EFFECTS OF EIGHT WEEKS OF NECK STABILISATION AND DYNAMIC EXERCISES ON SELECTED CLINICAL AND PSYCHOSOCIAL VARIABLES AMONG PATIENTS WITH NON-SPECIFIC NECK PAIN

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A Thesis in the Department of Physiotherapy, Submitted to the Faculty of Clinical Sciences in partial fulfilment of the requirements for the Degree of

DOCTOR OF PHILOSOPHY

of the

UNIVERSITY OF IBADAN

NOVEMBER, 2015

CERTIFICATION

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DEDICATION

This work is dedicated to my father and my lovely mother (Alh. Kaka Sani and Haj. Rukkaya Abdullahi) for the foundation they laid which enabled me to be what I am today. Without that foundation I would not be here for this programme.

ABSTRACT

Non-specific Neck Pain (NsNP) constitutes a burden to the bearers and a management challenge to physiotherapists globally. Effectiveness of neck stabilisation and dynamic exercises in the management of NsNP has been documented but it is not clear which of the exercise regimen is more effective in alleviating its associated clinical and psychosocial factors. This study was carried out to compare the effectiveness of neck stabilisation and/or dynamic exercises on pain intensity, functional disability, fear avoidance beliefs, depression and anxiety among patients with NsNP.

Eighty-eight consenting individuals with NsNP participated in this single-blind randomised controlled trial. They were consecutively recruited from outpatient physiotherapy clinics of National Orthopaedic Hospital, Dala and Aminu Kano Teaching Hospital, Kano, Nigeria. Participants were randomly assigned into one of three intervention groups: Neck Stabilisation Exercise Group (NSEG; n=30), Neck Dynamic Exercise Group (NDEG; n=29) and Neck Stabilisation and Dynamic Exercise Group (NSDEG; n=29). Treatment was administered thrice weekly for eight consecutive weeks. Variables were assessed at baseline, end of fourth and eighth week. Clinical variables: Pain intensity and functional disability were assessed using Visual Analogue scale and Neck disability index Questionnaire respectively. Psychosocial variables: Fear avoidance beliefs, depression and anxiety were assessed using Fear Avoidance Belief Questionnaire, Beck Depression Inventory and Beck Anxiety Inventory respectively. Data were analysed using descriptive statistics, analysis of variance, Kruskal-Wallis and post-hoc tests at p=0.05.

Age of participants in NSEG (46.8±12.4 years), NDEG (48.6±11.6 years) and NSDEG (45.1±13.4 years) were comparable. There was no significant difference in participants' scores on pain intensity, functional disability, fear avoidance beliefs, depression and anxiety across the three groups at baseline. At the end of the fourth week, scores for pain intensity (4.8±1.3; 5.8±1.4; 5.6±1.7), fear avoidance beliefs [28.0 (10.0); 35.0 (7.0); 34.0 (10.0)] and anxiety [13.0 (8.0); 18.0 (7.0) 13.0 (10.0)], for NSEG, NDEG and NSDEG respectively were significantly different across the three groups, while scores for functional disability [18.0 (7.0); 15.0 (7.5); 16.0 (7.5)] and depression [12 (6.0); 12 (6.0); 12 (6.0)] were not. At the end of eighth week, scores for pain intensity (2.7±1.27; 4.1±0.9; 4.5±1.4), functional disability [12.0 (2.0); 14.0 (6.7), 14.0 (6.5], fear avoidance beliefs [22.0 (9.0); 30.5 (7.8); 30.0 (14.5)] and depression [11.5 (5.0); 12.0 (2.8); 12.0 (5.0)] in NSEG, NDEG and NSDEG respectively, were significantly different, while scores of anxiety [13.0 (9.8); 14.0 (7.0); 12.0 (5.0)] were not. Post-hoc tests showed that NSEG had more significant reduction in pain intensity, functional disability and fear avoidance beliefs at end of weeks 4 and 8 and in depression at week 8 than the other two groups.

Neck stabilisation is the most effective regimen in the management of non-specific neck pain.

Keywords: Neck pain, Neck stabilisation exercises, Fear avoidance, Neck disability.

Word count: 438.

ACKNOWLEDGEMENT

I am grateful to Almighty Allah for giving me the opportunity to complete this work. My sincere gratitude goes to my supervisor, Dr Omoyemi O. Ogwumike, for her effort to see that my dream becomes reality. She has really been a mother to me. She did not only supervises my work, but she guides me in my career and mentors me on how to progress in life. I have no words adequate to thank you, I pray that God Almighty continues to guide you, protect you and your children wherever they go. It was great being mentored by you from my Masters to Ph.D. level.

My sincere gratitude also goes to my co-supervisor, Prof. S. O. Ogunlade, for his contributions and simplicity. Despite his tight schedule as an orthopaedic surgeon, he still found time to contribute to my work and my life in general.

I would like to thank my Head of Department, Prof. T. K. Hamzat, for his advice, concern and help during my academic challenges. I want to appreciate Prof. Arinola O. Sanya for her advice and encouragement, to be in academic arena. My appreciation also goes to Dr A.F. Adeniyi, for his support and guidance throughout my stay in Ibadan.

My gratitude also goes to Dr B. O. A. Adegoke and Dr Aderonke O. Akinpelu for their concern, encouragement and advice on how to go about my academic work throughout my stay in great University of Ibadan. My sincere gratitude also goes to my lecturers Dr O. Ayanniyi, Dr Adesola C. Odole, Rev. A. O. Jaiyesimi, Mrs. Nse A. Odunaiya, Dr A. A. Fabunmi, Dr A. A. Akinremi, and Dr Olubukola A. Olaleye.

I would also like to express my appreciation to the management of the National Orthopaedic Hospital, Dala, Kano (NOHDK) Physiotherapy Department and the Medical Director, Dr S. M. Nuhu, for their support and for allowing me to use their gymnasium for data collection. And to all the physiotherapists, consultants and resident doctors at NOHDK I say thank you.

Sincere appreciation goes to my colleague and my research assistant Mr. S. Raheem, Mr. O. Olajide and Mr. I. U. Malik for helping me during my data collection. May God Almighty continue to guide you in your own academic pursuits. My gratitude goes to the management of Bayero University Kano, for supporting me in the pursuit of this academic work, morally and financially. I said a big thank you.

I thank all my colleagues in the Department of Physiotherapy, Bayero University Kano and Aminu Kano Teaching Hospital, Kano for their support and prayers, and Dr H. Vernon Chiropractor from Canada for his contribution during the translation phase.

I am profoundly grateful to all the patients who volunteered for this study. Thank you for supporting this work. I also thank all the non-teaching staff of the Department of Physiotherapy, University of Ibadan for their support.

My gratitude goes to my wife Rasi'a Lawal, my children Abdulwahab (late), Muhammad, Mustapha and Al-Amin and my parents for their prayers and support throughout my stay in Ibadan, to ensure that I succeed in my endeavours. To everyone, including all my friends and students, who made this work successful, I say thank you.

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

Neck pain is an unpleasant sensory experience in the neck which may be manifested as fatigue, tension or pain that radiates to the shoulders, upper extremities or head (Siivola et al, 2002). Non-specific Neck Pain (NsNP) refers to neck pain (with or without radiation) whose underlying cause cannot be traced to any specific systemic disease (Green, 2008).

Many researchers have tried to classify neck pain and many different methods have been proposed (Borghouts et al, 1998; Cote et al, 2009). The best and most widely-accepted method of classification of neck pain is diagnostic triage, whereby patients are categorized into three groups (Borghouts et al, 1998): serious spinal pathology; neurological involvement; and non-specific neck pain (Kietrys et al, 2007). Non-specific neck pain may be attributed to numerous structures in the neck and surrounding regions, such as the muscles, joint structures, ligaments, intervertebral disks, and neural structures (Borghouts et al, 1998).

Neck pain appears to be a common ailment all over the world, especially in Western countries. It is a public health problem associated with significant disability (Cote et al, 2000; Fejer et al 2006). In 1996, the total cost of health utilization and sick leave attributable to neck pain in the Netherlands was estimated at $686 million (US) (Borghouts et al, 1998). The lifetime prevalence has been reported to be between 14.2% and 70%. The one-year prevalence of neck pain among adults ranges from 12.1% to 71.5% while the point prevalence is reported to be between 12% and 34% (Fejer et al, 2006). In Scandinavian countries, as many as 71% of the adult population have had neck pain at some time in their life (Makela et al, 1991) and 75% of these during the past year (Rauhala et al, 2000). A large epidemiologic study in the Netherlands reported a lifetime prevalence of neck pain in 30% of the male and 43% of the female participants (Borghouts et al, 1999). In Saskatchewan, neck pain is highly prevalent, with 67% of adults having experienced neck pain at some time in their life and 54% reporting having had neck pain in the previous 6 months. More importantly, almost 5% of adults in Saskatchewan were significantly disabled by neck pain during any 6-month period (Cote et al, 2000).

The lifetime, one-year and point prevalence of neck pain in the rural community in Northwestern Nigeria were 67.9%, 65.9% and 17.0% respectively (Ogwumike et al, 2015). However, lower prevalence has also been reported. For example in Sweden, a lifetime prevalence of 26% was reported, and in Finland, only 17% had had neck pain during the past year (Takala et al, 1982). Thus, great variation exists regarding the prevalence of neck pain. Three systematic reviews of literature have provided possible explanations for this large variation in the neck pain prevalence estimates (Cote et al 1998; Ariens et al 1999; Nachemson et al, 2000). In Nigeria, neck pain is becoming a common problem, probably due to more frequent use of electronic communication gadgets such as computers, mobile phones, android tablets and the like (Adedoyin et al, 2004) particularly among the young population. It is seen often in our clinical setting and constitutes a significant burden on the physiotherapy care facilities (Ayanniyi et al, 2007).

Neck pain is assumed to be a multifactorial disease, implying that there are a number of risk factors contributing to its development (Hill and Lewis, 2004). These risk factors can be work-related (low co-worker support, high perceived workloads, high job demands and work place design) or non-work-related (age, gender, educational level, mental stress and smoking). They can also be divided roughly into three groups, i.e., physical, psychosocial, and individual-related (Bot et al, 2005). Many studies have been conducted to identify the most important risk factors for neck pain (Hill and Lewis, 2004; Mana et al, 2009; Fejer et al, 2006). Most of these studies focus on only one or a few risk factors, or on one particular category of risk factors (Mana et al, 2009). While most attention has been given to physical risk factors, psychosocial risk factors also seem to play a major role in the development of neck pain (Geertje et al, 2001).

Musculoskeletal conditions are the most common cause of severe long term clinical factors which affect hundreds of millions of people around the world (Woolf and Akesson, 2001). They significantly affect the psychosocial status of people as well as their families (Motamedzade and Moghimbeigi, 2012). Musculoskeletal conditions are a diverse group with regard to pathophysiology but are linked anatomically and associated with pain and impaired physical function. They encompass a spectrum of conditions, from those of acute onset and short duration to lifelong disorders, including neck pain, rheumatoid arthritis, low back pain and osteoarthritis (Woolf and Pfleger, 2003). The burden of musculoskeletal disorders can be measured in terms of the associated problems that are the clinical factors (pain and impaired functioning or disability) related to the musculoskeletal system, or in relation to the psychosocial factors such as anxiety, depression and fear avoidance beliefs (Solidaki et al, 2010).

Pain is the most prominent symptom in most people with non-specific neck pain (Neupane et al, 2013), and is the most important determinant of disability in patients with non-specific neck pain (Neupane et al, 2013). Pain is a significant public health problem, chronic pain is one of the most common reasons for temporary and permanent work disability (Chaman et al, 2015) and is frequently accompanied by psychosocial comorbidity (such as depression, anxiety and fear avoidance beliefs). These symptoms often present together with pain in patients with musculoskeletal disorders such as neck pain, back pain, rheumatoid arthritis, and osteoarthritis (Chaman et al., 2015).

Musculoskeletal conditions are the main cause of disability; in addition the pain and physical disability brought about by musculoskeletal conditions affect psychosocial factors such as anxiety, depression and fear avoidance beliefs, further diminishing the patient’s quality of life (Woolf and Pfleger, 2003).

Depression is one of the most common mental health problems in the general medical setting and is present in 10% to15% of patients (Demmerlmaier et al, 2008). Depression produces substantial disability and decrements in health-related quality of life (HRQoL), often exceeding the impairment seen in patients with chronic medical disorders, such as heart disease, diabetes, arthritis, neck and low back pain (Thompson et al, 2010). Major depression is the fourth leading cause of disease burden worldwide and projected to move into second place by 2020 (Woolf, 2005). Depression is not simply a comorbid condition in musculoskeletal condition but interacts with pain to increase morbidity and mortality. Depressed pain patients report greater pain intensity, greater interference from pain, more pain behaviours, less life control, and more use of avoidance coping strategies than chronic pain patients without depression (Weickgenart, 1993).

Anxiety is another important psychosocial factor that is believed to be associated with the existence of higher levels of pain and disability in musculoskeletal pain conditions (Bru et al, 1993). Anxiety is co-morbidity to acute, sub-acute and chronic musculoskeletal pain with incidence rates between about 15 and 40% (SBU, 2005).

Fear is an emotional reaction to a specific, identifiable and immediate threat, such as a dangerous animal or an injury. Fear may protect the individual from impending danger as it instigates defensive behavior that is associated with the fight or flight response (George et al, 2001). The three main components of fear (interpretation of the stimulus as threatening, increased sympathetic arousal, and defensive behavior) are loosely coupled and can change at different paces (George et al, 2001; Landers et al, 2008). Defensive escape behaviors reduce fear levels in the short term, but may strengthen the fear in the long run. They may prevent disconfirmation of the patient's beliefs and sometimes they make the feared outcome more likely to occur. Fear avoidance belief due to fear of pain or re-injury is considered an important factor for prolonged pain and disability in patients with musculoskeletal disorders (Jull et al, 2008). Fear avoidance belief has been found to be associated and to be able to predict chronic neck pain disability in musculoskeletal disorders (George et al, 2001; Landers et al, 2008). Additionally, Pool et al, (2010) found that the recovery of patients with sub-acute non-specific neck pain can be impeded by fear avoidance belief.

Psychosocial factors play an important role in persisting symptoms and disability, and influence the response to treatment and rehabilitation (Daffner et al, 2003). There is evidence that psychosocial factors are more important than biomechanical factors in the development of back pain and probably neck pain (Fejer et al, 2006). Neck pain causes considerable personal suffering due to pain, disability, and impaired quality of work and life in general, which can be a great socioeconomic burden both for patients and society (Hestbaek et al, 2003). Neck pain is responsible for huge personal and societal costs, and is a major cause of work disability (De Loose et al, 2008). It is noteworthy that neither back pain nor neck pain is a problem that resolves itself. In addition, recurrences are usual and their course is variable (Korhonen, 2003; Cote et al, 2009).

Exercise programmes for managing neck pain differ with regard to duration, training frequency, intensity, and mode of exercise. Previous studies have shown that isometric exercises and strength training can have positive effects on neck pain (Chiu et al, 2004).

Stabilisation exercises are exercises that are meant to maximize function, and prevent injury progression or re-injury. They require coordination and training of the anterior and posterior cervical and shoulder girdle musculature (Lagattuta and Falco, 2000).

Neck stabilisation exercises were introduced as a rehabilitation programme to limit pain, maximize function, and prevent further injury (Hides et al, 2001, Saa, 1996). It is a method of exercise which, like its counterpart for the lumbar spine, is designed to improve the inborn mechanisms by which the cervical spine maintains a stable, injury-free state (Hides et al, 2001). This is accomplished through series of exercises that are relatively simple with respect to time and equipment, but are physiologically complex. Stabilisation exercises have, over the years, been used in the treatment of back and pelvic pain (Kose et al, 2007).

Chiu et al (2004) and Dusunceli et al (2009) has provided evidence to support the use of neck stabilization exercises to reduces the non-specific neck pain, Chiu et al, conclude that four hours of neck stabilization over six weeks produced statistically and clinically significant improvement in patients with non-specific neck pain. While Dusunceli et al (2009) conclude that ten hours of neck stabilization exercises over three weeks produces statistical and clinical improvements among non-specific neck pain patients. But all these authors have combine stabilization exercises with other physiotherapy modalities so no definitive conclusion of effectiveness can be drawn.

Dynamic Neck Exercises is progressive-resistive strength training that involves movement of other parts of the body and neck (Michael et al, 2002). Strengthening exercises involve any exercise done by the individual/patient that includes resistance, for example isometric, isokinetic or isotonic. It could include strength training with machines (Waling et al, 2002), thera-band, free weights, or low load endurance exercises to train muscle control (Jull et al, 2002). They may start as uniplanar, working specific major muscles, and then advance to multiplanar exercises as tolerated. Exercise may progress from elastic bands to weight machines to free weights. Initially, weight is kept low and repetitions are increased as tolerated. Later, weight may be increased as tolerated (Brower, 1999).

Ylinen et al (2004) demonstrated that dynamic strengthening exercises are effective in alleviating pain and disability among patients with non-specific neck pain, however the authors was follow up for twelve month after initial six weeks interventions with home programmes. Previous randomised trials combine these exercises with other physiotherapy modalities which is very difficult to attribute the effectiveness to stabilization or dynamic exercises alone. However it’s not clear which of these exercises is most effective in alleviating clinical and psychosocial factors among patients with non-specific neck pain. The clinical variables in the present study are pain and disability while psychosocial variables are fear avoidance belief, depression and anxiety.

Cochrane review on the effect of exercises for non-specific neck disorders concluded that the summarized evidence indicates that exercises have a role in the treatment of acute and chronic non-specific neck pain but that the relative benefit of each type of exercise needs to be studied extensively (Kay et al 2005). The aim of this study was to investigate and compare the effects of eight weeks of neck stabilisation and dynamic exercises on selected clinical and psychosocial variables among patients with non-specific neck pain.

1.2 Statement of the problem

Moderate evidence indicates that exercise is effective for reducing disability attributed to neck pain (Giannoula, 2009). A systematic review from the Cochrane database recommended that the quality of future trials should improve through more effective 'blinding' procedures and better control of compliance and co-intervention (Kay et al, 2012). Clinical trials would help identify the most effective treatment characteristics and dosages. Previous studies that support the clinical benefit of dynamic neck strength training (Berg et al, 1994; Highland et al 1992) as well as isometric training (Ylinen et al, 2004) in the management of neck pain have methodological shortcomings; there were no control groups. However, they suggest that specific neck muscle training could be a potentially effective treatment for non-specific neck pain and merits more careful study.

Thus our randomized clinical trial with blinding, co-intervention and control of compliance that focuses on the comparative effects of specific therapeutic exercises on clinical and psychosocial variables in patients with non-specific neck pain would give more details of whether therapeutic exercises could produce changes in clinical and psychosocial parameters in patients with non-specific neck pain. Most of the previous studies (Taimela et al, 2000; Jull et al, 2002; Chiu et al, 2004) investigated the effect of exercise protocol on pain and disability. To the best of knowledge, studies that investigated the comparative effects of stabilisation and dynamic exercises on psychosocial and clinical variables for NsNP have not been reported in the literature to date.

Nichol (2012) and Damgaard et al, (2013) recommended that future trials should test the use of more commonplace instruments for dynamic neck strengthening. Another option is for further research to focus on neck stabilisation exercises without any additional physiotherapy intervention to determine if improvements can be solely attributed to the stabilisation exercises.

Therefore this study investigated the effects of eight-week of neck stabilisation and dynamic exercises on selected clinical and psychosocial variables among patients with non-specific neck pain. Therefore these questions arose:

1. What would be the effects of an eight-week neck stabilisation and dynamic exercises on selected clinical and psychosocial variables among patients with non-specific neck pain?
2. Would the effects of eight-week stabilisation exercises, eight-week dynamic exercises and eight-week stabilisation plus dynamic exercises, differ on selected clinical and psychosocial variables among patients with non-specific neck pain?

1.3 Aims of the study

The aims of the study were to:

1. Determine the effects of eight-week of neck stabilisation and dynamic exercises on selected clinical and psychosocial variables among patients with non-specific neck pain.

2. Compare the effects of eight-week of stabilisation exercises, eight-week dynamic exercises and eight-week stabilisation plus dynamic exercises on selected clinical and psychosocial variables among patients with non-specific neck pain.

1.4 Hypotheses

1.4.1 Major hypothesis

1. An eight-week neck stabilisation exercises or stabilisation plus dynamic exercises or dynamic exercises programme would not have significant effects on selected clinical and psychosocial variables among patients with non-specific neck pain.

1.4.2 Sub-hypotheses

1. There would be no significant difference in the pain intensity scores of participants in the neck stabilisation exercises group (NSEG) across weeks 0, 4, and 8 of the study.
2. There would be no significant difference in the neck disability index scores of participants in the neck stabilisation exercises group across weeks 0, 4 and 8 of the study.
3. There would be no significant difference in the fear avoidance belief scores of participants in the neck stabilisation exercises group across weeks 0, 4 and 8 of the study.
4. There would be no significant difference in the Beck depression inventory scores of participants in the neck stabilisation exercises group across weeks 0, 4 and 8 of the study.
5. There would be no significant difference in the Beck anxiety inventory scores of participants in the neck stabilisation exercises group across weeks 0, 4 and 8 of the study.
6. There would be no significant difference in the pain intensity scores of participants in the neck stabilisation plus dynamic exercises group (NSDEG) across weeks 0, 4, and 8 of the study.
7. There would be no significant difference in the neck disability index scores of participants in the neck stabilisation plus dynamic exercises group across weeks 0, 4 and 8 of the study.
8. There would be no significant difference in the fear avoidance belief scores of participants in the neck stabilisation plus dynamic exercises group across

weeks 0, 4 and 8 of the study.

9. There would be no significant difference in the Beck depression inventory scores of participants in the neck stabilisation plus dynamic group across weeks 0, 4 and 8 of the study.
10. There would be no significant difference in the Beck anxiety inventory scores of participants in the neck stabilisation plus dynamic exercises group across weeks 0, 4 and 8 of the study.
11. There would be no significant difference in the pain intensity scores of participants in the neck dynamic exercises group (NDEG) across weeks 0, 4, and 8 of the study.
12. There would be no significant difference in the neck disability index scores of participants in the neck dynamic exercises group across weeks 0, 4 and 8 of the study.
13. There would be no significant difference in the fear avoidance beliefs scores of participants in the neck dynamic exercises group across weeks 0, 4 and 8 of the study.
14. There would be no significant difference in the Beck depression inventory scores of participants in the neck dynamic exercises group across weeks 0, 4 and 8 of the study.
15. There would be no significant difference in the Beck anxiety inventory scores of participants in the neck dynamic exercises group across weeks 0, 4 and 8 of the study.
16. There would be no significant difference in the effects of the three treatment regimens (neck stabilisation exercises, stabilisation plus dynamic exercises and dynamic exercises) on pain intensity scores at week four of the study.
17. There would be no significant difference in the effects of the three treatment regimens on neck disability index scores at week four of the study.
18. There would be no significant difference in the effects of the three treatment regimens on fear avoidance belief scores at week four of the study.
19. There would be no significant difference in the effects of the three treatment regimens on Beck depression inventory scores at week four of the study.
20. There would be no significant difference in the effects of the three treatment regimens on Beck anxiety inventory scores at week four of the study.
21. There would be no significant difference in the effects of the three treatment

regimens on pain intensity scores at week eight of the study.

22. There would be no significant difference in the effects of the three treatment regimens on neck disability index scores at week eight of the study.
23. There would be no significant difference in the effects of the three treatment regimens on fear avoidance belief scores at week eight of the study.
24. There would be no significant difference in the effects of the three treatment regimens on Beck depression inventory scores at week eight of the study.
25. There would be no significant difference in the effects of the three treatment regimens on Beck anxiety inventory scores at week eight of the study.

1.5 Delimitation

This study is delimited to the following:

Participants

Inclusion criteria

1. Participants diagnosed with non-specific neck pain.
2. Participants who can comprehend instructions in English or Hausa
3. Participants who are not involved in any other form of exercise training during the course of the study.
4. The pain should be for more than six weeks duration.

Exclusion criteria

1. Patients with co-morbidity that influence overall well-being, example sickle cell anaemia.
2. Specific disorders of the cervical spine, such as: disk prolapse, spinal stenosis, postoperative conditions, history of severe trauma, spasmodic torticollis, frequent migraine, fibromyalgia, shoulder diseases, inflammatory rheumatic diseases and psychiatric illness.
3. Patients with obvious spinal deformity or neurological disease.
4. A reported history of cardiovascular diseases contraindicated to exercise.
5. Beck depression scores of < 11.
6. Beck anxiety scores <1.
7. Patients below 18 years.

Variables

Clinical variables

1. Functional disability

2. Pain intensity

Psychosocial variables

1. Fear avoidance beliefs
2. Anxiety
3. Depression

Instrument

1. Visual analogue scale
2. Neck disability index questionnaire
3. Fear avoidance beliefs questionnaire
4. Beck depression inventory
5. Beck anxiety inventory

1.6 Limitations

1. The outcome measures were questionnaires; therefore recall bias from participants may potentially be a limitation.

1.7 Significance of the study

The outcome of this study has provided clinical evidence on the appropriateness of neck stabilisation and dynamic exercises in the management of patients with non-specific neck pain, with the finding of this study serving as a basis for recommending the most efficacious exercise that offers the greatest benefit to patients with non-specific neck pain in clinical practice. Information needed to set priorities for future research on the use of specific exercises for patients with neck pain has also been established.

1.8 Definition of terms

The recall bias refers to a systematic error caused by possible differences in accuracy to recall memory of past events or experience relevant to disease under investigation.

CHAPTER TWO

LITERATURE REVIEW

2.0 Literature review

2.1 Definition of Neck pain

Neck pain has been defined as pain located between the occiput and the third thoracic vertebrae (Cote et al, 2003). It is the second largest cause of time off work after low back pain (Saturno et al, 2003), and has been observed to be one of the most common conditions for referral to a physical therapist (Albright et al 2007; Dusunceli et al, 2009). Although neck pain has been regarded as self-limiting and benign in most cases, it is still a serious burden as it consumes a substantial proportion of health care resources, causes the affected person a lot of discomfort, contributes significantly to time off work (Viljanen et al, 2002).

Non-specific neck pain (NsNP) that is neck pain without a specific underlying disease is a serious public health problem that has become a major cause of disability around the world. Each year, 27% to 48% of workers suffer NsNP (Peter et al, 2010). The established risk factors for non-specific neck pain include age, sex, genetics, smoking, and poor psychological health. Prognosis of NsNP appears to be multifactorial. Poor health, prior neck pain, poor psychological health, worrying, and passive coping are associated with poor prognosis (Peter et al, 2010).

