EFFECT OF LOW INTENSITY RESISTANCE TRAINING ON CHRONIC LOW BACK PAIN OF ADULTS IN KADUNA METROPOLIS, NIGERIA

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DECLARATION

I declare that the research work in this Dissertation titled '**Effect of low intensity resistance training programme on chronic low back pain of adults in Kaduna metropolis, Nigeria**' has been conducted by me in the Department of Physical and Health Education, Faculty of Education, Ahmadu Bello University, Zaria, under the supervision of Prof. E. A. Gunen and Prof. M. A. Chado. All quotations and authors cited in this work have been indicated and the sources of information are specifically acknowledged by means of references. No part of this dissertation was previously presented for another degree or diploma at any University.

______________________ ______________________

Edward Yohanna Bahago Date

CERTIFICATION

This dissertation titled **'Effect of low intensity resistance training programme on chronic low back pain of adults in Kaduna metropolis, Nigeria'** by BAHAGO Edward Yohanna meets the regulations governing the award of Master of Science (M. Sc.) degree in Exercise and Sports Science, Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

______________________________ Prof. E. A. Gunen Chairman, Supervisory Committee	________________ Date
______________________________ Prof. M. A. Chado Member, Supervisory Committee	________________ Date
______________________________ Prof. T. N. Ogwu Head of Department	________________ Date
______________________________ Prof. K. Bala Dean, School of Postgraduate Studies	________________ Date

DEDICATION

This work is dedicated to God Almighty who has been my help in the days passed and has always been in the present times, and to my family members for their support and love.

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The researcher returns all glory to God Almighty, who has been the ever present help in times of need. The researcher appreciates the supervisory roles of Prof. E. A. Gunen, Prof. M. A. Chado and Prof. K. Venkatsewarlu for their critical comments and corrections at every stage of this work. Indeed, this study is a product of their expertise and careful attention to details. Without inhibition, they have allowed the researcher to tap from their wealth of knowledge and experiences.

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ABSTRACT

This study was designed to investigate the effect of low intensity resistance training on pain, disability and flexibility among adults with nonspecific chronic low back pain in Kaduna metropolis. A single group pre-test – post-test design was adopted in which 18 adults participated out of 32 patients through purposive sampling technique. Subjects were between the ages of 35 and 55 years with diagnosis of nonspecific chronic low back pain attending Physiotherapy and Orthopaedic clinics of Barau Dikko Specialist Hospital, Kaduna. The data was collected at baseline and at the end of 8 weeks of low intensity cycling training resistance training programme aimed at strengthening the core muscles of the back and its supporting regions, at frequency of 3 times per week on alternate days. And using a load of 40-60% 1-RM, 10 repetitions per set, in 1 – 3 sets per session in progression. The data was subjected to statistical analysis and student t-test was used to test the difference between pre-test and post-test of pain, disability and flexibility in the subjects at ($p = 0.05$) level of significance. The result of the study showed that there was significant reduction in pain intensity and disability index, while there was significant increase in low back flexibility. It can also be deduced from the study that low intensity resistance training programmes can improve the quality of life of chronic low back pain sufferer in terms of pain and functionality. It is therefore recommended that low intensity resistance training programme should be incorporated into chronic low back pain management by the health care providers managing low back pain patients. And a large scale study should be carried out to see if the same result can be replicated in a larger population.

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OPERATIONAL DEFINITION OF TERMS

Acute low back pain- refers to a low back pain in either male or female adult with duration of less than three (3) months, in which the cause of the pain can or cannot be ascertained.

Chronic low back pain**–** refers to low back pain in either male or female adult lasting for more than three (3) months in duration, whether the cause of the pain can be ascertained or not.

Non-specific low back pain- refers to low back pain in either male or female adult, which source or cause of pain cannot be ascertained or attributed. This excludes low back pain as result of degenerative disc disease, traumatic injury to the back and infectious diseases of the spine like tuberculosis of the spine.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The term low back pain refers to pain in the lumbosacral areas of the spine encompassing the distance from the first lumbar vertebra to the first sacral vertebra. This is the area where the lordotic curve forms. Nia, Haghdoost, Beheshti, Soleymani, Bahrami, Hojjati and Hosseine (2011) define low back pain as discomfort in the spinal area (between the lower costal margins and gluteal fold), with or without radiation into the leg to below the knee for at least one day during the past 12 months. Other researchers defined low back pain as any back pain between the ribs and the top of the leg from any cause (Frank, Brooker, DeMaio, Kerr, Maetzel, Shannon, Sullivan, Norman & Wells, 1996). Current research evidence stressed that low back pain is an important public health problem in all industrialized nations and many developing countries of the world (Harreby, Hesselsoe, kjer & Neergard, 1995; Szpalski, Nordin, Skovron, Melot & Cukier, 1995).

Low back pain has been classified by duration of symptoms as acute, sub-acute and chronic. Within these classifications, there is no agreement across medical, health and fitness organizations for specific duration of symptoms but generally, pain lasting less than six weeks is classified as acute, pain lasting 6 to 12 weeks is sub-acute, and low back pain of more than 12 weeks is described as chronic (Koes, van-Tulder, Lin, Macedo, McAuley, & Maher, 2010).

Despite the prevalence of low back pain, the source of pain is not established in the majority of cases and the term “non-specific low back pain” is used (Hancock, Landrigan &

Silver, 2007). In majority of cases, specific diagnosis for low back pain cannot be defined on the basis of anatomical or physiological abnormalities. Although imaging strategies can be employed to exclude serious cause of low back pain such as tumours and infectious, anatomical abnormalities, such as those associated with the aging process, commonly observed in otherwise asymptomatic, healthy individuals (Deyo, 2002). While specific therapies can be employed to correct identifiable anatomical or physiological abnormalities, nonspecific low back pain can only be treated empirically (Walker & Williamson, 2009).

Most episodes of low back pain are mechanical in origin and resolve within a 12-week period. These acute episodes of back pain are associated with muscle strain andintervertebral disc herniation with radiculopathy (Deyo, 2002). A smaller proportion of individuals have back pain with duration greater than 12 weeks. These patients have back pain secondary to a wide variety of mechanical and non-mechanical disorders. The mechanical disorders associated with chronic low back pain include osteoarthritis and lumbar spinal stenosis. The non-mechanical disorders include infectious, neoplastic, rheumatologic, endocrinologic, vascular, and gynaecologic. The clinical symptoms associated with each variety of disorder helps guide the appropriate diagnostic evaluation. Although most of the disorders that cause chronic low back pain cannot be cured, therapy can decrease pain and improve function of the symptomatic patient.

Exercise is one of the management strategies that is widely used in low back pain in the developed nations. It encompasses a heterogeneous group of interventions ranging from general physical fitness or aerobic exercise to muscle strengthening and various types of flexibility or stretching exercises. Most treatments for chronic low back pain have modest efficacy at best (Bogduk, 2004). Exercise is one of the few proven treatments for chronic low back pain; however, its effect is often small, and no form has been shown to be clearly better than another (Van-Tulda, Malmivaara, Esmail & Koes, 2000).

Physical activity in general is considered important for health, depression, and pain experience, and exercise is recommended and widely used in low back pain management in many developed countries of the world (Krismer & Van-Tulder, 2007).

1.2 Statement of the Problem

Low back pain is a universal health problem with high prevalence rate the world over. Management of low back pain is a major health and economic concern, and low back pain is one of the leading causes of physical limitation in most developed nations of the world. In Nigeria, the change in lifestyle from a physically active population to automobile and sedentary lifestyles have led to the emergence of new disease conditions, including low back pain. Low back pain is a chief source of incapacitation, suffering and expense (Lahad, Malter, Berg & Dego, 1994).

Low back pain has resulted in a substantial personal and economic burden among many families and workers in this country. Currently, it is a leading contributor to work absenteeism. It should be noted that even though; long absence from work is more dependent on socioeconomic and job-related influence, and not physical severity (Waddell, 1987). Globally, it is the leading cause of disability in adults aged less than 45 years, and second to arthritis in people aged 45-65 years (Frank,et al, 1996). The disability of chronic low back pain increasingly associated with emotional distress, failed treatment and the adoption of a sick role, all of which are resistant to traditional medical management.

There is no definitive indication that any treatment for low back pain is superior to others, with evidence only showing interventions providing modest success for unknown duration (Lahad et al, 1994, van Tulda et al, 2000, Bogduk, 2004).

Most clinicians agree that the treatment of low back pain should focus on known deficiencies. Typically, these sufferers lack normal level of flexibility, muscular strength and muscular endurance in various muscles of the trunk; lumbar and abdominal muscles, including the hip flexors and extensors. Often times, these patients are overweight and deconditioned, therefore the role of exercise in the treatment and prevention of low back pain should be to correct or improve these deficiencies.

A paucity of information exists concerning the exact role of exercise in the management of low back pain. Few controlled clinical studies exist, and the selection of an exercise programme is often relegated to traditional or empirical regimens. Aerobic conditioning exercises appear to offer the greatest benefit for all types of patients with back problems, although the value of these exercises is often overstated. The researcher was not aware of any study that had been conducted or documented to investigate the effect of low intensity resistance training programme on adults between the ages of 35-55 years with chronic low back pain in Kaduna State.

Indirect evidence can be found for strengthening exercises that treat physical incapacity. No information is available to substantiate the effects on pain relief of chronic low back pain sufferers in Kaduna State. There is therefore the need for comprehensive studies and controlled clinical studies to validate the effect of low intensity resistance exercises in the management of adults with chronic low back pain in Kaduna State, Nigeria.

1.3 Research Questions

The following research questions were raised for this study.

i. Can low intensity resistance training programme relieve pain in adults with chronic low back pain?

ii. Can low intensity resistance training programme reduce the magnitude of disability in adults with chronic low back pain?

iii. Can low intensity resistance training programme improve low back and hamstrings flexibility in adults with chronic low back pain?

1.4 Purpose of the Study

The main aim of this study was to assess the effects of low intensity resistance training on chronic low back pain of adults in Kaduna metropolis while the specific objectives of the study include the following;

i. to assess the effect of low intensity resistance training programme on pain in adults with chronic low back pain.

ii. to assess the effect of low intensity resistance training programme on improving the magnitude of disability in adults with chronic low back pain.

iii. to determine the effect of low intensity resistance training programme on low back and hamstrings flexibility of adults with chronic low back pain.

1.5 Basic Assumptions

On the basis of available research evidence, the following assumptions were made;

i. Low intensity physical activity is an effective and safer management modality for adults with chronic low back pain.
ii. Low intensity resistance exercise is effective in reducing pain and improving function in adults with chronic low back pain.
iii. Chronic low back pain has great economic impact and acts as burden on any population it affects.
iv. Low back pain has high prevalence the world over, including Nigeria.

1.6 Research Hypotheses

The following null hypotheses were tested.

Major Hypothesis;

i. There is no significant effect of low intensity resistance training on pain, disability and flexibility of adults with chronic low back pain in Kaduna metropolis, Nigeria.

