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Effectiveness of Regular Resistance Exercises on Muscles Strength of Patients with Stroke: Evidence-Based Practice

A Dissertation by

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Submitted to the Council of College of Nursing University of Babylon in Partial Fulfillment of the Requirements for the Degree of Doctorate Philosophy in Nursing

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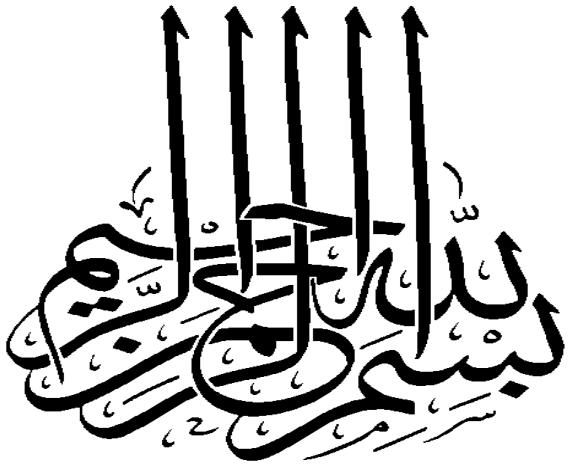

﴿ وَإِذَا مَرِضْتُ فَهُوَ يَشْفِينِ ﴾

صدق الله العلي العظيم

القران الكريم – سورة الشعراء – الآية (٨٠) .

Supervisor Certification

I certify that this dissertation, which is entitled **(Effectiveness of Regular Resistance Exercise on Muscles Strength of Patients with Stroke: Evidence-Based Practice)**, was prepared under my supervision at the College of Nursing, University of Babylon in partial fulfillment of the requirements for the Degree of Doctorate Philosophy in Nursing.

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Dedication

To

- *The memory of my father with respect.*
- *My beloved family; mainly mother, brothers, and sisters with all love and respect.*
- *My wife, & children with all love and respect*
- *My dear friends with my love and respect.*

Mohammed AL-Hchaim

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Abstract

Stroke is one of the foremost reasons leading to mortality and morbidity throughout the world. Also is one of the largest causes of disability and half of all stroke survivors experience a major limitation in daily functioning. The loss of strength after stroke is a common and important impairment. Muscle weakness after stroke is mainly caused by inactivity and non-use extremities.

The study aimed to determine the effectiveness of regular resistance exercise on muscle strength of patients with stroke.

A quasi-experimental design was implemented in the present study by which the patients are assigned into two groups (experimental and comparison groups), and consist of four assessments (Pre-resistance exercise test, and three tests after implementation of regular resistance exercise) for experimental and comparison groups. A non-probability (purposive sample) of (82) patients were included in the present study and divided as (43 patients for the experimental group and 39 patients for the comparison group). All patients are medically diagnosed with stroke disease. The study is conduct in Al-Najaf City/ Al-Najaf Al-Ashraf Health Directorate at Middle Euphrates Neuroscience Center from 7th November 2021 to 2nd April 2023.

Results of the study shows that significant differences in muscle strength at different periods of measurement (first, second and third post-test) at a p-value less than (0.01). Mean of muscle strength score changed from (3.02) at first post-test to (4.67) at third post-test. (This means that the exercise used for patients in the experimental group is an effective way to improve muscle strength after stroke).

The study concludes that the regular resistance exercise implement for at least for six weeks is an effective approach to improving the muscle strength of patients with stroke compared to the comparison group.

The study recommended that a nursing rehabilitation guideline should be prepared and up to date under the supervision of nursing experts to use by the health staff in the ministry of health as a standard in the management of patients with stroke.

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List of Abbreviations and Symbols

Abbreviation	Meaning
ADL	Activity of Daily Living
AF	Atrial Fibrillation
ATP	Adenosine Triphosphate
AVMs	Arteriovenous Malformations
CAA	Amyloid Angiopathy
CHD	Coronary Heart Disease
CNS	Central Nervous System
CPP	Cerebral Perfusion Pressure
CVA	Cerebrovascular Accidents
e.g.	For Example (Example Gratia)
ECG	Electrocardiogram
EDV	End Diastolic Volume
FDA	Food And Drug Administration
HbA1c	Hemoglobin A1c
HF	Heart Failure
HS	Highly Significant
IADLs	Instrumental Activities of Daily Living
ICH	Intracerebral Hemorrhage
IHD	Ischemic Heart Disease
IVT	Intravenous Thrombolysis
L	Litter
m.s.	Mean of Score
MI	Myocardial Infarction
MST	Muscle Strength Testing
n	Sample Number
NS	Non-Significant
p	Page
p.p.	Pages
P.value	Probability Value
PA	Physical Activity
PNF	Proprioceptive Neuromuscular Facilitation
QOL	Quality of Life
RT	Resistance Training
ROM	Range of Motion

S	Significant
SAH	Subarachnoid Hemorrhage
SPSS-19	Statistical Package of Social Sciences-Version 19
TIA	Transient Ischemic Attack
TSH	Thyroid Stimulating Hormone
U.K	United Kingdom
U.S	United States
UTI	Urinary Tract Infection
Vol.	Volume
VTE	Venous Thromboembolism
WHO	World Health Organization
χ^2	Chi-Sequare
%	Percentage
<	Less Than
>	More Than

Chapter One

Introduction

Chapter One

Introduction

Stroke are an umbrella term that refers to a functional anomaly of the central nervous system (CNS) that occurs when the normal blood flow to the brain is disturbed. Cerebrovascular disorders are most often associated with stroke and traumatic brain injury. Stroke is the most common cerebrovascular disorder in the United States, and it is the third leading cause of mortality in the country, after heart disease and cancer (Pandit, 2020). One in every five persons who have a stroke dies within the first 30 days, and more than 40% of those who survive are left functionally dependent at six months. In most cases, these individuals have an atherosclerotic disease as well as conventional vascular risk factors such as hypertension, diabetes, dyslipidemia, obesity, and physical inactivity, which are also present in patients with coronary heart disease (CHD), (Wang, *et al*., 2019).

Stroke has been depicted as a deadly illness with high death and recidivism rates, as well as the potential for life-ending consequences. Among adults, the sequelae of stroke are considered the most common causes of disability (Aidar *et al*., 2016).

Reduced stability affects 80% of those who have had a stroke for the first time, which is linked to poor recovery of daily living activities and mobility as well as a higher risk of falling. Stiffness and difficulty transferring weight to the afflicted side while sitting or standing are all signs of stroke-related asymmetry in the trunk and pelvis. They also have a

lower degree of trunk performance compared to healthy people. Disruption of the patient's ability to maintain a stable/dynamic equilibrium and to engage in fundamental physical activities diminishes their quality of life (Lee, *et al*., 2019). One of the primary reasons for long-term impairment in adults globally is stroke, and the optimization of therapy management in these patients has a high socio-economic importance (Mozaffarian *et al*., 2015; Veldema and Jansen, 2020).

According to studies on the health issues that follow a cerebrovascular accident (CVA), up to 96% of all patients who are hospitalized with a CVA have one or more medical or neurological issues while they are there. Aspiration pneumonia, urinary tract infections (UTI), falls after CVA, bed sores or pressure ulcers, constipation, and pressure ulcers are the most frequent medical consequences. Fewer individuals seem to have symptomatic venous thromboembolism (VTE), within the first two weeks after a CVA, the majority of medical issues occur (Tanovic, *et al*., 2014).

Nervous system control problems due to brain injury in both central and peripheral mechanisms that characterize muscle changes, such as skeletal changes, adaptations, and compensatory patterns due to inactivity and indolence, affect muscle weakness (Cai *et al*., 2019).

After a stroke, around two-thirds of patients have arm paresis (and hence restricted hand-arm function), resulting in diminished upper extremity function, and six months after the stroke, about half of all patients still have no function in the afflicted arm. To lessen this load, a

large number of stroke victims undergo comprehensive therapy as soon as possible. Despite this, only 5% to 20% of patients achieve full functional recovery; in other words, four out of five patients leave rehabilitation with limited arm functionality. Thus, there still exists an urgent need for new inpatient and outpatient rehabilitation and training strategies that match the specific needs of stroke survivors and their relatives (Mehrholz *et al*., 2018).

The loss of strength after a stroke is a common and important impairment. The average strength of the affected upper and lower limb in people who have had a significant stroke ranges from 30 to 50% of age-matched controls. This lack of strength may have a significant impact on one's ability to engage in previously possible activities. Therefore, it is important to know which interventions are effective for improving strength after stroke. In persons without disabilities, progressive resistance exercise may be used to increase strength. In those who have had a stroke, it can be used to increase strength. It is important to note that resistance exercise is defined by the muscles functioning at high weights with low repetitions, such as 8 to 12 repetitions maximum for at least two sets with a gradually increasing load over time (Sousa *et al*., 2018).