2.2 Anatomy of neck

The cervical spine is made up of the first 7 vertebrae, referred to as C1-C7 (as shown in figure 1). It provides mobility and stability to the head while connecting it to the relatively immobile thoracic spine. The cervical spine may be divided into 2 parts: upper and lower. The upper cervical spine consists of the atlas (C1) and the axis (C2) (Bogduk et al, 1988). These first 2 vertebrae are quite different from the rest of the cervical spine (as shown in figure 1). The atlas articulates superiorly with the occiput (the atlanto-occipital joint) and inferiorly with the axis (the atlantoaxial joint). The atlantoaxial joint is responsible for 50% of all cervical rotation, while the atlanto-occipital joint is responsible for 50% of flexion and extension. The unique features of the anatomy of C2 and its articulations complicate assessment of its pathology **(**Panjabi et al, 1991).

The atlas is ring-shaped and does not have a body, unlike the rest of the vertebrae. Fused remnants of the atlas body have become part of C2, and are called the odontoid process, or dens. The odontoid process is held in tight proximity to the posterior aspect of the anterior arch of the atlas by the transverse ligament, which stabilizes the atlantoaxial joint. The apical, alar, and transverse ligaments, by allowing spinal column rotation, provide further stabilisation and prevent posterior displacement of the dens in relation to the atlas. The atlas is made up of a thick anterior arch, a thin posterior arch, 2 prominent lateral masses, and 2 transverse processes. The transverse foramen, through which the vertebral artery passes, is enclosed by the transverse process. On each lateral mass is a superior and inferior facet (zygapophyseal) joint. The superior articular facets are kidney-shaped, concave, and face upward and inward. These superior facets articulate with the occipital condyles, which face downward and outward. The relatively flat inferior articular facets face downward and inward to articulate with the superior facets of the axis (Bogduk et al, 1988).

The axis has a large vertebral body, which contains the odontoid process (dens). The odontoid process articulates with the anterior arch of the atlas via its anterior articular facet and is held in place by the transverse ligament. The axis is composed of a vertebral body, heavy pedicles, laminae, and transverse processes, which serve as attachment points for muscles. The axis articulates with the atlas via its superior articular facets, which are convex and face upward and outward (Bogduk et al, 1988).

2.2.1 *Embryology*

C2 has a complex embryologic development. It is derived from 4 ossification centres: 1 for the body, 1 for the odontoid process, and 2 for the neural arches. The odontoid process fuses by the seventh gestational month. At birth, a vestigial cartilaginous disc space called the neurocentral synchondrosis separates the odontoid process from the body of C2. The synchondrosis is seen in virtually all children aged 3 years and is absent in those aged 6 years. The apical portion of the dens ossifies by age 3-5 years and fuses with the rest of the structure around age 12 years. The synchondrosis should not be confused with a fracture. Parts of the occiput, atlas, and axis are derived from the proatlas. The hypocentrum of the fourth sclerotome forms the anterior tubercle of the clivus. The centrum of the proatlas sclerotome becomes the apical cap of the dens and the apical ligaments. The neural arch components of the proatlas are divided into rostral and ventral components. The rostral component forms the anterior portion of the foramen magnum and the occipital condyles; the caudal component forms the superior part of the posterior arch of the atlas and the lateral atlantal masses. The alar and cruciate ligaments are formed from the lateral portions of the proatlas (Bogduk et al, 1988).

2.2.2 *Ligaments*

The craniocervical junction and the atlantoaxial joints are secured by external and internal ligaments. The external ligaments consist of the atlanto-occipital, anterior atlanto-occipital, and anterior longitudinal ligaments. The internal ligaments have 5 components, as follows: The transverse ligament holds the odontoid process in place against the posterior atlas, which prevents anterior subluxation of C1 on C2. The accessory ligaments arise posterior to and in conjunction with the transverse ligament and insert into the lateral aspect of the atlantoaxial joint; the apical ligament lies anterior to the lip of the foramen magnum and inserts into the apex of the odontoid process. The paired alar ligaments secure the apex of the odontoid to the anterior foramen magnum. The tectorial membrane is a continuation of the posterior longitudinal ligament to the anterior margin of the foramen magnum. The 3 cm × 5 mm accessory atlantoaxial ligament not only connects the atlas to the axis but also continues cephalad to the occipital bone; functionally, it becomes maximally taut with 5-8° head rotation, lax with cervical extension, and maximally taut with 5-10° cervical flexion; it seems to participate in craniocervical stability; future improvements in magnetic resonance imaging (MRI) may lead to better appreciation of the structure and integrity of this ligament.

The 5 cervical vertebrae that make up the lower cervical spine, C3-C7, are similar to each other but very different from C1 and C2. Each has a vertebral body that is concave on its superior surface and convex on its inferior surface (as shown in figure 1). On the superior surfaces of the bodies are raised processes or hooks called uncinate processes, each of which articulates with a depressed area on the inferior lateral aspect of the superior vertebral body, called the echancrure or anvil **(**Panjabi et al, 1991).

2.2.3 ***Anterior and posterior columns***

The subaxial cervical spine can conveniently be divided into anterior and posterior columns. The anterior column consists of the typical cervical vertebral body sandwiched between supporting disks. The anterior surface is reinforced by the anterior longitudinal ligament and the posterior body by the posterior longitudinal ligament, both of which run from the axis to the sacrum. Articulations include disk-vertebral body articulations, uncovertebral joints, and zygapophyseal (facet) joints. The disk is thicker anteriorly, contributing to normal cervical lordosis, and the uncovertebral joints in the posterior aspect of the body define the lateral extent of most surgical exposures. The facet joints are oriented at a 45º angle to the axial plane, allowing a sliding motion; the joint capsule is weakest posteriorly. The supporting ligamentum flavum, posterior, and interspinous ligaments also strengthen the posterior column **(**Panjabi et al, 1991).

2.2.4 ***Facet joints***

The facet joints in the cervical spine are diarthrodial synovial joints with fibrous capsules. The joint capsules are more lax in the lower cervical spine than in other areas of the spine to allow gliding movements of the facets. The joints are inclined at an angle of 45° from the horizontal plane and 85° from the sagittal plane. This alignment helps prevent excessive anterior translation and is important in weight-bearing (Bogduk et al, 1988).

2.2.5 ***Nerve supply***

The fibrous capsules are innervated by mechanoreceptors (types I, II, and III), and free nerve endings have been found in the subsynovial loose areolar and dense capsular tissues (Bogduk et al, 1988). In fact, there are more mechanoreceptors in the cervical spine than in the lumbar spine (Bogduk et al, 1988). This neural input from the facets may be important for proprioception and pain sensation and may modulate protective muscular reflexes that are important for preventing joint instability and degeneration. The facet joints in the cervical spine are innervated by both the anterior and posterior rami. The atlanto-occipital and atlantoaxial joints are innervated by the anterior rami of the first and second cervical spinal nerves. The C2-C3 facet joint is innervated by two branches of the posterior ramus of the third cervical spinal nerve — a communicating branch and a medial branch known as the third occipital nerve. The remaining cervical facets, C3-C4 to C7-T1, are supplied by the posterior rami medial branches that arise 1 level cephalad and caudad to the joint (Bogduk et al 1988). Therefore, each joint from C3-C4 to C7-T1 is innervated by the medial branches above and below. These medial branches send off articular branches to the facet joints as they wrap around the middle of the articular pillars.

2.2.6 *Intervertebral discs*

The intervertebral discs are located between the vertebral bodies of C2-C7. They are between each vertebral body caudad to the axis. These disks are composed of four parts: the nucleus pulposus in the middle, the annulus fibrosis surrounding the nucleus, and two end plates that are attached to the adjacent vertebral bodies. They serve as force dissipators, transmitting compressive loads throughout a range of motion. The disks are thicker anteriorly and therefore contribute to normal cervical lordosis. The intervertebral disks are involved in cervical spine motion, stability, and weight-bearing. The annular fibres are composed of collagenous sheets (lamellae) that are oriented at a 65-70° angle from the vertical and alternate in direction with each successive sheet. As a result, they are vulnerable to injury by rotation forces because only one half of the lamellae are oriented to withstand force applied in this direction (Bogduk et al, 1988).

2.2.7 *Myology*

The muscles of the neck can be grouped according to their location. The ones immediately in front and behind the spine are the prevertebral, postvertebral, and lateral vertebral muscles and on the side the neck are the lateral cervical muscles. In addition, there is the platysma, a unique superficial broad muscle located on the side of the neck. It arises from a subcutaneous layer and fascia covering the pectoralis major and deltoid at the level of the first or second rib and is inserted into the lower border of the mandible, the risorius, and the platysma of the opposite side. It is supplied by the cervical branch of the facial nerve. The platysma depresses the lower lip and forms ridges in the skin of the neck and upper chest when the jaws are clenched, denoting stress or anger. It also serves to draw down the lower lip and angle of the mouth in the expression of melancholy.

The sternocleidomastoid is the prominent muscle on the side of the neck. It arises from the sternum and clavicle by two heads. The medial or sternal head arises from the upper part of the anterior surface of the manubrium sterni and is directed upward, lateralward, and backward. The lateral or clavicular head, which is flatter, arises from the superior border and anterior surface of the medial third of the clavicle; it is directed almost vertically upward. Its two heads are separated from each other at their origins by a triangular interval, but they gradually blend, below the middle of the neck, into a thick, rounded muscle. It is inserted by a strong tendon into the lateral surface of the mastoid process, from its apex to its superior border, and by a thin aponeurosis into the lateral half of the superior nuchal line of the occipital bone. It is supplied by the accessory nerve and branches from the anterior rami of the second and third cervical nerves. When only one side of the muscle acts, it draws the head toward the shoulder of the same side and rotates the head toward the opposite side. Acting together from their sternoclavicular attachments, the muscles flex the cervical part of the vertebral column. If the head is fixed, the two heads of the muscle assist in elevating the thorax in forced inspiration.

The trapezius arises from the spinous processes of the cervical and thoracic vertebrae and inserts into the spine of the scapula and the acromion; it is innervated by the spinal accessory nerve and branches from the third and fourth cervical roots. Its upper fibres shrug the shoulder and aid in suspension of the shoulder girdle. The muscles in the front of the neck are the suprahyoid and infrahyoid muscles and the anterior vertebral muscles. The suprahyoid muscles are the digastrics, stylohyoid, mylohyoid, and geniohyoid. The infrahyoid muscles are the sternohyoid, sternothyroid, thyrohyoid, and omohyoid

2.2.8 *Anterior vertebral muscle*

The anterior vertebral muscles are the longus colli, longus capitis, rectus capitis anterior, and rectus capitis lateralis. The longus colli muscle is situated on the anterior surface of the vertebral column, between the atlas and the third thoracic vertebra. It is broad in the middle, narrow and pointed at either end, and consists of three portions:

superior oblique, inferior oblique, and vertical. The superior oblique portion arises from the anterior tubercles of the transverse processes of the third, fourth, and fifth cervical vertebrae and, ascending obliquely with a medial inclination, is inserted by a narrow tendon into the tubercle on the anterior arch of the atlas. The inferior oblique portion, the smallest part of the muscle, arises from the front of the bodies of the first two or three thoracic vertebrae and, ascending obliquely in a lateral direction, is inserted into the anterior tubercles of the transverse processes of the fifth and sixth cervical vertebrae. The vertical portion arises, below, from the front of the bodies of the upper three thoracic and lower three cervical vertebrae and is inserted into the front of the bodies of the second, third, and fourth cervical vertebrae. The longus capitis is broad and thick above, narrow below, and arises by four tendinous slips, from the anterior tubercles of the transverse processes of the third, fourth, fifth, and sixth cervical vertebrae, and ascends, converging toward its fellow on the opposite side, to be inserted into the inferior surface of the basilar part of the occipital bone.

The rectus capitis anterior is a short, flat muscle, situated immediately behind the upper part of the longus capitis. It arises from the anterior surface of the lateral mass of the atlas and from the root of its transverse process, and passing obliquely upward and medialward, it is inserted into the inferior surface of the basilar part of the occipital bone immediately in front of the foramen magnum. The rectus capitis lateralis is a short, flat muscle, which arises from the upper surface of the transverse process of the atlas and is inserted into the undersurface of the jugular process of the occipital bone as shown in figure 2.

The rectus capitis anterior and the rectus capitis lateralis are supplied from the loop between the first and second cervical nerves; the longus capitis, by branches from the first, second, and third cervical; the longus colli, by branches from the second to the seventh cervical nerves. The longus capitis and rectus capitis anterior are the direct antagonists of the muscles at the back of the neck, serving to restore the head to its natural position after it has been drawn backward. These muscles also flex the head, and from their obliquity, rotate it, so as to turn the face to one or the other side. The rectus lateralis, acting on one side, bends the head laterally. The longus colli flexes and slightly rotates the cervical portion of the vertebral column **(**Panjabi et al, 1991)

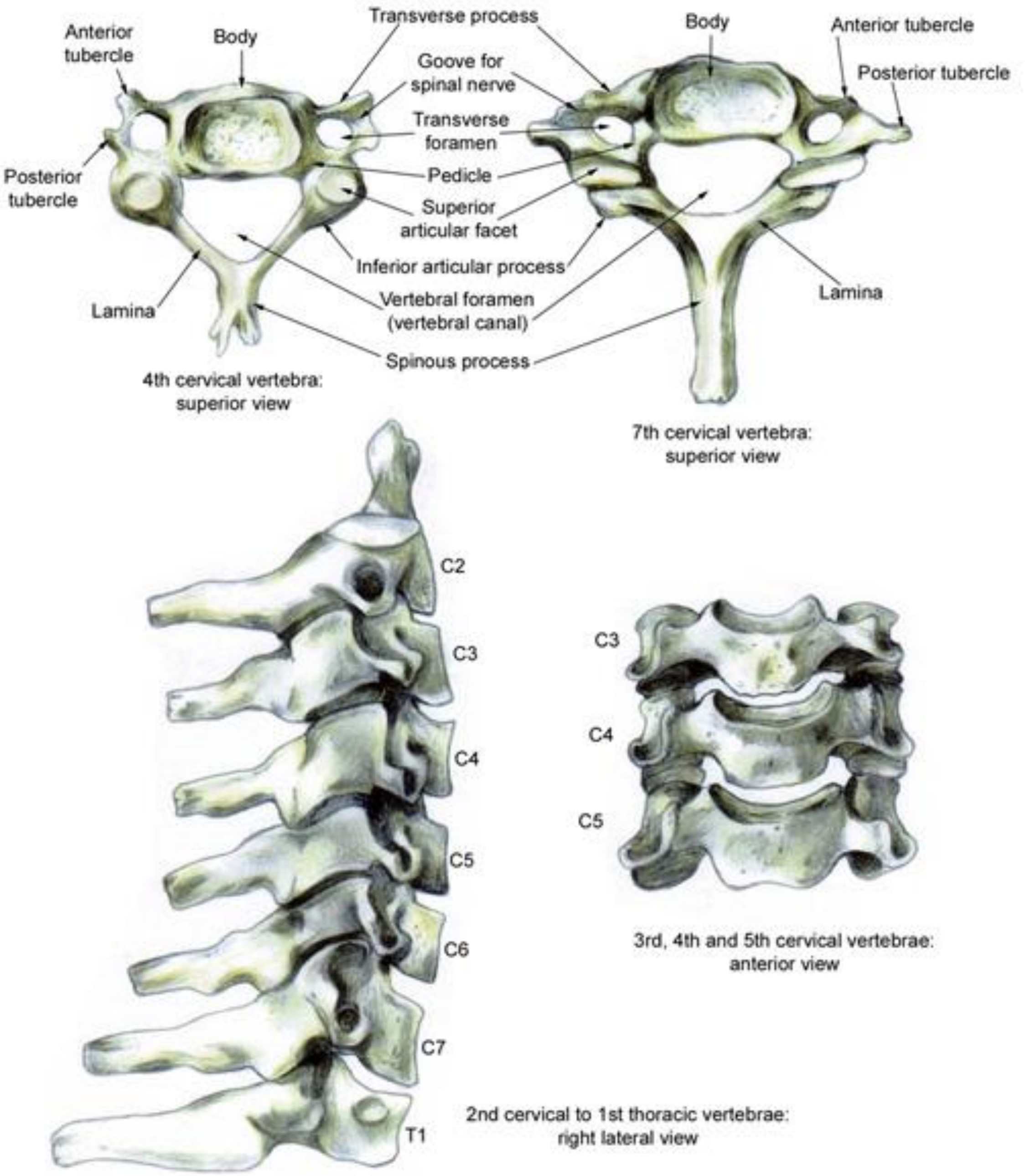
2.2.9 *Lateral vertebral muscles*

The lateral vertebral muscles are the scalenus anterior, scalenus medius, and scalenus posterior. Scalenus anterior lies at the side of the neck, behind the sternocleidomastoid. It arises from the anterior tubercles of the transverse processes of the third, fourth, fifth, and sixth cervical vertebrae, and descending, almost vertically, is inserted by a narrow, flat tendon into the scalene tubercle on the inner border of the first rib and into the ridge on the upper surface of the rib in front of the subclavian groove. Scalenus medius, the largest and longest of the three scaleni, arises from the posterior tubercles of the transverse processes of the lower six cervical vertebrae, and descending along the side of the vertebral column, is inserted by a broad attachment into the upper surface of the first rib, between the tubercle and the subclavian groove.

Scalenus posterior, the smallest and most deeply seated of the three scaleni, arises, by two or three separate tendons, from the posterior tubercles of the transverse processes of the lower two or three cervical vertebrae and is inserted by a thin tendon into the outer surface of the second rib, behind the attachment of the serratus anterior. It is occasionally blended with the scalenus medius. The scaleni are supplied by branches from the second to the seventh cervical nerves. When the scaleni act from above, they elevate the first and second ribs, and are, therefore, inspiratory muscles. Acting from below, they bend the vertebral column to one or the other side; if the muscles of both sides act, the vertebral column is slightly flexed.

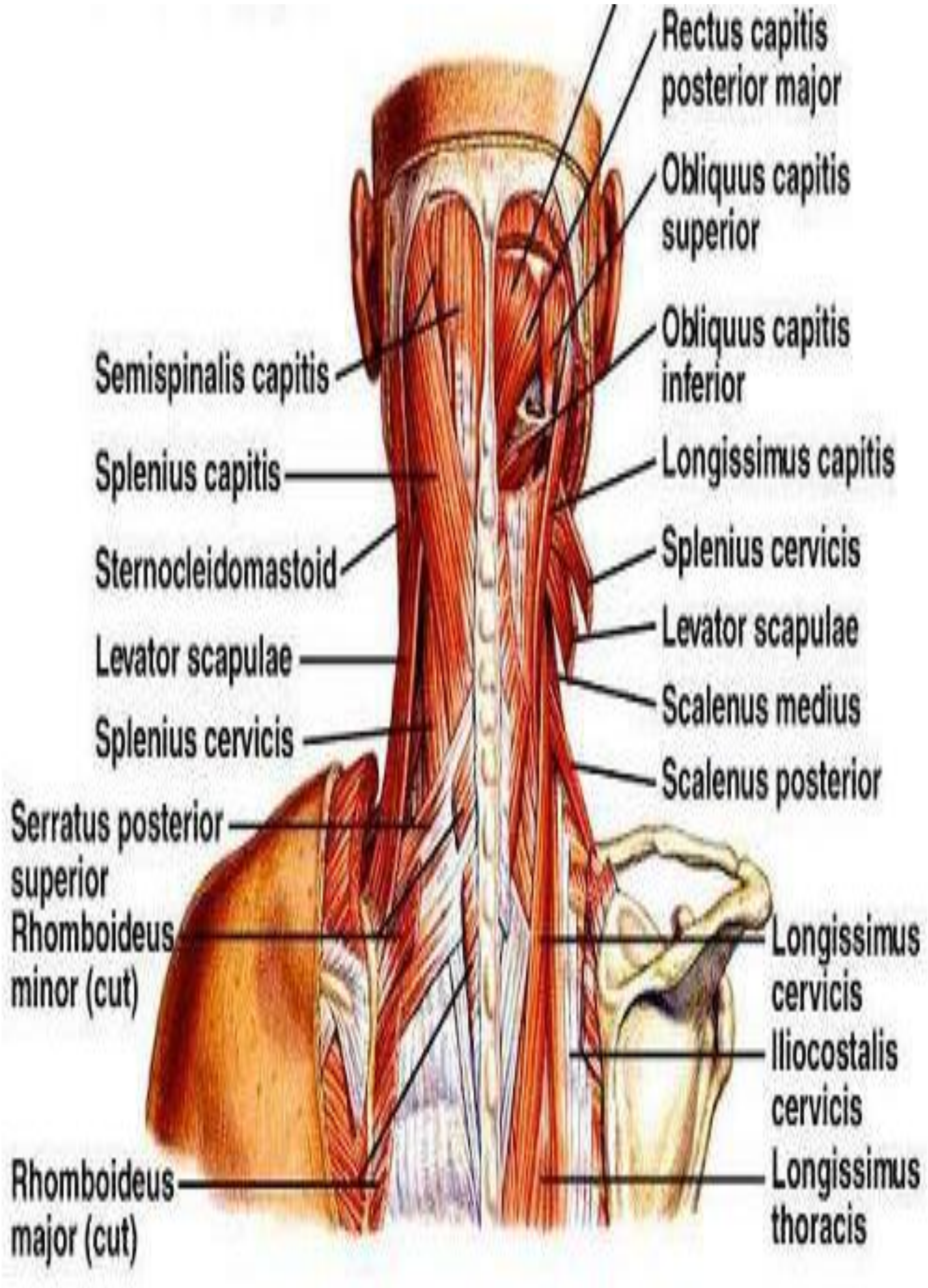
2.2.10 *Suboccipital muscle*

The suboccipital group comprises the rectus capitis posterior major, rectus capitis posterior minor, obliquus capitis inferior, and obliquus capitis superior. Rectus capitis posterior major (rectus capitis posticus major) arises by a pointed tendon from the spinous process of the axis, and, becoming broader as it ascends, is inserted into the lateral part of the inferior nuchal line of the occipital bone and the surface of the bone immediately below the line. As the muscles of the two sides pass upward and lateralward, they leave between them a triangular space, in which the recti capitis posteriores minores are seen.



(Panjabi et al, 1991)

Figure 1. Upper and lower cervical spine.



(Britanica.com, 2014)

Figure 2. Muscles of the cervical spine.

2.3 Epidemiology of neck pain

Numerous studies have presented prevalence data, which are as varied as the samples and time frames studied. For neck pain in the general population, the lifetime prevalence has been reported to be greater than 70%. The one-year prevalence of neck pain among adults ranges from 12.1% to 71.5%. The point prevalence of neck pain is reported to be between 12% and 34% (Hush et al., 2006). In a study by Siivola et al (2004), it was reported that the weekly prevalence of neck and shoulder pain in adolescents rose from 17% to 28% in the years 1989 through 1996. The authors opine that this was related to the increased sedentary nature of adolescents, including increased computer use.

Some epidemiological studies in various countries, such as Finland, England, Sweden, and Nigeria have put the life prevalence of neck pain at between 50% and 73% in different study populations (Aker et al 1996; Douglass and Bope, 2004; Adedoyin et al, 2004). Also it has been found to be more common in women than in men (Cromie et al, 2000; Cote et al, 2003). Several research studies have shown that many spinal problems are preventable because they result mainly from poor posture (both during activity and rest), and posture which subjects the spine to abnormal stress (Glover, 2002; Adedoyin et al, 2004; Udoye and Agunwa, 2007). Neck pain has been found to have a higher incidence and influence on work in women than in men (Gerr et al, 2002; Korhonen et al, 2003; Brandt et al, 2004; Ostergen et al, 2005; Skillgate, 2007).

Epidemiological studies from around the world have cited neck pain as the second largest cause of musculo-skeletal disorders among various study populations; it was rated next to back pain (Balogun and Owoaje, 2003; Adedoyin et al, 2004; Binder, 2007; Gureje et al, 2007; Udoye and Agunwa, 2007). A high prevalence has been reported among health professionals (including Physiotherapists) in developed countries, including Nigeria (Glover, 2003; Udoye and Agunwa, 2007).

2.4 Classification of neck pain

Presently, unlike for back pain, there are no accepted national guidelines for the classification or medical management of neck pain (Leigh et al, 2004). Several methods of classification have been highlighted by some experts. These classifications were done based on pain severity, severity of disability, and causes of the pain. Neck pain can thus be classified using various parameters namely:

Classification by cause:

(i) Neck pain /simple /non-specific neck pain – causes include minor injuries or sprains to muscles and ligaments, and bad posture.

(ii) Whiplash injury – most commonly due a car accident, acute (sudden onset) primary torticollis, usually caused by minor injury, and poor sleeping posture.

(iii) Degenerative ('wear and tear'), e.g. cervical spondylosis – usually due to aging process.

(iv) Diseased condition – neck pain due to conditions like rheumatoid arthritis, bone disorders, cancers, and serious injuries that damage the vertebrae, spinal cord or nerves in the neck (Douglass and Bope, 2004; Eyadeh et al, 2004).

Classification by duration:

I. Acute neck pain: Pain of duration of thirty (30) days from onset of symptoms (<4weeks).

II. Sub-acute neck pain: Pain of duration of 30 to 90 days (<3months) from the time of onset.

III. Chronic neck pain: Pain that persists for more than 3months (Kroeling et al 2009).

2.5 Risk factors in neck pain

Certain factors predispose an individual to either having the first episode of neck pain or a re-occurrence. These factors can also either prolong the time of recovery or encourage the acute neck pain to progress to a chronic neck pain with its attendant burdens. Most of the time, these factors are preventable or, at least, adjustable. Identification of these risk factors may offer a method of reducing neck pain prevalence, severity, disability and neck pain-related costs.

These factors are:

a) Poor posture: maintaining a posture that puts stress on the neck muscles and the supportive structures for hours, consistently on a daily basis (for example, sitting in front of a computer with the wrong posture), causes micro trauma which then accumulates and precipitates or worsens neck pain;

b) Repetitive activity/overuse injury: performing repetitive movements without breaks in the cervical region (Adedoyin et al 2004)

c) Lack of breaks in activities of daily living at home or at the work-place: this will encourage overuse of the neck musculature and ligaments thus predisposing the individual to injury (Glover 2002; Mohammed 2005)

d) Prolonged and sustained posture: prolonged hours maintaining a static position puts a lot of stress on the cervical vertebrae and supportive structures (Adedoyin et al, 2004; Udoye and Agunwa 2007)

e) History of a previous injury: this is due to the muscle inhibition and joint instability that results from the injury (Cote et al 2003)

f) Smoking;

g) Presence of co-morbid conditions, e.g. respiratory disorders, cardiovascular disorders, depression, high blood pressure and low back pain;

h) Socio-economic factors such as low level of education and poor health (Cote et al 2003);

i) Gender: Women have been found to be more predisposed to neck pain than men;

j) Stress/psychological factors/life events (Cote et al, 2003; Korhonen et al, 2003; Brandt et al, 2004; Ostergen et al 2005; Skillgate, 2007).

2.6 Assessment of Patients with neck pain

An assessment is done to gather information about impairment (pain level, mobility, dizziness), function or activity limitations (work, home, driving, reaching) and participation restrictions –social or family (Skillgate, 2007). The assessment should first rule out red flags (indicators that further medical treatment or investigation is necessary (Cote et al, 2003). It should also identify yellow flags; these are psychological risk factors that may lead to disability (Torp et al, 2001; Cote et al, 2003; Korhonen et al, 2003; Brandt et al, 2004; Ostergen et al, 2005; Skillgate, 2007).