Sub-hypotheses;

i. There is no significant effect of low intensity resistance training programme on pain of adults with chronic low back pain in Kaduna metropolis, Nigeria.
ii. There is no significant effect of low intensity resistance training on magnitude of disability of adults with chronic low back pain in Kaduna metropolis, Nigeria.
iii. There is no significant effect of low intensity resistance training on low back and hamstrings flexibility of adults with chronic low back pain in Kaduna metropolis, Nigeria.

1.7 Significance of the Study

This study would be of the following importance.

i. This study would contribute to existing body of literature in the use of exercise programmes in the management of chronic low back pain. It has demonstrated that 8 weeks of low intensity resistance training programme is enough to cause a significant pain relief and disability reduction in adults with chronic low back pain.

ii. The study would provide more information on the effects of low intensity resistance training programme on pain relief, disability reduction, flexibility and functional improvement in adults with chronic low back pain.

iii. It would proffer another avenue for improving the outcome measures of individuals with chronic low back pain. Low intensity resistance exercises that strengthen the core muscles of the back can be taught to the patient as part of the self-care management of chronic low back pain.

iv. The results derived from this study would provide management techniques for improve functional ability and to reduce the number of work absenteeism in individuals with chronic low back pain.

1.8 Delimitation of the Study

This study was delimited to only adult patients with nonspecific chronic low back pain who were attending Physiotherapy and Orthopaedic Clinics of Barau Dikko Specialist Hospital in Kaduna metropolis.

This study excluded those patients with “specific” chronic low back pain (those whose low back pain can be attributed to a single cause). For example, degenerative disc disease, traumatic injury, and infectious disease of the spine, like tuberculosis of the spine.

Also chronic low back pain patients with severe hypertension, renal failure, cardiac disease or any medical condition that precludes physical exercise were not recruited for this study.

1.9 Limitations

i. Patients were allowed to continue with their normal or conventional low back pain treatment/management techniques, which had effect or not on the outcome of the study.

ii. Inability of some of the subjects that started the study to comply till the end. Some subjects were given transport fares for them to keep up with the 3 times a week appointment for the training programmes.

iii. Individual difference in pain perception, might have affected the assessment of pain. Proper explanation was given to the subjects about the Visual Analogue Scale, in a language they will understand before administering it.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

Low back pain or lumbago was a common musculoskeletal disorder affecting 80% of people at some point in their lives. In the United States of America it was the most common cause of job-related disability, a leading contributor to missed work, and the second most common neurological ailment of which only headache is more common.It can either be acute, subacute or chronic in duration.

The majority of lower back pain was referred to as non-specific low back pain and does not have a definitive cause (Casazza, 2012). It is believed to stem from benign musculoskeletal problems such as muscle or soft tissues sprain or strains. This is particularly true when the pain arose suddenly during physical loading of the back, with the pain lateral to the spine. Over 99% of back pain instances fall within this category (Henschke,Maher, Refshauge, Herbert, Cumming, Bleasel, York, Das & McAuley, 2009).

Related literature has been reviewed under the following sub-headings:

2.2 Structures of the Back

2.3 Causes of Low Back Pain

2.3.1 Pathophysiology of Low Back Pain

2.3.2 Diagnosis of Low Back Pain

2.3.3 Treatment/Management of Chronic Low Back Pain

2.4 The Use of Exercise in the Management of Low Back Pain

2.4.1 Safety of Exercise in Low Back Pain

2.4.2 Role of Exercise in Improving Back Function

2.4.3 Exercise for Improving Impaired Flexibility

2.4.4 Strengthening Exercise for Improving Back Strength

2.4.5 Exercise as Modality for Reducing Chronic Low Back Pain

2.4.6 Exercise as Treatment for Disability Components of Chronic Low Back Pain

2.5 Summary

2.2 Structures of the Back

The lumbar region (or lower back region) is made up of five vertebrae (L1-L5). In between these vertebrae lie fibrocartilage discs (intervertebral discs), which act as cushions, preventing the vertebrae from rubbing together while at the same time protecting the spinal cord. Nerves stem from the spinal cord through foramina within the vertebrae, providing muscles with sensations and motor associated messages. Stability of the spine is provided through ligaments and muscles of the back, lower back and abdomen. Small joints which prevent, as well as direct, motion of the spine are called facet joints (zygapophysial joints) (Floyd & Thompson, 2008).

2.3 Causes of Low Back Pain

Causes of lower back pain are varied. Most cases are believed to be due to a sprain or strain in the muscles and soft tissues of the back. Over activity of the muscles of the back can lead to an injured or torn ligament in the back which in turn leads to pain. An injury can also occur to one of the intervertebral discs (disc tear, disc herniation). Due to aging, discs begin to diminish and shrink in size, resulting in vertebrae and facet joints rubbing against one another. Ligament and joint functionality also diminishes as one ages, leading to spondylolisthesis, which causes the vertebrae to move much more than they should. Pain is also generated through lumbar spinal stenosis, sciatica and scoliosis. At the lowest end of the spine, some patients may have tailbone pain (also called coccyx pain or coccydynia). Others may have pain from their sacroiliac joint, where the spinal column attaches to the pelvis, called sacroiliac joint dysfunction which may be responsible for 22.6% of low back pain (Bernard & Kirkaldy-Willis, 1987). Physical causes may include osteoarthritis, rheumatoid arthritis, degeneration of the discs between the vertebrae or a spinal disc herniation, a vertebral fracture (such as from osteoporosis), or rarely, an infection or tumor (Burke, 1964).

2.3.1 Pathophysiology

Although the lifetime prevalence of back pain is 60–80% (Nachemson,Giesecke, Gracely, Grant, Petzke, et al, 2004), little is known of its pathophysiology. Clinically, the natural course of low back pain is usually favorable; acute low back pain frequently disappears within one to two weeks. In some cases, however, acute low back pain becomes chronic and quite difficult to treat and has a major socioeconomic impact. Any of the spinal structures, including intervertebral discs, facet joints, vertebral bodies, ligaments, or muscles could be an origin of back pain, which is, unfortunately, quite difficult to determine (Balague, Mannion, Pellise & Cedraschi, 2012). In those cases in which the origin of back pain cannot be determined, the diagnosis given is nonspecific low back pain (Balague,et al, 2012). In general, pain is an unpleasant feeling in response to stimuli that have the potential to damage or do damage the body's tissues (noxious stimuli). There are four fundamental steps in the process of pain perception: transduction, transmission, perception and modulation. The process starts when the painful event stimulates the endings of the pain-sensing nerve cells (nociceptors). A nociceptor converts the stimulus into an electrical signal by transduction. Several different types of nerve fibers carry out the transmission of the electrical signal from the transducing nociceptor to the dorsal horn of the spinal cord, from there to the brain stem, and then from the brain stem to the various parts of the brain such as the thalamus and the limbic system, where pain signals are processed and given context in the process of pain perception. Through modulation, the brain can then modify the sending of further pain impulses by signaling the release of neurotransmitters that either inhibit them (for example, serotonin and endorphins) or excite them (Salzberg, 2012).

2.3.2 Diagnosis of Low Back Pain

For correct diagnosis, non-specific low back pain must be differentiated from radiculopathy and serious spinal problems such as a tumor, infection or spinal fracture. Certain signs, termed "red flags," may indicate a more serious condition, and prompt a more extensive investigation usingdiagnostic imaging or laboratory testing; even so, most individuals seeking treatment for acute low back pain have one or more red flags but no serious underlying problem. With other causes ruled out, people with non-specific low back pain typically are treated symptomatically, without exact determination of the underlying cause (Koes et al, 2010; Casazza, 2012).

Complaints of lower back pain are one of the most common reasons why people visit doctors. Although medical societies do not recommend imaging tests such as an X-ray, CT scan, or MRI within a few weeks of the onset of pain as the pain is likely to subside, many patients and doctors use them to try to find the cause of the pain. Such tests are not required in lower back pain except in the cases where "red flags" are present (Chou, Fu, Carrino & Deyo, 2009), and less than 1% of imaging tests identify the cause of a problem. In most cases, the tests are not necessary, and most people will feel better after a month regardless of whether they undergo imaging. Routine imaging may be harmful to a person's health from the radiation used, and more imaging is associated with higher expense and higher rates of surgery but no resultant benefit (Chou, Qaseem, Owens & Shekelle, 2011). Imaging may also detect harmless abnormalities which encourage the patient to request further unnecessary testing or to worry. Even so, from 1994 to 2006, in the United States, MRI scans of the lumbar region increased by more than 300% among Medicare beneficiaries (Deyo, Mirza, Turner & Martin, 2009).

Low back pain is a common clinical problem and a significant socioeconomic problem. Nonspecific low back pain is defined as low back pain not attributable to a recognizable, known specific pathology, such as infection, tumor, osteoporosis, fracture, structural deformity, inflammatory disorder, radicular syndrome, or cauda equina syndrome (Balague et al, 2012). The intensity of low back pain is usually evaluated by a visual analogue scale (VAS), numerical rating scale, or a disability scoring system, such as the Oswestry

Disability Index (ODI), Roland Morris Disability Questionnaire, and others. However, the use of these established rating systems does not fully evaluate the characteristics of low back pain.

Previous studies suggested that low back pain varies in different situations (O’Sullivan, 2005; Dankaerts, O’Sullivan, Straker, Burnett & Skonen, 2006). Some patients have pain in motion, but no pain when standing, and some have pain after standing for long time, but no pain in motion. O'Sullivan proposed a mechanism-based classification system dividing nonspecific low back pain into three subtypes based on pain provocative spinal postures and movement patterns (O’Sullivan, 2005; Dankaerts et al, 2006). This classification system uses three subtypes: flexion pattern, active-extension pattern, and multidirectional pattern. In adolescents with nonspecific low back pain, sitting is a common aggravating factor and accounts for significant disability (Balague, Troussier & Salminen, 1999). Conversely, there is a clinical impression that elderly patients have low back pain while in motion and standing, but less pain when sitting.

2.3.3 Treatment/management of Chronic Low Back Pain

While there are a myriad of treatment options for chronic low back pain, there is only one clinical practice guideline for chronic non-specific low back pain: The European Guideline. This guideline and the relevant Cochrane reviews (Cochrane Collaboration Back review Group Review, 2004) provide the most reliable sources of evidence on treatment for this condition. Unfortunately, the Cochrane reviews (2004) provide fairly bleak reading for both clinicians and patients. Most of the reviews concluded that the treatment under review was of unknown value. Five of the thirteen reviews concluded that there was some evidence for the treatment under review however, significant limitations for each treatment were noted. These limitations included: no long term effect (e.g. back school); serious side effects (e.g. muscle relaxants); small effect size (e.g. massage); treatment improves outcomes other than pain (e.g. work conditioning) and no information available on patient or dose selection (e.g. behavioural treatment). The European Guideline produced similar conclusions. In only one Cochrane review, the review of multidisciplinary rehabilitation/functional restoration, the reviewers conclude that there was strong evidence for the therapy. However, the reviewers also noted that these programs were only effective when they included over 100 hours of therapy. Because these programs are multidisciplinary, they are typically provided in a tertiary setting and because of the amount of time involved, they are also very expensive. Accordingly, functional restoration is usually reserved for the most severe cases of chronic low back pain.