Walking is one of the most important problems that patients face after a stroke, as it is one of the important activities of daily living and movement regime. In particular, hemiparesis after a stroke sharply reduces the amount of muscle used during physical activity. It has a negative effect on reducing walking speed (Dragin *et al*., 2014).

Muscle weakness after a stroke is mainly caused by inactivity and disuse, which reduces the amount of force a muscle can generate due to reduced movable motor units and a reduced cross-sectional area of the muscle.

Resistance exercise and Proprioceptive Neuromuscular Facilitation (PNF), is a technique that stimulates muscles, tendons, and joints to improve motor function and increase strength, flexibility, and balance. The basic principle used in PNF is that muscle contraction can be induced by simultaneously applying various patterns in spiral and diagonal directions. Resistance exercise improves muscle strength by inducing higher levels of neuromuscular activation (Bruton and O` Dwyer, 2018).

Poststroke gait disturbance is associated with muscle weakness, impaired coordination and balance, reduced sensation, and spasticity of the affected limbs. Lower limb muscle weakness is a major predictor of ambulatory performance; in particular, muscle strength during extension of the knee on the affected side is strongly correlated with gait function. Physical inactivity and an immobility-related deconditioned state may emerge from poststroke functional impairments such as postural imbalance and muscular weakness (Lee *et al*., 2018).

After a stroke, muscle weakness is widely documented as the principal deficit that impairs walking ability. As a result, post-stroke gait therapy should prioritize improving leg strength. To improve muscle weakness after a stroke, strength exercise is an effective intervention, and as a result, stroke clinical practice guidelines around the world recommend

strength exercise, including progressive resistance exercise, for people who present with muscle weakness after stroke (Dorsch *et al*., 2018; Tole *et al*., 2020).

A balanced diet and regular physical exercise are essential factors in reducing the risk of having a second stroke. Diets low in sodium and based on the Mediterranean diet are advised for lowering the risk of stroke. Patients who have had a stroke are more vulnerable to sedentary and extended sitting habits, and they should be encouraged to engage in physical activity under the supervision of a healthcare professional. It takes more than just basic advice or a pamphlet from their healthcare providers to help patients change their habits, such as their diet, exercise, and medication compliance. Programs that use theoretical models of behavior change, proven techniques, and multidisciplinary support are needed (Kleindorfer *et al*., 2021).

Recent years have seen a rise in interest in the benefits of physical activity and exercise on brain health. physical activity and exercise, according to some studies, not only improve neurological and cardiovascular health but may also assist to slow down cognitive decline and lower the chance of developing dementia. Physical activity and exercise, in addition to being a modifiable risk factor for stroke, may also have neuroprotective properties. More physical activity and exercise before a stroke are related to a reduction in stroke severity whereas post-stroke physical activity and aerobic exercise may play a significant role in rehabilitation and neuroplasticity (Kramer *et al*., 2019).

Physical fitness may be divided into two categories: health-related and skills-related fitness. Physical fitness has two components: one is health-related physical fitness, which includes cardiorespiratory and muscular endurance, muscular strength, body composition, and flexibility; and the other is skill-related physical fitness, which is more focused on athletic performance and includes agility and balance as well as coordination, speed, power, and reaction time (Fini *et al*., 2017).

Exercise is a planned, organized, and repeated kind of physical activity that may be referred to as therapeutic exercise when intended and recommended by physicians to attain particular therapeutic purposes (Holden *et al*., 2020). After a stroke, physical fitness training is safe and increases walking speed and balance. However, less attention has been paid to whether exercise can reduce secondary vascular risk (Wang, *et al*. 2019).

Resistance exercise using elastic bands provides continuous and appropriate resistance at various angles where the whole movement is performed in several ergonomic movement directions so that functional movement and muscle strength improvement rather than fragmentary movement are possible (Kang, *et al*., 2017).

In order to increase muscle growth and strength, fitness and medical experts often use elastic resistance as a kind of resistive training. Resistance may be created in whichever direction the band is stretched, which gives elastic resistive bands a special benefit. In contrast, lifting free weights against gravity is required to provide the necessary resistance when using them as the preferred kind of resistance. By stretching the

elastic band, elastic resistance is produced linearly, and the stiffness of the band and the length of the employed elastic band are directly inversely correlated with the elastic resistance (Picha *et al*., 2019).

1.1. Importance of the Study:

Stroke is the third-ranking cause of death, with an overall mortality rate of 18 % to 37 %. There are approximately two million people surviving strokes that need assistance with activities of daily living (World Heart Federation, 2016). Globally, stroke is the second leading cause of death above the age of 60 years, and the fifth leading cause of death in people aged 15 to 59 years old. Every year, 15 million people worldwide suffer a stroke. Nearly six million die and another five million are left permanently disabled. Although stroke is the fifth largest cause of death in the world, it remains the top cause of disability. By 2030, there will be over 12 million stroke fatalities and 70 million stroke survivors in the world, according to the World Health Organization. Stroke has a negative impact on the quality of life of patients (Alamri, *et al*., 2019).

Stroke is the second leading cause of disability, after dementia. A disability may include loss of vision and / or speech, paralysis and confusion (Pandit, 2020).

In the United States (US), many stroke survivors suffer from medical consequences and incapacity for a lengthy period after their recovery from the stroke. There are about 795000 people who have a stroke in the U.S. each year, with 87 percent (690000) being ischemic and 185000

being recurring in nature. On an annual basis, around 240000 people suffer from a transient ischemic attack (TIA). However, with adequate secondary stroke prevention, the chance of having another stroke or TIA. may be reduced (Kleindorfer *et al*., 2021).

Between 2003 and 2015, the prevalence of stroke in Australia remained consistent at 1.7 percent, whereas the number of people who die as a result of a stroke has decreased. A similar pattern has been seen in both the United States and Europe. However, despite the fact that fewer people are dying from stroke, around two-thirds of stroke survivors need some kind of support in their daily life. Stroke may be prevented in around 80 percent of cases if modifiable risk factors are addressed. Regular physical activity (PA) is one of these modifiable risk factors for stroke, with increased levels of regular PA being associated with a lower risk of stroke. The health advantages of regular exercise and PA are widely documented (Kramer, *et al*., 2019).

Stroke is one of the most common health problems in the United Kingdom (UK). It accounted for over 56,000 deaths in England and Wales in 1999, which represent 11% of all deaths. Most people survive a first stroke, but often have significant morbidity. Every year, around 110,000 individuals in England suffer from either their first or subsequent stroke, and an additional 20,000 people get a transient ischemic attack (TIA). More than 900,000 people in England are impacted in some way by the aftereffects of having a stroke, with more than half of those impacted needing the aid of others with their day-to-day activities. (Virani *et al*, 2021).

After heart disease and cancer, stroke is the third leading cause of death in the Western world, and it is responsible for around 20% of all deaths that occur among the older population. Stroke is the most prevalent cause of brain injury that results in lifelong disability (Newman, *et al*., 2014).

Stroke is becoming a major cause of morbidity and death in Saudi Arabia, and it is growing at an alarming rate. According to recent numbers released by the Saudi Society of Stroke, the incidence of stroke in the Kingdom has increased to around 20 thousand cases each year. The King Abdul Aziz University Hospital in Jeddah, Saudi Arabia, recorded 50 to 100 stroke patients on any given day, according to the findings of a workshop on the condition that was held there. Each year, there are about 20,000 new cases reported in Saudi Arabia, of which 4,000 are fatal and 8,000 result in neurological and motor impairments that impair the patient's mental abilities. Blood clots in the brain, which prevent oxygen from reaching certain areas of the brain and impair its ability to function normally, are responsible for 69% of stroke cases (S. S. A., 2017).

In Iraq, stroke is becoming more and more common as a health problem. A number of people who go to Iraqi hospitals: 23442 in 2013, and 28876 in 2014. This number was based on the Ministry of Health's Annual Report for 2013. There were 14315 stroke deaths in Iraq in 2017, which is 8.13 percent of all deaths in the country (WHO, 2017).

Individuals of all ages and both sexes may minimize their risk of having a stroke by engaging in frequent leisure-time physical activity (Prior

and Suskin, 2018). Rehabilitation is a systematic and continuing process, in which nurses play an essential part in the care of stroke patients, and through which they can reduce the consequences that follow a stroke while also improving the patient's health condition. Additionally, they are able to enhance the patient's self-management by transferring skills learned in treatment into useful activities outside of therapy (Kirkevold, 2012).