During the first treatment session, a medical history is taken. This includes the patient's biodata, history of present complaints, pain behaviours, aggravating and relieving factors, etc. A physical examination should also be performed, during which the main goal is to rule out red flags and identify yellow flags. An objective assessment is then done using appropriate tests and assessment protocol (Kerr and White, 2007). The assessment should include neuromuscular test, muscle strength assessment, postural assessment, pain provocative tests (restricted isometric tests) for musculo-tendinous pathology, compression, and distraction tests (Kerr and White, 2007).

In order for the assessment to be complete and effective, there must be appropriate and standardized outcome measures, that is, means of objectively assessing physiotherapy interventions/effectiveness of management (Kerr and White, 2007). The common outcome measures in neck pain are: (a) Neck Disability Index – this is probably the most well-known scale, it measures pain and disability; (b) Patient-specific functional scale – used for measuring disability; (c) Copenhagen Neck Functional Disability Scale; (d) Northwick Park Neck Pain Disability Scale; (e) Core Neck Pain Questionnaire; (f) Visual Analogue Scale; (g) Quality of Life Measures, e.g. SF-36 questionnaire (Kerr and White, 2007).

2.7 Management of neck pain

The goals in the management of neck pain, based on the World Health Organization classification of neck pain, are to: (a) increase early activation (decrease disability); (b) increase participation (decrease handicap, i.e. work, psychosocial and recreational). The National Electronic Library for Health has the following goals: maintain activities of daily living, increase function, decrease pain, relieve anxiety, reduce days off work, prevent chronicity (Kerr and White, 2007). Physiotherapeutic management of neck pain encompasses a variety of interventions such as: manual therapy, therapeutic exercises, electro-physical modalities, ergonomics and education (Cherkin et al, 2003; Bronfort et al 2001; Heintz, 2008).

2.7.1 Physical modalities: A wide array of physical modalities is commonly included as a part of physiotherapeutic interventions for neck pain (Kroeling et al 2009). These interventions include electrotherapy modalities (laser therapy, therapeutic ultrasound and transcutaneous electrical nerve stimulation (TENS), heat/cold, traction, laser, ultrasound, short wave, interferential, corsets and collars (Albright et al, 2001; Moffet and McLean 2006). The placebo effects of passive modalities probably account for most of the benefits that are gained. This can have a powerful effect where both the therapist and the patient have faith in the treatment (Moffet and McLean 2006).

2.7.2 Electrotherapy

The common forms of electrotherapy include transcutaneous electrical nerve stimulators and electrical stimulation. The literature does not contain enough information to indicate that either of these devices provides significant benefit for the treatment of cervical pain. There are studies showing that electrotherapy may provide some relief in the treatment of low back pain, but return to work or ultimate functional status was unchanged by its use (Moffet and McLean 2006). Electrotherapy may be used as an adjunct in the nonsurgical treatment of cervical pain, with varying benefits.

2.7.3 Cervical Orthoses

Cervical orthoses have been a mainstay of the conservative treatment of cervical radiculopathies for quite some time. As early as 1908, Smith (1996) described the use of cervical orthoses in the fifth Egyptian dynasty from 2750 to 2625 B.C. Clinicians have continued to use and adapt newer materials, such as plastics, to provide better and more functional bracing. A cervical collar may be reasonable to use to aid immobilization and pain control during the acute phase of cervical radiculopathy (Redford and Patel, 1995). A soft collar diminishes rotation by approximately 26%. It is believed that this device works as a kinaesthetic reminder only. The feeling of warmth around the neck may contribute to the usefulness of the cervical orthosis in controlling pain. Hard collars can diminish movement by **75%** in the sagittal plane but still have difficulty controlling rotation and lateral bending (Shur et al, 1990).

2.7.4 Traction

Traction is used to apply a distracting force, usually carried out through pneumatic or pulley devices. Traction has been recommended since the time of Hippocrates for the treatment of scoliosis or kyphosis (Atchison et al, 2000). Several articles have confirmed that cervical traction benefits patients with nerve root compromise or radiculopathy by diminishing the compression component and alleviating pressure on soft tissues (presumed to be annular pressure) (Atchison et al, 2000).

2.7.5 Manual Therapy (Mobilisation and Manipulation Techniques)

Manual therapy refers to any intervention that entails the use of the therapist's hands on the spine. Some consider it to be a core skill for physiotherapists. The term 'spinal manipulation' usually refers to a high-velocity, low-amplitude thrust that is commonly used by therapists (Cherkin et al 2003; Bronfort et al 2001). Gentler and more conservative techniques, such as Maitland's mobilization and McKenzie's technique are frequently used by physiotherapists, applying pressure through the therapist's hands to move the vertebral joints passively through a given range (Moffet and McLean 2006).

2.7.6 Exercise therapy

Supervised exercise therapy commonly forms part of the treatment offered by physiotherapists for patients with neck pain. It can vary greatly in content and method of delivery (Heintz and Hegedus, 2008; Dusuncelli et al, 2009). It has been defined as: 'any programme in which, during the therapy sessions, the participants were required to carry out repeated voluntary dynamic movements or static muscular contractions in each case, either "whole-body" or "region-specific"; and either with or without external loading (Moffet and McLean 2006; Heintz and Hegedus, 2008). The aim in using exercise therapy is to gain muscle strength, flexibility and endurance, to restore injured tissues, and to contribute to ability to sustain normal life activities, and it is one of the most frequently used modalities in the rehabilitation of subjects with neck pain (Woloko et al, 2003).

2.7.6.1 Stabilisation exercises

Cervicothoracic stabilisation is a necessary part of the rehabilitation programme to limit pain, maximize function, and prevent injury progression or re-injury. It requires coordination and training of anterior and posterior cervical and shoulder girdle musculature. Training begins within a pain-free range of motion, then progresses to maintaining stabilisation even with advanced movements and positional changes (Hides et al, 2001, Saa, 1992). It is necessary to condition the lumbar spine and lower limbs as part of the kinetic chain for successful stabilisation because they provide a base for the cervicothoracic spine (Hides et al, 2001).

2.7.6.2 Aerobic conditioning

Aerobic capacity may diminish rapidly with the inactivity that often accompanies cervical pain. A deconditioned status may limit a patient's ability to perform strengthening exercises. Early aerobic conditioning can be completed without significant loading of the injured musculature. Aerobic exercises initially include pool therapy, walking, or riding a stationary bicycle. Activity is limited by patient comfort, and is increased as tolerated. A goal of at least 30 minutes a day is optimal. It is postulated that increasing aerobic capacity may result in the release of neurotransmitters that have a beneficial effect on pain (Gogia and Sabahi, 1994).

2.7.6.3 Strengthening

Patients with cervical disc degeneration tend to splint and protect the cervical region during acute exacerbation of cervical pain. Repeated exacerbations lead to muscle atrophy, ligament atrophy, joint adhesions, and abnormal joint lubrication. Patients with disc disease and degenerative changes of the cervical spine have been shown to develop increased fatigue of the anterior and posterior neck muscles (indicating relative deconditioning) (Gogia and Sabahi, 1994). Subsequent disuse leads to decreased physical capacity. A specific exercise programme designed to strengthen deconditioned cervical, shoulder girdle, and upper trunk and peripheral musculature is an essential part of rehabilitation. It is one of the most important protective mechanisms in preventing recurrences. It is believed that if a patient can develop normal strength and endurance of essential muscles, the likelihood of overstressing any structure and causing injury is reduced (Hansen and Skov, 1993).

2.7.6.4 Isometrics

During weaning from use of a cervical collar in the subacute period, isometric cervical strengthening exercises should be introduced. Strengthening the muscles against a fixed resistance without motion is most appropriate at this stage; it allows for strengthening without reaggravation and prevents weakness and atrophy. Isometric exercise should include single-plane strengthening against cervical flexion, extension, lateral bending, and rotation, and scapular stabilizing muscles (ie, trapezius, rhomboids, serratus anterior, latissimus dorsi) (Malanga, 1997). Gentle range-of-motion exercises, limited stretching, and aerobic conditioning usually are initiated at the same time. It is often helpful to measure isokinetic strength in the involved side and compare with the uninvolved side. This measurement provides objective evidence of strength and allows the patient to be monitored for progress or development of progressive weakness. This form of exercise is not functional, so there should be progression to dynamic exercises as tolerated.

2.7.6.5 Dynamic progressive-resistive exercise

Cervical and shoulder girdle weakness commonly develops with cervical pain, so more advanced exercises, such as progressive-resistive strengthening, may be initiated after the patient has some pain-free range of motion. This phase of rehabilitation marks the transition from static to dynamic exercises. These exercises should be performed within the pain-free range of motion and may advance as range of motion improves. They may start as uniplanar, working specific major muscles, and then advance to multiplanar exercises as tolerated. Exercise may progress from elastic bands to weight machines to free weights. Initially, weight is kept low and repetitions are increased as tolerated. Later, weight may be increased as tolerated (Brower, 1999). Exercises concentrate on the upper trunk and shoulder girdle because they help to support the cervical spine. Stabilisation exercises help to build paraspinal muscle strength and to prevent from recurrence.

2.7.6.6 Home exercise programme

There must be a transition to an independent home exercise programme for successful rehabilitation. Consistent patient participation in a home programme helps to prevent recurrence. This maintenance programme must be tailored individually for patients. It is based on specific diagnosis, patient status, available resources, and abilities.

2.7.7 Acupuncture

Acupuncture is used in some clinical practices with varying degrees of success. It has recently gained popularity in Western medicine and is reported to have clinical benefits for pain control. However, an extensive literature search produced minimal corroborating research to validate its use. A few studies did suggest that there was some benefit, whereas others demonstrated contradictory results.

2.7.8 Cognitive and Behavioural Therapy

Neck pain is commonly accompanied by other physical and emotional conditions (yellow flags). Appropriate management of neck pain must address all symptoms, patient's pain and distress (Andersen et al, 2002). Yellow flags are psychosocial risk factors that may potentially increase the risk of developing long-term disability and work loss (Cote et al, 2003; Cromie et al, 2007). Yellow flags should be identified early in order to determine if these factors need to be addressed to improve the patient outcomes through cognitive and behavioural management strategies (Moffet and McLean, 2006; Kerr and White, 2007).

2. 8. Clinical variables

2.8.1 Pain

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage. It is noteworthy that pain is always subjective which makes is unquestionable but also limits our ability to assess it with objective methods. It is a sensation in a part or parts of the body, but it is also always unpleasant and therefore an emotional experience (International Association for the Study of Pain, 2015) (IASP). Chronic pain is in turn defined as pain persisting over a certain period of time; often three or alternatively six month duration (Gatchel et al, 2007). The bio-psychosocial approach is now widely accepted as a heuristic perspective to the understanding of chronic pain disorders. The bio-psychosocial model of pain, views physical illnesses such as pain as the result of the dynamic interaction among physiologic, psychological, and social factors, which perpetuates and may even worsen the clinical presentations, each individual experiences pain uniquely, and a range of psychological and socioeconomic factors can interact with physical pathology to modulate a patient's report of symptoms and subsequent disability (Gatchel et al, 2007).

The neurobiological systems of nociception and pain are plastic; i.e. when submitted to significant nociception, the function may change in different ways (Woolf, 2005). Chronic pain is a process where both the peripheral and the central nervous system develop an increased sensitivity for different sensory signals (sensitization). Earlier non painful stimuli become painful (allodynia) and/or painful signals are perceived as more painful (hyperalgesia). In acute pain, sensitization is a normal process protecting against more damage. Under certain circumstances this protective mechanism may be over activated and prolonged, i.e. a pathological and noxious sensitization (Cervero and Laird, 1996). Several neurobiological processes are involved in the sensitization. In the peripheral nervous system, the nociceptors become more sensitive by pain mediating and pain modulating substances which leads to peripheral sensitization (Mcmahon and Jones, 2004). In the central nervous system several different processes interact to create the central sensitization. Repetitive stimulation of Aδ-fibers leads to a gradual increase of the nerve cell (Woolf and Salter, 2000). In heterosynaptic central sensitization, silent synapses are opened leading to pain produced by low-threshold afferent inputs and the spread of hypersensitivity to regions beyond injured tissue (Ji et al, 2003). Long Term Potentiation is coincident activity of pre- and post-synaptic elements, bringing about a facilitation of excitatory input to the dorsal horn and is triggered by short high frequented nociceptive input (Ji et al, 2003; Cookes and Bliss, 2006). There are both inhibitory and facilitating descending pathways for controlling pain transmission (Suzuki et al, 2004). An altered balance between those two can lead to a net facilitation of pain transmission.

2.8. 2 Functional disabilities

The International classification of functioning, disability and health (ICF) offers an integrated bio-psychosocial model of human functioning and disability and provides a classification system handling several aspects of health and disability (WHO, 2001). The structure of ICF contains several levels and parts and the components interact with each other. If one component is affected it may modify another component or the health disorder. If body functions and structures are affected, this is referred to as impairment. The reduction of activities is called activity limitation and in participation, a participation restriction. Functioning serves as a sum up term including, body functions, activities and participation. The negative aspect of functioning is disability and includes impairments, activity limitations and participation restrictions (WHO, 2001). If placing a chronic pain disorder as a health condition in the diagram, it illustrates clearly the great impact on and the great impact of the different components expressing health and disability, including environmental factors. Further, the concept of ICF fits well with the bio-psychosocial model of pain described earlier (Geisser et al, 2003).

2.9 Psychosocial variables

2. 9. 1 Depression

Depression is not simply a comorbid condition but interacts with pain to increase morbidity and mortality. Depressed pain patients report greater pain intensity, greater interference from pain, more pain behaviours, less life control, and more use of passive/avoidance coping strategies than chronic pain patients without depression (Haythorthwaite et al, 1991; Weickgenant et al, 1993). The temporal relationship between pain and depression is under debate. Fishbain et al, (1997) found strong support for the consequence hypothesis: depression is a consequence that follows the development of pain. To describe the relationship between chronic pain and depression, Banks and Kerns (1996) suggested a diathesis-stress-model where the diathesis is described as pre-existing, semi-dormant characteristics of the individual before the onset of chronic pain. These characteristics are activated by the stress of the chronic condition and may lead to depression. Qualitative differences between depression as a result of chronic pain and depression as a primary psychiatric disorder have been reported (Fishbain et al, 1997; Pincus and Williams, 1999). Pincus and Williams suggest that affective distress, which incorporates wider emotions such as anger, frustration, fear, and sadness, is a better term than depression (Pincus and Williams, 1999) Depression is a predictor of disability in chronic pain patients in long-time follow-up studies (Gatchel et al, 2007). There is also a relationship between depression and poorer self-reported functional activity among persons with chronic pain (Geisser et al, 2003).

2. 9. 2 Anxiety

Anxiety is co-morbidity to acute, sub-acute and chronic pain with incidence rates between about 15 and 40% (SBU, 2005) co-morbidity also exist between mood and anxiety disorders (Krueger, 1991; Alongo et al, 2004). Several studies have found pain conditions being more strongly associated with several anxiety disorders than with depression (Breslau and Davis, 1993; McWilliams et al, 2004). Patients with anxiety disorders reported the highest pain intensity and interference and the lowest general activity level in neck pain (Thieme, 2004). Pain related anxiety includes physiological, cognitive, behavioural and affective manifestations of anxiety within the context of pain (McCracken et al, 1992) Heightened levels of anxiety about pain are believed to contribute to avoidance of activities that are perceived to promote pain, which in turn, often lead to physical deconditioning, secondary behavioural problems and reduced social contact (Hadjistavropoulos and LaChapelle, 2000).

This pattern of responding is likely to become cyclic in nature, such that emotional responsivity and physical deconditioning lead to greater levels of pain, behavioural interference, perceived lack of control over life activities and affective distress (Asmundson et al, 1997; Asmundson, et al, 1999). In this model, anxiety about pain is a critical psychological factor involved with the production of maladaptive responding, behavioural interference, and emotional distress. Anxiety sensitivity is the fear of arousal-related bodily sensations arising from beliefs that these sensations have harmful consequences, a catastrophically misinterpretation (Asmundson, et al, 1999; Reiss et al, 1986). Anxiety sensitivity has been closely associated with negative pain experiences in acute and chronic settings (Lang et al, 2006; Asmunson et al, 1999).

2. 9. 3 Fear avoidance beliefs

Fear is the emotional reaction to a specific, identifiable and immediate threat, such as a dangerous animal or an injury (Rachman, 2004). Fear may protect the individual from impending danger as it instigates defensive behavior that is associated with the fight or flight response (Rachman, 2004). The three main components of fear (interpretation of the stimulus as threatening, increased sympathetic arousal, and defensive behavior) are loosely coupled and can change at different paces (Bouton, 2002). Defensive escape behaviors reduce fear levels in the short term, but may strengthen the fear in the long run. Not least they may prevent disconfirmation of the patient's beliefs and sometimes they make the feared outcome more likely to occur. Three findings in fear research are notable. First, people with a phobia (intense irrational fear) do not necessarily have a history of being exposed to a traumatic incident (Hermans et al., 2006). Second, during extinction procedures, no unlearning takes place, but rather new learning that leaves the original association between the conditioned and unconditioned stimulus intact, making relapse likely (Bouton, 2002). Third, individual differences in vulnerabilities exist that can affect how likely fear will be experienced, acquired or maintained over time (Mineka and Zinbarg, 2006).
Fear avoidance beliefs play a key role in the development of sub-acute or chronic musculoskeletal pain, in particular fear of pain. Fear of pain leads to avoidance of

activities (physical, social, and professional) that patient's associate with the occurrence or exacerbation of pain, even after they may have physically recovered (Leeuw et al, 2007). Whereas this response is adaptive in the acute phase, rest promotes recovery but it leads to disability and distress when avoidance behavior is continued after the injury has healed. Fear avoidance belief has been found to be associated and to be able to predict chronic neck pain disability in musculoskeletal disorders (Geoge et al, 2001; Landers et al, 2008). There is a substantial economic cost to excessive fear of pain. In the acute phase, only activities directly related to pain are avoided. However, the pattern of avoidance may gradually spread across activities, cumulating into a sedentary lifestyle, characterized by the fear that any activity may lead to re-injury or pain. This pattern adds to the social and economical cost of musculoskeletal pain, as fear of pain prolongs and sometimes increases disability, absenteeism, and health care utilization (Vlaeyen and Lintol, 2000).

2. 9. 4 Psychosocial aspect of neck pain

The onset, development, and treatment outcome of spinal pain problems may be related to psychological factors. Weiser and Cedraschi (1992) conducted a systematic literature review of psychosocial factors in chronic lower back pain (CLBP). They found psychological distress, as measured by the Minnesota Multiphasic Personality Inventory (MMPI), relates to outcome. Cognitive factors such as coping and illness beliefs were related to recovery in chronic sufferers, with some evidence for their relationship to the development of the problem. Job satisfaction and stress also predicted outcome. Linton (2000a) examined the reviews already conducted, examining the relationship between psychosocial factors and neck or back pain. His search for prospective studies found 36 investigations, but no support for a "pain-prone" personality. Significant findings seemed related to personality disorders such as depression and anxiety. Stress, distress, or anxiety was reported in 11 studies, all of which found a significant relationship. Mood and depression were investigated in 16 articles, of which 14 indicated that depressed mood increases risk for pain problems. Eight of nine studies found a significant relationship between chronicity and cognitive functioning, including fear-avoidance beliefs and coping strategies. Finally, six of seven studies suggested that high levels of pain behaviour and dysfunction served as risk factors for future back pain problems. According to Linton's (2000a) systematic review of prospective studies, strong evidence exists that psychosocial factors are strongly linked to the transition from acute to chronic pain disability and that they can be associated with reporting of onset of back and neck pain. Strong evidence also exists that psychosocial variables generally have more impact than biomedical or biomechanical factors on back and neck pain disability, and that attitudes, cognition, and fear-avoidance beliefs are strongly related to development of pain and disability. Depression, anxiety, distress, and related emotions are also strongly related to pain and disability (level A evidence). Poor self-perceived health is moderately related to chronic conditions (level A evidence), and psychosocial factors are moderate predictors for long-term pain and disability (level A/B evidence).

2.10 Outcome measures

2.10.1 Visual Analogue Scale – Hausa version

The visual analogue scale (VAS) proposed for this study is the alternate VAS-Hausa (Odole and Akinpelu, 2009). It consists of an adaption of the original form in which the continuous line has been converted into continuous boxes of 10 centimeters on the whole with polar descriptors of the two extremes of the pain at each end of the scale. Raters would read the descriptors and place a mark in the corresponding box that they feel best describes their pain experience at that moment. The alternate VAS has been reported to have a significant correlation with the English version of r= 0.93 and therefore is reliable and recommended for use in the Nigerian clinical setting (Odole and Akinpelu, 2009).

2.10.2 Neck disability index (NDI)

The neck disability index (NDI) (Vernon and Moir, 1991) is designed to measure neck-specific disability. The questionnaire has 10 items concerning pain and activities of daily living, including personal care, lifting, reading, headaches, concentration, work status, driving, sleeping and recreation. The measure is designed to be given to the patient to complete, and can provide useful information for management and prognosis of patients with neck pain.

Scoring and interpretation

Each item is scored out of five (with the no disability response given a score of 0), giving a total score for the questionnaire out of 50. Higher scores represent greater disability. The result can be expressed as a percentage (score out of 100) by doubling the total score.

2.10.3 Fear avoidance beliefs questionnaire (FABQ)

The FABQ is a useful questionnaire to assess fear avoidance beliefs. The psychometric properties of the subscales are better established than the total FABQ so use of the subscales may be preferable. The physical activity subscale (FABQpa) may be more appropriate for patients who do not work. However, Kovacs et al, (2006) suggest there may be a ceiling effect for the FABQpa as 23.9% of their sample scored the highest score possible. This was not seen for the total FABQ or FABQw (work subscale). The majority of reliability and validation studies have been undertaken in chronic LBP populations but recently there has been an interest in its ability to predict long term disability in acute populations. Results have been contradictory in this area. Some studies show that it can be used to identify acute low back pain patients at risk of poor outcome (Fritz and George 2002) while others show it not to be a useful predictor in this patient group (Dimitriadis et al, 2015). At present, there are no values to define what constitutes an elevated FABQ score. A FABQpa > 15 (based on the median score of the population studied) should be considered an elevated score but this requires further validation. Fritz and George (2002) found that a FABQw > 34 identified patients at risk of not returning to work four weeks post injury in patients with acute work-related LBP. However these authors emphasized that more research is needed to establish cut off scores for 'at risk' patients. Establishing such values would improve the usefulness of the instrument in the clinical setting. The change in FABQ scores that reflects a clinically important change in beliefs has not been established. Changes in FABQ have been shown to correlate with changes in disability following treatment (Dimitriadis et al, 2015) indicating a relationship between the two. Further research in this area may help to explain patient responses to treatment. The role of fear avoidance beliefs in the development of long-term disability has been gaining importance in recent years. It is important that this psychological factor is assessed so that treatment can address unhelpful beliefs that may contribute to the development or maintenance of disability. The FABQ is a reliable and valid measurement that can be used for this purpose although further research into its use as a diagnostic tool is warranted.

Scoring of instrument

The FABQ assesses patient beliefs with regard to the effect of physical activity and work on their neck pain. It consists of 16 items and patients rate their agreement with each statement on a 7- point Likert scale (0 = completely disagree, 6 = completely agree). The original factor analysis revealed two subscales: the work subscale (FABQw) with 7 questions (maximum score = 42) and the physical activity subscale (FABQpa) with 4 questions (maximum score = 24). A higher score indicates more strongly-held fear avoidance beliefs. The questionnaire takes approximately 10 minutes to complete.

2.10.4 The Beck Depression Inventory (BDI)

This is a 21-item multiple choice self-report inventory widely used to measure the presence and degree of depression in adolescents and adults (Beck et al, 1996). The BDI can be self-administered or administered verbally by a trained administrator, and is validated for completion by patients aged 13 to 80 years. It has a high test-retest reliability (Pearson r = 0.93) (Beck and Brown, 1996) and high internal consistency (Alpha 0.91) (Beck et al., 1996). The BDI assesses both cognitive and somatic symptoms of depression, unlike the Hospital Anxiety and Depression Scale which was developed solely for use with somatic illness.

Interpreting and scoring the Beck Depression Inventory (BDI)

The scores for each of the 21 items are added by counting the number to the right of each question marked. The highest possible total for the whole test would be sixty-three and the lowest possible score for the test would be zero. This would mean the respondent circled zero on each question. Then depression can be evaluated according to the table below.

Total Score Levels of Depression

0-10 = these ups and downs are considered normal

11-16 = Mild mood disturbance

17-20 = Borderline clinical depression

21-30 = Moderate depression

31-40 = Severe depression

Over 40 = Extreme depression

2. 10. 5 The Beck Anxiety Inventory (BAI)

Created by Beck (1961) is a 21-item multiple-choice self-report inventory that measures the severity of anxiety in adults and adolescents. Because the items in the

BAI describe the emotional, physiological, and cognitive symptoms of anxiety but not depression, it can discriminate anxiety from depression. Although the age range for the measure is from 17 to 80, it has been used in peer-reviewed studies with young adolescents aged 12 and older. Each of the items on the BAI is a simple description of a symptom of anxiety in one of its four expressed aspects: (1) subjective (e.g., "unable to relax"), (2) neurophysiologic (e.g., "numbness or tingling"), (3) autonomic (e.g., "feeling hot") or (4) panic-related (e.g., "fear of losing control"). The BAI requires only a basic reading level, can be used with individuals who have intellectual disabilities, and can be completed in 5 - 10 minutes using the pre-printed paper form and a pencil. Because of the relative simplicity of the inventory, it can also be administered orally for sight-impaired individuals. The BAI is psychometrically sound. Internal consistency (Cronbach's alpha) ranges from 0.92 to 0.94 for adults and test-retest (one week interval) reliability is 0.75 (Beck et al, 1988).

Administration, Scoring and Interpretation

Respondents are asked to report the extent to which they have been bothered by each of the 21 symptoms in the week preceding (including the day of) completion of the BAI. Each symptom item has four possible answer choices: Not at All; Mildly (It did not bother me much); Moderately (It was very unpleasant, but I could stand it); and Severely (I could barely stand it). The clinician assigns the following values to each response: Not at All = 0; Mildly = 1; Moderately = 2, and; Severely = 3. The values for each item are summed yielding an overall or total score for all 21 symptoms between 0 and 63 points. A total score of 0 - 7 is interpreted as a "Minimal" level of anxiety, 8 - 15 as "Mild", 16 - 25 as "Moderate", and 26 - 63 as "Severe". Clinicians examine specific item responses to determine whether the symptoms appear mostly subjective, neurophysiologic, autonomic, or panic-related. The clinician can then further assess using DSM criteria to arrive at a specific diagnostic category and plan interventions targeting the underlying cause of the respondent's anxious symptomatology and/or diagnosis.