The majority of patients with chronic low back pain have less severe pain (i.e. Grades I–III) and are typically managed in primary care. Not surprisingly clinicians find managing chronic low back pain difficult with qualitative research reporting that therapists' inability to identify effective treatment choices for their patients makes them state clinicians perhaps feel 'helpless' 'disillusioned' and 'pessimistic' (Chew & May, 1997). Studies of patients reveal similar negative feelings and emotions (Hawson, Bostrom & Harms-Rindahl, 2001).

To address this major problem, there is need for a coordinated programme of research in treatments that seem to be more promising and can rigorously be evaluated in randomised controlled trials. A promising treatment is the one that (i) appear to have clinically important effects that are maintained in the long term, (ii) are readily available and of modest cost and (iii) there is biological plausibility for the effect. Exercise training is candidate for evaluation because it satisfies each of these three criteria, however at present trials have reported conflicting results.

2.4 The Use of Exercise in the Management of Low Back Pain

Over the last few decades, exercise has been promoted with increased enthusiasm for the treatment of Back pain. This has prompted a systematic review of the evidence concerning the effectiveness of exercise, with the conclusion that exercise may be helpful for patient with chronic low back pain in terms of return to normal activities and work (van-Tulder, Malmivaara, Esmail & Koes, 2000). While some trials of exercise therapy have reported large, durable and clinically important effects of treatment (O'Sullivan, Twomey & Allison, 1997; Kankaanpaa, Taimela, Airaksinen & Hanninen, 1999) others have not (Yelland, Glaszious, Bogduk, Schluter & McKernon, 2004). The uncertainty is reflected in the conclusion of the Cochrane review of exercise therapy: '...there is conflicting evidence on the effectiveness of exercise therapy...' (Van-Tulder, et al, 2000).

Many factors are likely to have contributed to the inconsistent results across trials. Importantly, interpretation of the results of exercise trials is difficult because most trials have been pragmatic trials, comparing two active treatments delivered in routine practice (e.g. *exercise vs. usualmedical care (O'Sullivan et al, 1987);exercise vs. physiotherapy (Hemmila, Keinanen-Kinkaanniemi & Levoska & Puska, 2002).* These comparisons cannot provide a clear estimate of the effects of exercise treatment because most of the comparison treatments are also of unknown efficacy. Secondly, there has been insufficient appreciation by researchers conducting trials and by reviewers summarising trials of the wide variety of forms exercise can take and also trials do not control the quality of exercise intervention.

While exercise is typically regarded as a single class of treatment it is believed that this level of conception is inappropriate and analogous for not distinguishing between different classes and doses of drugs when prescribing medication. The types of exercise programs for chronic low back pain vary widely from land-based exercise versus exercise in water to isolated trunk exercise versus a walking program and it is unlikely that all programs are equally effective for all patients.

2.4.1 Safety of Exercise in Low Back Pain

When considering any therapeutic modality, one must consider the risk, the benefit of that versus the risks and benefits of alternative treatments (Rainville, Hartigan, Martinez, Limke, Jouve & Finno, 2004). With exercise, the primary risk would be the potential for precipitating additional back pain or further spinal degeneration. Indeed, some people note back pain during and after exercise.

Several epidemiological studies have examined the prevalence of back pain related to fitness. (Suni, Oja, Miilunpalo, Asikainen, Laukkanen, Pasanen, Vuori & Bos, (1998) evaluated 498 adults and found that low levels back fitness were associated with back dysfunction and pain, and high fitness related to positive back health. A 25-year prospective observational study of physical exercise among 640 school children found those who exercised at least 3 hours per week had significantly lower lifetime risk for back pain (Harreby, Hesselsoe, Kjer & Neergaard, 1997. Croft, Papageorgion, Thomas, Mactarlane and Silman (1999), prospectively followed 2,715 adults with no low back pain and found greater leisure-time physical activity does not increase the 1-year risk of low back pain and that poor physical health increases the risk of new low back pain episodes.

Videman, Sarna, Battie, Koskinen, Gill,Paananen & Gibbons (1995) found that low back pain occurred less commonly and that sciatica occurred with equal frequency among former elite athletes compared with controls. For sciatic symptoms, one study comparing over 2,000 workers without sciatic pain to 327 workers with sciatic pain for one year found that exercise and most sports activities had no effect on sciatic pain (Maranda, Vikari-Juntura, Martikainen, Takala & Rihimaki, 2002). These studies suggest that for general population, exercise does not increase the risk of back pain or sciatica, and may actually have a slight protective effect against back pain.

Because exercise does not increase the risk of back pain in asymptomatic population, it seems plausible that regular exercise by people with back pain may be relatively safe, without unreasonable risk for additional injury or pain (Rainville et al, 2004). Individuals with low back pain could benefit from general positive health effects of exercise (Hartigan, Rainville, Sobel, & Hipona, 2000). Also, it would be encouraging if regular exercise benefited individuals with history of back pain by reducing the risk for future episodes of pain.

Several studies have examined the effect of exercise on recurrence rates of acute low back pain, and a number have reported positive results. In a study of 39 patients with acute back pain, Hides, Jull and Richardson (2001) demonstrated significant short term and long term decrease in the number of recurrence of back pain in a group of subjects randomized into treatment consisting of specific spine stabilization exercises compared with control group. Moffette, Torgerson, Bell-Syer, Jackson, Llewlyn-Phillips, Farrin & Barber (1999) demonstrated significantly fewer sick days at one year follow-up for subjects with low back pain randomized to an exercise programme that included strengthening and stretching as compared with traditional general practitioner management. Soukup, Glomsrol, Lonn, Bo and Larsen (1999) randomized 77 patients who had completed treatment for episode of low back pain in to a group that underwent 20 sessions of exercises that focused on pelvic, hip and abdominal exercises or a control group. At 12 months follow-up, there was significant reduction in recurrent low back pain episodes in the exercise group, but no difference in subsequent sick leave was noted.

For sub-acute, recurrent and chronic low back pain, some studies have also suggested that exercise may have a positive influence on the recurrence rates of back pain and work absence. Lindstrom,Ohlund, Eek, Wallin, Peterson, Fordyce & Nachemson (1992) reports on population sick- listed with subacute low back pain and noted that those randomized to an exercise programme had significantly less sick leave resulting from low back pain compared with the control group. Donchin, Woolf, Kaplan and Floman (1990) randomized 142 hospital employees reporting three annual episodes of low back pain into 3 months calisthenics group, a five-session back school or a control group. At one year, the calisthenics group reported significantly fewer “painful months” compared with the back school and control groups. Taimela, Diederich, Hubsch and Heinricy (2000) evaluated 125 patients with recurrent or chronic low back pain an average of 14 months after completion of 12 weeks active low back rehabilitation programme. They found recurrences of persistent pain occurred significantly less frequently among those who had maintained regular exercise habits after the treatment than among those who had been physically inactive. They also found significantly less work absenteeism among physically active individuals. They noted that those individuals with the best rehabilitation outcomes were more likely to maintain exercise.

A lack of effect on recurrence of low back pain or work absence has been noted by other studies. Dettori, Bullock, Sutlive, Franklin and Patience (1995) found no differences in recurrence rate among patients with acute low back pain 6 to 12 months after treatment regardless of randomization to a flexion exercise, an extension exercise or a no exercise group for 8 weeks. Faas, Chavannes, van Eijk, and Gubbels (1993), and Faas, van Eijk, Chavannes,and Gubbels (1995) found that exercise therapy for patients with acute low back pain did not reduce sickness absence. Bendix T, Bendix, Labriola, Haestrup and Ebbehoj (2000) compared patients with chronic back pain undergoing intensive physical training for 39 hours per week for 3 weeks with effect of outpatient intensive physical training one and a half hours 3 times a week for 8 weeks and found no difference in sick leave at one year follow-up. Bentsen, Lindgarde and Manthorpe (1997) randomized 74 women with chronic low back pain to either a dynamic strengthening exercise programme at a fitness centre or to a home training programme. Exercise adherence was better in the supervised training, but no differences in days of sick leave were noted for either group at 3 year follow-up.

2.4.2 Role of Exercise in Improving Back Function

Because the most obvious benefit of exercise is its ability to improve or maintain musculoskeletal and cardiovascular function, exercise may be useful for improving back function for patients with low back pain. With this goal in mind, exercise-based spine rehabilitation programmes are typically designed around the goals of strengthening, the back, increasing back flexibility and improving cardiovascular fitness.

This focus resulted from research demonstrating that impairments of trunk strength (Mayer, Smith, Keeley, & Mooney, 1985; Holmes,Leggett, Mooney, Nichols, Negri,&

Hoeyberghs, 1996; Risch, Norwell, Pollock, Risch E, Langer, Futton & Leggett, 1993; Rissanen, Kalimo & Alaranta, 1995), flexibility (Mayer T., Gatchel, Mayer H., Kishino, Keeley& Mooney, 1987; Waddell, Newton, Henderson, Somerville & Main, 1993; Rainville, Ahern, phalen, Childs & Sutherland, 1992) and endurance (van der Velde & Mierau, 2000) are in many people with chronic low back pain. These impairments result in part from long-term inhibition of movements and physical inactivity that result in neurological and physiological changes in the spine.

These changes include weakness of the paraspinal musculature, with selective loss of type 2 muscle fibres (Rissanen et al, 1995), alteration of the relaxation response of the paraspinal musculature associated with full spinal flexibility (Ahern, Hannon, Goreczny, Follick & Parziale, 1990) and shortening of muscles and connective tissues of the spinal region. This limitation of movement and activity is largely voluntary, as people both consciously and unconsciously limit activities that induce back pain, or avoid these altogether for fear of producing injury or harm. Inhibition of movements and activities usually begins early in the course of back pain and may be reinforced by health-care providers through their advice to patients to avoid activities and movements that induce pain (Rainville, Ahern & Phalen, 1993). Reversal of these impairments in back functions can be approached using established principles of exercise.

2.4.3 Exercise for Improving Impaired Flexibility

Studies have shown that lack of hamstring muscle flexibility/extensibility conditions a decrease of pelvic mobility (Kendall, McCreary & Provance, 2005). This invariably leads to biomechanical changes in the pressure distribution of the spine, and consequent spinal disorders (da Silva Dias & Gomez-Conesa, 2008). Therefore, poor hamstring extensibility has been associated with thoracic hyperkyphosis (Fisk, Baigent & Hill, 1984), Spondylosis (Standaert & Herring, 2000) and low back pain (Biering-Sorensen, 1984, Mierau, Cassidy & Yong-Hing, 1989).

Stretching exercise can be used to eliminate impaired flexibility and restore normal trunk range of motion. In order to be successful, however, stretching must be performed at the patient's physiological end range and therefore within the range of motion that may induce back discomfort. Stretching within painful range is safe and acceptable to patients when their health-care providers suggest it with confidence (Rainville et al, 2004).