Regular resistance exercise (RRE) is defined as muscular activities performed against an external load on a regular basis. It may be easier to implement and maintain in the home environment than aerobic exercise because it provides an alternative mode of exercise for adults who have limited space, access to equipment, and time availability compared to aerobic exercise. Most studies of RRE. have focused on changes in skeletal muscle size and strength, with few investigating cardiometabolic health effects as primary outcomes although several have reported cardiometabolic variables as secondary outcomes. Resistance training has long been recognized as a means of promoting favorable changes in muscle morphology (e.g., muscle growth) and muscular function (e.g., strength, power, and strength endurance) in individuals (Raymond *et al*., 2013; Ashton RE, *et al*. 2020).

In Iraq, there are relatively few studies that concentrate on nursing rehabilitation, and even fewer that do so especially for patients who have had strokes. In order to address this deficiency in nursing research, the current study focuses its attention on the most significant aspect of nursing studies. The problem statement of the current thesis is the Effectiveness of Regular Resistance Exercise on Muscle Strength of Patients with Stroke.

1.2. Statement of the Problem:

Effectiveness of regular resistance exercises on muscle strength of patients with stroke.

Stroke has a significant effect on patient health and responsible for many health problems that involve all the body systems. Moreover, patients with stroke commonly facing a muscle weakness or/ and muscle paralysis. The muscle weakness associated with stroke is a chronic condition that affecting a patient's activity of daily living & quality of life. When this problem continue, the patient can't return to their society as an active person because their independency level is decreased. Muscle weakness is treated by many therapeutic modalities. One of the therapeutic modality is an exercise. The nurse plays an important role in improving muscle strength in patients with stroke. The present study is designed to improve muscle strength among patients with stroke through a non-pharmacological modality. There are no previous studies in Iraq focus on such problem. Therefore, the present study fill a gap in nursing research.

1.2.1. Hypothesis of the study:

Patients who attend the regular resistance exercise exhibit improving in muscle strength compared with those patients who don’t attend the exercise training.

1.2.2. Study Objectives:

1. To determine the effectiveness of regular resistance exercise on muscle strength through:

- Assess muscle strength of upper and lower extremities at (pre-test, post-test 1, 2 and 3)

2. To determine the influence of demographic and clinical data on the effectiveness of the regular resistance exercise.

1.3. Definitions of Terms:

1.3.1. Resistance exercise:

Theoretical Definition:

Any activity requiring physical exertion and causing muscles to contract against an external resistance in the hopes of increasing their strength, mass, or endurance qualifies (Kotecki, 2018).

Operational Definition:

It is a kind of physical exercise that generates muscular contraction against external resistance in order to enhance muscle strength in patients who have had a stroke.

1.3.2. Muscle Strength:

Theoretical Definition:

The capacity of a muscle group to generate maximum contractile force against a resistance in a single contraction (Williams, et al., 2018).

Operational Definition:

Refers to the reduced capacity of a muscle or muscle group to generate force during a voluntary contraction as a result of neurological deficits from the stroke.

Chapter Two

Review of Literature

Chapter Two

Review of Literatures

2.1. Stroke Overview:

Stroke is one of the most common causes of mortality and disability on a global scale.), and that it represents a significant global healthcare burden (Lozano et al., 2012). It is defined by the World Health Organization (WHO) as a clinical syndrome characterized by rapidly developing clinical symptoms and/or signs of focal and sometimes global loss of cerebral function, with symptoms lasting more than 24 hours, resulting in disability and/or death from vascular origin. (Al-Ibraheemi and AL-Bayati, 2018).

Stroke also, is one of the leading causes of death and disability acquisition all over the world, especially in the developing countries (Thrift, 2017). In the majority of instances, survivors of strokes are left with a range of symptoms that impact motor function, speech, swallowing, vision, emotion, and cognition. Recovery may be delayed, and in some circumstances, it may be incomplete (Crichton *et al*., 2016; Laver *et al*., 2020). Because of these symptoms, many individuals have trouble keeping their actions under control, and as a result, they are unable to fully engage in the lives of their families and communities. Almost half of those who survive a stroke go on to engage in some kind of therapy after they are discharged from the hospital (Gonsalves *et al*., 2020; Laver *et al*., 2020).

Stroke is a severe and rapidly expanding global health problem. Stroke is the second leading cause of mortality in middle-to-high-income countries and the main cause of acquired physical disability in people globally. The total incidence of ischemic and hemorrhagic stroke in these nations has grown over the previous decade to 85-94 per 100,000, but it is

significantly higher (1151-1216 per 100,000) among those over 75 years old. Furthermore, low-income nations account for 85 percent of all stroke fatalities and 87 percent of stroke-related disability-adjusted life-years. (Murphy and Werring, 2020).

In today's, the young and middle-aged are more likely to get a stroke, which makes them more disabled (Sofer, 2016). People who get better even if the treatment works for the majority of them still have a hard time getting back to their normal lives and jobs. There is a risk that many social institutions, such as the family and even the government, could fall apart (Skirtach and Pokul, 2020). According to the W.H.O., stroke is responsible for the deaths of 17 million people annually, which accounts for almost one third of all deaths (Bhuvaneshwari and Somiya, 2020).

Stroke is the sixth leading cause of mortality in the United States (US), and sixty percent of strokes occur outside of hospitals. One person has a stroke every forty seconds, and another person loses their life as a direct result of a stroke every four minutes. Having a stroke is one of the most common causes of disability in the world now (Benjamin *et al*., 2017). In the United States, there are 800,000 new strokes each year. Stroke is the fifth most common cause of death and the first most common cause of long-term disability in the U.S. (Reinemeyer *et al*., 2021).

Over 80,000 people in England are admitted to hospitals each year after suffering an acute stroke; more than half of these patients are left with a long-term disability, which results in huge financial burdens for both the patients and society (Flynn *et al.,* 2017). Following an ischemic stroke, reperfusion therapy such as intravenous thrombolysis (IVT) and mechanical thrombectomy can reduce the likelihood of permanent impairment and the need for institutional care. In the UK, these therapies were provided to 11.7 percent and 1.8 percent of acute stroke patients,

respectively, in 2019–2020. (Allen *et al*., 2021).

In India, the prevalence of stroke is projected to be 18,012,222 per 100,000 people, with a total population of 1,06,570,6075 people. Following recent research, it was discovered that the annual age-balanced incidence rate of stroke in the urban network of Kolkata was 105 per 100,000 people whereas it was 262/100,000 in the provincial network of Bengal (Bhuvaneshwari and Somiya, 2020).

The World Health Organization has published information that the troke was the second biggest cause of death in Saudi Arabia in 2012, accounting for 14,400 of the country's total deaths. Research indicates that the average age of a person who has their first stroke in the Kingdom is 63 years old, compared with age of 69 years in the United States and around 70 years in England (Al-Senani *et al*., 2020).

Estimates indicate that 87.8% of all fatalities in Iraq in 2013 were caused by stroke. Since 1990, the annual stroke fatality rate per 100,000 people in Iraq has decreased by 16.9 percent, which is equivalent to a fall of 0.7 percent on average per year. In Iraq women who reach the age of 70 or older, they have the highest risk of dying from a stroke; the mortality rate for strokes among women in 2013 was 3,060.4 per 100,000 women. The peak mortality rate for females was higher than the peak mortality rate for males, which was 2,471.1 deaths per 100,000 men. When measured in terms of years of healthy life lost per 100,000 men, the health burden of stroke on males in Iraq reaches its highest point around the age of 85. The highest incidence of strokes in Iraq may be attributed to females over the age of 70. (Raza, 2020).

Competing the mortality rate of stroke in Iraq with other locations in North Africa and Middle East. Learn how it has changed over time in each location. Interact with the filters to see how the deadliness of stroke

varies for specific demographic groups within these locations. In Egypt, Tunisia, Yemen, Syria, Turkey, Libya, Algeria, Iraq, Sudan and Lebanon the mortality rate per 100,000 patients was 104.7, 68.8, 62.6, 60.2, 60.1, 59.3, 57.3, 51.5, 50.9 and 43.1 as the percentage changes during 1990-2013 were -7%, 42%, -4%, -16%, -10%, 36%, 16%, -17%, -16% and -24% respectively (Health Grove, 2017).

2.2. Theoretical Framework:

In this study, the researcher used the theory of self-care deficit as a theoretical framework. The researcher concentrated on enhancing the patients' self-care activities, hence this idea was involved.