2.11 Summary of previous studies of non-specific neck pain

1. **Jull et al (2002)** conducted a multi-centered, randomized clinical trial (n=200) in participants who met the diagnostic criteria for cervicogenic headache. The inclusion criteria were unilateral or unilateral dominant side-consistent headache associated with neck pain and aggravated by neck postures or movement, joint tenderness in at least 1 of the upper 3 cervical joints as detected by manual palpation and a headache frequency of at least 1 per week over a period of 2 months to 10 years. Subjects were randomized into 4 groups: mobilization/manipulation group, exercise therapy group, combined mobilization/manipulation and exercise group, and a control group. The primary outcome was a change in headache frequency. At the 12-month follow-up, the mobilization/manipulation, combined mobilization/ manipulation and exercise, and the specific exercise groups had significantly reduced headache frequency and intensity. Additionally 10% more patients experienced a complete reduction in headache frequency when treated with mobilization/manipulation and exercise than those treated with the alternative approaches (Jull et al 2002).

2. Dynamic muscle training and relaxation training did not lead to better improvements in neck pain compared with ordinary activity. In a randomized clinical trial, **Bronfort et al (2001)** found that a combined programme of strengthening and endurance exercises combined with manual therapy resulted in greater gains in strength, endurance, range of motion, and long-term patient pain ratings in those with chronic neck pain than in programmes that only incorporated manual therapy. Additionally, Evans et al (2002) found that these results were maintained at a 2-year follow-up.
3. **O' Leavy et al (2007)** compared the effect of two specific cervical flexor muscle exercise protocols on immediate pain relief in the cervical spine of people with chronic neck pain. They found that those performing the specific craniocervical flexion exercises demonstrated greater improvements in pressure pain thresholds, mechanical hyperalgesia, and perceived pain relief during active movement.
4. In a randomized clinical trial, **Viljanen et al (2003)** assessed the effectiveness of dynamic muscle training (n= 135), relaxation training (n=128), or ordinary

activity (n=135) for female office workers with chronic neck pain. Dynamic muscle training and relaxation training did not lead to better improvements in neck pain compared with ordinary activity.

5. In a prospective case series, **Nelson et al (1999)** followed up patients with cervical and lumbar pain and found that an aggressive strengthening programme was able to prevent surgery in 35 of the 60 patients (46 of the 60 completed the programme, 38 were available for follow up, and only 3 reported having surgery). Despite the methodological limitations of this study, some patients that were originally given the option of surgery were able to successfully avoid surgery in the short term following participation in an aggressive strengthening exercise programme.
6. In a systematic review of 9 randomized clinical trials and 7 comparative trials with moderate methodological quality for patients with mechanical neck disorders, **Sarig-Bahat (2003)** reported relatively strong evidence supporting the effectiveness of proprioceptive exercises and dynamic resisted strengthening exercises of the neck-shoulder musculature for patients with chronic or frequent neck disorders. The evidence identified could not support the effectiveness of group exercise, neck schools, or single sessions of extension-retraction exercises.
7. In a randomized clinical trial, **Chiu and Sing (2002)** found that after a 6-week treatment of transcutaneous electrical nerve stimulation or exercise, patients with chronic neck pain (n= 218) had a better and clinically relevant improvement in disability, isometric neck muscle strength, and pain compared to a control group. All the improvements in the intervention groups were maintained at 6-month follow-up.
8. **Hammill et al (1996)** used a combination of postural education, stretching, and strengthening exercises to reduce the frequency of headaches and improve disability in a series of 20 patients, with results being maintained at 12-month follow-up.
9. **Chiu et al (2004)** assessed the benefits of an exercise programme that focused on both motor control training of the deep neck flexors and dynamic strengthening. A total of 145 patients with chronic neck pain were randomized to either an exercise or a non-exercise control group. At week 6, the exercise group had significantly better improvements in disability scores, pain levels,

and isometric neck muscle strength. However, at the 6-month follow up, significant differences between the two groups were found only in pain and patient satisfaction.

TABLE 1. Summary of previous studies on exercise therapy in patients with non-specific neck pain.

Author	Participants	Interventions	Main outcome measures	Study results on effect of intervention on pain
Cunha et al (2008)	Women, aged 35-60, with diagnosed primary mechanical myogenous or arthrogenous, neck pain lasting > 12wks (N = 33)	(1) GPR group (n = 15), manual therapy for stretching fasciae for 30 min, muscle stretching in the form of global posture reeducation (GPR) for 30 min. (2) Conventional stretching group (n = 16), manual therapy for stretching fasciae for 30 min, muscle stretching through conventional stretching exercise for 30 min. All: two weekly physiotherapy sessions during a 6 week period.	VAS, ROM, SF – 36	There were no statistically significant differences in effect between groups after treatment and at 6-week follow-up.
Dellve et al. (2001)	Women, aged 35-60, with work disability (at least 50%) and pain in the neck (diagnosed cervicobrachial pain syndrome) for at least 1 year (N = 60)	(1) Myofeedback training (n= 20), min 8 hours/wk, registered the muscle activity (EMG) of upper trapezius muscles and gave alarm if the preset level of muscular rest was	Work ability index (WAI) Single item on work ability, working degree, changed work ability Pain, NRS	There were no statistically significant differences in effect between groups after 1mth and at follow-up after 3mths

		not reached. Personal visit once/week from a physiotherapist browsing EMG profiles with reference to diary entries. (2) Intensive muscular strength training (*n* = 20), a structured 5-10 min programme to be performed twice a day for 6 days/wk. A physiotherapist coached by two personal visits and additional phone calls twice/wk (3) Control group (*n* = 20) All: kept a diary 6 days/wk recording activities, discomfort, pain, and sleeping disturbances. All interventions lasted 1mth	Copenhagen Psychosocial Questionnaire Cutlery wiping performance test, dexterity, max. grip strength	
Griffiths et al.(2009)	Chronic neck pain (diagnosed spondylosis, whiplash, non-specific neck pain, and discogenic pain), age 18 and over (*N* = 74)	(1) Specific neck stabilisation exercises (*n* = 37) in addition to the same programme as group 2 (2) General neck exercise programme (*n* = 37),	NPDS, NPQ, VAS**	There were no significant between-group differences in the NPDS at either 6wks or 6mths

		posture correction technique, and active range of movement exercise All: max. four 30 min treatment sessions within the first 6wks, advice to perform exercises 5-10 times daily, written sheets, after 6wks the therapist could discharge the patient or continue		
Randlov et al (1998)	Females with chronic neck/shoulder pain (> 6mths), age 18 – 65 (N = 77)	(1) Light training (n = 41) (2) Intensive training (*n* = 36) All: three times per wk, in total 36 sessions	Pain measures with two 11-point box scales, activities of daily living, strength, endurance	There were no statistically significant differences in effect between groups after 6 and 12 mths follow-up
Revel et al. (1994)	Patients with chronic neck pain (>3mths), age > 15 (*N* = 60)	(1) Rehabilitation group (*n* = 30), receiving common symptomatic treatment, besides eye-head exercises improving neck proprioception in individual exercise sessions twice a wk for 8 wks (2) Control group (*n* = 30), receiving only symptomatic treatment	Head repositioning accuracy, VAS, medication intake, ROM	Significant difference between groups for the rehabilitation group on VAS pain (−21.8 ± 25.2) (*P* = 0.04) at 10wk follow-up

		without rehabilitation		
Taimela et al. (2000)	Patients with chronic, non-specific neck pain (>3mths), half had local pain and half referred pain below the elbow, age 30–60 (*N* = 76)	(1) Active treatment (*n* = 25), proprioceptive exercises, relaxation and behavioural support, 24 sessions (2) Home regimen (*n* = 25), neck lecture and two sessions of practical training for home exercises and instructions for maintaining a diary (3) Control group (*n* = 26), a lecture regarding care of the neck with a recommendation to participant	VAS, ROM, PPT	The VAS scores after the intervention at 3mths were significantly lower in the active treatment (22 mm) and home regimen (23 mm) groups than in the control group (39 mm) (*P* = 0.018) after 3mths. No statistically significant differences between the groups were noted at 12mths
Vonk et al. (2009)	Patients with chronic non-specific neck pain (>3mths), age 18–70 (*N* = 139)	(1) Behaviour graded activity programme (*n* = 68), biopsychosocial model guided by the patient's functional abilities (2) Conventional exercise (*n* = 71), reflected usual care, exercises, massage and mobilization and traction All: treatment period 9wks	Global perceived effect, NDI, NRS	There were no statistically significant differences in effect between groups at 4, 9, 26, and 52wks

Ylinen et al. (2003)	Female office worker, age 25-53, with constant or frequently occurring neck pain of more than 6mths. Motivated to continue working and rehabilitation (N = 180)	(1) Endurance group (n = 60), endurance training, dynamic neck exercises (2) Strength group (n = 60), strength training, high-intensity isometric neck strengthening and stabilisation exercises Groups 1 and 2: 12-day institutional rehabilitation programme with training lessons, behavioural support, 4 sessions of physical manual therapy, advice to continue exercise 3 times a wk at home (3) Control group (n = 60): 3-day institutional rehabilitation programme with recreational activities All: advice to perform aerobic exercise 3 times a wk for half an hour at home	VAS, neck and shoulder pain and disability index, Vernon neck disability index	At the 12mth follow-up, both neck pain and disability had decreased in both training groups compared with the control group ($P < 0.01$). Decrease Pain VAS in the endurance group: −35 ((−42)–(−28)); in the strength group: −40 ((−48)–(−32))
Ylinen et al (2007)	Female, age 25–53, with constant or frequently occurring neck pain of	Crossover trial, after 4wks (1) Manual therapy group (n = 62), low-velocity osteopathic-type	VAS, neck and shoulder pain and disability index, NDI,	There were no statistically significant differences in effect between groups at

	more than 6mths duration, pain > 44mm on VAS (*N* = 125)	mobilisation of cervical joints, traditional massage, passive stretching, two treatments a wk for 4wks (2) Stretching exercises group (*n* = 63) consisted of instruction to perform neck stretching exercises at home for 4wks		the 1 and 3-year follow-up
Gustavsson et al. (2010)	Patients with musculoskeletal tension-type neck pain of persistent duration (>3mths), age 18–65 (*N* = 156)	(1) Multicomponent pain and stress self-management group intervention (PASS) (*n* = 77), relaxation training, body awareness exercises, lectures and group discussions, seven 1.5 h sessions over a 7 wk period, and a booster session after 20wks (2) Control group receiving individually administered physiotherapy (IAPT) (*n* = 79)	Questionnaire comprising the self-efficacy scale, NDI, coping strategies questionnaire, hospital and depression scale, fear-avoidance beliefs questionnaire, and questions regarding neck pain, analgesics, and utilisation of health care	There was a statistically significant effect on ability to control pain ($P < 0.001$), and on neck related disability (NDI) ($P < 0.001$) in favour of PASS at the 20wks follow-up
Hakkinen et al (2008)	Non-specific neck pain of more than 6mths, age 25–53, pain > 29 mm on	(1) Strength training and stretching (*n* = 49). Sessions once a wk for 6wks and thereafter one	VAS, neck and shoulder disability index, NDI, ROM, isometric	There were no statistically significant differences in effect between groups

	VAS (N = 101)	session every second mth for 12mths (2) Stretching group (n = 52) in a single group session instructions All: encouraged to perform home training regimen three times a wk and to keep weekly exercise diary	strength	after two and 12 months measured with VAS and NDI
Jull et al (2002)	Females with chronic neck pain of idiopathic or traumatic origin and abnormal measures of joint position sense (N = 64)	(1) Proprioceptive exercise intervention (n = 28) (2) Craniocervical spine flexion exercise intervention (n = 30) All: personal instruction and supervision once a wk for 6 wks	Joint position error, NDI, NRS	There were no statistically significant differences in effect between groups measured in the week immediately after intervention (week 7)

CHAPTER THREE

MATERIALS AND METHODS

3.1 Materials

3.1.1 Participants

The participants for this study were patients with non-specific neck pain. They were aged between 22 to 65 years and were recruited from the National Orthopaedic Hospital, Dala, Kano (NOHDK) and Aminu Kano Teaching Hospital, Kano (AKTHK). NOHDK is a specialist hospital with two hundred beds that provides tertiary health care service to the Northern part of Nigeria, while AKTHK is a Bayero University teaching hospital with five hundred beds that provides tertiary health care services to the people of Kano state and neighbouring states, is one of three teaching hospitals in the Northwest of Nigeria. Eighty one per-cents of the participants were from NOHDK and nineteen per-cents from AKTHK. They were randomly allocated into the three study groups: neck stabilization exercise group (NSEG; n= 30); neck stabilization plus dynamic exercise group (NSDEG; n = 29); or neck dynamic exercise group (NDEG; n =29). However seventy six participants completed the study NSEG; n = 27, NSDEG; n = 25, NSDEG; n = 24. A 13.6% (12 participants) Drop-out was observed in this study as the only 76 (86.36%) completed the 8week programme of the study, of the 88 participants recruited for the study.

Inclusion criteria

The following categories of patients were recruited into the study:

1. Patients diagnosed with non-specific neck pain
2. Patients with moderate to severe neck pain
3. Patients with non-specific neck pain who were able to comprehend instruction in English or Hausa language
4. Patients who were not involved in any other form of exercise training during the course of the study.
5. Patients with non-specific neck pain of at least six weeks duration

Exclusion criteria

The following categories of patients were excluded from the study:

8. Patients with co-morbidities that influence overall well-being, for example sickle cell anaemia

9. Patients with specific disorders of the cervical spine, such as; disk prolapse, spinal stenosis, postoperative conditions, history of severe trauma, spasmodic torticollis, frequent migraine, fibromyalgia, shoulder diseases, inflammatory rheumatic diseases and psychiatric illness
10. Patients with obvious spinal deformity or neurological disease
11. Patients with a reported history of cardiovascular diseases contraindicated to exercise
12. Patients with Beck depression scores of < 11
13. Patients with Beck anxiety scores <1
14. Patients below 18 years.

3.1.2 Instruments

The following instruments were used to collect data during the course of carrying out this study:

1. **Biodata form:** This was used to obtain socio-demographic information of participants. This included: age, sex, marital status, religion, tribe, educational status, occupation, household income and smoking/tobacco consumption history. (Appendix 2)
2. **Informed consent form** (Appendix 1)
3. **Beck Depression Inventory (BDI):** This was used for screening participants for depression and follow-up for treatment (Beck et al, 1996). (Appendix 10)
4. **Beck Anxiety Inventory (BAI):** This was used for screening participants for anxiety and follow-up for treatment (Beck et al, 1988). (Appendix 12)
5. **Neck Disability Index Questionnaire**: This questionnaire was used to assess functional ability, activity limitation and participation restriction of the participants (Vernon and Mior 1991). (Appendix 6)
6. **Fear-Avoidance Belief Questionnaire (FABQ)**: This is a 16-item questionnaire that was used to measure participants' fear of pain (Waddell et al, 1993). This was translated into Hausa language and validated (Kaka et al 2015) before being used for this study. (Appendix 8 and 9)
7. **Visual Analogue Scale-Hausa (VAS-H)**: This scale was used to assess pain severity in participants. It is an adaptation of the original VAS in which the ten-centimeter long, ungraduated horizontal line has been converted into continuous boxes; one end defines the minimum or no pain,

while the other end defines the maximum or extreme pain ever experienced by the participant (Odole and Akinpelu, 2009). (Appendix 5)

8. **Thera-band: (**Theraband, Hygiene Corp., Akron, OH) was used for dynamic strengthening exercises.
9. **A wooden chair**, on which participants sat, was used for dynamic exercises.
10. **A hooks and pulley system**, made in China, was used for dynamic exercises.
11. **A wall bar**, made in Nigeria, was used for dynamic exercises.
12. **Treat Your Own Neck** (McKenzie, 2006): This neck care educational instruction manual was used as an instructional guide for neck care for participants.

3.1.4 Venue of Research

The study was carried out in the Physiotherapy Department, National Orthopaedic Hospital, Dala, Kano. While those in AKTH were given incentive to enable them transport themselves to the venue and all their physiotherapy registration fees were paid by the researcher.

3.2 Methods

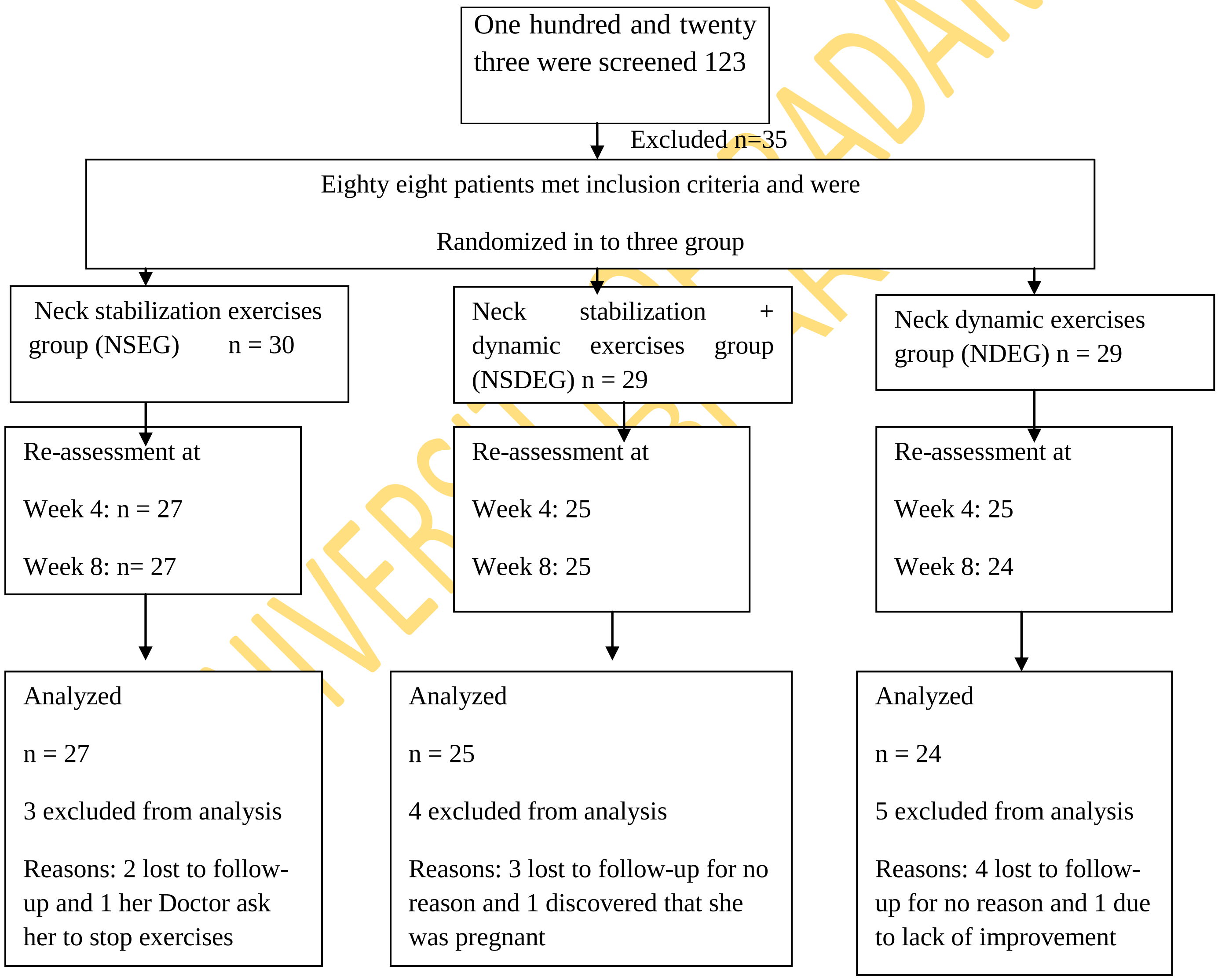
3.2.1 Sampling and randomization Technique

Patients referred for physiotherapy by the doctors were recruited for the study using a consecutive sampling technique. The subjects were screened to determine whether they met the inclusion criteria for the study. Patients who met the inclusion criteria for the study were randomized into three groups, viz. the neck stabilization exercise group (NSEG), the neck stabilization plus dynamic exercise group (NSDEG), and the neck dynamic exercise group (NDEG), as they became available. The participants were blinded to the group into which they were randomized. The prospective participants were asked to pick a single paper from a bowl containing 90 papers (30 of the papers had NSEG written on it, another 30 had NSDEG, and 30 had NDEG written). The papers were thoroughly mixed together. A participant belonged to the group that he/she picked. The papers were picked without replacement.

The neck stabilization exercise group (NSEG; n= 30); neck stabilization plus dynamic exercise group (NSDEG; n = 29); and neck dynamic exercise group (NDEG; n =29). However seventy six participants completed the study NSEG; n = 27, NSDEG; n = 25, NSDEG; n = 24. A 13.6% (12 participants) Drop-out was observed in this study as the only 76 (86.36%) completed the 8week programme of the study, of the 88 participants recruited for the study (figure 3 flow chart).

FIGURE 3 FLOW CHART

Flow diagram showing the progression of patients through the study



3.2.2 Sample Size Determination

The sample size for the study (N) was determined using Cohen's table (Cohen, 1988) at α = 0.05, degree of freedom (u) = k-1, where k is the number of groups in this study, which is equal to 3. Therefore, at α =0.05, u= 2, effect size (f) = 0.35 (medium value) and power (w) = 0.8, group sample size (n) = 20. Sample size (N) for the study was a minimum of 60 patients with non-specific neck pain. An extra 12 participants (20%) were added to make room for drop outs (attrition). Therefore, a minimum of 72 participants would be recruited for this study, with each group having at least 24 participants.

3.2.3 Research design

This study employed a randomized controlled clinical trial design, registered with Pan Africa Clinical Trial Registry PACTR 201402000727807.

3.2.4 Procedure

Step I

Ethical approval for the study was sought and obtained from the Health Research Ethics Committee of University of Ibadan and University College Hospital, Ibadan (UI/EC/14/0003) (Appendix A). Also ethical approval was obtained from the National Orthopaedic Hospital, Dala, Kano (NOHD/RET/ETHIC/60) (Appendix B) with a letter from the Department of Physiotherapy, College of Medicine, University of Ibadan, introducing the researcher.

Step II

3.2.5 Translation of instruments

All questionnaires were translated into the Hausa language through a forward-back translation process. A forward translation of the original version of the instrument into Hausa language was done by two experts from the Department of Nigerian Languages, Bayero University, Kano. Both experts compared their versions to identify discrepancies indicative of ambiguous wording compared with the original instrument. A third bilingual person in both languages was then asked to develop one version of the translated instrument. A fourth expert in the Hausa language then translated the new instrument back into English and compared it to the original version of the instrument.

Step III

3.2.6 Pilot study

The translated instruments were administered to a sample of 10 non-specific neck pain patients to test their validity and reliability.

3.2.6 Result

The instruments were successfully translated into Hausa language following the recommended guideline by Beaton et al (2000). The translated Hausa version of FABQ proved to be acceptable. The FABQ-H showed strong correlations (r=0.94, p=0.001) with the original English version. There was also high internal consistency between the FABQ-H and its subscales (physical activity component-α=0.88, p=0.001 and work component-α=0.94, p= 0.001). The FABQ-H also showed high test-retest reliability (intra-class correlation coefficient=0.98) (Kaka et al, 2015). The Hausa version of NDI showed good internal consistency (α = 0.741) and test-retest reliability of r=0.827 with interclass correlation coefficients (ICC) of 0.68 with 95% CI (0.40-0.83). Factor analysis revealed a 2 factor 10 items structure which explained variance of 49.7%.

Step IV

Recruitment Procedure

Clinical Assessment

Participants were recruited through referral, if they were interested in participating after an explanation of the aim and purpose of the research. Prospective participants were then assessed and screened during their first appearance by the researcher for inclusion into the study. The confirmatory test used for non-specific neck pain includes: X-ray or magnetic resonance imaging (MRI) if it is available to rule out any red flag or any specific neck diseases, physical tests (compression, distraction, vertebral artery test) and laboratory test if available. The Beck Depression Inventory was used to screen the participants for depression. Participants with scores >11 were included. For anxiety, the Beck Anxiety Inventory was used to screen the participants. Participants with scores ≥1 were included. Then, they were guided through the informed consent process. They were required to sign or thumbprint a consent form. After signed written consents had been obtained, then followed the random allocation to the three study groups – NSEG or NSDEG or NDEG. The demographic and baseline questionnaires were administered to the participants by the researcher after the randomization. The researcher then scheduled appointments for the interventions.

3.2.8 Measurement of the Parameters

1. **Pain intensity**: This was assessed using the alternate visual analogue scale in Hausa (VAS-H). The patient was requested to rate on a 0-10 scale, the level of pain he/she felt 6 weeks ago and now. On the scale, 0 indicates no pain/no interference while 10 is pain as bad as it could be/extreme interference (Odole and Akinpelu, 2009). The alternate VAS-Hausa has been reported to have a high validity, increased patient compliance, greater sensitivity of measurement and reduced bias (Odole and Akinpelu, 2009).
2. **Functional disability:** This was assessed with the aid of the Neck Disability index Questionnaire (NDIQ) which is a 10-item questionnaire. It has a test-retest reliability of r = 0.89 (Vernon and Mior, 1991). Each of the 10 items was scored from 0 to 5, and the final score was scale transformed and expressed as a percentage, with a high number indicating greater disability. 0-20%: minimal disability, 20-40%: moderate disability, 40-60%: severe disability, 60-80%: crippled: 80-100%, bed bound or exaggerating (Vernon and Mior, 1991).
3. **Fear-Avoidance Belief Questionnaire (FABQ)**: This is a 16-item questionnaire which assessed participants' beliefs regarding the effect of physical activity and work on their neck pain. Patient's belief is rated on a 7-point Likert scale (0= completely disagree, 6 = completely agree). The FABQ has two subscales: the physical activity subscale (FAB-pa) with 5 questions and a maximum score of 24 (1 question is not included in the scoring of this domain); and the work subscale (FAB-w) with 11 questions and a maximum score of 42 (4 questions are not included in the scoring of this domain). The higher the score obtained the greater the fear avoidance beliefs. It takes approximately 10 minutes to complete the questionnaire. The test-retest reliability was 0.97 (Williamson, 2006; Waddell et al, 1993)
4. **Beck Depression Inventory (BDI):** This is a 21-item multiple choice self-reported inventory, widely used to assess the presence and degree of depression in adolescents and adults (Beck et al*, 1996*). The BDI is a self-administered questionnaire and it has high test-retest reliability (Pearson r = 0.93) (Beck and Brown, *1996*). It also has high internal consistency (Alpha 0.91) (Beck et al, *1996*). The BDI scores were added up by counting the numbers of correct answers of each question marked. The highest possible

score is sixty-three while the lowest possible is zero. Depression is then evaluated based on the total score: 0-10 = these are considered normal, 11-16 = mild mood disturbance, 17-20 = borderline clinical depression, 21-30 = moderate depression, 31-40 = severe depression and over 40 = extreme depression.

