, vegetables, low fat cheese, popcorn without butter should be given to tuberculosis patients along with taking time for daily exercise or to join an organized exercise group. The research findings showed that the weight gain occured more after eigth weeks post exercise than after the first four weeks. Weight gain was very gradual.

The finding further justifies the previous findings of recovery process from tuberculosis as explained by Primo (1993), according to which within few days with drugs, diet and exercise the patients will notice more remarkable changes of well being in the body. The sense of smell and taste improves. Breathing becames easier: weight was gained due to fluid retention. Basic exercises ensure that water taken the previous day goes through the colon; and within four (4) days water therapy with drugs, exercise and diet, the body of tuberculosis patient will definitely begin to correct itself (Kafaru, 1992). In agreement with this, changes of improvement started showing after a few days exercise training in this study.

Observations were made on the muscle soreness of Calfmuscle, Chest pains, Cough and expectoration, the eating habit, sleeping habit and the rate of discharge from hospital. Kallet (1990) explained that studies showed that younger tuberculosis patients who exercise are likely to become involved in less tuberculosis complications than older tuberculosis patients. In this study the single influence on tuberculosis patient's decision to

exercise or not with drugs and diet, gave interest to exercise with muscle soredness and pains in chest. The pains soon disappeared after contaning the exercise. However dizziness and paroxysmal cough were mild. Exercise has the ability to propel out mucus (Mori, 1992). The eating habits, drinking and rest periods improved.

All patients were discharged after one month of the commencement of exercise as against six months hospitalization in agreement with (Lewis, 1992), and for that case patients only came back for their injections as out patients. The rapid discharge from hospital was therefore associated with the increased free movement of patient seen by doctors and the level of physical fitness index. After exercise and drug treatment, the patients's sputum was negative for the germ tubercle bacilli. Frank (1992) explained that the success of every cure of tuberculosis patient must result in a progressive concentrated effort. This showed that bed rest in the milder cases of tuberculosis was no longer necessary. There is no need to stay in bed for six months, no need to be spoon fed, but can f ely go to the toilet.

Transient painful spasms of the muscles of the feet or muscle of the legs sometimes occured. Such cramps had been attributed to Calcium deficiency and temporary slowed circulation to muscles or circulatory insufficiency (Braucha and Darling, 1992). This study with the above findings and muscular pains during exercise and also observed THAT the cramps tended to decrease to painless state in late exercise and were no longer troublesome.

CHAPTER FIVE

5. SUMMARY, CONCLUSIONS AND RECOMMENDATION

5.1 SUMMARY

Recent development in exercise and sports sciences have shown great potentials for the application of exercise training in prophylactic and curative disciplines. Exercise training has been sucessfully used not only to prevent obesity and degenerative disorders, like hypertension, diabetes millitus and atheriosclerosis, but to cure some of these disorders. Research evidence on the effects of exercise training on patient of pulmonary tuberculosis has beeninconclusive. This investigation was therefore conducted to find out the exercise training on cardio-respiratory endurance of these patients.

The purpose of the study was to determine the effect of bench stepping exercise on patients of pulmonary tuberculosis undergoing chemotherapy in their recovery from tuberculosis as indicated by the cardio-respiratory endurance and body weight. To achieve this purpose, five patients of pulmonary tuberculosis were selected to serve as subjects of the study.

An eight week bench stepping exercise training was given to the subjects from which physical fitness index of the subjects was to be determined. The subjects were given this exercise training on alternate days, three days a week for eight weeks. Before the subjects were given training they were tested for blood pressure, body weight, temperature, pulse rate and physical fitness index. Again after four weeks of training and at the end of eight weeks training, these tests were repeated. The data thus collected was statistically analysed to test the hypothesis of the study.

5.2 CONCLUSIONS

In view of the limitations of the study, the following conclusions are drawn from the findings already presented:

(1) Eight week of bench step exercise training significantly improved the cardio-respiratory endurance of the pulmonary tuberculosis patients, suggesting the work capacity of the subjects significantly improved due to training.

(2) Eight week bench step exercise training significantly decreased the diastolic blood pressure of the subjects, indicating that the subjects adapted to the training.

(3) As a result of eight weeks training, the body weight of the subjects significant increased.

(4) As a result of eight week bench step training, the physical fitness index training of the subjects significantly increased.

(5) The modifications found in heart rate, diastolic blood pressure, body weight, cardio-respiratory endurance and physical fitness index became significant only after eight weeks of training, suggesting that four weeks training was not adequate to produce significant modifications in the physiological variables of the subjects.

5.3 RECOMMENDATIONS

Based on findings from this study, it was clear that tuberculosis patients should receive special attention in the treatment, since tuberculosis continue to impose a burden of widespread illness resulting in low socio-economic status of the nation especially rural dwellers. The investigator recommend the following:

(1) In line with the findings and the water supply and Sanitation Decade (1981 - 1990) the following should be done to reduce the spread of tuberculosis: good environment, good pipe-born water, cooked milk, vaccinations against tuberculosis, ventilation of shelter and avoidance of overcrowding.

(2) Pulmonary tuberculosis patients especially those leading a sedentary life and are rested for every long time, should consider under-taking aerobic fitness activities on regular basis. This is necessary in order to avoid or delay the onset of complications of the disease such as collapsed lungs and chronic chest infection.

(3) Bench stepping exercise programmes for pulmonary tuberculosis should consider limitations imposed by the taboo that ambulant exercise for pulmonary tuberculosis patients could be dangerous, but from the findings the process of bench stepping exercise does not damage, but could be used for longer survival and could be used to hasten recovery from sickness, when the client starts exercise from his fitness level and progresses steadily and systematically.

Special consideration must be given to prevention of injury, hence the need to avoid injury prone activities.