The Theory: Self-care deficit nursing theory

The Theorist: Dorothea E. Orem

Dorothea Elizabeth Orem, one of America's foremost nursing theorists, was born in Baltimore, Maryland (Berbiglia and Banfield, 2013). She received her diploma in nursing from Providence Hospital School of Nursing in Washington, and her baccalaureate degree in nursing from Catholic University in 1939. In 1945, she also earned her master's degree from Catholic University (McEwen and Wills, 2019).

Major Assumption of Orem's Theory:

1- Humans require continuous, deliberate self-care for health, development, and well-being. (Smith and Marilyn, 2015).

2- Individuals have the power to make decisions about their self-care by identifying needs and taking specific actions (Chattanooga, 2016).

3- Successfully meeting universal and development self-care requisites is an essential component of primary care prevention and ill health.

4- Nurses maintain an individual's capacity for self-care and assist when he or she is unable to do so (Johnson and Webber, 2015).

5- Self-care and dependent care are both behaviors learned within a socio cultural context element.

The general theory is composed of three interrelated theories are:

1. Theory of self-care,
2. Theory of self-care deficit,
3. The theory of nursing systems.

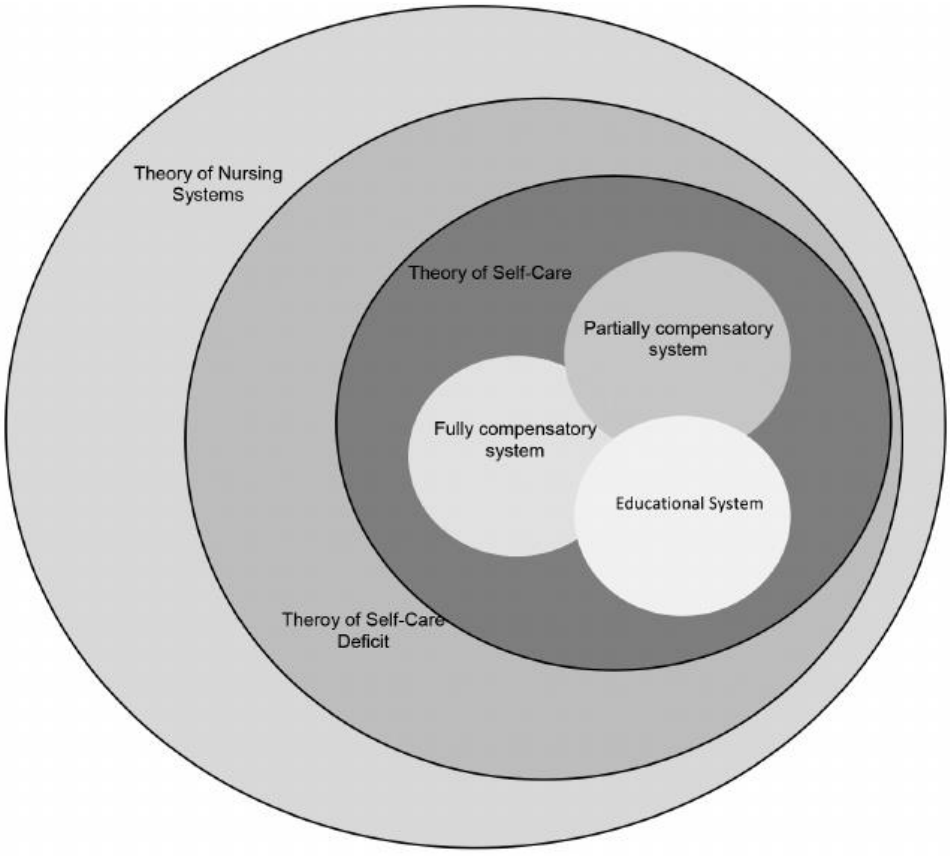


Figure 2-1: Self-Care Deficit Nursing Theory (Orem, D. 2001).

2.2.1. Theory of self-care:

The main idea shows how self-care is different from other kinds of care. Self-care, or care for oneself, must be learned and be deliberately performed for life, human functioning, and well-being (Smith and Marilyn, 2015). Explains why individuals take care of themselves and incorporates the concepts of therapeutic self-care desire, self-care agency, and fundamental conditioning elements. Self-care needs are also part of the theory and give people a way to take care of themselves (Chattanooga, 2016). Orem's general theory of self-care for nurses can be seen in the (figure 2-7).

The three classifications of self-care requisites are:

• Universal self-care requirements, also known as activities of daily living, such eating, relaxing, sleeping, and interacting with others;

• Developmental requirements, which are linked to responding to life's transitions like going to college, landing a job, getting married, and growing old.

• Prerequisites for health deviations, such as trauma, surgical procedures, and the need for crutches after breaking a leg (George, 2014).

2.2.2. Theory of self-care deficit:

The central idea describes why people need nursing care (Smith and Marilyn, 2015). Orem specifies five methods that nurses use to help meet the self-care needs of the patient:

2.2.2.a. Acting for or doing for another,

2.2.2.b. Guiding and directing,

2.2.2.c. Providing physical or psychological support,

2.2.2.d. Providing and maintaining an environment that supports personal development,

2.2.2.e. And teaching (johnson and Webber, 2015).

The first technique may take into account all three of the aforementioned requirements universal, developmental, and health deviation, but the other four ways are just concerned with the health deviation requirements (Masters, 2014).

2.2.3. Theory of nursing systems:

Nursing systems: Defines and explains the three systems which can be used to reach the self-care requirements and build the self-care of the patients. The system's selection depends on the nurse's assessment of the patient's abilities to conduct self-care exercises (Meleis, 2012).

2.2.3.a. In the wholly compensatory system: the patient cannot perform any self-care actions and depends on the nurse to perform them; (McEwen and Wills, 2019).

2.2.3.b. In the partially compensatory system: both patient and nurse perform self-care actions, with the major role shifting from the nurse to the patient as the self-care demand changes (Alligood, 2017).

2.2.3.c. In the support-educational system: the nurse's function is to promote the patient as the self-care agent. The patient can perform self-care but cannot do so without assistance from the nurse in decision-making and acquiring knowledge and skill learning. For example, patients with newly diagnosed diabetes can eat but need help in selecting an appropriate diet (Johnson and Webber, 2015).

As they learn and use the information and skills, they move toward caring for their healthcare requirements. As the balance shifts from self-

care abilities to self-care demands, the nursing agency is needed. (McEwen and Wills, 2019). In addition, in the present study, the researcher depends on all the theory approaches supportive-education system to help patients to meet their physical needs.

Orem's theory application by nursing process: implementing the theory of self-care deficiency depends on three main steps are:

Step one: Assessment and diagnosis are used to determine why a patient needs therapy or care. The study instrument is used to complete the first stage, during which the researcher evaluates and examines the demographic and clinical information about the patients. In addition, the patients' muscle strength is measured through using a Muscle Strength Testing Scale.

Step two: Design and develop a nursing system and plan care delivery.

Step three: Management of nursing systems - planning, initiating, and controlling nursing actions includes (intervention and evaluation).

The second and third steps are dependent on the first step and include clinically implementing Orem's idea. The researcher identified the patient's problems (nursing diagnosis) and then designed the appropriate approach (intervention) to improve the patient's physical performance and resolve the patient's problems (Bicakci et al., 2015).

In addition, during the present study, the researcher focused on the theory of self-care deficit to employ the following methods:

1. Guiding and directing.
2. Giving the patient physical assistance by showing them how to do regular resistance exercises (McEwen and Wills, 2019).

2.3. The following nursing diagnosis was adopted from NANDA based on the assessment phase:

2.3.1. Ineffective exercises related to impaired physical performance.

2.3.2. Impaired physical mobility related to decrease in muscle function (reduction in muscle strength).

In addition, the researcher achieves the second step through selecting and applying the resistance exercise training method as an effective and efficient physical rehabilitation technique. The third step is achieved through applying the resistance exercise training methods. After the complete application of the resistance exercise method based on Orem's theory, the researcher applies the different ways of application of that theory mentioned previously.