5. **Beck Anxiety Inventory (BAI):** This is a 21-item multiple-choice self-reported inventory that measures the severity of anxiety in adults and adolescents. It can be completed in 5 - 10 minutes. The BAI is psychometrically sound. Internal consistency (Cronbach's alpha) ranges from 0.92 to 0.94 for adults and test-retest (one week interval) reliability is 0.75 (Beck et al, 1988). In scoring the BAI, respondents are asked to report the extent to which they have been bothered by each of the 21 symptoms in the week preceding (including the day of) completion of the BAI. Each symptom item has four possible answer choices: Not at all, mildly (It did not bother me much), moderately (It was very unpleasant, but I could stand it), and severely (I could barely stand it). Not at all = 0, mildly = 1, moderately = 2, and severely = 3. The values for each item are summed yielding an overall score of 63 points. A total score of 1 - 7 is interpreted as a "Minimal" level of anxiety, 8 - 15 as "Mild", 16 - 25 as "Moderate", and 26 - 63 as "Severe".

3.2.9 Intervention

Neck stabilization exercises

The neck stabilization exercise training is designed to restore cervical muscle endurance and coordination (Provinciali et al, 1996; Koskimies et al, 1997; Flor et al, 1997). All the participants in this group performed the following exercises. As summarise in table 3 and appendix C

Chin tuck

In standing position, participant pulls back the chin (as if trying to make a double chin) while keeping the eyes level. This was done for 15 repetitions.

Cervical extension

In standing position, participant grasps the base of the neck, with both hands while extending the neck as far as possible. This was done for 15 repetitions.

Shoulder shrugs

In standing position, participant shrugs the shoulders, bringing them up towards the ears. This was done for 15 repetitions.

Shoulder rolls

In standing position, participant rolls the shoulders forward in a circle. Then, rolls the shoulders backwards in a circle. Then participant relaxes and repeats the procedure for 15 times.

Scapular retraction

In standing position, participant brings the shoulder blades together in the back; participant then relaxes and repeats the procedure for 15 times (Provinciali et al, 1996; Koskimies et al, 1997; Flor et al, 1997).

Neck dynamic exercises

Thera-band was used for dynamic muscle training. Dynamic exercises training are aimed at increasing muscle strength (Ylinen et al, 2006). The progression of exercises was done using different colours of Thera-band indicating varied resistance as shown in the table below, as summarise in table 4 and appendix D

Table 2. Thera-band colour progression

Band Colour	Increase from Preceding Colour at 100% Elongation	Resistance in pound 100% Elongation
Thera-Band Red	25%	3.7
Thera-Band Green	25%	4.6
Thera-Band Blue	25%	5.8

Participants started with the Thera-band with the least resistance, coloured red, and progressed to those with increasingly greater resistance, green then blue. During the exercises, elongation was encouraged to be maintained at 100% depending on pain level and the ability of each participant to maintain elongation. The length of thera-band was three inches, so elongation of band is measure to ensure the band elongated to 6 inches.

Cervical extension-dynamic isometric (sitting)

The participant sits in an upright position and one end the loop of thera-band is attached to the participant's head and the other end to a sturdy stand. The participant bends forward, then holds for 30 seconds and slowly returns to the starting position, keeping the spine posture erect throughout the exercise. This is done for 15 repetitions in either direction (Salo et al, 2010; Ylinen et al 2006; Ylinen et al, 2003) Plate 1 and 2.

Cervical Flexion-Dynamic isometric (sitting)

The participant sits in an upright position and backs a sturdy stand. One end of a loop of thera-band is securely attached to the sturdy stand and the other to the participant's head. The participant bends forward, then holds for 30 seconds and slowly returns to the starting position, keeping the spine posture erect throughout the exercise. The number of repetitions is 15 in each direction (Salo et al, 2010; Ylinen et al 2006; Ylinen et al, 2003) Plate 4 and 5.

Chest flies exercises (standing position)

With the participant in standing position, the middle of the thera-band is fastened securely to a sturdy stand at shoulder level. The participant backs the sturdy stand, with one leg slightly in front of the other. The participant then grasps the bands at shoulder height with the elbows straight, and pulls bands inward with palms facing each other and then slowly returns. This was done 15 times in each direction (Delfino et al, 2012; Ylinen et al, 2006; Ekstrom et al, 2003). Plate 6 and 7

Frequency: Stabilization and dynamic exercise sessions were held three times a week on alternate days for eight weeks.

The researcher provided the treatment, which involved three sessions per week, each lasting approximately 45 minutes, for 8 weeks. Altogether, each participant had 24 treatment sessions.

Two research assistants were employed and were trained by the researcher on the treatment protocols. The research assistants were chief physiotherapists.

Table 3 Summary of neck stabilization exercises protocol

Exercises	**Description**	**Frequency**	**Progression**
Chin tuck	In standing position, participant pulls back the chin (as if trying to make a double chin) while keeping the eyes level. This was done for 15 repetitions.	15 repetition hold for 30 second, three times per week for eight weeks	Participant continues the exercises for eight weeks
Cervical extension	In standing position, participant grasps the base of the neck, with both hands while extending the neck as far as possible. This was done for 15 repetitions.	15 repetition hold for 30 second, three times per week for eight weeks	Participant continues the exercises for eight weeks
Shoulder shrugs	In standing position, participant shrugs the shoulders, bringing them up towards the ears. This was done for 15 repetitions.	15 repetition hold for 30 second, three times per week for eight weeks	Participant continues the exercises for eight weeks

Shoulder rolls	In standing position, participant rolls the shoulders forward in a circle. Then, rolls the shoulders backwards in a circle. Then participant relaxes and repeats the procedure for 15 times.	15 repetition hold for 30 second, three times per week for eight weeks	Participant continues the exercises for eight weeks
Scapular retraction	In standing position, participant brings the shoulder blades together in the back; participant then relaxes and repeats the procedure for 15 times	15 repetition hold for 30 second, three times per week for eight weeks	Participant continues the exercises for eight weeks

Table 4 Summary of Dynamic exercises protocol

Exercises	Description	Frequency	Progression
Thera-band Cervical extension-dynamic isometric (sitting)	The participant sits in an upright position and one end the loop of thera-band is attached to the participant's head and the other end to a sturdy stand. The participant bends forward, then holds for 30 second and slowly returns to the starting position, keeping the spine posture erect throughout the exercise. This is done for 15 repetitions in either direction	Three times per week for eight weeks.	The participant progress from thera-band red to thera-band green after initial four weeks and thera-band blue after six weeks. The number of repetition decreases as the weight of thera-band changes.
Thera-band cervical flexion-dynamic isometric (sitting)	The participant sits in an upright position and backs a sturdy stand. One end of a loop of thera-band is securely attached to the sturdy stand and the other to the participant's head. The participant bends forward, then holds for 30 second and slowly returns to the starting position,	Three times per week for eight weeks.	The participant progress from thera-band red to thera-band green after initial four weeks and thera-band blue after six weeks. The number of repetition decreases as the weight of thera-band changes.

	keeping the spine posture erect throughout the exercise. The number of repetitions is 15 in each direction.		
Thera-band chest flies exercises (standing position)	With the participant in standing position, the middle of the thera-band is fastened securely to a sturdy stand at shoulder level. The participant backs the sturdy stand, with one leg slightly in front of the other. The participant then grasps the bands at shoulder height with the elbows straight, and pulls bands inward with palms facing each other and then slowly returns. This was done 15 times in each direction.	Three times per week for eight weeks.	The participant progress from thera-band red to thera-band green after initial four weeks and thera-band blue after six weeks. The number of repetition decreases as the weight of thera-band changes.

Plate 1 shows cervical extension-dynamic exercises using thera-band, starting position.

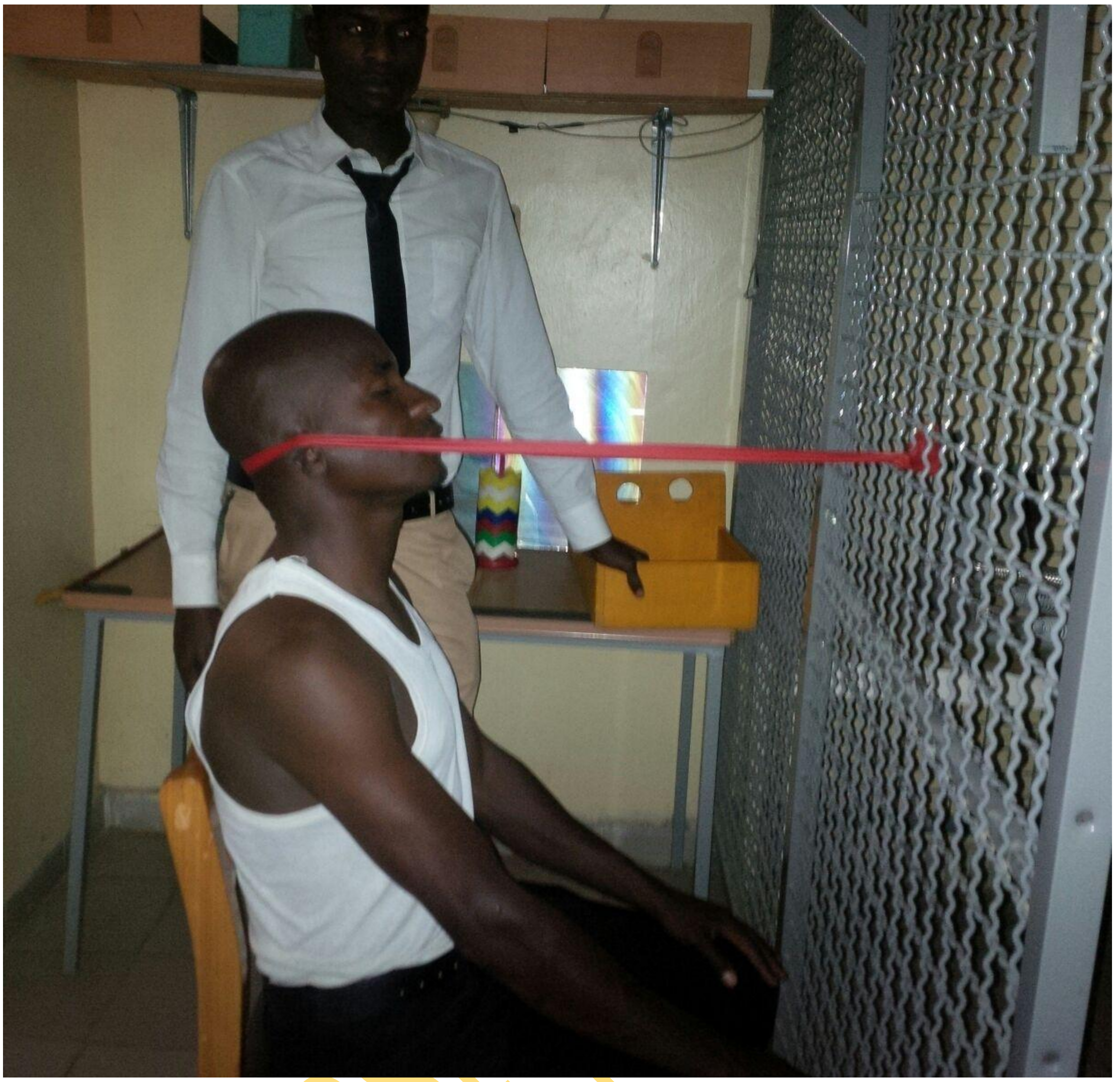


Plate 2 shows cervical extension-dynamic exercises using thera-band

Plate 3 shows cervical extension-dynamic exercises using thera-band

Plate 4 shows cervical flexion-dynamic exercises using thera-band, starting position

Plate 5 shows cervical flexion-dynamic exercises using thera-band

Plate 6 shows Chest flies exercises using thera-band

Plate 7 shows Chest flies exercises using thera-band

3.3 Data Analysis

1. Descriptive statistics of mean, standard deviation and percentages were used to summarize all data obtained from the participants.
2. One-way analysis of Variance (ANOVA) was used to compare age and pain intensity at baseline in the three groups – NSEG, NSDEG and NDEG.
3. Analysis of Variance (ANOVA) was used to compare the effects of NSEG, NSDEG and NDEG on the pain intensity of participants. Least significant difference (LSD) post-hoc multiple comparison was used to further test for any significant difference found in the ANOVA F-ratios.
4. Repeated measures ANOVA was used for within group comparison of the effects of the NSEG, NSDEG and NDEG on pain intensity. LSD post-hoc multiple comparisons analysis was used to test for any significant difference found in the F-ratios.
5. Kruskal Wallis test was used to compare the categorical variables such as neck disability index (NDI), fear avoidance beliefs questionnaire (FABQ), Beck depression inventory (BDI), and Beck anxiety inventory (BAI) scores at baseline in the different treatment groups.
6. Kruskal Wallis test was also used to compare the effects of the different treatment programmes on neck disability index, fear avoidance beliefs questionnaire, Beck depression inventory, and Beck anxiety inventory scores. Mann-Whitney U-test multiple comparisons was used for post-hoc test analysis.
7. Friedman's ANOVA was used for within-group comparison of the effects of the different treatment programmes on the NDI, FABQ, BDI and BAI scores. Wilcoxon signed ranked test was used as the post-hoc multiple comparisons to test for any significant difference found in the Friedman's F-ratios.

   Alpha level was set at 0.05.

The data analyses were carried out using the SPSS version 18.0 (SPSS Inc., Chicago, Illinois, USA).

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Results

4.1.1 Characteristics of participants

Eighty-eight participants were recruited for this study. They were randomly allocated to one of three groups: neck stabilization exercises group (NSEG; n=30), neck stabilization plus dynamic exercises group (NSDEG; n=29) and neck dynamic exercises group (NDEG; n=29). Seventy-six of the participants completed the eight week programme: NSEG, n =27; NSDEG, n =25; NSDEG, n = 24. This gave a 13.6% (12 participants) drop-out. Participants' ages ranged from 22 to 67 years, mean 46.8 ± 12.43 years. Seventy (74.5%) were married and 68 (77.3%) were from the Hausa/Fulani tribe. These can be observed in table 5.

4.1.2 Effects of neck stabilisation exercises, neck stabilisation plus dynamic exercises and dynamic exercises on clinical variables of participants

Pain

With the aid of repeated measures ANOVA, within-group comparison of participants' pain scores in different groups were made across the baseline, the 4th and 8th weeks of the study. For NSEG, there were reductions in mean pain scores from baseline 7.48 ± 1.62 to 4.77 ± 1.98 and 2.66 ± 1.27 at the 8th week ($p < 0.05$). For NSDEG, significant reductions in mean pain scores were also observed from baseline 6.92 ± 1.32 to 5.64 ± 1.68 and 4.48 ± 1.38, at the 8th week ($p < 0.05$). The same trend was observed for NDEG in which mean pain scores were significantly reduced from 7.04 ± 1.26 at the baseline to 5.79 ± 1.40 and 4.12 ± 0.89 at the 8th week ($p < 0.05$). The greatest reduction in the mean pain scores of participants was however observed in the NSE group, all these are as shown in table 6.

Functional disability

Within-group comparison of functional disability using the neck disability index scores of participants in the different groups was done with the aid of Friedman's ANOVA across the baseline, 4th and 8th week of the study. In the NSEG, there were reductions in disability scores and significant median reduction were observed from baseline, to the 4th and 8th week of the study ($p<0.05$). The same trend was observed in NSDEG from baseline to the 4th and 8th week of the study ($p< 0.05$). In the NDEG however, significant reductions in disability median scores were only observed from baseline to the end of the 8th week of the study (p<0.05), as shown in table 7.

4.1.3 Effects of neck stabilisation exercises, neck stabilisation plus dynamic exercises and dynamic exercises on psychosocial variables of participants

Fear avoidance beliefs

Within-group comparison of the fear avoidance beliefs scores of participants in the different groups was made with the aid of Friedman's ANOVA, across the baseline, 4th and 8th week of the study. The effect of NSE, NSDE and NDE on the domains of fear avoidance variables of participants according to different domains of FABQ – fear avoidance beliefs physical activity (FAB-pa), fear avoidance beliefs work (FAB-w), and fear avoidance beliefs total (FAB-t) – are presented in table 8.

The NSEG had a significant reduction in FAB-pa median scores from baseline, 4th and 8th week of the study (p< 0.05). There were only significant reductions in FAB-pa median scores from baseline and 8th week of the study in NSDEG (p<0.05). However there were significant reductions in median scores from baseline, 4th and 8th week of the study of FAB-pa for NDEG (p <0.05) as presented in table 8.

Depression

Within-group comparisons of the depression scores of participants in the three study groups were made with the aid of Friedman's ANOVA, across the baseline, 4th and 8th week of the study. Significant reductions in median depression scores were observed in the NSEG from baseline and 8th week of the study (p<0.05), but there were no significant changes in depression scores from the 4th to the 8th week of the study. Significant reductions in median depression scores were however observed from baseline, 4th and 8th week of the study in the NSDEG (p<0.05). The same trend was observed in the NDEG (p <0.05), as shown in table 9.

Anxiety

Within-group comparisons of anxiety scores of participants in the three groups were made with the aid of Friedman's ANOVA from baseline, through to the 8th week of the study. Significant reductions in anxiety scores were observed between the baseline, 4th and 8th week of the study in the NSEG (p<0.05). Significant reductions were only observed in anxiety scores from baseline to the 8th week of the study in the

NSDEG ($p<0.05$). There were, however, significant reductions in anxiety scores from baseline, 4th and 8th week of the study in the NDEG ($p< 0.05$) as shown in table 10.

Table 5. Participants Socio-demographic Characteristics

Variable	n	%
Gender		
Male	42	47.7
Female	46	52.3
Marital status		
Single	18	20.5
Married	70	79.5
Tribe		
Hausa/Fulani	68	77.3
Yoruba	10	11.4
Igbo	5	5.7
Others	5	5.7
Educational qualification		
Nil	6	6.8
Primary/ Secondary	55	62.5
Tertiary	27	30.7
Employment		
Unemployed	19	21.6
Self-employed	47	53.5
Government employed	22	25.0
Income per month		
Low/Middle	41	46.6
Moderate/High	47	53.4
Pain duration in weeks		
6-8	19	21.6
9-12	64	72.7
13 and above	5	5.7

Key

n= frequency of variables

%= percentage

Table 6. Repeated Measures ANOVA and LSD Post-hoc multiple comparisons of mean pain intensity scores among participants across the 3 time points of the study

Group	Baseline $\bar{X} \pm SD$	4 Weeks $\bar{X} \pm SD$	8 Weeks $\bar{X} \pm SD$	F-ratio	P value
NSEG	$7.48 \pm 1.62^{*}$ (n=30)	$4.77 \pm 1.98^{\#}$ (n=27)	$2.66 \pm 1.27^{\$}$ (n=27)	102.069	0.01
NSDEG	$6.92 \pm 1.32^{*}$ (n=29)	$5.64 \pm 1.68^{\#}$ (n=25)	$4.48 \pm 1.38^{\$}$ (n=25)	56.711	0.01
NDEG	$7.04 \pm 1.26^{*}$ (n=29)	$5.79 \pm 1.4^{\#}$ (n=25)	$4.12 \pm 0.89^{\$}$ (n=24)	65.867	0.01

Alpha level was set at 0.05

Post hoc. Superscripts (*, #, $) for a particular variable: Mean values with different superscripts are significantly different; Mean values with the same superscripts are not significantly different.

Key:

VAS = Visual Analogue Scale
NSEG = Neck stabilization exercises group
NSDEG = Neck stabilization plus dynamic exercises group
NDEG = Neck dynamic exercises group
n = Number of participants in the group

Table 7. Friedman's ANOVA and Wilcoxon signed ranked test comparison of median neck disability scores among participants across the 3 time points of the study.

Group	Baseline Median(IQR)	4 Weeks Median(IQR)	8 Weeks Median(IQR)	X^2	p value
NSEG	21.0(4.5)* (n=30)	18.0(7.0)# (n=27)	14.0(6.7)$ (n=27)	19.82	0.01
NSDEG	20.0(6.5)* (n=29)	16.0(7.5)# (n=25)	14.0(6.5)$ (n=25)	17.61	0.01
NDEG	23.5(8.5)* (n=29)	15.0(2.0)# (n=25)	12.0(2.0)# (n=24)	50.64	0.01

Alpha level was set at 0.05

Post hoc. Superscripts (*, #, $) for a particular variable: Median values with different superscripts are significantly different; Median values with the same superscripts are not significantly different.

Key:

NSEG = Neck stabilization exercises group

NSDEG = Neck stabilization plus dynamic exercises group

NDEG = Neck dynamic exercises group

n = Number of participants in the group

IQR = Inter-Quartile Range

Table 8. Friedman's ANOVA and Wilcoxon signed ranked test comparison of median domain and total scores on fear avoidance beliefs (FAB) among participants across the 3 time points of the study

Group	Baseline Median(IQR)	4 Weeks Median(IQR)	8 Weeks Median(IQR)	X^2	P value
NSEG					
Physical activity	16.0(3.5)*	12.0(5.0)#	10.0(8.0)$	14.47	0.01
Work	24.0(10.0)*	13.0(6.0)#	14.0(9.0)#	24.92	0.01
Total	41.0(7.5)* (n=30)	28.0(10.0)# (n=27)	22.0(9.0)# (n=27)	30.68	0.01
NSDEG					
Physical activity	15.0(3.5)*	13.0(7.5)#	12.0(6.0)#	12.23	0.01
Work	24.0(10.0)*	21.0(9.0)#	19.5(10.5)#	26.33	0.01
Total	40.0(9.5)* (n=29)	34.0(10.0)# (n=25)	30.0(14.5)$ (n=25)	24.00	0.01
NDEG					
Physical activity	15.0(4.0)*	14.0(5.0)#	12.0(8.0)$	50.64	0.01
Work	23.0(8.0)*	21.0(6.5)#	19.5(5.8)$	46.32	0.01
Total	40.0(11.3)* (n=29)	35.0(7.0)# (n=25)	30.5(7.8)$ (n=24)	49.58	0.01

Alpha level was set at 0.05

Post hoc. Superscripts (*, #, $) for a particular variable: Median values with different superscripts are significantly different; Median values with the same superscripts are not significantly different.

Key

NSEG	=	Neck stabilization exercises group
NSDEG	=	Neck stabilization plus dynamic exercises group
NDEG	=	Neck dynamic exercises group
n	=	Number of participants in the group
IQR	=	Inter-Quartile Range

Table 9. Friedman's ANOVA and Wilcoxon signed ranked test comparison of median depression scores among participants across the 3 time points of the study

Group	Baseline	4 Weeks	8 Weeks	X^2	p value
	Median(IQR)	Median(IQR)	Median(IQR)		
NSEG	17.0(8.5)* (n=30)	12.0(6.0)$^\#$ (n=27)	11.5(5.0)$^\#$ (n=27)	16.87	0.01
NSDEG	14.0(7.0)* (n=29)	12.0(6.0)$^\#$ (n=25)	12.0(5.0)$^\$$ (n=25)	17.68	0.01
NDEG	16.5(7.3)* (n=29)	12.0(6.0)$^\#$ (n=25)	12.5(2.8)$^\$$ (n=24)	45.67	0.01

Alpha level was set at 0.05

Post hoc. Superscripts (*, #, $) for a particular variable: Median values with different superscripts are significantly different; Median values with the same superscripts are not significantly different.

Key:

NSEG = Neck stabilization exercises group

NSDEG = Neck stabilization plus dynamic exercises group

NDEG = Neck dynamic exercises group

n = Number of participants in the group

IQR = Inter-Quartile Range

Table 10. Friedman's ANOVA and Wilcoxon signed ranked test comparison of median anxiety scores among participants across the 3 time points of the study

Group	Baseline Median(IQR)	4 Weeks Median(IQR)	8 Weeks Median(IQR)	X^2	P value
NSEG	$19.0(13.5)^{*}$ (n=30)	$13.0(8.0)^{\#}$ (n=27)	$12.0(9.7)^{\$}$ (n=27)	19.48	0.01
NSDEG	$19.0(15.5)^{*}$ (n=29)	$13.0(10.0)^{\#}$ (n=25)	$12.0(7.5)^{\#}$ (n=25)	23.28	0.01
NDEG	$23.0(13.3)^{*}$ (n=29)	$18.0(7.0)^{\#}$ (n=25)	$14.0(7.0)^{\$}$ (n=24)	36.24	0.01

Alpha level was set at 0.05
Post hoc. Superscripts (*, #, $) for a particular variable: Median values with different superscripts are significantly different; Median values with the same superscripts are not significantly different.

Key:

NSEG = Neck stabilization exercises group
NSDEG = Neck stabilization plus dynamic exercises group
NDEG = Neck dynamic exercises group
n = Number of participants in the group
IQR = Inter-Quartile Range

4.1.4 Between-groups comparison of effects of neck stabilisation exercises, neck stabilisation plus dynamic exercises and dynamic exercises on clinical variables of participants

Pain

Table 11 shows the comparison of pain intensity of participants in the NSEG, NSDEG, and NDEG at the baseline and at the end of the 4th and 8th week of the study. With the aid of the One-way ANOVA, the study revealed that there were no significant differences in the pain intensity scores at the baseline among the three groups p = 0.714. While at week 4 of the study, there were significant differences in reduction of pain intensity scores among the three groups (p = 0.01), There were significant differences in the reduction of mean pain intensity scores among the NSEG, NSDEG and NDEG (p = 0.01) at the end of eight week of study respectively. Fisher's Least significant difference (LSD) post hoc was used to revealed were significant differences in reduction of mean pain intensity scores between the three groups lie at week 4 and 8 of the study.

Functional disability

With the aid of the Kruskal-Wallis test, comparisons of the neck disability index scores of the NSEG, NSDEG, and NDEG of participants were made at the baseline, and the end of 4th and 8th week of the study. There were no significant differences in the neck disability index scores at the baseline among the three groups, p = 0.71. Similarly, at week 4 of the study, there were no significant differences in the disability scores among the three groups, p = 0.56.

At the end of week 8 of the study, significant reductions were observed in disability scores among the three groups ($p<0.05$). Multiple comparisons showed that there were no significant differences in reduction of functional disability scores between the NSDEG and NDEG at the end of week 8 of the study as shown in table 12.

Table 11. One way ANOVA and LSD post hoc multiple comparison of participants mean pain intensity scores using the Visual Analogue Scale by treatment group at baseline, 4th and 8th week of the study

Group	Baseline Mean+SD	4 week Mean +SD	8 week Mean + SD
NSEG	7.48±1.62 (n=30)	4.77±1.27* (n=27)	2.66±1.27* (n= 27)
NSDEG	6.92±1.32 (n=29)	5.64±1.68# (n=25)	4.48±1.38# (n=25)
NDEG	7.04±1.62 (n= 29)	5.76±1.41# (n=25)	4.12±0.89# (n=24)
F	0.135	9.79	10.83
P value	0.71	0.01	0.01

Alpha level was set at 0.05

Post hoc. Superscripts (*, #, $) for a particular variable: Mean values with different superscripts are significantly different; Mean values with the same superscripts are not significantly different.