Accurate assessment of trunk mobility is helpful for identifying impairments in flexibility and monitoring progress toward improvement. Useful motions to assess include lumbosacral flexion, extension and lateral flexion. Multiple techniques for measuring trunk range of motion are available for clinicians (Rainville et al, 2004). The most accurate measurements are obtained using dual inclinometer (Mayer et al, 1985). This technique allows for the measurement of total lumbosacral motion along with its lumbar and pelvic components. A simpler alternative uses a single inclinometer placed over the T_{12} to L_1 inter space and measures total lumbosacral motion only (Rainville et al, 1993). This technique has been found to be reliable and valid. For total lumbosacral motion, normal values for trunk flexion (100 – 120 degrees), extension (25 – 45 degrees) and lateral flexion (25 – 45 degrees) have been established (Mayer, et al, 1985; Waddell, et al, 1993). Angular tests such as, straight leg raise can be measured using an inclinometer by holding it on the tibial tuberosity while passively raising the leg until significant back or leg pain occurs or the pelvis is observed to rotate. Normal values for straight leg raise are 75 to 85 degrees (Mayer, et al, 1985; Waddell, et al, 1993; Ayala, Sainz de Baranda, De Ste Croix & Santonja, 2011). Nevertheless, due to the necessity of sophisticated instruments, qualified technicians and time constraints, the use of these angular tests seem to be limited in several settings (Castro-Pinero, Chillon, Ortega, Montesinos, Sjostrom & Ruiz, 2009).

Unlike the angular tests, lineal tests such as sit and reach test have a simple procedure, are easy to administer, require minimal skills training for their application, and the equipment necessary perform them is very affordable (Castro-Pinero, et al, 2009). Sit and Reach (SR) test in which a fingertips to tangent feet distance is measured are probably the most used linear measures of flexibility (Holt, Pelma & Burke, 1999).

Several methods of stretching are available. Ballistic stretching is not a design generally recommended because this activates muscle spindle reflexes that are counterproductive for improving muscle length (Rainvile, et al, 2004). Techniques using proprioceptive neuromuscular facilitation have been demonstrated to be effective but require a specially trained therapist or partner and are impracticable for independent home programmes. Static stretching is an effective means of improving flexibility and, it requires only minimal training and can be done without supervision (Rainville, et al, 2004). Static must be held at least for 30 seconds in order to induce changes in flexibility and can be repeated in up to 4 sets with additional benefits. Three sessions of stretching per week improve flexibility, but even greater gain in flexibility is made when stretching is performed five times per week. After flexibility has been increase through a training programme, one session of stretching per week is enough to maintain the increase (Rainville, et al, 2004). Stretching exercise should address the six directions of lumbar motion: flexion, extension, lateral flexion to the right and left, and rotation to the right and left. Additionally, stretches aimed at improving the length of hip flexors, extensors, rotators, abductors and adductors, hamstrings, quadriceps and calves should be emphasized (Rainville, et al, 2004). Multiple studies have documented the efficacy of stretching for improving trunk flexibility deficits in patients with chronic low back pain, with average improvement of about 20% noted (Lindstrom, et al, 1992; Mayer, et al, 1985; Rainville, et al, 1992; Sachs, David, Olimpio, Scala & Lacroix, 1990; Mellin,Harkapaa, Vanharanta, Hupli, Heinonen& Javikoski, 1993; Estlander, Mellin, Vanharata & Hupli, 1991). Long-term compliance with a therapeutic stretching regimen has been documented and is generally high (Hartigan, et al, 2000).

2.4.4 Strengthening Exercise for Improving Back Strength

Multiple studies have shown that trunk muscles of patients with chronic back pain are weaker than those of healthy individuals (Mayer, et al,1985; Holmes et al, 1996; Risch, et al, 1993; Rissanen, et al, 1995), many programmes advocate strength training to correct this impairment.

Resistance training is the most studied form of exercise used for the development of lumbar extension strength (Rainville, et al, 2004). The effectiveness of resistance-training programme for stimulating adaptation of trunk musculature is dependent on many factors.

These include load, frequency, volume and mode of training. Different authors advocate various mode of resistance training. Some advocate isoinertial resistive training on specifically developed equipment. These include advocates for equipment that isolated the spinal musculature and eliminate pelvic motion by firmly fixing the pelvis (Holmes, et al, 1996; Risch, et al, 1993; Tucci, Carpenter, Pollock, Graves & Leggett, 1992; Elnaggar, Nordin, Sheikhzadeh, Parnianpour & Kahanovitz, 1991; Nelson, Carpenter, Dreisinger, Mitchell, Kelly& Wegner, 1999; Carpenter & Nelson, 1999) and other who allow more contribution of pelvic motion during back extension (Taimela, Diederich, Hubsch, & Heinricy, 2000; Mayer et al, 1985; Rissanen et al, 1995; Kankaanpaa, Taimela, Airaksinen & Hanninen, 1999). One advantage of the isoinertial exercise equipment for resistance training is that performance level is constantly quantified, thereby giving continuous feedback concerning progress toward treatment goals.

For optimum strength training of deconditioned individuals using isoinertial exercises, the performance of sets of 8 to 12 repetition maximum (RM) is recommended (Donchin, Woolf, Kaplan & Floman, 1990; Feigenbaun & Pollock, 1999; Kraemer, Adams, Cafarelli, Dudley, Dooly, Feigenbaum,...,Triplett-McBride, 2002). Training at low loads (less than the RM) may be beneficial for reducing fear and voluntary inhibitions during initial training sessions but does not lead to improvement of strength and therefore should be limited to few sessions. The frequency of strength training has been studied, and no differences were noted in one versus three times per week (Graves, Pollock, Foster, Leggett, Carpenter, Vuoso & Jones, 1990) or two versus three times per week (Kraemer, et al, 2002). Currently, programmes recommend twice per week for most individuals (Holmes, et al, 1996; Risch, et al, 1993; Elnaggar, et al, 1991; Leggett, Mooney, Matheson, Nelson, Dreisinger, Van Zytveld & Vie, 1999) with higher frequencies of strength training recommended for disabled workers (Mayer et al, 1985; Rissanen, et al, 1995; Hazard, Fenwick, Kalisch, Redmond, Reeves, Reid & Frymoyer, 1989; Estlander et al, 1991; Edwards, Zusman, Hardcastle, Twomey, O'Sullivan& McLean, 1992), and those with needs for higher level of higher level of strength, such as athletes (Kraemer et al, 2002). In general, improvements of 30% to 80% of volitional muscle strength are observed during these programmes (Mayer, et al, 1985; Rissanen, et al, 1995; Mellin, et al, 1993; Hazard et al, 1989; Estlander, et al, 1991; Elnaggar, et al, 1991; Leggett et al, 1999; Rainville, Jouve, Hartigan, Martinez & Hipona, 2002). Maintenance of lumbar extensor strength has been demonstrated with training at one session per week (Carpenter & Nelson, 1999) and even as low as one session per month (Tucci et al, 1992).

Some advocate strengthening training using body weight as resistance. Multiple methods are possible, including simple floor exercises, the use of an exercise ball or methods in which the lower or upper part of the body is fixed or supported on a platform or table, and the remaining body is lifted or suspended from the edge of the platform using the strength of the trunk muscle (Manniche, Lundberg, Christensen, Bentzen & Hesselsoe, 1991; Ljunggren, Weber, Kogstad, Thom & Kirkesola, 1997; Hansen, Bendix, Skov, Jensen, Kristensen, Krohn & Schioeler, 1993). For most of these types of exercise, strength cannot be accurately quantified (although improvements in quality of performance and in number of repetitions is usually noted by the patient and therapist), and potential benefits for improving strength have received limited documentation. For trunk suspension training, measurement of improvement in duration of ability to perform a lumbar isometric hold was documented (Manniche et al, 1991; Ito,Shirado, Suzuki, Takahashi, Kaneda & Strax, 1996).

2.4.5 Exercise as Modality for Reducing Chronic Low Back Pain

A prevailing reason to use exercise for the treatment of chronic low back pain is that it may reduce back pain intensity and its accompanying disabilities. This effect has been observed in multiple uncontrolled, observational studies (Rainville et al, 2004).

Results from several randomized, controlled studies using a variety of types of exercise have demonstrated a positive effect on pain. Frost, Klaber, Moffett, Moser and Fairbank (1995) note that an active exercise programme consisting of eight sessions over 4 weeks was found to be superior to unsupervised home exercise instruction for pain reduction (38% in the exercise versus 13% in the home group). Torstensen, Ljunggren, Meen, Odland, Mowinckel and Geijerstom (1998) compared an active graded exercise programme consisting of three weekly sessions for 12 weeks with conventional physical therapy and unsupervised walking programme. They observed a 30% pain reduction in the active exercise group versus 23% pain reduction in the physical therapy group and 9% pain reduction in walking group at the end of the treatment. Alaranta,Rytokoski, Rissanen, Talo, Ronnemaa, Puukka,...and Slatis (1994) randomized 378 patients with back pain for less than six months and substantial work absences into 3-week functional restoration programme consisting of intensive exercise with educational and behavioural support or a control group that received passive physical therapy and low intensity exercise. The intensive exercise group reported greater pain reduction at follow up compared with control group (30% versus 20%). Manniche, et al (1991) randomized patients into various intensities back extension strengthening (50 repetitions versus 15 repetitions versus controls). He found that the most intensively exercised group had a significantly greater reduction in pain symptoms. Kankaanpaa, et al (1999) randomized patients with chronic back pain into a 12-week active rehabilitation programme consisting of resistive training versus a control group receiving passive treatments and noted a 54% reduction of pain in the active rehabilitation group versus no change in the control group.

Not all studies have demonstrated pain reduction with exercise. Bendix, et al (2000) performed a study using functional restoration versus community treatment but noted no change in pain in the treatment or the control group. Additionally, low intensity exercise may have less effect on back pain as reported by Hansen, et al (1993) no post treatment differences in pain in patient randomized into treatment consisting of floor exercises versus conventional physical therapy or placebo traction.

The mechanisms through which exercise may reduce back pain are not currently established. It has been theorized that exercise may reduce back pain through a process of neurological or physiological desensitization of pain producing tissue, through the repeated application of force or stress to that tissue (Rainville, et al, 2002).

Of importance, delayed onset muscle soreness is known to peak one to two days after exercise and may experienced or interpreted as an exacerbation of back pain by some patients (Evans, 1991). This muscle soreness occasionally aggravates patients' fears about re-injury and must be addressed effectively in order to avoid undermining the exercise programme. Frequent reassurance that fluctuations in pain are expected in response to exercise may be important for the successful use of exercise treatments (Rainville et al, 2004).

2.4.6 Exercise as Treatment for Disability Components of Chronic Low Back Pain

It is recognized that psychosocial, behavioural, cognitive and affective factors play crucial roles in the development of chronic low back pain syndromes and especially back pain-related disability (Rainville et al, 2004). By understanding the mechanisms by which these factors influence back pain; one can envision ways that exercise may be used as a therapeutic modality these issues.