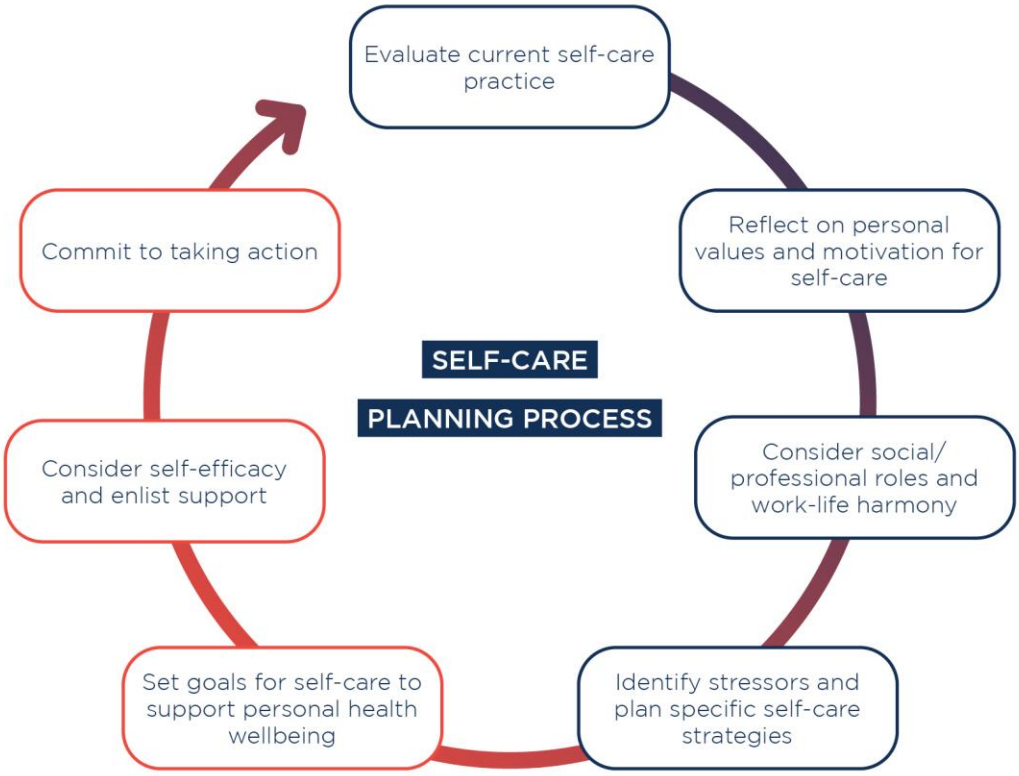


Figure 2-2: Self-care planning process adapted from (Miller, *et al.*,2017).

2.4. Application of Self-Care Theory through the Nursing Process:

The application of the nursing process can be shown in the figure 2.2.

2.4.1. Assessment Step: The first phase of the nursing process is assessment. This phase includes gathering data about the patient's health status. This data can be collected in a variety of ways (White et al., 2013).

In the current study, the assessment phase includes collecting data about the stroke patients' physical activity through the muscle strength testing scale before using a regular resistance exercise program.

2.4.2. Diagnosis Step: The diagnosis phase involves a clinical judgment about the patient's potential or actual health problem. Multiple diagnoses are sometimes made for a single patient. These assessments not only include an actual description of the problem (e.g., sleep deprivation) but also whether or not a patient is at risk of developing further problems (Narsigan, 2015). These diagnoses are also used to determine a patient's readiness for health improvement and whether or not they may have developed a syndrome. The diagnosis phase is a critical step used to determine the course of treatment (Carpenito, 2013).

During the present study, the researcher determines the following nursing diagnosis according to the data collected during the assessment step, the nursing diagnosis is (Ineffective exercises related to impaired physical performance and Impaired physical mobility related to decrease in muscle function (reduction in muscle strength).

2.4.3. Planning Step: Once a nursing diagnosis is determined, a plan of action can be developed. If multiple diagnoses need to be addressed. Each problem is assigned a clear, measurable goal for the expected

beneficial outcome (Williams and Hopper, 2015).

In the present study, the researcher selected the regular resistance exercise program as a physical rehabilitation technique to improve the physical performance of patients with muscle weakness as result a stroke disease. Additionally, the planning step is formulated based on the nursing diagnosis by which the researcher the partially compensatory system, to minimize patients' suffer and to a chive the health related requests.

2.4.4. Implementing Step: The implementing phase involves the implementation of a nursing care plan, including monitor the patient for signs of change or improvement, directly caring for the patient or performing necessary medical tasks, educating and instructing the patient about further health management, and referring or contacting the patient for follow-up. Implementation can occur over hours, days, weeks, or even months (White et al., 2013).

During the current study, the researcher used the regular resistance exercise training program to the patients to enhance their ability to perform physical performance under the researcher's supervision.

2.4.5. Evaluation Step: Once all nursing intervention has taken place, the evaluation to determine the goals for patient wellness have been determined. The possible patient outcomes are generally described under three terms: the patient's condition improved, the patient's condition stabilized, and the patient's condition deteriorated, died, or discharged. In the event the patient's condition has shown no improvement, or if the wellness goals were not met, the nursing process begins again from the first step (Carpenito, 2013).

2.5. Classification of Stroke:

Hemorrhagic and ischemic strokes are the two most common types.

2.5.1. Ischemic Stroke:

Ischemic stroke, also known as a cerebrovascular sickness (stroke) or brain assault is a sudden loss of function that happens as a result of a disruption in the blood flow to a region of the brain. Other names for this condition include brain attack and cerebrovascular illness.

Ischemic stroke accounts for the vast majority of stroke occurrences (87 percent). It has been suggested to health care practitioners and the general public that a stroke is an urgent health care concern, comparable to that of a heart attack, by using the phrase "brain attack".

With the approval of thrombolytic therapy for the treatment of acute ischemic stroke in 1996 came a revolution in the care of patients after a stroke (Al-Ibraheemi and AL-Bayati, 2018). When administered promptly, thrombolytic therapy for ischemic stroke reduces the severity of stroke symptoms and the amount of function that is lost. After the beginning of a stroke, the sole thrombolytic therapy that has been authorized by the Food and Drug Administration (FDA) in the United States has a treatment window of three hours; nevertheless, scientific statements have recommended its extended usage for as long as four and a half hours (Hinkle and Cheever, 2018). Even if the time for treatment has been extended in certain facilities, there is still a pressing need for the public and healthcare practitioners to expedite the transfer of the patient to a hospital as quickly as possible for evaluation and medicine delivery (Lapchak and Zhang, 2017).

Ischemic strokes are subdivided into five different types based on

the cause:

2.5.1.a. Large artery thrombotic strokes: are kinds of stroke that affects twenty percent of people who have had a stroke and may be linked to cerebral vascular plaques. This might lead to the development of thrombosis as well as ischemia in blood circulation.

2.5.1.b. Lacunar strokes, also known as small penetrating artery thrombotic strokes, may impact up to 25 percent of people who have had a stroke, and they can occur in more than one vessel.

2.5.1.c. Cardiogenic embolic strokes, accounting for twenty percent of all cases. These strokes may be accompanied with cardiac dysrhythmias (atrial fibrillation) and thrombi in the left ventricle. After being formed in the heart, emboli travel to blood arteries in the brain, most often the middle cerebral artery on the left, where they cause a stroke.

2.5.1.d. Cryptogenic strokes, which have unclear reasoning for the occurrence of stroke, it involves (30%).

2.5.1.e. Strokes from other causes account for five percent of all cases. These strokes may be brought on by a variety of factors, such as migraines, the use of illicit drugs, or coagulopathies (Williams, *et al*., 2015; Hinkle and Cheever, 2018).

2.5.1.1. Pathophysiology:

Ischemic brain attacks are caused when there is a disturbance in the normal blood flow to the cerebral cortex as a result of the occlusion of a blood artery. The ischemia cascade is a complicated set of cellular metabolic activities that is triggered when there is an interruption in the normal flow of blood (Fig. 2.4). The ischemic cascade begins when cerebral blood flow decreases to less than 25 mL per 100 g of blood per minute. At this stage, neurons can no longer function to sustain aerobic

respiration. It is therefore necessary for the mitochondria to transition to anaerobic respiration, which results in the production of a significant quantity of lactic acid and a shift in pH (Geng *et al.*, 2018).

This switch to the less efficient anaerobic respiration also renders the neuron incapable of producing sufficient quantities of adenosine triphosphate (ATP) to fuel the depolarization processes. The membrane pumps that maintain electrolyte balances begin to fail, and the cells cease to function. Early in the cascade, an area of low cerebral blood flow, referred to as the penumbra region, exists around the area of infarction. The penumbra region is ischemic brain tissue that may be salvaged with timely intervention.

In the area known as the penumbra, there is ischemic brain tissue that, if treated quickly enough, may be saved (Kuriakose and Xiao, 2020).

Ischemic cascade poses a hazard to cells in the penumbra due to the fact that membrane depolarization of the cell wall leads to an increase in intracellular calcium and the release of glutamate. If they persist, the inflow of calcium and the release of glutamate will activate a variety of harmful pathways, causing the cell membrane to deteriorate, the release of even more calcium and glutamate, vasoconstriction, and the generation of free radicals. Because of these processes, the area of infarction extends into the penumbra, which results in an increase in the duration of the stroke. A person who is suffering a stroke would ordinarily have a loss of 1.9 million neurons per minute if a stroke is not treated, and the brain of an ischemic patient will age by 3.6 years per hour if treatment is not received. If treatment is not obtained, a stroke victim will normally have a loss of 1.9 million neurons per minute.. (Hinkle and Cheever, 2018).