Key: NSEG = Neck stabilization exercises group

NSDEG = Neck stabilization plus dynamic exercises group

NDEG = Neck dynamic exercises group

n = number of participants in the group

SD = standard deviation

Table 12. Kruskal-Wallis test comparison of median neck disability scores of participant treatment outcomes, by treatment group at 0, 4 and 8 week of the study

Group	Baseline Median(IQR)	4 weeks Median(IQR)	8 weeks Median (IQR)
NSEG	21.0(4.5) (n=30)	18.0(7.0) (n=27)	$12.0(2.0)^{*}$ (n=27)
NSDG	20.0(6.5) (n=29)	16.0(7.5) (n=25)	$14.0(6.5)^{\#}$ (25)
NDEG	22.0(7.5) (n=29)	15.0(7.5) (n=25)	$14.0(6.7)^{\#}$ (24)
H	9.70	6.71	16.20
p value	0.71	0.56	0.01

Alpha level was set at 0.05

Post hoc. Superscripts (*, #, $) for a particular variable: Median values with different superscripts are significantly different; Median values with the same superscripts are not significantly different.

Key:

NSEG	=	Neck stabilization exercises group
NSDEG	=	Neck stabilization plus dynamic exercises group
NDEG	=	Neck dynamic exercises group
n	=	Number of participants in the group
H	=	Kruskal-Wallis value
IQR	=	Inter-Quartile Range

4.1.5 Between-groups comparison of effects of neck stabilisation exercises, neck stabilisation plus dynamic exercises and dynamic exercises on psychosocial variables of participants

Fear avoidance beliefs

Fear avoidance beliefs (Physical activity domain)

Table 13 shows the comparison of the FAB-PA of the NSEG, NSDEG, and NDEG of participants at baseline, end of the 4th and 8th week of the study. With the aid of the Kruskal-Wallis test, the study revealed that there were no significant differences in the fear avoidance beliefs physical activity (FAB-pa) scores at the baseline between the three groups, p = 0.14. However, at the end of the 4th and 8th week, there were significant differences in the reduction of the FAB-pa scores among the three groups, p = 0.04 and p = 0. 01respectively. multiple comparisons also revealed that there were no significant differences in reduction of FAB-pa scores between the NSDEG and NDEG at the 4th and 8^{th} week of the study.

Fear avoidance beliefs (Work domain)

Comparisons of the FAB-w of the NSEG, NSDEG, and NDEG of participants were made with the aid of the Kruskal-Wallis test, at baseline, and at the end of the 4th and 8th week of the study. The study revealed that there were no significant differences the fear avoidance beliefs work (FAB-w) scores at the baseline among the three groups, p = 0.85. However at week 4 of the study there were significant differences in the reduction of the FAB-W scores among the three groups, p = 0.01. Similarly, at the end of week 8 of the study, there were significant differences in the reduction of FAB-w scores among the three groups, p = 0.01. Multiple comparisons revealed that there were no significant differences in the reduction of FAB-w scores between the NSDEG and NDEG at weeks 4 and 8 of the study, as presented in table 14.

Fear avoidance beliefs Total

With the aid of the Kruskal-Wallis test, the study revealed that there were no significant differences in the fear avoidance beliefs total (FAB-t) scores at the baseline among the three groups, p = 0.25. However, at the end of the 4th week of the study, there were significant differences in the reduction of FAB-t among the three groups, p = 0.01. Also at the end of the 8th week, there were significant differences in the FAB-t scores among the three groups, p = 0. 01. Multiple comparisons revealed that there were no significant differences in reduction of FAB-t between the NSDEG and NDEG at the end of weeks 4 and 8 of the study, but the NSEG reported high reduction in FAB-t scores, as showed in table 15.

Depression

With the aid of the Kruskal-Wallis test, comparisons of the depression scores of the NSEG, NSDEG, and NDEG of participants were made at the baseline, and at the end of the 4th and 8th week of the study. At the baseline, there were no significant differences in depression scores among the three groups, p = 0.96.

Also at week 4 of the study, there were no significant differences in reduction of depression scores among the three groups, p = 0.63, but there were reductions in depression scores of participants. Meanwhile at the end of week 8 of the study there were significant differences in reduction of depression scores between the three groups p = 0. 05. Multiple comparisons revealed that there were no significant differences between the NSDEG and NDEG at week 8 of the study but the NSEG recorded high reduction in depression, as shown in table 16.

Anxiety

With the aid of the Kruskal-Wallis test, the anxiety scores of the NSEG, NSDEG, and NDEG of participants were compared at baseline, and at the end of the 4th and 8th week of the study. The study revealed that there were no significant differences in the anxiety scores of the three groups at the baseline, p = 0.19.

While at week 4 of the study, there were significant differences in anxiety scores among the three groups, p = 0.01, at the end of week 8, there were no significant differences in anxiety scores between the three groups, p = 0. 53. Multiple comparisons however show that there were no significant differences between the anxiety scores of the NSDEG and NDEG at week 4 of the study as shown in table 17.

Table 13. Kruskal-Wallis test for comparison of participant's median treatment outcomes for fear avoidance beliefs (physical activity) scores by treatment group at 0, 4 and 8 weeks of the study

Group	0 week Median (IQR)	4 week Median (IQR)	8 week Median (IQR)
NSEG	17.0(3.5) (n=30)	12.0(8.0)* (n=27)	10.0(8.0)* (n=27)
NSDEG	15.0(3.5) (n=29)	13.0(7.5)# (n=25)	12.0(6.0)# (25)
NDEG	15.0(4.0) (n=29)	14.0(5.0)# (n=25)	12.0(5.5)# (24)
H	3.99	3.99	10.70
p value	0.14	0.04	0.01

Alpha level was set at 0.05

Post hoc. Superscripts (*, #, $) for a particular variable: Median values with different superscripts are significantly different; Median values with the same superscripts are not significantly different.

Key: NSEG = Neck stabilization exercises group
NSDEG = Neck stabilization plus dynamic exercises group
NDEG = Neck dynamic exercises group
n = Number of participants in the group
H = Kruskal-Wallis value
IQR = Inter-Quartile range

Table 14. Kruskal-Wallis test comparison of participant's median treatment outcomes for fear avoidance beliefs work scores by treatment group at 0, 4 and 8 weeks of the study

Group	0 week Median (IQR)	4 week Median (IQR)	8 week Median (IQR)
NSEG	24.0(10.) (n=30)	18.0(6.0)* (n=27)	14.0(9.0)* (n=27)
NSDG	24.0(10.) (n=29)	21.0(9.0)# (n=25)	19.5(10.5)# (25)
NDEG	23.0(8.0) (n=29)	21.0(6.5)# (n=25)	19.5(5.8)# (24)
H	0.32	11.31	10.79
P value	0.85	0.01	0.01

Alpha level was set at 0.05

Post hoc. Superscripts (*, #, $) for a particular variable, median values with different superscripts are significantly different. Median values with the same superscripts are not significantly different.

Key: NSEG = Neck stabilization exercises group

NSDEG = Neck stabilization plus dynamic exercises group

NDEG = Neck dynamic exercises group

n = Number of participants in the group

H = Kruskal-Wallis value

IQR = Inter-Quartile Range

Table 15. Kruskal-Wallis test comparison of median fear avoidance beliefs total scores of participants treatment outcomes by treatment group at the 0, 4th and 8th week of the study.

Group	0 week Median (IQR)	4 week Median (IQR)	8 week Median (IQR)
NSEG	41.0(7.5) (n=30)	28.0(10.0)* (n=27)	22.0(9.0)* (n=27)
NSDEG	40.0(9.5) (n=29)	34.0(10.0)# (n=25)	30.0(14.5)# (25)
NDEG	40.0(11.25) (n=29)	35.0(7.0)# (n=25)	30.5(7.8)# (24)
H	2.78	15.43	17.66
p value	0.25	0.01	0.01

Alpha level was set at 0.05

Post hoc. Superscripts (*, #, $) for a particular variable: Median values with different superscripts are significantly different; Median values with the same superscripts are not significantly different.

Key:
NSEG = Neck stabilization exercises group
NSDEG = Neck stabilization plus dynamic exercises group
NDEG = Neck dynamic exercises group
n = Number of participants in the group
H = Kruskal-Wallis value
IQR = Inter-Quartile Range

Table 16. Kruskal-Wallis test comparison of median depression scores of participant's treatment outcomes by treatment group at 0, 4 and 8 weeks of the study.

Group	0 week Median (IQR)	4 week Median (IQR)	8 week Median (IQR)
NSEG	17.0(8.5) (n=30)	12.0(6.0) (n=27)	11.5(4.0)* (n=27)
NSDEG	14.0(7.0) (n=29)	12.0(6.0) (n=25)	12.0(5.0)# (25)
NDEG	16.5(7.3) (n=29)	12.0(6.0) (n=25)	12.0(2.8)# (24)
H	6.34	0.09	6.07
p value	0.96	0.63	0.05

Alpha level was set at 0.05

Post hoc Superscripts (*, #, $) for a particular variable: Median values with different superscripts are significantly different; Median values with the same superscripts are not significantly different.

Key:

NSEG	=	Neck stabilization exercises group
NSDEG	=	Neck stabilization plus dynamic exercises group
NDEG	=	Neck dynamic exercises group
n	=	number of participants in the group
H	=	Kruskal-Wallis value
IQR	=	Inter-Quartile Range

Table 17. Kruskal-Wallis test comparison of median anxiety scores of participants' treatment outcomes by treatment group at 0, 4 and 8 week of the study.

Group	0 week Median (IQR)	4 week Median (IQR)	8 week Median (IQR)
NSEG	19.0(13.5) (n=30)	13.0(8.0)* (n=27)	13.0(9.8) (n=27)
NSDEG	19.0(15.5) (n=29)	13.0(10.0)# (n=25)	12.0(7.8) (25)
NDEG	23(13.3) (n=29)	18.0(7.0)# (n=25)	14.0(7.0) (24)
H	3.34	9.39	1.28
P value	0.19	0.01	0.53

Alpha level was set at 0.05

Post hoc. Superscripts (*, #, $) for a particular variable, median values with different superscripts are significantly different. Median values with the same superscripts are not significantly different.

Key: NSEG = Neck stabilization exercises group
NSDEG = Neck stabilization plus dynamic exercises group
NDEG = Neck dynamic exercises group
N = Number of participants in the group
H = Kruskal-Wallis value
IQR = Inter-Quartile Range

4.2 HYPOTHESES TESTING

Hypothesis 1: There would be no significant difference in the pain intensity scores of participants in the neck stabilization exercises group across weeks 0, 4, and 8 of the study.

Alpha level: 0.05

Test statistics: Repeated measure ANOVA

Observed F-ratio for pain intensity = 203.23 ($p < 0.05$)

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 2: There would be no significant difference in the neck disability index scores of participants in the neck stabilization exercises group across weeks 0, 4 and 8 of the study.

Alpha level: 0.05

Test statistics: Friedman's ANOVA

Observed F-ratio = 19.82 ($p < 0.05$)

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 3: There would be no significant difference in the fear avoidance beliefs scores of participants in the neck stabilization exercises group across weeks 0, 4 and 8 of the study.

Alpha level: 0.05

Test statistics: Friedman's ANOVA

Observed F-ratio for fear avoidance beliefs Physical activity = 14.47 ($p < 0.05$)

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Observed F-ratio for fear avoidance belief Work = 24.92 ($p < 0.05$)

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Observed F-ratio for fear avoidance belief Total = 30.68 ($p < 0.05$)

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 4: There would be no significant difference in the Beck depression inventory scores of participants in the neck stabilization exercises group across weeks 0, 4 and 8 of the study.

Alpha level: 0.05

Test statistics: Friedman's ANOVA

Observed F-ratio = 16.87 $(p < 0.05)$

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 5: There would be no significant difference in the Beck anxiety inventory scores of participants in the neck stabilization exercises group across weeks 0, 4 and 8 of the study.

Alpha level: 0.05

Test statistics: Friedman's ANOVA

Observed F-ratio = 19.48 $(p < 0.05)$

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 6: There would be no significant difference in the pain intensity scores of subjects in the neck stabilization plus dynamic exercises group across weeks 0, 4, and 8 of the study.

Alpha level: 0.05

Test statistics: Repeated measure ANOVA

Observed F-ratio for pain intensity = 93.61 $(p < 0.05)$

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 7: There would be no significant difference in the neck disability index scores of participants in the neck stabilization plus dynamic exercises group across weeks 0, 4 and 8 of the study.

Alpha level: 0.05

Test statistics: Friedman's ANOVA

Observed F-ratio = 17.61 $(p < 0.05)$

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 8: There would be no significant difference in the fear avoidance beliefs scores of participants in the neck stabilization plus dynamic exercises group across weeks 0, 4 and 8 of the study.

Alpha level: 0.05

Test statistics: Friedman's ANOVA

Observed F-ratio for fear avoidance belief Physical activity = 12.23 $p = 0.01$

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Observed F-ratio for fear avoidance belief Work = 26. $(p < 0.05)$

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Observed F-ratio for fear avoidance belief Total = 24.00 $(p < 0.05)$

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 9: There would be no significant difference in the Beck depression inventory scores of participants in the neck stabilization plus dynamic exercises group across weeks 0, 4 and 8 of the study.

Alpha level: 0.05

Test statistics: Friedman's ANOVA

Observed F-ratio = 17.68 $(p< 0.05)$

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 10: There would be no significant difference in the Beck anxiety inventory scores of participants in the neck stabilization plus dynamic exercises group across weeks 0, 4 and 8 of the study.

Alpha level: 0.05

Test statistics: Friedman's ANOVA

Observed F-ratio = 23.28 (p <0.05)

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 11: There would be no significant difference in the pain intensity scores of subjects in the neck dynamic exercises group across week 0, 4, and 8 of the study.

Alpha level: 0.05

Test statistics: Repeated measure ANOVA

Observed F-ratio for present pain intensity = 107.12 (p <0.05)

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 12: There would be no significant difference in the neck disability index scores of participants in the neck dynamic exercises group across weeks 0, 4 and 8 of the study.

Alpha level: 0.05

Test statistics: Friedman's ANOVA

Observed F-ratio = 50.64 (p < 0.05)

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 13: There would be no significant difference in the fear avoidance beliefs scores of participants in the neck dynamic exercises group across weeks 0, 4 and 8 of the study.

Alpha level: 0.05

Test statistics: Friedman's ANOVA

Observed F-ratio for fear avoidance beliefs Physical activity = 50.64 p = 0.01

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Observed F-ratio for fear avoidance beliefs Work = 46.32 p = 0.01

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Observed F-ratio for fear avoidance belief Total = 49.58 ($p < 0.05$)

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 14: There would be no significant difference in the Beck depression inventory scores of participants in the neck dynamic exercises group across weeks 0, 4 and 8 of the study.

Alpha level: 0.05

Test statistics: Friedman's ANOVA

Observed F-ratio = 45.67 ($p <0.05$)

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 15: The hypothesis stated there would be no significant difference in the Beck anxiety inventory scores of participants in the neck dynamic exercises group across weeks 0, 4 and 8 of the study.

Alpha level: 0.05

Test statistics: Friedman's ANOVA

Observed F-ratio = 36.24 ($p < 0.05$)

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 16: There would be no significant difference in the effect of the three treatment regimens on pain intensity scores at week 4 of the study.

Alpha level: 0.05

Test statistics: One-way ANOVA

Observed F-ratio for present pain intensity scores = 9.79 ($p< 0.05$)

Since the observed p-value was less than 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 17: There would be no significant difference in the effect of the three treatment regimens on neck disability index scores at week 4 of the study.

Alpha level: 0.05

Test statistics: Kruskal-Wallis test

Observed H-ratio = 6.71 p = 0.56

Since the observed p-value was greater than the 0.05 Alpha level, the null hypothesis was therefore **ACCEPTED**.

Hypothesis 18: There would be no significant difference in the effect of the three treatment regimens on fear avoidance beliefs scores at week 4 of the study.

Alpha level: 0.05

Test statistics: Kruskal-Wallis test

Observed H-value for FAB (physical) = 3.99 p = 0.04

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Observed H-value for FAB (work) = 11.31 p = 0.01

Since the observed p-value was less than the 0.05 Alpha level I fail to accept the null hypothesis.

Observed F-ratio for fear avoidance Total = 15.43 p = 0.01

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 19: There would be no significant difference in the effect of the three treatment regimens on Beck depression inventory scores at week 4 of the study.

Alpha level: 0.05

Test statistics: One-way ANOVA

Observed F-ratio for muscle fatigue to static test = 0.09 p = 0.63

Since the observed p-value was greater than 0.05 Alpha level, the null hypothesis was therefore **ACCEPTED**.

Hypothesis 20: There would be no significant difference in the effect of the three treatment regimens on Beck anxiety inventory scores at week 4 of the study.

Alpha level: 0.05

Test statistics: Kruskal-Wallis test

Observed H-ratio = 9.395 $p = 0.01$

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 21: There would be no significant difference in the effect of the three treatment regimens on pain intensity scores at week 8 of the study.

Alpha level: 0.05

Test statistics: One-way ANOVA

Observed F-ratio for pain intensity scores = 10.83 ($p < 0.05$)

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 22: There would be no significant difference in the effect of the three treatment regimens on neck disability index scores at week 8 of the study.

Alpha level: 0.05

Test statistics: Kruskal-Wallis test

Observed H-ratio = 16.20 ($p < 0.05$)

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 23: There would be no significant difference in the effect of the three treatment regimens on fear avoidance belief scores at week 8 of the study.

Alpha level: 0.05

Test statistics: Kruskal-Wallis test

Observed H-value for FAB (physical) = 10.70 $p = 0.01$

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Observed H-value for FAB (work) = 10.79 $p = 0.01$

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Observed H value for FAB (Total) = 17.66 ($p < 0.05$)

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 24: There would be no significant difference in the effect of the three treatment regimens on Beck depression inventory scores at week 8 of the study.

Alpha level: 0.05

Test statistics: Kruskal-Wallis test

Observed H-ratio = 6.07 $p = 0.05$

Since the observed p-value was less than the 0.05 Alpha level, I fail to accept the null hypothesis.

Hypothesis 25: There would be no significant difference in the effect of the three treatment regimens on Beck anxiety inventory scores at week 8 of the study.

Alpha level: 0.05

Test statistics: Kruskal-Wallis test

Observed H-ratio = 1.28 $p = 0.53$

Since the observed p-value was greater than the 0.05 Alpha level, the null hypothesis was therefore **ACCEPTED**.

4.3 Discussion

4.3.1 Participants' characteristics

This study compared the effects of stabilization and dynamic exercises on selected clinical and psychosocial variables in patients with non-specific neck pain. The age of the participants ranged from 22 to 67 years, an age range consistent with those of patients affected by neck pain in most epidemiological studies (Taimela et al, 2000; Adedoyin et al, 2004; Ayanniyi et al, 2007).

4.3.2 Comparison of baseline parameters of participants in the three groups

The results obtained in this study show that there were no significant differences in the physical characteristics of participants at the baseline, including age, pain intensity, disability, fear avoidance beliefs, depression and anxiety. This implies that the three groups were comparable at the point of commencement of the programme. It can therefore be concluded that the results obtained at different time points in the course of this study could have been largely due to the effect of the various treatment interventions.

4.3.3 Effect of neck stabilisation exercises on clinical variables in patients with non-specific neck pain

Stabilisation exercises significantly reduced pain intensity and enhanced functional ability in patients with non-specific neck pain. This finding is consistent with the results of previous studies on the effect of neck stabilisation exercises on non-specific neck pain (Jull et al 2002; Griffiths et al, 2009; Dusunceli et al, 2009; Nichol, 2012).

The mechanism through which stabilization exercises reduce non-specific neck pain may be based on the belief that intense exercise increases activity in the motor pathways, thereby exerting an inhibitory effect on pain centres in the central nervous system. Furthermore, muscle contraction and strain on different connective tissues will stimulate the mechanoreceptors and increase sensory nerve activity, which in turn may inhibit the pathways mediating pain (Hides et al, 2001).

Since specific neck muscle dysfunction appears to be associated with pain and disability, exercises that will improve spinal stabilisation of the neck are used in the conservative management of neck pain to relieve pain. However, till date, evidence for the effectiveness of this approach is limited (Dusunceli et al, 2009); only a few trials have shown evidence of its effectiveness. The problem with the previous trials is that they combined stabilisation exercises with other modalities. This study has provided proof for the theory that stabilisation exercises will be more effective than other exercise regimes in providing relief for patients with non-specific neck pain (Dusunceli et al, 2009). The results show the advantage of stabilisation exercises alone over a combination of stabilization and dynamic exercises, particularly as regards pain and improvement in functional disability scores over others groups. Stabilisation exercises showed improvements in pain intensity scores and reduction in functional disability scores even at week 4 of the study and especially at the week 8.

Previous studies that were compared with this study combined neck stabilisation exercises with some physiotherapy treatments. The present study has provided more evidence to prove the effectiveness of stabilisation exercises without combining it with any exercises.

4.3.4 Effect of neck stabilisation plus dynamic exercises on clinical variables

Stabilisation plus dynamic exercises significantly reduced pain intensity and disability in patients with non-specific neck pain. This finding is consistent with previous studies that demonstrated evidence for the use of a combination of strengthening exercises and stabilisation exercises (George et al, 2000; Ahlgren et al, 2001).

According to Ylinen (2003), the mechanism by which the stabilization and dynamic exercises achieves its therapeutic effect on patients with non-specific neck pain is that the cervical muscles that tend to be weakened with neck pain are strengthened by strength or endurance exercises. The deep neck flexors and extensors scapular stabilizers and upper thoracic extensors are some of the muscles that are affected. Strengthening exercises for the shoulders and upper extremities reduce pain arising from the trapezius muscles and improved function as demonstrated by Ahlgren et al. (2001) in a study evaluating the effects of 10 weeks of dynamic strength, endurance, and coordination exercises on pain and physical performance. The effects, however, had disappeared by the follow-up at 8 months (Ahlgren et al, 2001).

Levoska and Keinänen-Kiukaanniemi (1993) showed that the occurrence of neck and shoulder pain was greatly diminished after 5 weeks of dynamic exercises for the shoulders and upper extremities, but the symptoms returned within 3 months. Taimela et al. (2000), in a randomized controlled study, compared training consisting of stabilisation, postural and dynamic neck muscle exercises to a home regimen consisting of stretching and strengthening exercises in subjects with chronic non-specific neck pain. Pain was reduced by about 50% in both training groups and was significantly lower compared with the control group after the intervention period of 3 months. However, no significant difference was found in neck pain between the groups at 12-month follow-up. In the present study, training was continued regularly for 8 weeks, which also explains the success recorded when compared with previous randomized studies. However, the long term effect could not be compared.

Thera-band was used in the present study to add resistance in the dynamic exercise in sitting and standing positions in order to strengthen the weaker muscles, therefore bringing about stability of the muscles and spine. This procedure reduced pain and improved the functional ability of the patients. Also, a timing delay of the neck stabilizers occurs during arm motion, most noticeably the deep neck flexors compromising spinal control during upper extremity function (Falla et al, 2004). Studies have shown a tendency toward over-activity in the upper trapezius muscle and anterior superficial neck muscles during repetitive arm activities and head lift with prolonged relaxation times post activity (Mederhand et al, 2000; Falla et al, 2004 and Zito et al, 2006).

During any upper extremity exercises, pre-set deep neck flexors recruitment would help retrain the timing impairment. Progression onto higher load exercises will help regain strength of the full synergy, but it must be ensured that there is contribution from the deeper muscle groups. These strength training and stabilisation exercises, when achieved within a specific period, that is 4 or 8 weeks, would help in reducing pain and disability in patients with non-specific neck pain.

4.3.5 Effect of neck dynamic exercises on clinical variables

Dynamic exercises in this study significantly reduced pain and functional disability in patients with non-specific neck pain. The effect of dynamic exercises was comparable with the previous studies that used dynamic exercises in the management of non-specific neck pain (Berg et al, 1994; Ylinen et al, 2006).

This intervention probably works because exercise has both physical and mental benefits through its effects on numerous systems, such as the cardiovascular system, immune system, brain function, sleep, mood, and the musculoskeletal system. Exercise also increases flexibility and mobility of structures, improves muscle strength and endurance, increases the tensile strength of ligaments and capsule, amplifies strength and prevents injury of tendons and cartilage, and is also important for repair of these tissues, thereby relieves pain (Zimmerman et al, 2000).

Strength exercises with thera-band as a load for resistance to strengthen muscles that may have been weakened as a result of inactivity due to pain, are equally as effective in reducing pain and disability. Strength exercises using added resistance like thera-band are reported to be more effective in regaining full strength and endurance (Kennedy, 2011). Therefore, to optimize return of normal neck muscle function, strength exercises progressions should be included at some point in the treatment programme for non-specific neck pain.

The result seen in this study may be attributed to progressive resistance training programme in increasing the resistance to strengthen the muscles of the neck and upper limbs. Since pain is associated with muscle weakness and disability, with the strengthening of these muscles there will be a decrease in pain and disability, as seen from this study. However, in cases of more severe neck pain, higher load exercises, if done too early, tend to exacerbate the pain which would further inhibit normal muscle function (Kennedy, 2011).

4.3.6 Effects of neck stabilisation exercises on selected psychosocial variables in patients with non-specific neck pain

Stabilisation exercises had significant effect on the reduction of fear avoidance beliefs, depression and anxiety. It had been reported that fear avoidance beliefs, depression and anxiety are the most common among patients with neck pain (Blozik et al, 2009).

Dusunceli et al (2001) had reported that stabilisation exercises are effective in reducing depression in patients with non-specific neck pain. To the best of the knowledge of the researcher, no trial had compared the effectiveness of stabilisation exercises in the reduction of anxiety and fear avoidance beliefs in patients with non-specific neck pain.

Barnhill (2009) reported the interrelationship among neck pain, depression, anxiety and fear avoidance. Neck pain not only interferes with sleep and daytime functional activities but also affects the neurotransmitters in a person's brain responsible for sensory input processing and memory storage, thus changing the manner in which pain is perceived and dealt with. As a consequence, these patients often become depressed and/or anxious, in addition to the fact that the chronic symptoms of neck pain can lead patients to avoid social settings, favorite physical activity and even work or sex.

Ironically, because these patients had chronic pain they might have been taking pain medication which itself can contribute to depression. In addition, some of the pain drugs can cause nausea, which in turn cause appetite and loss of weight (Barnhill, 2009).

Kay et al (2012) reported that low impact physical activities such as walking or swimming may help in reducing symptoms of depression, anxiety and fear avoidance. This study employed stabilisation exercises, which are considered free active exercises to the neck region, in managing patients with non-specific neck pain. The exercises were quite effective in reducing symptoms of depression, anxiety and fear avoidance in patients with non-specific neck pain. The mechanism by which it achieves this is by producing positive biochemical changes in the body and brain; the endorphins released post exercise act as natural pain relievers and antidepressants (Zimmerman et al, 2000).