In 1983, a fear avoidance model of exaggerated pain perception was introduced citing two extreme possible behavioural responses to the threat of pain; confrontation or avoidance (Lethem, Slade, Troup & Bentley, 1983). Theoretically, those who were able to effectively confront their pain were able to maintain and increase their physical/social activities leading to reduction in fear overtime and recovery. Those who exhibited primarily avoidance responses were more prone to developing chronic symptoms and associated physical impairment and disability. Philips (1987) postulated that pain avoidance was influenced by the expectancy that further exposure to certain stimuli will result in pain and suffering. Subsequent research in the area has focused on fear pain (McCracken, Zayfert & Gross,1992; Al-Obaidi, Nelson, Al-Awadhi & Al-Shuwaie, 2005), fear of movement presumed to cause re-injury (Kori, Miller & Todd,1990; Vlaeyen, Kole-Snijders, Boeren & van Eek, 1995) and pain attitudes and beliefs (Riley, Ahern & Follick,1988; Rainville, Sobel, Hartigan & Wright, 1997; Council, Ahern, Follick & Kline, 1988), and all have demonstrated that fears, attitudes and beliefs strongly influence back pain related disability.

With this in mind, exercise can potentially be used as a tool to confront fears, reshape attitudes and beliefs and alter behavioural responses to pain. Over the last two decades, multiple studies using exercise as the primary mode of treatment have demonstrated significant reduction of disability after training, presumably in part because of the influence of exercise on these parameters (Taimela, et al, 2000; Risch, et al, 1993; van der Velde & Mierau, 2000; Kankaanpaa, et al, 1999; Rainville, et al, 2002).

2.5 Summary

Low back pain has constituted a major health problem the world over, with a very high prevalence rate. Low back pain is self-limiting, but some will advance into chronic stage. Majority of low back pain is referred to as "non-specific" low back pain and does not have definitive cause (Casazza, 2012).

The low back region also called the lumbar region is made up of five (5) vertebrae (L_1-L_2). In between these vertebrae lie intervertebral discs which act as cushion, at same time protecting the spinal cord. Stability of the spine is provided through ligaments and muscles of the back.

Causes of low back pain are varied, most cases are believed to be due to sprain or strain in the muscles and stiffness of the soft tissue. Over activity of the muscles can lead to injury and pain. Degenerative changes in the spine and aging process have also been implicated. The intensity of low back pain is usually evaluated by a visual analogue scale (VAS), numerical rating scale, or a disability scoring system, such as the Oswestry Disability Index (ODI), Roland Morris Disability Questionnaire, and others.

A promising treatment is the one that appear to have clinically important effects that are maintained in the long term, are readily available and of modest cost and there is biological plausibility for the effect. Exercise training has seemed to satisfy all these criteria.

Exercise has been suggested to have important effects on back pain. However, over the years, there have been conflicting evidences concerning the efficacy of exercise in the management of low back pain. Several studies had been carried out to ascertain the safety of exercise on low back pain patients (Suni, et al, 1998, Herreby, et al, 1997, Croft, et al, 1999, Hides, et al, 2001) and many others reported no risk. The safety of exercise in adults with low back pain has long been established, provided there are no existing conditions that preclude exercise (Rainville, et al, 2004).

Various forms of exercises were employed in the past with the aim of relieving pain, improving spinal strength, flexibility, functional ability and reducing disability. Because of its ability to improve or maintain musculoskeletal and cardiovascular function, exercise may be useful for improving back function for people with chronic low back pain.

Multiple studies have shown that trunk muscles of patients with chronic back pain are weaker than those of healthy individuals, many programmes advocate strength training to correct this impairment. Resistance training is the most studied form of exercise used for the development lumbar extension strength (Rainville, et al, 2004).

A prevailing reason to use exercise for the management of chronic low back pain is that it may reduce back pain intensity and its accompany disabilities. Results from several randomized, controlled studies using variety of types of exercise have demonstrated a positive effect on pain.

It is also recognised that psychosocial, behavioural, cognitive and affective factors play crucial roles in the development of chronic low back pain syndromes and especially back pain related disability. By this, one can envision ways that exercise may be used as therapeutic modality for these issues. Exercise can potentially be used as a tool to confront fears, reshape attitudes and beliefs and alter behavioural responses to pain. Over the last two (2) decades, multiple studies using exercise as the primary mode of treatment have demonstrated significant reduction of disability after training, presumably in part because of the influence of exercise on these parameters.

From afore review of literatures, it is not sensible to talk about evaluating the efficacy of exercise without specifying the type of exercise. Hence this study investigated the effect of resistance training programme on patients with nonspecific chronic low back pain.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This study investigated the effect of low intensity resistance training programme on pain, disability and flexibility in adults with nonspecific chronic low back pain in Kaduna metropolis. To achieve this purpose, the research design, population, sample and sampling technique, research instruments and procedures for data collection, training methods and statistical techniques employed for this study are described in this chapter.

3.2 Research Design

A single group pre-test - post-test research design was used for the study. This is a design that has no separate control group, same subjects were used for both the experimental and control groups. The data from the same participants were collected before the training programme (low intensity resistance training) and at the end of the 8 weeks low intensity resistance training. The data before the training programme (pre-treatment) was analysed against the data at the end of the 8 weeks of low intensity resistance training programme (post-treatment).

3.3 Population of the Study

The subjects for this study were 32 adults with chronic low back pain attending Physiotherapy and Orthopaedic Clinics of Barau Dikko Specialist Hospital, Kaduna, in Kaduna State, Nigeria. They were male and female adults between the ages of 35 and 55 years.

3.4 Sample and Sampling Procedure

Using purposive sampling technique, 21 adults both male and female with chronic low back pain were selected from among the 32 patients attending Physiotherapy and Orthopaedic Clinics in Barau Dikko Specialist Hospital, Kaduna with a case of low back pain. The case files of the 32 patients attending Physiotherapy and Orthopaedic clinics in Barau Dikko Specialist Hospital, Kaduna on the account of low back pain were screened. Only adults between the ages of 35 and 55 years with chronic low back pain (history of more than 12weeks) and non-specific (non- identifiable cause) were selected. Adults with "specific" chronic low back pain and those that could not agree to sign the informed consent form were also excluded in the study.

3.5 Instrumentation

The following instruments were used for data collection.

3.5.1 Weighing Scale/ Standiometer

Weighing scale with Height measure (ZT-120), made in China (Ningbo TianHou) was used to measure the body weight and height of the subjects.

3.5.2 Sphygmomanometer and Stethoscope

Accoson mercury sphygmomanometer and Littman stethoscope were used to monitor the arterial blood pressure of the subjects by means of direct method. (Accoson mercury sphygmomanometer DEKAMET 300mmHg, plastic tube adult bandage cuff, made in England by A. C. Cossor & Sons (SURGICAL) Ltd and Littman Classic stethoscope, made in England by 3M Health Care).

Sphygmomanometer is a device that measures blood pressure. It composes of an inflatable rubber cuff, which is wrapped around the arm. A measuring device indicates the cuff's pressure. A bulb inflates the cuff and a valve releases pressure. A stethoscope is used to listen to arterial blood flow sounds.

Procedure: To begin blood pressure measurement, the proper size blood pressure cuff is used. The length of the cuff's bladder should be at least equal to 80% of the circumference of the upper arm. The cuff is wrapped around the upper arm with the cuff's lower edge one inch above the antecubital fossa. The stethoscope's bell or diaphragm is lightly pressed over the brachial artery just below the cuff's edge. The cuff is rapidly inflated to 200mmHg, and the air is being released from the cuff at a moderate rate of 3mm/sec, while using the stethoscope to listen and simultaneously observing the mercury guage. The first knocking sound is the subject's systolic, and when the knocking sound disappears, that is the diastolic. The corresponding values on the mercury gauge when the first knocking sound is heard, and when it disappears is recorded as the systolic and diastolic blood pressures.

Reliability: Mercury Sphygmomanometer still remains the gold standard in measuring blood pressure.

3.5.3 Heart Rate Monitor

Polar Heart Rate Monitor (FT1), made in Finland by Polar

3.5.4 Quadriceps Exercise Bench

Standard Weight Bench with barbells, made in USA by CAPBARBELL.

3.5.5 Cycle Ergometer

Two Magnetic Upright 1300 Cycle Ergometers, made in China.

3.5.6 Free Weights

Sand bags, dumb-bells and bar-bells (of various weights)

3.5.7 Sit and Reach Testing Box: locally constructed to specifications. This is box made out of plywood, measuring 12 inches in height and 10 inches in width. The top of the box measures 21 inches, with 9 inches protruding forward. With this arrangement the feet level is at 9 inches. The sit and reach test is a common measure of flexibility, and specifically measures the flexibility of low back and hamstring muscles. This test is important because tightness in this area is implicated in lumbar lordosis, forward pelvic tilt and low back pain. The test was first described by Wells and Dillon in 1952, and is now widely used as a general test of low back and hamstring flexibility (Holt, et al, 1999; Castro-Pinero, et al, 2009).

There are few variations of the test. Many variations of this test involve the differences in value of the level of the feet. The most logical measure is to use the level of the feet as recording zero; so that any measure that does not reach toes is negative any reach past the toes is positive. However, using negative values is more difficult for statistical analyses, and for comparing results.

Procedure: the test involves sitting on the floor with the legs stretched out straight ahead, with the knees fully extended. Shoes should be removed. The sole of the feet placed flat against the box. Both knees should be locked and pressed flat to the floor. The tester may assist by holding them down. With the palms facing downwards, and the hands on top of each other or side by side, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level, not one reaching further forward than the other. After some practice reaches, the subject reaches out and holds that position for at 1-2 seconds while the distance is recorded. There should not be jerky movements.

Scoring: The score is recorded to the nearest centimetre or half inch as the distance reached by hand.

3.5.8 Visual Analogue Scale (VAS)

Visual Analogue Scale is a graphic rating scale. It was first developed and described by Hayes and Patterson in 1921 (Hayes & Patterson, 1921). A Visual Analogue Scale (VAS) is a measurement instrument that tries to measure a characteristic or attitude that is believed to range across a continuum of values and cannot easily be directly measured. It is often used in epidemiologic and clinical research to measure the intensity of frequency of various symptoms. For example, the amount of pain that a patient feels ranges across a continuum from none to an extreme amount of pain. From the patient's perspective, this spectrum appears continuous and pain does not take discrete jumps, as a categorization of none, mild, moderate and severe would suggest. It was to capture this idea of an underlying continuum that the VAS was devised (Gould, Kelly, Goldstone & Gammon, 2001).

Purpose: The pain VAS is a uni-dimensional measure of pain intensity, which has been widely used in diverse adult populations including those with rheumatic diseases and low back pain.

Reliability: Test-retest reliability has been shown to be good, but higher among literate ($r = 0.94$, $p = 0.001$) before and after attending a rheumatology out-patient clinic.