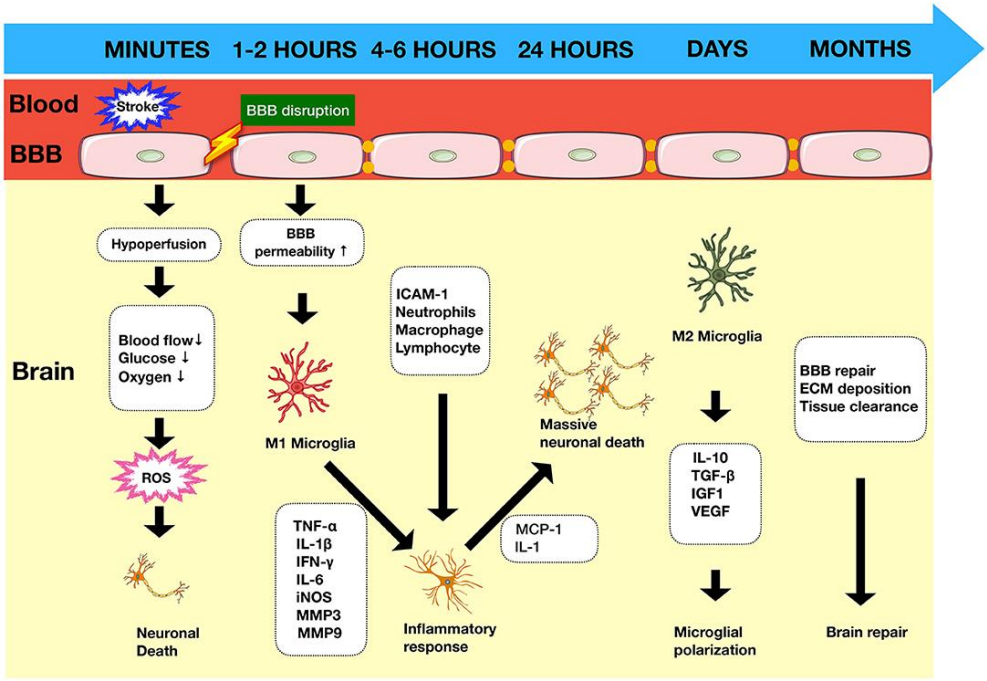


Figure 2-3: Adaptive Immunity Regulation and Cerebral Ischemia adapted from (Qin, *et al.*, 2020)

2.5.2. Hemorrhagic Strokes:

Hemorrhage occurs for around 13% of all strokes, and are primarily caused by intracranial (7%), subarachnoid hemorrhage (8%), and other causes. Hemorrhagic strokes are caused by bleeding into the brain tissue, the ventricles, or the subarachnoid space. Uncontrolled hypertension is the leading cause of primary intracerebral bleeding from a spontaneous rupture of tiny arteries, which accounts for around 80% of hemorrhagic strokes. In nearly half of the instances, subarachnoid hemorrhage is caused by a burst intracranial aneurysm (Rass and Helbok, 2019).

Another common reason for primary intracerebral bleeding in older persons is a condition known as cerebral amyloid angiopathy (CAA). This condition is characterized by the presence of damage brought on by the deposition of beta-amyloid protein in the brain's smaller and medium-sized blood vessels. The CAA causes these blood vessels to become unstable, making them more prone to bleeding. Some medical diseases, such as

arteriovenous malformations (AVMs), intracranial aneurysms, and intracranial neoplasms, as well as specific medicines (such as anticoagulants and amphetamines), have the potential to cause secondary intracerebral hemorrhage. In certain circumstances, the mortality rate after a brain hemorrhage has been estimated to be as high as fifty percent of all cases. individuals who have had an ischemic stroke often have more severe impairments and a lengthier recovery phase than individuals who are able to survive the early phase of therapy for their condition (Rammos *et al*., 2016; Hinkle and Cheever, 2018).

2.5.2.1. Pathophysiology

2.5.2.1.a. Intracerebral Hemorrhage (ICH)

It refers to the bleeding that occurs in the brain tissue as a result of a rupture in a blood vessel. This most often occurs in individuals who suffer from hypertension and cerebral atherosclerosis as a result of degenerative changes. Other factors that might lead to this kind of bleeding include the presence of brain tumors, certain kinds of vascular disorders, and the use of medicines. The key regions of the brain that are susceptible to bleeding include the thalamus, the brain lobes, the basal ganglia, the pons, and the cerebellum. Because of the bleeding and hemorrhaging that may occur in the intraventricular region, the wall of the lateral ventricle can sometimes burst, which ultimately results in the patient's passing (Boccardi, *et al*., 2017).

2.5.2.1.b. Intracranial (Cerebral) Aneurysm

It is characterized by dilatation, which is then followed by the weakening of the artery walls of the brain, and the reason for this condition is unclear. Atherosclerosis may cause the vessel wall to become weakened and damaged, which can contribute to the occurrence of this complication.

Other factors that might contribute to bleeding include high blood pressure, a congenital abnormality in the arterial wall, advanced age, or trauma to the head. In most cases, aneurysms develop close to the intersections of the major arteries at the circle of Willis. Multiple cerebral aneurysms are the most common (Omofoye *et al*., 2018).

2.5.2.1.c. Arteriovenous Malformations (AVMs)

Arteriovenous Malformations (AVMs) are most frequent in young individuals, and most AVMs are caused by faulty fetal development, which produces a twisting of the brain arteries and veins, as well as the lack of a tiny vessel bed, which causes vessel wall dilatation and eventually tears (Grossman & Porth, 2014).

2.5.2.1.d. Subarachnoid Hemorrhage

This bleed has occurred in the subarachnoid area of the patient's brain. This may be the result of head trauma, an arteriovenous malformation (AVM), high blood pressure, or an intracranial aneurysm. Bleeding from an aneurysm in the circle of Willis region of the brain, which is situated in the brain, is the most common cause (Hinkle & Cheever, 2018).

2.6. Strokes may also be categorized based on the duration and progression of symptoms as follows:

2.6.1. A transient ischemic attack, often known as a TIA, is a brief instance of neurologic impairment that is immediately characterized by a loss of sensory, motor, or visual function. It may last a few seconds or minutes, but less than 24 hours. In most cases, complete healing takes place in the time between assaults. symptoms that a patient experiences as a consequence of atherosclerosis, a tiny embolus that blocks cerebral microcirculation, a transient drop in cerebral perfusion pressure (CPP),

or cardiac dysrhythmias. The momentary deterioration of the blood flow to a particular region of the brain associated with a drop in CPP may be the source of these symptoms. It is regarded as a warning of an impending stroke, the frequency of which is greatest in the first 30 days following the first attack. In a patient who has had transient ischemic attacks in the past, failure to diagnose and treat the condition might result in a stroke with lifelong impairments (Grossman & Porth, 2014; Boccardi, *et al*., 2017).

2.6.2. Stroke in Evolution: deterioration of neurologic clinical characteristics over a period of time, which might range from minutes or hours to as many as three days. This is a stroke progressing.

2.6.3. Completed Stroke: steadying of the neurologic features. This indicates no more the defect of oxygen that supplying brain tissue from this particular ischemic event (2018; Shah *et al*., 2019).

Table (2.1): Comparison of the Main Stroke Types

Type of stroke	Causes	Main presenting symptoms	Function recovery
Ischemic.	▪ Large artery thrombosis ▪ Small presenting ▪ Cardiogenic embolic ▪ Cryptogenic (no known cause) ▪ Others	Specifically on one side of the body, the face, arm, or leg may be numb or weak.	Usually plateaus at 6 months
Hemorrhogic	▪ Intracranial bleeding ▪ Subarachnoid bleeding ▪ Cerebral aneurysm ▪ Arteriovenous malformation	Headache Decrease level of conscious	Slower usually plateau at 18 month

Adapted from Hinkle and Cheever (2018).

2.7. Etiology and Risk Factors of stroke:

The most common causes of stroke include ischemic stroke usually due to large or branch artery occlusion by thrombosis or embolism from a proximal source in the heart, aortic arch, or extra cranial carotid and vertebral arteries. Hemorrhage stroke resulting from hypertensive vascular disease (which causes an intracerebral hemorrhage), a ruptured aneurysm, or an atria venous malformation (Leary and Yacoub, 2017).