4.3.7 Effects of neck stabilisation plus dynamic exercises on selected psychosocial variables in patients with non-specific neck pain

Stabilisation plus dynamic exercises in this study significantly reduced fear avoidance beliefs, depression and anxiety in patients with non-specific neck pain. Several investigators suggest three mechanisms that account for possible associations between psychosocial factors and musculoskeletal disorders (Bongers et al., 1993; Hales and Bernard, 1996; Sauter and Swanson, 1996). First, that psychosocial demand can exceed an individual's coping capabilities, resulting in a stress response, which, in turn, can produce muscle tension or static loading of the muscles or generate other physiological responses that may result in neck pain. Second, psychosocial demands may affect the awareness and reporting of musculoskeletal disorders, or increase its attribution to the work environment. The third possible mechanism is that, in certain situations, psychosocial demands may be highly correlated with physical demands. This suggests that any association between a psychosocial risk factor and musculoskeletal disorders may actually reflect a relationship between a physical risk factor and musculoskeletal disorders. So, because of the possible relationship between psychosocial factors and musculoskeletal disorders, patients with non-specific neck pain may report depression, anxiety and fear avoidance, and any treatment that can influence the musculoskeletal affectation is likely to influence the psychosocial variables, thus the improvement reported in this study may be due to this factor.

4.3.8 Effects of neck dynamic exercises on selected psychosocial variables in patients with non-specific neck pain

Dynamic exercises significantly reduced fear avoidance beliefs, depression and anxiety in patients with non-specific neck pain. Exercise has both physical and mental benefits through its effects on numerous body systems such as the immune system; brain function; sleep; mood. Exercise relieves stress, anxiety and depression; improves mood; and increases self-esteem by producing positive biochemical changes in the body and brain. Endorphins released post exercise act as natural pain relievers and antidepressants (Zimmerman et al, 2000).

There is a dearth of literature to compare the effect of dynamic exercise on selected psychosocial variables. The present study also confirms the possible relationship between clinical and psychosocial variables, as reported by Dimitriadis et al, (2015) that there is a relationship between pain and anxiety in patients with non-specific neck pain.

A significant correlation has been found previously between fear-avoidance beliefs about physical activity and neck disability indices in subjects with chronic neck pain (George et al 2001; Waddell et al 1993). Neck muscle training should therefore not only be viewed as a means to improve physical function. A painful condition may lead one to avoid activities that stress the neck. Advice, such as to move within the limits of pain, can increase disuse, even though the aim may be to encourage the subject to be more active. The neck rehabilitation programme in the present study sought to change this pattern. Training may be seen as part of a cognitive therapy seeking to facilitate the adoption of a more active lifestyle by subjects. The high-intensity exercises showed the subjects that it is possible to move and load the neck considerably more than is done in ordinary daily life without aggravating their painful condition. Moreover, feedback from the strength test results and improved function, presumably encouraged the subjects to continue training.

4.3.9 Comparative effects of neck stabilisation exercises, neck stabilisation plus dynamic exercises and dynamic exercises on clinical and psychosocial variables in patients with non-specific neck pain

Neck stabilisation exercises led to higher significant improvement in pain, disability, and fear avoidance belief at week 4 and in depression, pain, disability and fear avoidance belief at week 8 of the study. Neck stabilisation plus dynamic exercises led to higher reduction in anxiety scores.

From the results, the neck stabilisation exercises group showed greater pain reduction, disability scores reduction, fear avoidance belief scores reduction and depression reduction, followed by the neck stabilisation plus dynamic exercises group and then the neck dynamic exercises group. In all the variables, at week 4 and 8 of the study, there were no significant differences between the neck stabilisation plus dynamic exercises group and the dynamic exercises group. This may not be unconnected with the time required for dynamic strength training to strengthen the muscles.

Dusunceli et al. (2009), in a study on efficacy of neck stabilisation exercises for neck pain, compared three treatment protocols: physical therapy agent, physical therapy agent plus isometric and stretching exercises, and physical therapy plus stabilisation exercises. Dusunceli et al. (2009) concluded that the stabilisation protocol and physical therapy agent for chronic neck pain patients were equally effective in reducing pain, neck disability index score and depression. Another study by Chiu et al. (2004) examined the efficacy of exercise for patients with chronic neck pain. The intervention included activation of the deep neck muscles and dynamic strengthening of the neck muscles plus infrared irradiation. Chiu et al. (2004) concluded that the combination treatment of neck stabilisation exercises plus physical therapy agent is a more effective intervention for the management of neck pain, with some advantages in the outcomes for pain and disability over the combination of isometric exercises plus physical therapy agent or physical therapy agent alone.

The observed effects of the neck stabilisation group, neck stabilisation plus dynamic group and neck dynamic exercises group in this study could be as a result of the fact that the intervention for each group contained active exercises with some carried out in extension positions. Many studies have shown that exercises and postures in extension improve and resolve symptoms in patients with non-specific neck pain. Although the present study shows that a single specific exercise intervention, in this case stabilisation alone, is effective in reducing the clinical and psychosocial variables in patients with non-specific neck pain, it also proved that a multimodal approach can also take care of these variables in patients with non-specific neck pain. The present study has also highlighted that specific exercises like stabilisation exercises produce better results than the combination of two exercises in reducing some clinical and psychosocial variables, although both the combination of stabilisation and dynamic exercises and dynamic exercises alone are effective in the management of non-specific neck pain.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY

Neck pain is a subjective unpleasant sensory experience in the neck which may manifest as fatigue, tension or pain that radiates to the shoulders, upper extremities or head (Siivola et al, 2002). It is a public health problem associated with significant disability (Cote et al, 2000; Fejer et al, 2006). Non-specific Neck Pain (NsNP) is neck pain (with or without radiation) whose underlying cause cannot be traced to any specific systematic disease (Green, 2008). In Nigeria, neck pain is a common symptom in our clinical setting and it constitutes a significant burden on physiotherapy care facilities (Ayanniyi et al, 2007). Exercise programmes for managing neck pain differ with regard to duration, training frequency, intensity, and mode of exercise. Previous studies have shown that isometric exercises and strength training can have positive effects on neck pain (Chiu et al, 2004). The Cochrane Review on the effect of exercises for mechanical neck disorders concluded that the summarized evidence indicates that there is a role for exercises in the treatment of acute and chronic mechanical neck pain plus headache but that the relative benefit of each type of exercise needs extensive research (Kay et al, 2005). The aim of this study was to investigate the effects of neck stabilization and dynamic exercises on selected clinical and psychosocial variables in patients with non-specific neck pain.

The literature review for this study focused on the definition, classification, epidemiology, aetiology and risk factors for non-specific neck pain (NsNP). The review examined the different management protocols for NsNP with emphasis on the bio psychosocial model which currently is the state of the art in rehabilitation and disability perspectives. The conservative and non-conservative management of NsNP were also studied. The common outcome measures in neck pain are: (a) Neck Disability Index – probably the most well-known scale – measures pain and disability, (b) Patient-specific Functional Scale – used for measuring disability, (c) Copenhagen Neck Functional Disability Scale, (d) Northwick Park Neck Pain Disability Scale, (e) Core Neck Pain Questionnaire, (f) Visual Analogue Scale, (g) Quality of Life Measures e.g. SF-36 questionnaire (Kerr and White, 2007) (h) Beck depression inventory (i) Beck anxiety inventory and Fear avoidance beliefs.

The participants for this study were patients with non-specific neck pain, who presented at the National Orthopaedic Hospital, Dala, Kano and the Aminu Kano Teaching Hospital, Kano. A consecutive sampling technique was used to recruit participants as they were referred for physiotherapy by the doctors. The study employed a randomized controlled clinical trial design registered with the Pan Africa Clinical Trial Registry PACTR 201402000727807. The subjects were screened in order to determine whether they met the inclusion criteria for the study. The participants were randomized into three groups: the neck stabilization exercises group (NSEG), the neck stabilization plus dynamic exercises group (NSDEG) and the neck dynamic exercises group (NDEG) as they became available. Ethical approval for the study was sought and obtained from the Health Research Ethics Committee of University of Ibadan/University College Hospital, Ibadan (UI/EC/14/0003). Also ethical approval was obtained from the National Orthopaedic Hospital Dala, Kano (NOHD/RET/ETHIC/60) with a letter from the Department of Physiotherapy, College of Medicine, University of Ibadan, introducing the researcher. Treatment was applied thrice weekly for eight weeks and outcomes were measured in terms of clinical variables of: pain intensity and disability index scores; and psychosocial variables of fear-avoidance beliefs, depression and anxiety beliefs at the baseline and at the end of the 4th and 8th week of study, using the Visual Analogue Scale (VAS), neck disability index questionnaire, fear avoidance beliefs questionnaire, Beck depression inventory and Beck anxiety inventory. Data were analysed using descriptive and inferential statistics of One-way analysis of variance (ANOVA), repeated measures of ANOVA, Friedman's ANOVA, Kruskal-Wallis test and multiple comparisons post-hoc tests at P=0.05.

Age of participants in NSEG (46.8±12.4 years), NDEG (48.6±11.6 years) and NSDEG (45.1±13.4 years) were comparable. There was no significant difference in participants' scores on pain intensity, functional disability, fear avoidance beliefs, depression and anxiety across the three groups at baseline. At the end of the fourth week, scores for pain intensity (4.8±1.3; 5.8±1.4; 5.6±1.7), fear avoidance beliefs [28.0 (10.0); 35.0 (7.0); 34.0 (10.0)] and anxiety [13.0 (8.0); 18.0 (7.0) 13.0 (10.0)], for NSEG, NDEG and NSDEG respectively were significantly different across the three groups, while scores for functional disability [18.0 (7.0); 15.0 (7.5); 16.0 (7.5)] and depression [12 (6.0); 12 (6.0); 12 (6.0)] were not. At the end of eighth week, scores for pain intensity (2.7±1.27; 4.1±0.9; 4.5±1.4), functional disability [12.0 (2.0); 14.0 (6.7), 14.0 (6.5], fear avoidance beliefs [22.0 (9.0); 30.5 (7.8); 30.0 (14.5)] and depression [11.5 (5.0); 12.0 (2.8); 12.0 (5.0)] in NSEG, NDEG and NSDEG respectively, were significantly different, while scores of anxiety [13.0 (9.8); 14.0 (7.0); 12.0 (5.0)] were not. Post-hoc tests showed that NSEG had more significant reduction in pain intensity, functional disability and fear avoidance beliefs at end of weeks 4 and 8 and in depression at week 8 than the other two groups.

Three of the twenty-five proposed null hypotheses were accepted while the twenty-two null hypotheses were fail to be accepted. Results were discussed by comparing and contrasting the findings of the study with those of related past literatures.

5.2 CONCLUSIONS

From the findings of this study, the following conclusions were made:

1. Neck stabilisation exercises however resulted in better reduction in pain intensity, functional disability, fear avoidance beliefs and depression in participants with non-specific neck pain.
2. Neck Stabilisation is the most effective regimen in the management of non-specific neck pain.

5.3 RECOMMENDATIONS

1. It is recommended that stabilisation exercises should be used in the management of patients with non-specific neck pain.
2. Further studies should be done to investigate the long-term effects of stabilisation exercises, stabilisation plus dynamic exercises and dynamic exercises in patients with non-specific neck pain.

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APPENDIX A UI/UCH ETHICAL APPROVAL

INSTITUTE FOR ADVANCED MEDICAL RESEARCH AND TRAINING (IAMRAT)
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E-mail: imratcomui@yahoo.com

UI/UCH EC Registration Number: **NHREC/05/01/2008a**

NOTICE OF FULL APPROVAL AFTER FULL COMMITTEE REVIEW

Re: Effects of Neck Stabilization and Dynamic Exercises on Selected Clinical and Psychosocial Variables in Patients with Non-Specific Neck Pain

UI/UCH Ethics Committee assigned number: UI/EC/14/0003

Name of Principal Investigators: **Bashir Kaka**

Address of Principal Investigators: Department of Physiotherapy,
College of Medicine,
University of Ibadan, Ibadan

Date of receipt of valid application: 07/01/2014

Date of meeting when final determination on ethical approval was made: **N/A**

This is to inform you that the research described in the submitted protocol, the consent forms, and other participant information materials have been reviewed and *given full approval by the UI/UCH Ethics Committee.*

This approval dates from 03/02/2014 to 02/02/2015. If there is delay in starting the research, please inform the UI/UCH Ethics Committee so that the dates of approval can be adjusted accordingly. Note that no participant accrual or activity related to this research may be conducted outside of these dates. *All informed consent forms used in this study must carry the* UI/UCH EC *assigned number and duration of* UI/UCH EC *approval of the study.* It is expected that you submit your annual report as well as an annual request for the project renewal to the UI/UCH EC early in order to obtain renewal of your approval to avoid disruption of your research.

The National Code for Health Research Ethics requires you to comply with all institutional guidelines, rules and regulations and with the tenets of the Code including ensuring that all adverse events are reported promptly to the UI/UCH EC. *No changes are permitted in the research without prior approval by the* UI/UCH EC *except in circumstances outlined in the Code. The* UI/UCH EC *reserves the right to conduct compliance visit to your research site without previous notification.*

UI/UCH EC
03 FEB 2014
APPROVED
COLLEGE OF MEDICINE

Professor A. Ogunniyi
Director, IAMRAT
Chairman, UI/UCH Ethics Committee
E-mail: uiuchirc@yahoo.com

Research Units ▪ Genetics & Bioethics ▪ Malaria ▪ Environmental Sciences ▪ Epidemiology Research & Service ▪ Behavioural & Social Sciences ▪ Pharmaceutical Sciences ▪ Cancer Research & Services ▪ HIV/AIDS

APPENDIX B NOHDK ETHICAL APPROVAL

NATIONAL ORTHOPAEDIC HOSPITAL

DALA - KANO

CHAIRMAN OF THE BOARD
ALH. MOHAMMED HASSAN SANTANAH FPSN

MEDICAL DIRECTOR
DR. KABIR ABUBAKAR MBBS, FWACS, FAOI.

HEAD OF ADMIN & SECRETARY OF THE BOARD
ABDULKADIR M. KABIR MDRM, B.Sc, CHPM, FIICA, AHAN, ANIM, AISM

NATIONAL ORTHOPAEDIC HOSPITAL
DALA - KANO

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E - MAIL: nohdala@orthopaedicdala.org

Ref. No NOHD/RET/ETHIC/60
Date 20TH September, 2013

OFFICE OF THE HEAD OF RESEARCH
NATIONAL ...
22 SEP 2013
DESPATCHED
SIGN

BASHIR KAKA
Dept of Physiotherapy
Bayero University Kano

ETHICAL CLEARANCE

TITLED: "EFFECTS OF NECK STABILIZATION AND DYNAMIC EXERCISES ON SELECTED CLINICAL AND PSYCHOSOCIAL VARIABLES IN PATIENTS WITH NON-SPECIFIC NECK PAIN"

Following deliberations by the hospital RESEARCH ETHICAL COMMITTEE, ethical clearance is hereby granted to you to carry out the above titled study.

You are advised to adhere strictly to approved methodology

Best wishes.

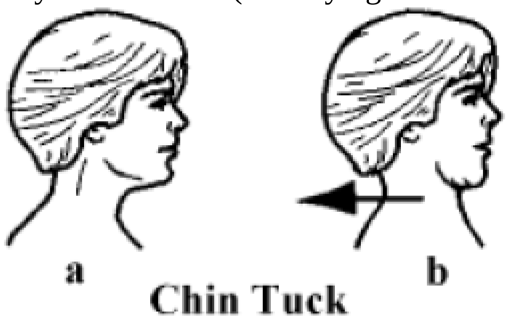
DR. (MRS.) E.C. ANAKO FWACP, FMCFM
CHAIRPERSON HOSPITAL RESEARCH ETHICS COMMITTEE
FOR: MEDICAL DIRECTOR

APPENDIX C. CERVICAL STABILIZATION EXERCISES PROTOCOL

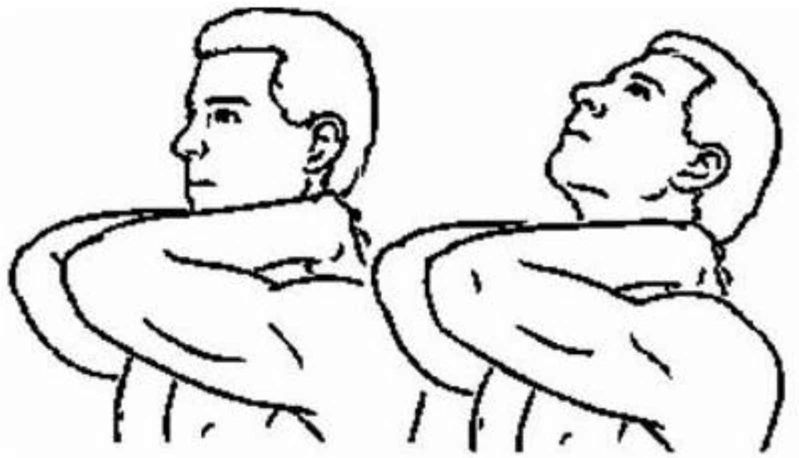
Do each exercise ____1_ times a day.
Repeat each exercise ____3__ times per week.
Hold each position for __30____ seconds.

These exercises can be done while sitting or standing

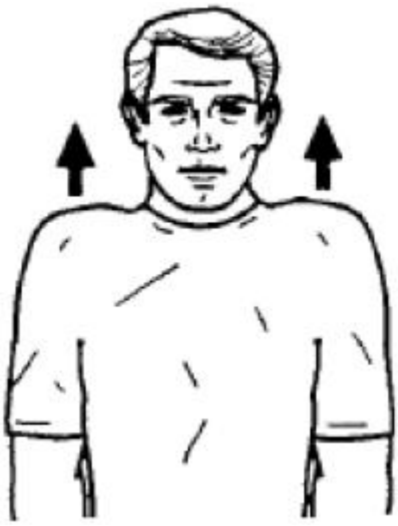
CHIN TUCK
Pull your chin back (as if trying to make a double chin) while keeping your eyes level.



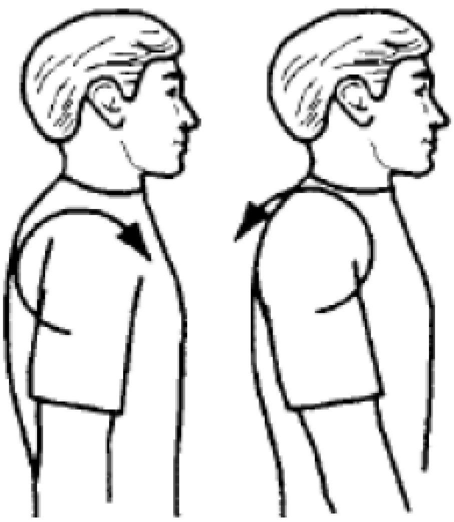
CERVICAL EXTENSION
With hands grasping the base of the neck, extend the neck as far as possible.



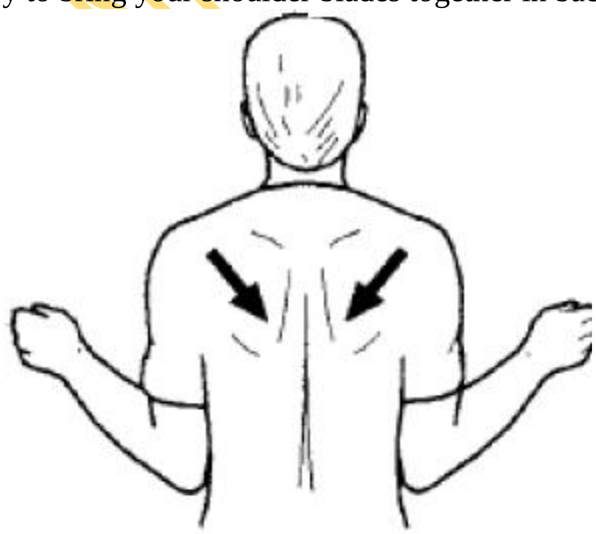
SHOULDER SHRUGS
Shrug your shoulders, bringing them up towards your ears.
Relax and repeat.



SHOULDER ROLLS
Roll your shoulders forward in a circle. Then, roll your shoulders backwards in a circle. Relax and repeat.



SCAPULAR RETRACTION
Try to bring your shoulder blades together in back of you. Relax and repeat.



APPENDIX D. DYNAMIC EXERCISES PROTOCOL

EXERCISE PROGRAM

Exercise Protocol for Neck Pain

Ylinen et al. 2006

Consult your healthcare provider before beginning this exercise program. If you experience any pain or difficulty with any exercises, stop and consult your healthcare provider. The Hygenic Corporation is not liable for any injuries incurred while using exercises or programs accessed via this website. User must wear suitable eye protection such as safety goggles to protect against possibility of eye injury as a result of the band or tube snapping towards the face if grip is lost or if the band or tube breaks.

Exercise Protocol for non-specific Neck Pain

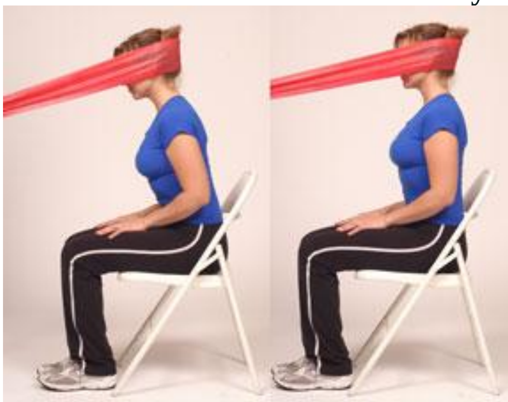
Description:

Ylinen et al. 2006

Instructions:

Perform these exercise three per week. For neck exercises, perform 3 sets of 15 repetitions in each direction.

Thera-Band Cervical Extension-Dynamic Isometric (sitting)

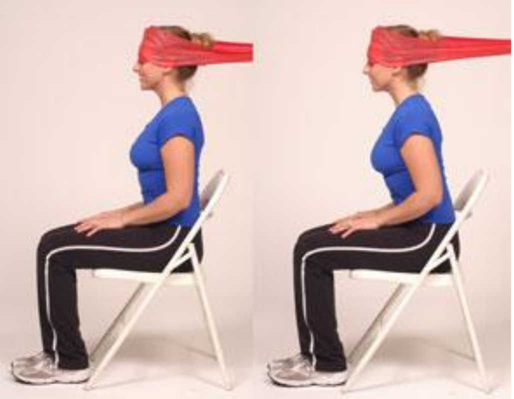


Thera-Band Cervical Extension

Instructions:

Begin in sitting with a loop of band securely attached on one end, and the loop around your head. Keep you back and neck straight while you slightly lean forward from your hips, moving your head about 10cm forward. Hold and slowly return to the starting position. Keep your neck straight, moving with your shoulders.

Thera-Band Cervical Flexion-Dynamic Isometric (sitting)



Thera-Band Cervical Flexion-Dynamic Isometric
Instructions:
Begin in sitting with a loop of band securely attached on one end, and the loop around your head. Keep you back and neck straight while you slightly lean forward from your hips, moving your head about 10cm forward. Hold and slowly return to the starting position. Keep your neck straight, moving with your shoulders.

Thera-Band Chest Flies

Thera-Band Chest Flies
Instructions:
Secure the middle of the band to a stationary object at shoulder level. Face away from the attachment. Use a staggered step with one leg slightly in front of the other. Grasp the bands at shoulder height with your elbows straight. Keep your elbows straight and pull bands inward with palms facing each other. Slowly return.
VARIATION: Vary the height of the attachment of the band for an incline (lower attachment height) or decline (higher attachment height) fly.
sp end of band with elbow straight. Pull band upward by bending elbows, bringing your hand to your waist. Hold and slowly return.

APPENDIX 1 INFORMED CONSENT FORM

My name is Bashir Kaka. I am a postgraduate student of the department of Physiotherapy, College of Medicine, University of Ibadan. I am carrying out a research on “Comparative effects of an eight-week neck stabilisation and dynamic exercises on selected clinical and psychosocial parameters in patients with non-specific neck pain”. Information will be obtained through intervention and questionnaire administration. Your participation and responses will be appreciated and kept confidential. Your name will not be required or linked to any information obtained. The information got from you and other participants will be used in treatment of non-specific neck pain patients to improve their condition.

The intervention will not cause you any harm or injury. You are free to refuse to take part in the study. You have the right to withdraw at any given time if you choose to. However, I shall greatly appreciate your participation in the study.

Consent: Now that the study has been well explained to me and i fully understand the content of the study process, I will be willing to participate.

__________________________________ ________________________

Signature/Thumbprint of participant/Date Signature of researcher/Date

APPENDIX 2 HAUSA VERSION OF INFORMED CONSENT

NEMAN IZINI DOMIN KASHIGA BINCIKE

Ni……………………………………………………………….Bayan anyiman bayani gameda bincike wanda aka yima lakanni da suna "AIKIN DAIDAITA WUYA DA MOTSASHI AKAN WASU ZABABIN ABUBUWAN LAFIYA DA KUMA NA RAYUWA YAU DA KULLUM GA MASU MATSALAR CIWON WUYA DA BASHI DA TAKAMAMEN ABUNDA YA HADDASASHI" Na yarda da inshiga cikin bayan an fahimtardani kuma ina da dammar d azan fitar a kowane lokaci na fahimta da cewar binciken ya kumshi motsa wuya da kuma bada takardar bincike kamar yadda aka yimini bayani na aminta da halaka da karuwa wanda zai faru akan wannan bincike da kayimini, kuma na sani duk wani bayani da zaa samu za ayi amfani dashi wurin kulada marasa lafiya masu wannan matsalar.

Kuma na fahimta cewa har innafita cikin wannan bincike ba zai shafi kulawar da nike samu ba a wannan asibiti.

Duk wani nauyi na sauran bicike da za a bukata ga bincike, mai bincike zai dauki nauyi

Ko kana da wata tambaya?

Sahannun mai mara lafiya……………………………………

Sahannun mai shedu…………………………………………..

Sahannun mai bincike…………………………………………

APPENDIX 3 BIODATA FORM

SERIAL NO/CODE -------------------

SOCIODEMOGRAPHIC DATA OF PARTICIPANT

1. AGE in years. ( )
2. GENDER (a) Male ( ) (b) Female ( )
3. MARITAL STATUS. (a) Married ( ), (b) Divorced ( ), (c) Separated **( ),** (d) Widow ( ).
4. TRIBE. (a) Hausa/Fulani ( ), (b) Yoruba ( ), (c) Igbo ( ), (d) Others ( ).
5. HIGHEST EDUCATIONAL QUALIFICATION (a) Never attend school ( ), (b) Primary school ( ), (c) junior secondary ( ), (d) senior secondary ( ), (e) Tertiary institution ( ).
6. OCCUPATION. (a) Unemployed ( ), (b) Artisan ( ), (c) petty trader( ), (d) peasant Famer ( ), (e) Junior C/S( ), (f) Senior C/S( ), (g) Medium scale Business ( ), (h) Big Business ( ).
7. HOUSEHOLD INCOME PER MONTH. (a) Less than ₦18, 000 ( ), (b) ₦ 18,000 - 49999 ( ), (c) ₦50, 000 –99,999 ( ), (d) ₦ 100,000 and above ( ).
8. SMOKING HISTORY, (a) smoking ( ), (b) non- smoke ( )
9. PAIN DURATION IN WEEK ( )
10. Weight ( )
11. Height ( )
12. BMI ( )

APPENDIX 4 HAUSA VERSION BIODATA FORM

LAMBA------------

Sashe na Bayani game da mai amsawa.