Validity: In the absence of a gold standard for pain, criterion validity cannot be evaluated. For construct validity, in patients with a variety of rheumatic diseases, the pain VAS has been shown to be highly correlated with 5-point verbal descriptive scale (Nil, mild, moderate, severe and very severe) and a numeric rating scale (with response options from no pain to unbearable pain), with correlation ranging from 0.71 – 0.78 and 0.62 – 0.92 respectively. The correlation between vertical and horizontal orientations of the VAS is 0.99.

Wewers and Lowe (1990) provide informative discussion of the benefits and shortcomings of different styles of VAS. These scales have proven a highly reliable and valid instrument in researches (Childs, Flynn, Fritz, Irrgang, Johnson, et al, 2004).

3.5.9 Oswestry Low Back Pain Disability Questionnaire

The most commonly used disability scales for people with low back pain are the Roland-Morris Disability Scale and the Oswestry Low Back Pain Disability Questionnaire (Beurskens, de Vet, Koke, van der Heijden & Knipschild, 1995). This is a self-administered questionnaire. This validated questionnaire was first popularized by Fairbank, Couper and Davies in 1980. The Oswestry Disability Index is considered by researchers as the gold standard for measuring degree of disability and estimating quality of life in a person with low back pain. The Oswestry Questionnaire indicates the extent to which functional level is restricted by back pain, concentrating on the effects rather than nature of pain. It includes 10 sections of 6 points scale (0-5) each, which rate the intensity of pain and the effect of pain on; personal care, lifting, walking, sitting, standing, sleeping, homemaking/job duties, social life and travelling. It represents a measurement of disability due to pain, rather than pain as impairment. It is the most often used in addition to VAS (Fairbank, Couper, Davies & O'Brien, 1980).

Scoring and Interpretation: Each section is scored between 0 and 5, with the higher values indicating greater disability. The score is calculated as the total score divide by the total possible score multiply by 100. The sum of scores is expressed as a percentage of the maximum score, known as the Oswestry Disability Index (ODI). ODI scores from 0 - 20% represent minimal disability, scores from 20 - 40% represent moderate disability, 40 - 60% represent severe disability, and scores over 60% represent severe disability in several areas of life.

Validity and Reliability: Oswestry scores correlated -0.23 with sense of Coherence Scale. An effect size of 8.80 has been reported for the Oswestry Questionnaire. It has test - re-test reliability of 0.99. Fairbank, et al (1980) also reported "good internal consistency" but offered no statistical summary. The measurement properties of both scales have been studied extensively, and report of the International Forum for Primary Care Research in Low Back Pain contended that both scales are acceptable for measuring disability related to low back pain (Deyo, Battie, Beurskens, Bombardier, Croft, Koes,…, Waddell, 1998).

3.6 Informed Consent and Ethical Approval

The approval of the management of Barau Dikko Specialist Hospital, Kaduna was sought and obtained in writing. An informed consent of all the subjects was also sought, after vivid explanation of the procedures and objectives of the study. Acceptance and agreement to participate in the research was given by each subject signing or thumb-printing the consent form.

3.7 Procedure for Data Collection

The data collection was carried out in the Physiotherapy Department of Barau Dikko Specialist Hospital, Kaduna. Prior to starting the training, individual's age, height, weight, blood pressure, resting heart rate and flexibility (using sit and reach test) were assessed, and Visual Analogue Scale (pain assessment) and Oswestry Low Back Pain Questionnaire (disability assessment) were administered. These tests were repeated after the eighth week of training.

The training programme was conducted three times per week on alternate days i.e. Monday, Wednesday and Friday for duration of 8 weeks.

3.7.1 Warm ups and Stretching Exercise

Each subject underwent warm up for 15 minutes. The warm up included low intensity cycling and stretching exercises.

3.7.1.1 Cycling

Each subject was engaged cycling ergometry at an intensity of 40% - 50% of HR_{max} (age predicted maximum heart rate) for 10 minutes. The maximum heart rate (HR_{max}) was obtained by subtracting the age of the individual from 220. The height of the cycle ergometer seat was adjusted accordance to each individual's height; the knee was slightly flexed to 15 degrees as suggested (Plowman and Smith, 1984), and each individual assumed an upright seated posture with the hands positioned on the handle bars. An effort was made to achieve the specified heart rate range within 2 minutes of initiating the exercise. The revolutions per minute (RPM) were kept between 70 and 90 to avoid local muscular fatigue.

The aim of the cycling exercise was to increase blood flow and raise the temperature of the muscles prior to the stretching and resistance exercises. It has been suggested that stretching is at it best when the muscles have been warmed up and with increased blood flow.

3.7.1.2 Stretching Exercises

3.7.1.2.1 Single Knee Pull: To stretch lower back and back of the leg. The subject lied on the back, hands at sides. One leg was pulled to the chest, grasped with both arms and held for 10 counts. This was repeated with opposite leg, with 5 repetitions each.

3.7.1.2.2 Double Knee Pull: To stretch lower back and buttocks. The subject lied on the back, hands sides. The legs were pulled to the chest and the arms were locked around the legs, the buttocks was slightly pulled off the ground and held for 10 counts. This was repeated for 5 times.

3.7.1.2.3 Seated Pike Stretch: To stretch lower back and hamstrings. The subject sat on the floor with legs extended and the knees together. The subject exhaled and stretched forward, slowly sliding hands towards the toes. The subject stretched till there was discomfort, and then held for 10 counts. This was repeated 5 times.

3.7.1.2.4 Sitting Stretch: To increase flexibility of lower back and hamstrings. The subject sat on the floor with the knees extended and the legs spread apart as it is comfortable. The subject stretched forward and reached as far as possible, until there was discomfort and then held for 10 counts. This was repeated for 5 times.

3.7.1.2.5 Half Bow: This was to stretch the top of the thigh and groin area. The subject was made to lie on the side (side lying), with the knee of the opposite side flexed, held the ankle with the corresponding hand, the back was slightly arch, until there was slight discomfort at the front of the thigh, and then held for 10 counts. This was repeated 5 times. The position was reversed and same procedure was done for the opposite side.

3.7.2 Resistance Training Programme

The training combined the use of free weights and body weight for the strengthening of the muscles of the spine (erector spinea) and abdomen (rectus abdominis, oblique abdominis, transverse abdominis), including the hip extensors (gluteal maximus) and flexors (ilio-psoas), and the quadriceps femoris.

3.7.2.1 Back extension in prone lying (prone cobra): Subject lied in prone on an exercise mat, with the arms at your side; lifted the head and chest off the couch; held the gluteus (buttock muscles) tight and squeezed the shoulder blades together; held briefly and returned to starting position. The resistance was produced by the upper part of the body. Ten repetitions were performed, one set per session initially and was progressed to two sets and three sets per training session at the interval of 2 weeks. The muscles that were directly strengthened are gluteal muscles (especially the gluteal maximus and the lower back extensors (lower portion of erector spinea).

3.7.2.2 Double legs lift: The subject was in prone position on a couch, holding the couch with both hands, with the hips downward hanging freely off the couch, the subject was made to lift both lower limbs simultaneously as much as possible or until the lower limbs were at horizontal level. And progression was achieved by how high the legs could go and the number of successful repetitions. Ten repetitions were performed, in one set per session initially and progressed to two sets and three sets per training session at intervals of 2 weeks. This exercise particularly strengthens the gluteus maximus and the erector spinea.

3.7.2.3 Hip flexion in supine lying with weights (sand bags). The subject lied on the back (supine lying), with a weight (Sand bag) tied at the ankle. First of all the sand bags were used to determine the 1-RM of the individual. The subject lifted the leg straight against the resistance while keeping the knee locked in extension and flexing the hip to about 45 degrees. Load of 40% of 1-RM was used initially, with ten repetitions per leg in one set per session for the first 2 weeks, and then later increased 50% and 60% of 1-RM, ten repetitions in 2sets and 3 sets per session was performed respectively at the incremental intervals of 2 weeks. This exercise strengthens primarily the hip flexors (the ilio-psoas muscles) and secondarily, the abdominal muscles (Rectus abdominis and oblique abdominis).

3.7.2.4 Hip extension in prone lying with weights (sand bags). The subject lied on the tummy facing down (prone lying), with a weight (sand bag) tied at the ankle. First of all the sand bags were used to determine the 1-RM of the individual. The subject lifted the leg straight against the resistance, locking the knee in full extension, while extending the hip at about 30 degree to horizontal. Load of 40% of 1-RM was used initially, with ten repetitions per leg in one set per session for the first 2 weeks, and then later increased 50% and 60% of 1-RM, eight to ten repetitions in 2sets and 3 sets per session was performed respectively at the incremental intervals of 2 weeks. This exercise strengthens the major hip extensor, the gluteus maximus and the lower portion of the back extensors (erector spinea).

3.7.2.5 Abdominal crunch or sit-up: The subject lied on an exercise mat in supine position, with the arms folded across the chest, and both legs straight together and fully supported by the researcher. The subject lifted up the trunk to a near sitting position, and then back to the starting position. With upper body serving as the weight or the resistance. Ten repetitions, in one set per session was performed initially for the first 2 weeks, which was progressed to two sets then three sets per session at the interval of 2 weeks each. This exercise strengthens the abdominal muscles (rectusabdominis, tranverse abdominis and obliqueabdominis), which are the prime flexors of the spine.

3.7.2.6 Quadriceps strengthening: the subject sat on the quadriceps bench, with the back fully supported, keeping the thigh at right angle with the vertical and the knee joint also at approximately 90^0. First of all the bar-bells were loaded to determine the 1-RM of the individual. The subject extended the knee against the resistance provided by the weights (bar-bells), then back to the starting point. Load of 40% of 1-RM was used initially, with ten repetitions per leg in one set per session for the first 2 weeks, and then later increased 50% and 60% of 1-RM, ten repetitions in 2sets and 3 sets per session was performed respectively at the incremental intervals of 2 weeks. This exercise basically strengthens the quadriceps femoris muscles (rectus femoris, vastus lateralis, vastus medialis and vastus intermedius).

3.7.2.7 Superman: Subject lied prone on an exercise mat with arms and legs extended; retracted shoulder blades down and in towards the midline of the spine and drew in abdominal muscles; maintaining this position, the subject lifted the opposite arm and opposite leg (the left arm and the right leg) ensuring that the hips stayed in contact with the floor; held for 3-5 seconds and reversed sides. Ten repetitions in one set per session was performed for the initial 2 weeks, and then progressed to 2 sets and 3 sets per training session at the interval of 2 weeks. This exercise strengthens the core muscles of the back, which are responsible for the stability of the back.