People who are above the age of 65 years accounts for roughly two-thirds of all cases of stroke, which may be caused by advanced age. The chance of having a stroke may be increased by several conditions among which systolic or atrial fibrillation, diastolic hypertension, dyslipidemia, inactivity, and diabetes are the most prevalent. In terms of inherited variables, it also seems to be important for understanding the pathophysiology of stroke. The majority of strokes, on the other hand, are brought on by a combination of environmental factors and polygenic risk factors. Stroke risk factors can be clearly shown as follows (Aminoff, *et al*., 2015).

2.7.1. Risk factors for stroke:

Risk factors are classified into two groups (Non-modifiable and Modifiable risk factor) as follow:

2.7.1.a. Non-modifiable risk factors

1. **Age:** This is the most significant factor that may increase the chance of having a stroke. After age 55, the incidence rate increases by a factor of two every decade.

2. **Sex:** As a result of the dangers associated with pregnancy and the use of oral contraceptives, premenopausal women have a risk of stroke

that is equal to or even greater than the risk that males have. At older ages stroke rates are somewhat greater in males. Strokes affect more women than males in the United Kingdom as a whole.

3. **Ethnicity:** In the U.K and U.S., African Caribbean people have double the chance of having an incident stroke as their white counterparts. The risk of ICH is twice as high in younger black adults as it is in age-matched white individuals. This might be related to the greater incidence of stroke risk factors among African Caribbean populations, such as uncontrolled hypertension, obesity, and diabetes. The risk of carotid stenosis is higher in Caucasians, metabolic syndrome is more prevalent among South Asians and Pacific Islanders, and East Asian groups have higher rates of intracranial stenosis and ICH.

4. **Genetics:** Along with the single-gene diseases associated with stroke (CADASIL, CARASIL, Fabry's disease, homo cystinuria, sickle cell disease, and connective tissue disorders), the mega stroke consortium also identified 32 genome-wide important loci, 22 of which were unique. It was discovered that these loci were linked to an elevated risk of stroke. Specific stroke causes, such as major artery disease, small artery disease, and cardiac embolism, were significantly 0associated with several loci, according to research. The largest link was found for blood pressure, whereas 50% of the loci revealed a common genetic relationship with other vascular diseases (Murphy and Werring, 2020).

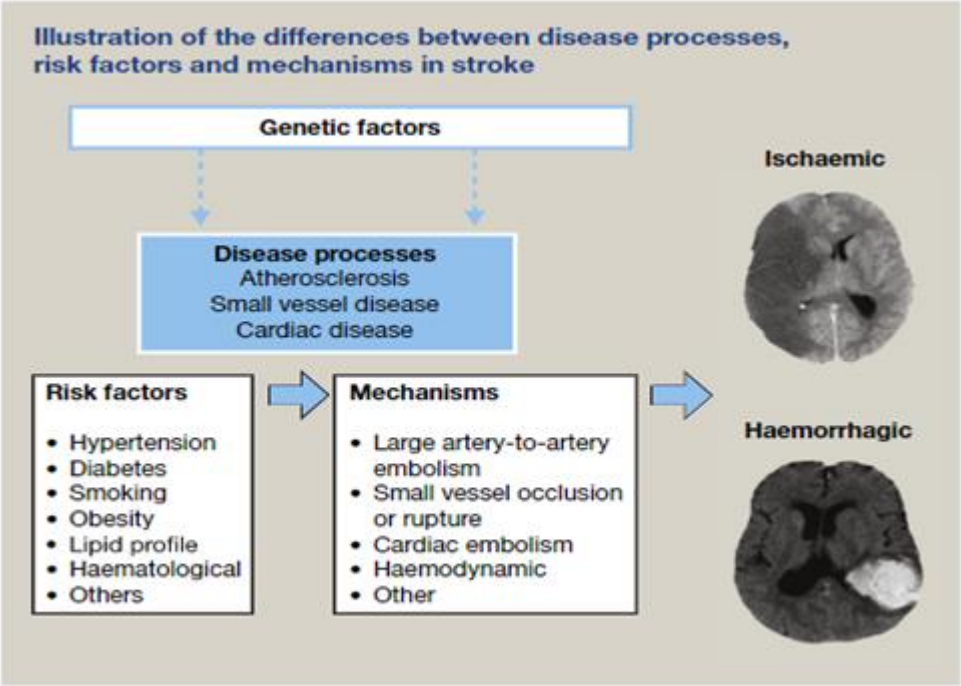


Figure 2-4: (Connected to Many Risk Factors and Disease Processes) Adapted from (Murphy and Werring, 2020).

2.7.1.b. Modifiable risk factors

1. **Hypertension:** This is the single most significant risk factor that may be modified to reduce the likelihood of stroke. A history of hypertension may be found in around half of all stroke patients and an even higher percentage of those with ICH. Even among those not defined as hypertensive, the higher the blood pressure, the higher the risk of stroke. This makes the diagnosis and control of hypertension paramount and secondary prevention of strokes. The attributable risk from hypertension declines after age 60 years, where it confers relative risk of 3.5, to a non-significant contribution at age 80.

2. **Diabetes mellitus:** This is a more hazard factor for stroke that stands on its own and is associated with a doubling of the risk. Stroke is the leading cause of death in people with diabetes, accounting for 20% of all deaths.

3. **Cardiac factors:** The most severe ischemic stroke subtype, cardioembolic infarction (primarily caused by atrial fibrillation (AF), is associated with substantial disability and death. AF is more common as people become older, with 20-25 percent of strokes occurring in those over the age of 80. In persons with AF, anticoagulation is particularly efficient at avoiding stroke (relative risk reduction about two-thirds).

4. **Smoking:** This increases the risk of a stroke by double. Smoking cessation decreases the risk quickly, with the increased risk practically eliminated within 2-4 years after quitting.

5. **Hyperlipidemia:** Stroke and dyslipidemia have a complex relationship. There is an increased risk of ischemic stroke with increased total cholesterol, and a decreased risk of ischemic stroke with elevated high-density lipoprotein-cholesterol. On the other hand, there is a negative correlation between total cholesterol and the risk of ICH. When taken as secondary prophylaxis, statins seem to reduce the incidence of ischemic stroke (as well as functional outcome and mortality) without appreciable increases in the risk of intracerebral hemorrhage. ICH survivors who have a strong justification for taking statins (such as clinically significant ischemic heart disease) should be given them, according to recent studies and expert opinion.

6. **Alcohol consumption and substance abuse:** Light and moderate alcohol use (less than 4 units per day) has been associated with a reduced risk of ischemic stroke, whereas higher quantities are clearly associated with increased stroke risk. The risk of ICH is proportional to the amount of alcohol consumed. Cocaine, heroin, amphetamines, cannabis, and ecstasy are among recreational substances that have

been linked to an elevated risk of stroke (both ischemic stroke and ICH).

7. **Sedentary lifestyles and obesity:** The majority of the influence that having a higher body mass index has on the chance of having a stroke is mediated by blood pressure, cholesterol, and glucose levels. People who lead sedentary lifestyles have a higher chance of having a stroke, as well as a higher risk of dying from a stroke, than those who are physically active.

8. **Inflammation:** Elevated levels of inflammatory biomarkers are associated, to a lesser extent, with an increased risk of atherosclerosis and stroke. Strokes may be caused by infections, and there is some evidence that those who have been vaccinated against influenza have a decreased risk of having one. Coronavirus disease, also known as COVID-19, has been connected to major artery blockings in conjunction with a hyper inflammatory & hypercoagulable condition (Murphy and Werring, 2020).

2.8. Clinical Manifestation:

2.8.1. Ischemic Stroke:

Depending on the location of the lesion (in which blood arteries are clogged), the size of the region of insufficient perfusion, and the quantity of collateral (secondary or accessory) blood flow, an ischemic stroke may result in a range of neurologic impairments. Any of the following signs or symptoms may appear in the patient:

1. Weakness or numbness in the arm, leg, or face. Notably on the body's one side.

2. Uncertainty or a shift in mental state.

3. Difficulty comprehending or speaking.
4. Disturbances to vision.
5. Balance and coordination loss
6. Severe headache
7. Other functions such as motor, sensory, cranial nerve, cognitive, and others may be affected. (Hu et al., 2017).

2.8.1.a. Motor Loss

Loss of voluntary control over one's motor movements is the result of a stroke, which is an upper motor neuron lesion. Because higher motor neurons decussate (cross), a disturbance in voluntary motor control on one side of the body may be a reflection of damage to the motor neurons in that area of the brain on the opposite side. The most typical kind of motor dysfunction is known as hemiplegia, which is characterized by paralysis on one side of the body or a portion of that side. This condition is brought on by damage to the opposite side of the brain. Another symptom is hemiparesis, which refers to a weakness on one side of the body or in one region of the body (Li, *et al*., 2021).