(4) Patients are becoming more interested in ambulant exercise in ailments are adviced to use exercise therapy for tuberculosis patients since safety of exercise in protracted illness is scientifically evident.

(5) The Government legislation that says exercise increases ill-health should be re-written so as to accept exercise therapy process in the Joint Nigerian Netherlands Leprosy/Tuberculosis Assisted Programs.

(6) Medical school, Health school, Nursing Institutions, and P.H.E. Departments of all institutions should begin to use any science available that makes exercise safe. Then educate the public to demand using exercise in protracted ailments along with their drugs and appropriate diets.

(7) The investigator suggested that this work should be reviewed as journal are scrutinized so that exercise can pass the hurdle of medical and paramedical controvercies.

(8) Medical tradition stands on two pillars of preventive and curative medicines. Preventive medicine is the most concern of health services. The recommendation therefore is that exercise should be used for preventive medicine, prophylactic treatment and palliative cure of pulmonary tuberculosis so that patients may remain in vigorous good health for however long their biological life span permits.

(9) The best test for validated measure of functional well being in defining the health status through bench step test, the investigator recommend that health education should be taken to hospitals and patients given guide booklets on exercise with bench step.

(10) To sustain primary health care the researcher recommends that exercise therapy should be started at grass-root planning and implementation of tuberculosis and leprosy programmes so as to encourage ambulatory treatments and reduce risks of tuber-culosis in over rest.

(11) To integrate this health study and for sufficient application to health and medical development process hospitals and health clinics be well equiped with fitness materials so as to encourage ambulatory exercise treatment.

(12) Early ambulation after sickness using exercise is recommended to aid breathing exercise to all tuberculosis patients.

(13) Other protracted diseases caused by micro-organisms not as a result of life style need to be researched into.

Example of these diseases are leprosy, asthma, and epilepsy.

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APPENDIX 'A'

PRE AND POST-TRAINING TEST RESULTS OF SUBJECTS ON DIFFERENT PHYSIOLOGICAL AND PHYSICAL VARIABLES

Variables		X_1	X_2	X_3	X_4	X_5	X MEAN	SD
Heart Rate	T_1	00	115	96	90	100	100.2	9.23
	T_2	88	86	74	70	90	81.6	8.99
Systolic B/P	T_1	20	130	120	120	130	124	5.48
	T_2	00	120	130	110	120	116	11.4
Diastolic B/P	T_1	80	80	90	90	90	86	5.48
	T_2	70	80	80	80	80	78	4.42
Body Weight	T_1	38	41.5	55	64	48	49.3	10.35
	T_2	45	46	60	69	59	55.8	10.1
	T_3	48.2	47.9	60.7	70.6	66.4	60.4	2.6

APPENDIX 'A' (CONT'D)

Variables		X	X	X	X	X	$\bar{X}$ MEAN	SD
Body Temp. °c	T_1	37.8	37.5	37.2	37	38	37.5	0.82
	T_2	37	37	36.8	37.5	37	37.06	2.6
Respiratory Freq.	T_1	38	28	30	26	28	30	9.96
	T_2	26	22	28	30	27	27	2.97
Bench Step (min)	T_1	26	20	28	30	25	26	3.77
	T_2	30	32	35	36	30	33	2.79
Height (cm)	-	150	160	170	155	166	160.2	8.07
Disease Duration	T_1	12	8	3	4	10	9	6.8
	T_2	20	20	15	16	22	19.4	3.85

T1 = Before training

T_2 = After 8 weeks training

B/P = Blood pressure

SD = Standard Diviation

SE = Standard Error.

Ahmadu Bello University, Nigeria.

APPENDIX 'B'

BENCH STEPPING DATA RECORDING FORM

SUBJECTS NAME:

DIAGNOSIS: WARD.....BED NO.....

WEIGHT (KG): DISEASE DURATION.....

HEIGHT (CM): DATE:.....TIME.....

	EXERCISE TRIAL				
WORK RATE		STAGES			
Steps/Minute	CLAPSED TIME	1	2	3	4
	MINUTES				
	1				
	2				
	3				
	4				
	5				

Heart Rate (Min.) .....

Blood Pressure .....

Body Temperature .....

Respiratory Frequency .....

APPENDIX 'C'

TRAINING PROTOCOL

A. Patient stands in front of 16 inches High stool, ready to stepup with right foot on count of one.

B. The subjects' left foot rises to the stool on the count of two.

C. When both legs are straight on the stool, the right returns to the floor at the count of three.

D. The left foot returns to the floor on the count of four.

STAGE I:

The above is done within 4 seconds and the subject repeats the full round trips at 20 - 30 stepping per minute for five minutes.

STAGE II:

Bench stepping Exercise 5 minutes Rest for 2 minutes.

STAGE III:

Bench stepping for 5 minutes Rest for 2 minutes.

STAGE IV:

Bench stepping Exercise for 5 minutes Rest for 10 minutes before recording vital data.

APPENDIX 'D'

CONSENT FORM

You Mr. .....

of Address) .....

will be placed on a modified 16 inches bench stepping exercise programme. The level will be 20 - 30 steps per minutes. The evaluation of your body temperature, pulse and respiration will be taken after a 10 minutes post exercise resting.

Please feel free to notify the tester (researcher) sudden rise in blood pressure, pulse, respiration rates, fainting, chest pains, and muscular pains.

The benefits expected is finding out type of activities you might engage safely in your daily life as once a tuberculosis patient.

In your responsibility, you may wish to give priority to regular attendance to 3 - 5 days free air exercise and sun bath per week.

I have read this consent form and that I understood the test procedures that I will perform. I consent to participate in this test.

....

(Signature Witness) (Signature of Patient)