Table 3.7.1: Summary of the 8 weeks Low Intensity Resistance Training

Exercise Components	**Week 1 & 2**	**Week 3 & 4**	**Week 5 - 8**
Back Extension in prone lying (Prone Cobra)	10 repetitions per set 1 set per session	10 repetitions per set 2 sets per session	10 repetitions per set 3 sets per session
Double leg lift	10 repetitions per set 1 set per session	10 repetitions per set 2 sets per session	10 repetitions per set 3 sets per session
Hip Flexion in supine lying with weights	40% of 1-RM load 10 repetitions per set 1 set per session	50% of 1-RM load 10 repetitions per set 2 sets per session	60% of 1-RM load 10 repetitions per set 3 sets per session
Hip Extension in prone lying with weights	40% of 1-RM load 10 repetitions per set 1 set per session	50% of 1-RM load 10 repetitions per set 2 sets per session	60% of 1-RM load 10 repetitions per set 3 sets per session
Abdominal Crunch or Sit-up	10 repetitions per set 1 set per session	10 repetitions per set 2 sets per session	10 repetitions per set 3 sets per session
Quadriceps Strengthening	40% of 1-RM load 10 repetitions per set 1 set per session	50% of 1-RM load 10 repetitions per set 2 sets per session	60% of 1-RM load 10 repetitions per set 3 sets per session
Superman	10 repetitions per set 1 set per session	10 repetitions per set 2 sets per session	10 repetitions per set 3 sets per session

One Repetition Maximum (1-RM) is the maximum amount of weight one can lift in a single repetition for a given exercise.

3.8 Statistical Techniques

The data collected for the research was analysed using Statistical Package for Social Science (SPSS). The descriptive statistics of mean, standard deviation and standard error of estimates of the physical and Physiological characteristics were computed. While the student t-test for paired sample was used to test the difference between pre-test and post-test, of pain, disability and flexibility in adults with chronic low back pain after 8 weeks of low intensity resistance training programme at 0.05 level of significance.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The purpose of this study was to assess the effects of low intensity resistance training on adults with chronic low back pain in Kaduna metropolis. To achieve this purpose, the data collected for this study were statistically analysed, the results of which are presented and discussed in accordance with the hypotheses in this chapter.

4.2 Results

Eighteen (18) subjects participated in the study; the training duration lasted for 8 weeks of low intensity resistance training at the frequency of 3 sessions per week for each subject. Data were collected at baseline and at the end of 8 weeks of training.

The baseline descriptive statistics of physical and physiological characteristics of the subjects are presented in table 4.2.1.

Table 4.2.1: Descriptive Statistics of Physical and Physiological Characteristics of the Subjects

Variables	Range	Mean	SD	SEE
Age (yrs)	35 - 54	48.33	4.65	1.097
Height (m)	1.62 – 1.81	1.69	0.051	0.012
Weight (Kg)	65 – 81	73.28	4.29	1.012
BMI (Kgm^{-2})	22.7 – 29	25. 69	1.93	0.455
RHR (beat/min)	64 – 76	70.41	3.81	0.899
SBP (mmHg)	110 – 140	127.78	8.61	2.031
DBP (mmHg)	80 – 90	83.33	4.54	1.071

SD = Standard deviation, SEE = Standard error of estimate, BMI = Body mass index, RHR = Resting heart rate, SBP = Systolic blood pressure, DBP = Diastolic blood pressure

The table 4.2.1 above shows the ranges of the distributions of age, height, weight, BMI, RHR, SBP and DBP of the subjects. It also shows the means, standard deviations and standard error of estimate of the physical and physiological characteristics.

Hypotheses Testing

Sub-hypothesis I

There is no significant effect of low intensity resistance training programmes on pain of adults with chronic low back pain in Kaduna metropolis.

In order to find out the effect of the training programme on pain, the data collected on pain at baseline and at the end of week 8 were statistically analysed using descriptive statistics and the student’s t-test, and the results are presented in tables 4.2.2a and 4.2.2b.

Table 4.2.2a: Descriptive Statistics of the VAS Score of Pain at Baseline and after 8 Weeks of resistance training

Period	N	mean	SD	SEE
Week 0	I8	4.22	1.060	0.250
Week 8	18	2.78	0.647	0.152

N = Number of subjects

Table 4.2.2b shows decrease in the mean and standard deviation between of the measurements at the end of the resistance training when compared with that of the measurements at baseline. Therefore, the decrease in mean and SD suggests a decrease in pain intensity.

Table 4.2.2b: t-test Analysis of pre and post-tests VAS Scores for Pain of Resistance Training

Period	Mean	SD	DF	t-cal	p
Week 0	4.22	1.060			
Week 8	2.78	0.647	17	8.695	0.000

$t(17) = 2.110$ $p < 0.05$

From table 4.2.2b, it can be seen that the calculated p value for the 2-tailed test is less than 0.0001, which is below chose α level of significance. The calculated t (-8.695) is greater than the t-critical for 2-tailed test. The negative sign signifies the decrease in pain level reported by the subjects. Therefore, the null hypothesis is rejected and the alternate hypothesis accepted. This means that low intensity resistance training programme has significant effect on pain as captured by VAS in adults with chronic low back pain in Kaduna metropolis.

Sub-hypothesis II

There is no significant effect of low intensity resistance training on the disability index of adults with chronic low back pain in Kaduna metropolis.

In order to find out the effect of the training programme on the disability index as captured by the Oswestry Disability Questionnaire, the data collected and scored at baseline and at the end of week 8, were analysed using descriptive statistics and the student's t-test and the results are presented in tables 4.2.3a and 4.2.3b.

Table 4.2.3a: Descriptive Statistics of the Disability Index Score at Baseline and after 8 weeks of Resistance Training

Period	N	mean	SD	SEE
Week 0	I8	30.78	5.621	1.325
Week 8	18	25.44	4.643	1.094

Table 4.2.3a above shows decrease in the mean and standard deviation of the measurements at end of the 8 weeks resistance training as compared with that of the measurements obtained at the baseline. Therefore, decrease in the mean and SD at the end of the resistance training suggests a reduction in disability index.

Table 4.2.3b: t-test Analysis of pre and post-tests Disability Index Scores of Resistance Training

Period	Mean	SD	DF	t-cal	p
Week 0	30.78	5.621			
Week 8	25.44	4.643	17	7.567	0.000

$t(17) = 2.110$ $p < 0.05$

From table 4.2.3b above, it can be seen that, the calculated t (7.567) is greater than the critical t value for 2-tailed test at 0.05 α level of significance and the degree of freedom (df) is 17. This shows that there was significant decrease in disability index as reported by the subjects. The calculated value of *p* is less than the level of significance for 2-tailed test value which is 0.025. This leads to the rejection of null hypothesis which states that, there is no significant effect of the training programme on the disability index of adults with chronic low back pain in Kaduna metropolis. Therefore the alternate hypothesis is here by accepted. Low intensity resistance training programme has a significant effect on the disability index of adults with chronic low back pain in Kaduna metropolis.

Sub-hypothesis III

There is no significant effect of low intensity resistance training programme on lumbar flexibility of adults with chronic low back pain in Kaduna metropolis.

In order to find out the effects of the combined training programmes on the low back flexibility as captured by sit and reach test, the data collected at baseline and at the end of week 8 were subjected to student's t-test and the results are presented in tables 4.2.4a and 4.2.4b.

Table 4.2.4a: Descriptive Statistics of the Lumbar Flexibility Scores at Baseline and after 8 weeks of Resistance Training

Time	N	mean	SD	SEE
Week 0	I8	9.517	2.328	0.549
Week 8	18	10.078	2.193	0.517

Table 4.2.4a shows increase in the mean and standard deviation between the measurements at baseline and at week 8 after the low resistance training. This suggests an increase in lumbar flexibility as measured by the sit and reach box.

Table 4.2.4b t-test Analysis of pre and post-tests Flexibility measurements of Resistance Training

Period	Mean	SD	DF	t-cal	p
Week 0	9.517	2.328			
Week 8	10.078	2.193	17	11.879	0.000

$t(17) = 2.110$ $p < 0.05$

From table 4.2.4b above, the calculated *t* value from the t-test which 11.879 is greater than the t-critical at 0.05 α level of significance for 2-tailed test and the p value is less than 0.00001, which is smaller than 0.05. This led to the rejection of the null hypothesis. Low intensity training programme has significant effect on lumbar and hamstring flexibility as analysed by the t-test.

4.3 DISCUSSION

The purpose of this study was to find out how effective could low intensity resistance training programme of 8 weeks duration be in the management of chronic low back pain in adults, viz a viz pain intensity, disability index and low back flexibility. A prevailing reason to use exercise for the treatment of chronic low back pain is that it may reduce back pain intensity and its accompanying disabilities. This effect has been observed in multiple uncontrolled, observational studies (Rainville, et al, 2004). From the analysed results of this study, it shows that the resistance training programme had appreciable effect on pain intensity, disability index and lumbar and hamstrings flexibility as reported by the subjects and from the sit and reach readings. From the descriptive statistics there has been an improvement in the mean and standard deviation of the flexibility index, when the baseline data is compared against the data collected at week 8. Inferential statistical analysis by the way of t-test has demonstrated that the changes are of statistical significance. Although the mechanisms by which the exercises improve the quality of life of the low back suffer is still unclear, but many factors are likely to have contributed to the reduction in pain perception and degree of disability.

It has been theorized that exercise may reduce back pain through a process of neurological or physiological desensitization of pain producing tissues, through repeated application of forces or stress to that tissue (Rainville et al, 2002). The positive effects of this study could be as a result of improved low back fitness brought about by the resistance training to strengthen the spinal muscles. It was observed by Suni et al, (1998), that low level of back fitness was associated with back dysfunction and pain, and high level of fitness related to positive back health. These impairments result in part from long-term inhibition of movements and physical inactivity that result in neurological and physiological changes in the spine.

This limitation of movement and activity is largely voluntary, as people both consciously and unconsciously limit activities that induce back pain. Reversal of these impairments in back functions can be approached using the established principles of exercise. Exercise based spine rehabilitation programmes are typically designed around the goals of strengthening the back, increasing back flexibility and improving cardiovascular fitness. The choice of resistance training programme that revolved around the lower back and the lower limbs muscles was aimed at improving spinal strength and stability.

This study has agreed with the finding of Frost et al (1995), which noted that active exercise programme consisting of 8 sessions over 4 weeks was found to be effective in pain reduction of back pain patients. Torstensen et al (1998) also recorded 30% pain reduction after 12 weeks of exercise programme. However, not all studies have demonstrated pain reduction with exercise. For instance, Bendix et al (2000) and Hansen et al (1993) reported no significant reduction in pain following exercise programmes. The factors that were likely to have contributed to inconsistent results across trials in the past, could be due to improper interpretations of the results of the exercise trials; because most trials have been pragmatic trials, comparing two active treatments delivered in routine practice (e.g. exercise Vs usual medical care (O'Sullivan et al, 1987); exercise Vs physiotherapy (Hemmila et al, 2002). These comparisons cannot provide a clear estimate of the effects of exercise because most of the comparison treatments are also of unknown efficacy. There has also been insufficient appreciation by the researchers conducting trials and by reviewers summarizing trials of wide variety of forms exercise can take and also trials do not control the quality of exercise intervention. While exercise is typically regarded as a single class treatment, I believe that this level of conception is inappropriate and analogous to not distinguish between different types exercise.