1. **Shekarun mai amsawa**. ( )
2. **Ginsi**, **a**. Mace ( ), **b**. Namiji ( )
3. **Aure a**. Baaure ( ), **b**. akwai aure ( ), **c**. saki ( ), **d**. anrabu ( ),**e**. mijiyarasu ( ),
4. **Kabila a**. Hausa/Fulani ( ), **b**. Bayarabe ( ), **c**. Ibo ( ), **d**. Saura ( ).
5. **Babbar takadar karatu a**. Bantaba yinyi makaranta ba ( ), **b**. Makarantar islamiya ( ), **c**. furamari ( ) **d.** Karamar sakandare ( ), **e**. babbar sakandare ( ), **f**. Makarantar gaba da sakandare ( )
6. **Aikin a**. Ba aiki ( ), **b**. aiki hannu ( ), **c**. kasuwan ci ( ), **d**. karamin akin noma ( ), **e**. karamin maaikaci ( ), **f.** babban maaikaci ( ),
7. **Kudin shiga na iyali a**. Kasa ga ₦ 18000, ( ), **b**. ₦ 18000- 49,999, ( ) **c**. ₦ 50,000 –99,999 ( ), **d**. ₦ 100,000 zuwa sama.
8. **Yanayin shantaba a**. inasha ( ) **b**. banasha ( )
9. **Nauyi ( )**
10. **Tsawo ( )**
11. **BMI ( )**

APPENDIX 5

Alternate visual analogue scale-Hausa (Odole and Akinpelu, 2009)

Instruction: please place a mark through the line below that most accurately represent the pain level that you are feeling at the moment.

0 — 10

No pain (Ba radadi) — Worst pain ever (Radadi maitsanani)

APPENDIX 6
NECK DISABILITY INDEX QUESTIONNAIRE (Vernon and Mior, 1991)

This questionnaire has been designed to give us information as to how your neck pain has affected your ability to manage in everyday life. Please answer every section and **mark in each section only the one box that applies to you**. We realise you may consider that two or more statements in any one section relate to you, but please just mark the box that most closely describes your problem**.**

Section 1: Pain Intensity
I have no pain at the moment
The pain is very mild at the moment
The pain is moderate at the moment
The pain is fairly severe at the moment
The pain is very severe at the moment
The pain is the worst imaginable at the moment

Section 2: Personal Care (Washing,Dressing,etc.)
I can look after myself normally without causing extra pain
I can look after myself normally but it causes extra pain
It is painful to look after myself and I am slow and careful
I need some help but can manage most of my personal care
I need help every day in most aspects of self care
I do not get dressed, I wash with difficulty and stay in bed

Section 3: Lifting
I can lift heavy weights without extra pain
I can lift heavy weights but it gives extra pain
Pain prevents me lifting heavy weights off the floor, but I
can manage if they are conveniently placed, for example 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 only lift very light weights
I cannot lift or carry anything

Section 4: Reading
I can read as much as I want to with no pain in my neck
I can read as much as I want to with slight pain in my neck
I can read as much as I want with moderate pain in my neck
I can't read as much as I want because of moderate pain in my neck
I can hardly read at all because of severe pain in my neck
I cannot read at all

Section 5: Headaches
I have no headaches at all
I have slight headaches which come infrequently
I have moderate headaches which come infrequently
I have moderate headaches which come frequently
I have severe headaches which come frequently
I have headaches almost all the time

Section 6: Concentration
I can concentrate fully when I want to with no difficulty
I can concentrate fully when I want to with slight difficulty
I have a fair degree of difficulty in concentrating when I want to
I have a lot of difficulty in concentrating when I want to
I have a great deal of difficulty in concentrating when I want to
I cannot concentrate at all

Section 7: Work
I can do as much work as I want to
I can only do my usual work, but no more
I can do most of my usual work, but no more
I cannot do my usual work
I can hardly do any work at all
I can't do any work at all

Section 8: Driving
I can drive my car without any neck pain
I can drive my car as long as I want with slight pain in my neck
I can drive my car as long as I want with moderate pain in my neck
I can't drive my car as long as I want because of moderate pain in my neck
I can hardly drive at all because of severe pain in my neck
I can't drive my car at all

Section 9: Sleeping
I have no trouble sleeping
My sleep is slightly disturbed (less than 1 hr sleepless)
My sleep is mildly disturbed (1-2 hrs sleepless)
My sleep is moderately disturbed (2-3 hrs sleepless)
My sleep is greatly disturbed (3-5 hrs sleepless)
My sleep is completely disturbed (5-7 hrs sleepless)

Section 10: Recreation
I am able to engage in all my recreation activities with no neck pain at all
I am able to engage in all my recreation activities, with some pain in my neck
I am able to engage in most, but not all of my usual recreation activities because of pain in my neck
I am able to engage in a few of my usual recreation activities because of pain in my neck
I can hardly do any recreation activities because of pain in my neck
I can't do any recreation activities at all

APPENDIX 7 HAUSA VERSION OF NECK DISABILITY INDEX (FIHIRISAR RASHIN LAFIYAR WUYA)

An gabatar da wannan tsarin tambayoyi ne domin a fahimci yadda zafin ciwon wuya ya addabi mutum yayin gudanar da al'amuran rayuwa na yau da kullum. Don Allah ana buqatar a amsa kowane vangare ta hanyar ***tozali ko sa alama a akwatin da aka bayyana irin matsalar da ta shafi mutum.*** An fahimci za a iya samun bayanai biyu ko ma fiye da haka na matsalolin da suka shafi mutum a vangare xaya daga cikin vangarorin da aka kawo, amma don Allah a sa alama a kwatin da yake xauke da tsayayyen bayanin matsalar da ta danganci rashin lafiyar mutum kai tsaye.

Sashe na Farko: Tsananin Ciwo

☐ Yanzu ba na jin zafin ciwo
☐ Yanzu zafin ciwon maras tsanani ne
☐ Yanzu ina jin matsakaicin zafin ciwon
☐ Yanzu zafin ciwon da dama-dama
☐ Yanzu zafin ciwon ya yi tsanani
☐ Yanzu zafin ciwon kwatancinsa ya yi muni

Sashe na Biyu: Gyara Kayanka (Wanke-Wanke da Sauran Ayyuka)

☐ Zan iya kula da kaina ba tare da na ji zafin ciwon ba
☐ Zan iya kula da kaina amma nakan fuskanci matsalar zafin ciwon
☐ Nakan fuskanci zafin ciwon yayin da nake kula da kaina amma ina bi sannu-a-hankali
☐ Nakan xan buqaci taimako amma ina iya gudanar da sauran da kaina
☐ Nakan buqaci taimako kullum a mafi akasarin al'amuran da zan aiwatar
☐ Ba na iya tufatar da kaina, cikin wahala nake domin ina zane koyaushe saman gado

Sashe na Uku: Aikin Qarfi

☐ Zan iya xaukar abu mai nauyi ba tare da na ji zafin ciwon ba
☐ Zan iya xaukar abu mai nauyi amma nakan ji zafin ciwon xan kaxan
☐ Zan iya xaukar abu mai xan nauyi musamman idan an xora bisa tebur amma zafin ciwon ba ya bari na xaga abu mai qarfi daga qasa
☐ Zan iya kimantawa in xaga abu marar nauyi idan an xora shi inda ya dace, in dai mai nauyi ne zafin ciwon ba ya bari na in xauka
☐ Zan iya xaukar abu marar nauyi kawai
☐ Ba zan iya xaukar kome ba

Sashen na Huxu: Nazari

☐ Zan iya karatu yadda nake buqata ba tare da na ji zafin ciwo a wuya na ba
☐ Zan iya karatu yadda nake buqata amma zan ji zafin ciwo kaxan a wuya na
☐ Zan iya karatu yadda nake buqata amma zan ji matsakaicin zafin ciwo a wuya na
☐ Ba zan iya karatu yadda nake buqata ba saboda zafin ciwo maras tsanani a wuya na
☐ Kwatakwata da kyar in iya karatu saboda matsanancin zafin ciwo a wuya na
☐ Kwatakwata ba zan iya karatu ba

Sashe na Biyar: Ciwon Kai

☐ Kwatakwata ba na jin zafin ciwon kai
☐ Nakan xan ji zafin ciwon kai amma ba sa-i-da-lokaci ba
☐ Nakan xan ji zafin ciwon kai can-ba-a-rasa ba
☐ Nakan xan ji matsakaicin zafin ciwon kai sa-i-da-lokaci
☐ Ina fuskantar matsanancin zafin ciwon kai sau-da-yawa

☐A ko da yaushe nake fama da zafin ciwon kai

Sashe na Shida: Natsuwa

☐Ina iya natsuwa sosai a duk lokacin da na buqata ba tare da na wahala ba
☐Ina iya natsuwa sosai a duk lokacin da na buqata tare da ‘yar wahala
☐Nakan fuskanci wahalar natsuwa da dama-dama a lokacin da na buqata
☐Nakan fuskanci wahalar natsuwa sosai a duk lokacin da na buqata
☐Nakan fuskanci babbar wahalar natsuwa a duk lokacin da na buqata
☐Kwatakwata ba na iya natsuwa

Sashe na Bakwai: Aiki

☐Zan iya gudanar da aiki kwatankwacin yadda na buqata
☐Zan iya gudanar da xan kaxan daga cikin aikina kullum
☐Zan iya gudanar da mafi akasarin ayyukana
☐Ba zan iya gudanar da ayyukana na yau da kullum ba
☐Mawuyacin abu ne in iya gudanar da wani aiki
☐Kwatakwata ba zan iya gudanar da wani aiki ba

Sashe na Takwas: Tuqi

☐Zan iya tuqa motata ba tare da na fuskanci zafin ciwon wuyana ba
☐Zan iya tuqa motata yadda na buqata amma zan fuskanci zafin ciwon wuya
☐ Zan iya tuqa motata yadda na buqata amma zan fuskanci matsakaicin zafin ciwon wuya
☐Ba zan iya tuqa motata yadda na buqata saboda matsakaicin zafin ciwon wuya da nakan fuskanta
☐Kwatakwata da wahala in yi tuqi saboda matsanancin zafin ciwon wuya
☐Kwatakwata ba zan iya tuqa motata ba

Sashe na Tara: Barci

☐Ba na fuskantar matsalar barci
☐Nakan fuskanci matsalar barci kaxan (aqalla qasa da awa xaya)
☐Nakan fuskanci matsalar barci maras tsanani (aqalla awa xaya zuwa biyu)
☐Nakan fuskanci matsalar barci gwargwadon hali (aqalla awa biyu zuwa uku)
☐Nakan fuskanci babbar wahalar barci (aqalla awa uku zuwa biyar)
☐Kwatakwata ba na iya barci (aqalla awa biyar zuwa bakwai)

Sashe na Goma:

☐Ina aiwatar da wasannin motsa jiki ba tare da na fuskanci zafin ciwon wuya ba
☐Ina aiwatar da kowane wasan motsa jiki amma zan xan ji raxaxin ciwo a wuya
☐Ina samun akasin aiwatar da wasannin motsa jiki dalilin zafin ciwon wuya
☐Ina iya aiwatar da kaxan daga cikin wasannin motsa jiki dalilin zafin ciwon wuya
☐Da qyar nake aiwatar da wasannin motsa jiki a dalilin zafin ciwon wuya
☐Kwatakwata ba zan iya aiwatar da wasannin motsa jiki ba.

APPENDIX 8 Fear-Avoidance Beliefs Questionnaire Neck (Waddell et al, 1993)

Date:______/_____/_____ (month/day/year)

Here are some of the things other patients have told us about their pain. For each statement please circle the number from 0 to 6 to indicate how much physical activities such as bending, lifting, walking or driving affect or would affect your neck pain.

	Completely Disagree			Unsure			Completely Agree
1. My pain was caused by physical activity.	0	1	2	3	4	5	6
2. Physical activity makes my pain worse.	0	1	2	3	4	5	6
3. Physical activity might harm my neck.	0	1	2	3	4	5	6
4. I should not do physical activities which (might) make my pain worse.	0	1	2	3	4	5	6
5. I cannot do physical activities which (might) make my pain worse.	0	1	2	3	4	5	6

The following statements are about how your normal work affects or would affect your neck pain.

	Completely Disagree			unsure			Completely Agree
6. My pain was caused by my work or by an accident at work.	0	1	2	3	4	5	6
7. My work aggravated my pain.	0	1	2	3	4	5	6
8. I have a claim for compensation for my pain.	0	1	2	3	4	5	6
9. My work is too heavy for me.	0	1	2	3	4	5	6
10. My work makes or would make my pain worse.	0	1	2	3	4	5	6
11. My work might harm by neck.	0	1	2	3	4	5	6
12. I should not do my regular work with my present pain.	0	1	2	3	4	5	6
13. I cannot do my normal work with my present pain.	0	1	2	3	4	5	6
14. I cannot do my normal work until my pain is treated.	0	1	2	3	4	5	6
15. I do not think that I will be neck to my normal work within 3 months.	0	1	2	3	4	5	6
16. I do not think that I will ever be able to go neck to that work.	0	1	2	3	4	5	6

APPENDIX 9 HAUSA VERSION OF FEAR-AVOIDANCE BELIEFS QUESTIONNAIRE (Kaka et al, 2015)

(TSARIN TAMBAYOYIN TSORO DA KAUCE WA ZATO)

Ga bayanai waxanda aka samu ta hanyar tattaunawar da aka yi da wasu marasa lafiya dangane da abun da ke addabarsu. Don Allah, ana buqatar a zagaye lambar da ke xauke da bayanin da ya zo daidai da yanayin cutar da ta shafi mutum daga lambobin sufuli zuwa shida (0-6) domin a fahimci fasalin ayyukan da idan mutum ya yi suke da alaqa da rashin lafyar wuyansa, misali kamar duqawa ko xagawa ko miqewa da tafiya ko tuqi da sauransu.

Ban amince ba ***Watakila*** ***Tabbas***

1. Na samu zafin ciwon wuya ne sanadiyyar wasar motsa jiki 0 1 2 3 4 5 6

2. Wasar motsa jiki na sa zafin ciwon wuyana ya qazanta 0 1 2 3 4 5 6

3. Wasar motsa jiki zai illata mun wuya 0 1 2 3 4 5 6

4. Bai kamata in yi wasannin motsa jikin da (ka iya) qarfafa zafin ciwo na ba 0 1 2 3 4 5 6

5. Ba zan iya aiwatar da wasannin motsa jiki da (ka iya) qarfafa zafin ciwo na ba 0 1 2 3 4 5 6

Waxannan bayanai da ke tafe suna bayyana yadda yanayin aikin mutum ke da alaqa da gamuwa da rashin lafiyar wuya da ke addabar mutum.

6. A dalilin haxari a wajen aiki ne sanadiyyar gamuwa ta da zafin ciwon wuya 0 1 2 3 4 5 6

7. Aikina kan kan haifar mun da tsananin zafin ciwon wuya 0 1 2 3 4 5 6

8. Na tura da da'awar ramuwar diyya dangane da zafin ciwon wuyana 0 1 2 3 4 5 6

9. Aikina ya yi mun nauyi sosai 0 1 2 3 4 5 6

10. Aikina zai sa zafin ciwon wuyana ya zamanto mafi muni 0 1 2 3 4 5 6

11. Aikina zai iya lahanta mun wuya 0 1 2 3 4 5 6

12. Bai dace in yi ayyukan yau da kullum ba duba da zafin ciwon da ke addabata 0 1 2 3 4 5 6

13. Ba zan iya ayyukan yau da kullum ba a yanayin zafin ciwon da nake ciki 0 1 2 3 4 5 6

14. Ba zan iya ayyukan yau da kullum har sai an mun maganin ciwon wuyana 0 1 2 3 4 5 6

15. Ba na tunanin zan iya dawowa aiki tsakanin watanni uku 0 1 2 3 4 5 6

16. Kwatakwata ba na tunanin zan iya dawowa aiki na yau da kullum har abada 0 1 2 3 4 5 6

APPENDIX 10 Beck Depression Inventory

Choose the one statement, from among the group of four statements in each question that best describes how you have been feeling during the past few days. Circle the number beside your choice.

1	0	I do not feel bad.
	1	I feel sad.
	2	I am sad all the time and I can't snap out of it.
	3	I am so sad or unhappy that I cannot stand it.
2	0	I am not particularly discouraged about the future.
	1	I feel discouraged about the future.
	2	I feel I have nothing to look forward to.
	3	I feel that the future is hopeless and that things cannot improve.
3	0	I do not feel like a failure.
	1	I feel I have failed more than the average person.
	2	As I look back on my life, all I can see is a lot of failure.
	3	I feel I am a complete failure as a person.
4	0	I get as much satisfaction out of things as I used to.
	1	I don't enjoy things the way I used to.
	2	I don't get any real satisfaction out of anything anymore.
	3	I am dissatisfied or bored with everything.
5	0	I don't feel particularly guilty.
	1	I feel guilty a good part of the time.
	2	I feel guilty most of the time.
	3	I feel guilty all of the time.
6	0	I don't feel that I am being punished.
	1	I feel I may be punished.
	2	I expect to be punished.
	3	I feel I am being punished.
7	0	I don't feel disappointed in myself.
	1	I am disappointed in myself.
	2	I am disgusted with myself.
	3	I hate myself.
8	0	I don't feel I am worse than anybody else.
	1	I am critical of myself for my weaknesses or mistakes.
	2	I blame myself all the time for faults.
	3	I blame myself for everything bad that happens.
9	0	I don't have any thoughts of killing myself.
	1	I have thoughts of killing myself but I would not carry them out.
	2	I would like to kill myself.
	3	I would kill myself if I had the chance.
10	0	I don't cry anymore than usual.
	1	I cry more now than I used to.
	2	I cry all the time now.
	3	I would kill myself if I had the chance.
11	0	I am not more irritated by things than I ever am.
	1	I am slightly more irritated now than usual.
	2	I am quite annoyed or irritated a good deal of the time.
	3	I feel irritated all the time now.

12	0 1 2 3	I have not lost interest in other people. I am less interested in other people than I used to be. I have lost most of my interest in other people. I have lost all my interest in other people.
13	0 1 2 3	I make decisions about as well as I ever could. I put off making decisions more than I used to. I have a greater difficulty in making decisions than before. I can't make decisions at all anymore.
14	0 1 2 3	I don't feel I look any worse than I used to. I am worried that I am looking old or unattractive. I feel that there are permanent changes in my appearance that make me look unattractive. I believe that I look ugly.
15	0 1 2 3	I can work about as well as before. It takes an extra effort to get started at doing something. I have to push myself very hard to do anything. I can't do any work at all.
16	0 1 2 3	I can sleep as well as usual. I don't sleep as well as I used to. I wake up 1-2 hours earlier than usual and find it hard to get back to sleep. I wake up several hours earlier than I used to and cannot get back to sleep.
17	0 1 2 3	I don't get more tired than usual. I get tired more easily than I used to. I get tired from doing almost anything. I am too tired to do anything.
18	0 1 2 3	My appetite is no worse than usual. My appetite is not as good as it used to be. My appetite is much worse now. I have no appetite at all anymore.
19	0 1 2 3	I haven't lost much weight, if any, lately. I have lost more than five pounds. I have lost more than ten pounds. I have lost more than fifteen pounds trying to lose weight. *Score 0 if you have been purposely trying to lose weight.*
20	0 I am no more worried about my health than usual. 1 I am worried about my physical problems such as aches and pains or upset stomach. 2 I am very worried about physical problems and it's hard to think of much else. 3 I am so worried about my physical problems that I cannot think about anything else.	
	0 1 2 3	I have not noticed any recent change in my interest in sex. I am less interested in sex. I am much less interested in sex. I have lost interest in sex completely.

APPENDIX 11 HAUSA VERSION OF BECK DEPRESSION INVENTORY

LISSAFIN BAKINCIKI NA BECK

1. 0 Bana jin badadi
   1 ina jin badadi
   2 ina jin bakin ciki ko da yaushe
   3 kuma bana iya fita cikin bakincikin
2. 0 Bana damuwa game da cigabana
   1 ina jin bana son cigabana
   2 ina jin bawani cigaba da zan iya yi
   3 ina jin bawani cigaba da zan iya samu kuma
3. 0 bana jin wai bazan iya kawo cigababa
   1 ina jin ina kasa ga madaidaicin mai kudi
   2 idan nadiba baya na rayuwa ta abunda zan iya gani shine rashin cigaba
   3 ina jin cewa ni na kasa a rayuwata
4. 0 ina jin nagamsu da abubuwan da nasabayi
   1 bana jin dadin abubuwan da nasaba yi
   2 bana jin cikaken dadin kowane abu
   3 bana jin gamsuwa ko damuwa ga komai
5. 0 banajin cewa ni mai laifine
   1 inajin cewa ni mailaifine wani lokaci
   2 inajin cewa ni mailaifine wani lokaci
   3 ina jin cewa ni mailaifine ko da yaushe
6. 0 bana jincewa an ladabtardani
   1 inajin cewa kamar an ladaftar dani
   2 inajiran aladaftar dani
   3 ina jin an ladaftar dani
7. 0 Bana jin an badani a rayuwa
   1 ina jin an bada ni a rayuwa
   2 ina jin bana jin kaina
   3 ina jinn a tsani kaina
8. 0 Bana jin cewa wani yafini
   1 nine nijawo kuskuren na ko rashin gazawata
   2 ina zargin kai game da dukwani abu marasa kyau da ya faru.
   3 ina zargin kai na game da dukwani abu mararsa kyau day a faru
9. 0 bana jin cewa wai inkashe kaina
   1 inajin cewa in kasha kaina amma bana yi.
   2 inason in kasha kaina
   3 inason inkashe kaina innasamu dama
10. 0 Bana kuka kamar yadda na saba
    1 yanzu ina kuka sosai
    2 ina kuka ko da yaushe
    3 zan iya kasha kaina innasamu dama
11. 0 Bana samun damuwa game da abubuwa kamar yadda nasaba
    1 ina samun damuwa kadan
    2 ina samun damuwa ko bakin ciki a lokaci kankani
    3 ina jin damuwa ko da yaushe.
12. 0 Banajin ban damu game da wasuba
    1 ina jin na damu game da wasu
    2 narasa damu game da mutane

3 narasa damu gaba dai game da mutane
13. 0 ina yanke hukunci kamar yadda na saba
1 nabar yanke hukunci kamar yadda na saba
2 ina samun matsala wurin yanke hukunci
3 bana iya yanke hukunci
14. 0 Bana jin cewa ina da matsala
1 Nadamu cewa ina tsuha yanzu
2 Inajin cewa akwai wasu chanji da nasa sona
3 Na yadda cewa ni bani da kyau.
15. 0 ina iya abubuwana nay au da kullum
1 Sai na kara hanzari kamin inyi wasu abubuwa
2 Sai nayi kwazo sosai kamin inyi aiki sosai
3 Bana iya yin kowane aiki
16. 0 ina iya barci kamar yadda nasaba
1 bana iya barci kamar yadda nasaba
2 Ina tashi barci duk bayan awa daya ko biyu kuma bana iya komawa barci
3 Ina tashi barci bayan awa daya kuma bana iya komawa barci
17. 0 Bana jinn a gaji kamar yadda na saba
1 Ina jin gajiya ba kamar yadda na sababa
2 ina jin nagaji wurin yin komai
3 ina jin nagaji gurin yin komai
18. 0 Dandanona yananan kamar yadda yake
1 Dandanona bayada dadi ba kamar yadda yake ba
2 Dandanona ya lalace yanzu
3 Bani da dandano ko kadan
19. 0 Banrage nauyi dayawaba har ma na rage kwananne
1 Na rage fiye da kilo biyar
2 Na rage fiye da kilo goma
3 Kokarin rage nauyi na rasa kilo gomasha biyar
20. 0 Bani da damuwa game da lafiya ta kamar koyaushe
1 Na damu da matsolin na kamar kaikayi, ciwon, kumburinciki
2 Na damu da matsalolina sosai
3 Nadamu da matsalolina dabazan iya tuna komai akai ba
21. 0 ban damu da wani chenji ba game da shawa ta jima'e
1 inada kadan ta jima'e
2 inda shawa da yawa game da jima'e
3 Narasa shawa ga jima'e gaba daya

Appendix 12 Beck Anxiety Inventory
Below is a list of common symptoms of anxiety. Please carefully read each item in the list. Indicate how much you have been bothered by that symptom during the past month, including today, by circling the number in the corresponding space in the column next to each symptom.

	Not At All	Mildly but it didn't bother me much.	Moderately - it wasn't pleasant at times	Severely – it bothered me a lot
Numbness or tingling	0	1	2	3
Feeling hot	0	1	2	3
Wobbliness in legs	0	1	2	3
Unable to relax	0	1	2	3
Fear of worst happening	0	1	2	3
Dizzy or lightheaded	0	1	2	3
Heart pounding/racing	0	1	2	3
Unsteady	0	1	2	3
Terrified or afraid	0	1	2	3
Nervous	0	1	2	3
Feeling of choking	0	1	2	3
Hands trembling	0	1	2	3
Shaky / unsteady	0	1	2	3
Fear of losing control	0	1	2	3
Difficulty in breathing	0	1	2	3
Fear of dying	0	1	2	3
Scared	0	1	2	3
Indigestion	0	1	2	3
Faint / lightheaded	0	1	2	3
Face flushed	0	1	2	3
Hot/cold sweats	0	1	2	3
Column Sum				

Scoring - *Sum each column. Then sum the column totals to achieve a grand score. Write that score here* ____________ .

APPENDIX 13 HAUSA VERSION BECK ANXIETY INVENTORY LISSAFIN DAMUWA NA BECK

	BA KOMAI 0	KADAN AMMA BAI DAMENI BA 1	MATSAKAICI WANI LOKACI BA DADI 2	SOSAI KUMA YANA DAMU NA 3
1. Mijirya ko suka 2. Jin zafi 3.Sarkewar kafafuwa 4.Rashin futawa 5.Tsoron faruwa mumunar alamari 6. Jiwa 7. Bugawar zuciya 8.Rashi natsuwa 9.Firgita ko jin tsoro 10. juyayi 11.Shakewa 12. Warar hannu 13.Rashin natsuwa 14.Tsoron rasa dai 15.Wahalar lumfashi 16. Tsoron mutuwa 17. Tsoro 18. Ciwon ciki 19.Suma 20. Zafin fuska 21. Jibi mai sanyi da zafi.				