Multiple studies have shown that trunk muscles of the patients with chronic back pain are weaker than those of healthier individuals (Mayer et al, 1985, Holmes et al, 1996, Risch et al, 1993, Rissanen et al, 1995). Therefore, resistance training is the most studied form of exercise used for the development of lumbar extensors strength (Rainville et al, 2004). It has also been recognised that psychosocial, behavioural, cognitive and effective factors play crucial roles in the development of chronic low back pain syndromes and especially back pain related disability (Rainville et al, 2004). People voluntarily limit movement and activity due to fear of producing injury or harm. In 1983, a fear avoidance model of exaggerated pain perception was introduced citing extreme possible behavioural responses to the threat of pain; confrontation or avoidance (Lethem et al, 1983). Theoretically, those who were able to effectively confront their pain were able to maintain and increase their physical/social activities leading to reduction in fear over time and recovery. Philips (1987) postulated that pain avoidance give rise to disability. Subsequent research in the area has focused on fear of pain (McCracken et al, 1992; Al-Obaidi, et al, 2005), fear of movement presumed to cause re-injury (Kori, et al, 1990; Vlaeyen, et al, 1995) and pain attitudes and beliefs (Riley, et al, 1988; Rainville, et al, 1997), and all have demonstrated that fears, attitudes and beliefs strongly influence back pain related disability. With this in mind, exercise acts as a tool to confront fears, reshape attitudes and beliefs and alter behavioural responses to pain. Basing their claims on this theory, multiple studies using exercise as the primary mode of treatment have demonstrated significant reduction of disability after training (Taimela, et al, 2000; Risch, et al,1993; van der Velde & Mierau, 2000; Kankaanpaa, et al, 1999; Rainville, et al, 2002. This could also be the reason why the study reported decrease in pain and reduction in disability index.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

Many studies in the past have tried to evaluate the efficacy of exercise in the management of back pain. However, various modes of exercise were employed to evaluate the effects of exercise in the management of low back pain. But there had always been conflicting results as to the efficacy of such exercise in low back pain management.

However, this study utilized low intensity resistance training programme in the management of adults with chronic low back pain in Kaduna metropolis. It looked at the effect the training programme would have on these parameters; pain intensity, disability index and low back flexibility, as they affect low back pain subjects. The resistance training concentrated on the muscles of the low back and those of it supporting regions. The training programme was administered for duration of 8 weeks at the frequency of 3 times per week on alternate basis.

Total of eighteen subjects started and concluded the study, ages between 35 to 55 years, with history of low back pain of above 12 weeks in duration. The subjects' physical and physiological characteristics were recorded at baseline and the body mass index for each subject was calculated. The parameters of pain, disability and flexibility were measured at baseline and the end of the 8 week training programme. The data generated were subjected to statistical analysis using descriptive and inferential statistics.

The result of the study showed that there was significant reduction in pain intensity and disability index, and significant increase in low back flexibility. It can also be deduced that low intensity resistance training programme of 8 weeks duration at a frequency of not less than 3 sessions a week on alternate days, can improve the quality of life of chronic low back pain sufferer, in terms of pain and functionality. But the mechanisms by which that were achieved still remain unclear.

5.2 Conclusion

On the basis of the finding of this study, the following conclusion can be made.

a. Low intensity resistance training programme is effective in the management of chronic low back pain.
b. Low intensity resistance training programme can bring about succour to chronic low back pain sufferer: it reduces pain, improves functional ability and decreases disability.
c. Chronic low back pain disability seen in Kaduna metropolis are no severe, as they range from mild to moderate according to Oswestry Disability Index classification.

5.3 Recommendations

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

a. Low intensity resistance training/exercises should be incorporated into the management programmes of chronic low back pain by the healthcare providers managing chronic low back pain patients. Also low intensity resistance exercises should be taught to people with chronic low back pain to form part of their self-care management.
b. A large scale study should be carried out to see if the same result can be replicated in a larger population.

c. Other studies should try to look at the mechanism(s) by which low intensity resistance training programme and other forms of exercise exert their effects on pain and disability index of chronic low back pain subjects.
d. It is also recommended that exercise guidelines for management of chronic low back pain be devised and experts in the field of Therapeutic Exercise be should be involved in the management of chronic low back pain.

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APPENDIX A

Department of Physical and Health Education,
Faculty of Education,
Ahmadu Bello University, Zaria.
26th June, 2013.

Medical Director,
Barau Dikko Specialist Hospital,
Kaduna.

Sir,

REQUEST FOR PERMISSION TO UNDERTAKE RESEARCH WORK IN YOUR FACILITY.

I am a postgraduate student of Ahmadu Bello University, Zaria, I wish to undertake a research work as part of the requirements leading to the award of Master of Science (M. Sc) degree in Exercise and Sport Science. I am working on a topic '**Effect of low intensity resistance training programme on chronic low back pain of adults in Kaduna metropolis'**.

I am writing to seek for your permission for the use of your facility and, some of your **"low back pain"** patients in Physiotherapy and Orthopaedics Clinics as subjects after seeking their informed consent. The programme will not in any way interfere with their normal treatment regime and will not affect their routine visit schedules. Other medical and physical parameters will be considered to ascertain their eligibility for the study. The information that would be obtained would be strictly used for research purpose only, while a high level of confidentiality shall be maintained.

Thank you, as I look forward to a favourable and speedy response.

Yours faithfully,

Edward Yohanna Bahago,
Researcher.

APPENDIX C

INFORMED CONSENT FORM

EFFECT OF LOW INTENSITY RESISTANCE TRAINING PROGRAMME ON CHRONIC LOW BACK PAIN OF ADULTS IN KADUNA METROPOLIS

EXPERIMENT IDENTIFICATION NUMBER:__________________

Dear Sir/Ma,

This study is aimed to investigate the effect of the two above mentioned exercise training programmes in the management of chronic low back pain. The programme is expected to be of benefit to you by decreasing your pain and help you manage the disability caused by the low back pain.

You will be required to participate in an exercise training programme of not more than one hour, three times a week, which will run for a period of 8 weeks, in Physiotherapy Department of Barau Dikko Specialist Hospital, Kaduna.

All information pertaining to your participation in this programme shall be kept confidential and used strictly for research purpose. Please note that participation is voluntary, you are not under obligation to participate and are free to withdraw your participation anytime.

Thank you.

Edward Y. Bahago (Investigator)
Physical and Health Education Department,
Faculty of Education.
Ahmadu Bello University, Zaria.

NB: Affirm your signature below if you agree to participate.

__________________________ __________________________

Signature of participant & Date Signature of witness & Date

APPENDIX D

EFFECT OF LOW INTENSITY RESISTANCE TRAINING PROGRAMME ON CHRONIC LOW BACK PAIN OF ADULTS IN KADUNA METROPOLIS

Experiment Identification Number:________________

MODIFIED VISUAL ANALOGUE SCALE

INSTRUCTION: Please tick a number across the line below that most appropriately and accurately represents the level of pain you are feeling at the moment.

0	1	2	3	4	5	6	7	8	9	10

No pain worst pain ever

APPENDIX E

OSWESTRY LOW BACK PAIN DISABILY QUESTIONNAIRE

Name:________________________________ Date:

This questionnaire has been designed to give your therapist information as to how your back pain has affected your ability to manage in everyday life. Please answer every question by placing a mark in the **one** box that best describes your condition today. We realize you may feel that two of the statements may describe your condition, but **please mark only the box which most closely describes your current condition**.

Pain Intensity

☐ I can tolerate the pain I have without having to use pain medication.
☐ The pain is bad but I can manage without having to take pain medication.
☐ Pain medication provides me complete relief from pain.
☐ Pain medication provides me with moderate relief from pain.
☐ Pain medication provides me with little relief from pain.
☐ Pain medication has no affect on my pain.

Personal Care (Washing, Dressing etc.)

☐ I can take care of myself normally without causing increased pain.
☐ I can take care of myself normally but it increases my pain.
☐ It is painful to take care of myself and I am slow and careful.
☐ I need help but I am able to manage most of my personal care
☐ I need help every day in most aspects of my care.
☐ I do not get dressed, wash with difficulty and stay in bed.

Lifting

☐ I can lift heavy weights without increased pain.
☐ I can lift heavy weights but it causes increased pain.
☐ Pain prevents me from lifting heavy weights off the floor, but I can manage if the weights are conveniently positioned (ex. on a table).
☐ Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.
☐ I can lift only very light weights.
☐ I cannot lift or carry anything at all.

Walking

☐ Pain does not prevent me from walking any distance.
☐ Pain prevents me from walking more than 2 kilometres.
☐ Pain prevents me from walking more than 1 kilometre
☐ Pain prevents me from walking more than 500 metres.
☐ I can only walk with crutches or a cane.
☐ I am in bed most of the time and have to crawl to the toilet.

Sitting
☐ I can sit in any chair as long as I like.
☐ I can only sit in my favorite chair as long as I like.
☐ Pain prevents me from sitting for more than 1 hour.
☐ Pain prevents me from sitting for more than ½ hour.
☐ Pain prevents me from sitting for more than 10 minutes.
☐ Pain prevents me from sitting at all.

Standing
☐ I can stand as long as I want without increased pain.
☐ I can stand as long as I want but it increases my pain.
☐ Pain prevents me from standing more than 1 hour.
☐ Pain prevents me from standing more than ½ hour.
☐ Pain prevents me from standing more than 10 minutes.
☐ Pain prevents me from standing at all.

Sleeping
☐ Pain does not prevent me from sleeping well.
☐ I can sleep well only by using pain medication.
☐ Even when I take pain medication, I sleep less than 6 hours.
☐ Even when I take pain medication, I sleep less than 4 hours.
☐ Evens when I take pain medication, I sleep less than 2 hours.
☐ Pain prevents me from sleeping at all.

Social Life
☐ My social life is normal and does not increase my pain.
☐ My social life is normal, but it increases my level of pain.
☐ Pain prevents me from participating in more energetic activities (ex. sports, dancing etc.)
☐ Pain prevents me from going out very often.
☐ Pain has restricted my social life to my home.
☐ I have hardly any social life because of my pain.

Traveling
☐ I can travel anywhere without increased pain.
☐ I can travel anywhere but it increases my pain.
☐ My pain restricts travel over 2 hours.
☐ My pain restricts my travel over 1 hour.
☐ My pain restricts my travel to short necessary journeys under ½ hour.
☐ My pain prevents all travel except for visits to the doctor/therapist or hospital.

Employment/Homemaking
☐ My normal homemaking/job activities do not cause pain.
☐ My normal homemaking/job activities increase my pain, but I can still perform all that is required of me.
☐ I can perform most of my homemaking/job duties, but pain prevents me from performing more physically stressful activities (ex. lifting, vacuuming)
☐ Pain prevents me from doing anything but light duties.
☐ Pain prevents me from doing even light duties.
☐ Pain prevents me from performing any job or homemaking chores.