The earliest clinical manifestations of a stroke may include drooping paralysis and a damage of or a reduction in deep tendon reflexes in the early stages of the disease. When these deep reflexes return (typically within forty eight hours), on the affected side, the extremities exhibit increased tone and spasticity (an abnormal increase in muscle tone) (Hinkle and Cheever, 2018).

2.8.1.b. Communication Loss:

Language and communication are two other brain processes that might be negatively impacted by a stroke. A stroke is, in point of fact, the

most prevalent cause of aphasia (inability to express oneself or to understand language). The following are examples of problems related to language and communication: Dysarthria, also known as trouble speaking, or dysphasia, often known as impaired speech, are both conditions that may result from paralysis of the muscles that are involved for creating speech. Aphasia may be classified as either expressive aphasia (the inability to express oneself), receptive aphasia (the inability to grasp language), or global aphasia (a combined form of the two). It is possible to diagnose a patient with apraxia, which is the inability to execute a previously taught activity, by observing the patient's use of verbal replacements for intended syllables or phrases (Clancy, *et al*., 2020).

2.8.1.c. Perceptual Disturbances:

The capacity to comprehend sensation is referred to as perception. Changes in visual-spatial interactions, sensory loss, and visual-perceptual dysfunctions may all be signs of a stroke. Disturbances in the key sensory pathways between the eye and the visual brain generate visual–perceptual dysfunctions. Stroke may cause homonymous hemianopsia (blindness in half of the visual field in one or both eyes), which can be transient or permanent. The paralyzed side of the body correlates to the impaired side of eyesight. In individuals with right hemisphere injury, disturbances in visual–spatial connections (perceiving the relationship of two or more objects in spatial domains) are common (Hinkle and Cheever, 2018).

2.8.1.d. Sensory Loss

Sensory impairments from stroke may range from modest to severe, including lack of proprioception (the ability to sense how body parts are moving and in what positions), and trouble understanding visual, tactile, and aural sensations. An agnosia is the loss of the ability to recognize

objects through a particular sensory system; it may be visual, auditory, or tactile (Abel *et al*., 2019).

2.8.1.e. Cognitive Impairment and Psychological Effects

It is possible for a person's learning ability, memory, or other upper cortical intellectual abilities to be affected if they have sustained an injury to their frontal lobe. A short attention span, difficulty with understanding, forgetfulness, and a lack of desire are some of the symptoms that may be associated with this disorder. Because of these changes, the patient may find that they get easily frustrated throughout the course of their rehabilitation. Depression is quite frequent, and its severity might be exacerbated by the patient's natural reaction to the traumatic incident that occurred. There is a possibility of experiencing emotional instability, aggression, frustration, resentment, a lack of collaboration, and other psychological issues (Hinkle and Cheever, 2018).

2.8.2. Hemorrhagic stroke symptoms might appear quickly or evolve over many days. A person with hemorrhagic stroke may experience:

1. A sudden headache
2. Change in vision
3. Balance and coordination loss
4. Unable to move
5. Weakness and tingling in one side of body
6. Seizure
7. Speech loss or misunderstanding
8. Confusion

9. Nausea & vomiting
10. Body part paralysis
11. In ability to look at bright light
12. Breathing and heartbeats change
13. Dysphagia

2.9. Complications of Cerebrovascular Accident:

Depending on how long the brain is deprived of blood supply and what portion of the brain is harmed, a stroke may occasionally create problems that are either transient or permanent (Sommer, 2017). Complications may include:

2.9.1. A lack of muscular movement or complete paralysis. It is possible that you could lose control of some muscles, such as those on one side of your face or one arm, or that you will become paralyzed on one side of your body.

2.9.2. Difficulty swallowing or speaking due to the condition. It is possible that a stroke may impair your ability to control the muscles of your mouth and throat, which will make it challenging for you to speak effectively, swallow, or eat. There's also a possibility that you're having trouble with language, whether it's speaking, comprehending spoken language, reading, or writing.

2.9.3. Difficulty thinking clearly or remembering recent events. Memory loss is a common side effect of having a stroke, which affects a large percentage of stroke survivors. Some people have trouble thinking, reasoning, forming decisions, and comprehending different ideas, while others struggle with all of these things.

2.9.4. Emotional difficulties: Stroke survivors may have increased difficulties managing their emotions, which may lead to the development of depression in certain cases.

2.9.5. Pain, numbness or other unusual sensations may occur in the parts of the body affected by stroke. For example, if a stroke causes you to lose feeling in your left arm, you may develop an uncomfortable tingling sensation in that arm.

2.9.6. Alterations in both their conduct and their capacity for self-care. People who have had strokes may become less social after the event. They may need assistance with personal hygiene tasks and other routine activities (Sommer, 2017)

2.10. Effects of Stroke on Vital Body Functions:

The University of Rochester Medical Center (URMC) did study in 2018, indicates that the consequences of a stroke might differ from one individual to the next depending on the kind, intensity, location, and the number of strokes that a person has had. The brain is a very complicated organ. One particular skill or talent is associated with the operation of a certain region of the brain. If a portion of the brain is injured as a result of a stroke, it is possible that a normal function of a component of the body will be lost. Because of this, one could end up with a handicap (Burke, 2018).

There are three primary regions of the brain:

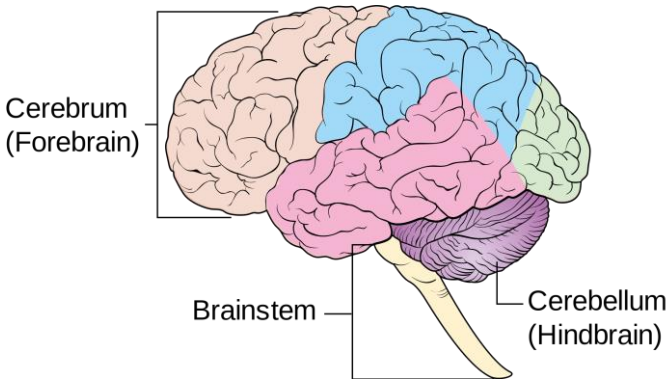


Figure 2-5: (Brain main areas) Adapted from (Murphy and Werring, 2020).

The cerebrum is the part of the brain that occupies the top and front portions of the skull. It controls movement and sensation, speech, thinking, reasoning, memory, vision, and emotions. The cerebrum is divided into the right and left sides, or hemispheres.

Depending on the area and side of the cerebrum affected by the stroke, any, or all, of these functions may be impaired:

1. Both motion and feeling
2. Vocabulary and language
3. Swallowing and eating
4. Vision
5. Cognitive skills, including memory, judgment, and thinking
6. Perception of the environment and direction to it
7. Capacity for self-care
8. Control of the bowels and bladder
9. Control of emotions

2.10. 1. The effects of a right hemisphere stroke:

According to the Grossman & Porth,(2014); Gainotti, (2021), the effect may include:

a. Weakness or paralysis on the left side, as well as sensory impairment.

b. Denial of paralysis or impairment and reduced insight into the problems created by the stroke (this is called left neglect)

c. Problems with one's sense of space and their ability to perceive depth or directions, such as front or behind, up or down, etc.

d. Incapacity to locate or identify certain sections of the body

e. An inability to comprehend maps and locate goods, such as articles of clothes or pieces of personal hygiene products

f. Memory difficulties

g. Alterations in behavior, including a lack of regard for the circumstances, impulsivity, inappropriateness, and sadness.

2.10. 2. The effects of a left hemisphere stroke may include:

a. Right-sided weakness or paralysis, as well as sensory impairment

b. Aphasia refers to difficulties with speech and language.

c. Visual problems, including the inability to see the right visual field of each eye

d. Impaired capacity to do mathematical tasks as well as to organize, reason, and evaluate information

e. Behavioral modifications, including sadness, caution, and hesitancy

f. Impaired capacity for reading, writing, and learn new information (Grossman & Porth, 2014).

The cerebellum is located behind the cerebrum at the rear of the skull. Through the spinal cord, it obtains information about how the body feels. It aids with muscular control and action, fine movement, coordination, balance, and fine motor abilities (Hughes, et al., 2020).

Although strokes are less common in the cerebellum area, the effects can be severe.

2.10.3. Four common effects of strokes in the cerebellum are listed below:

a. Inability to walk and problem balance and coordinatons (ataxia).

b. Dizziness

c. Headache

d. Nausea & vomiting

The brainstem is located at the base of the brain, directly above the spinal cord. The brainstem controls many of the body's vital life-support functions, including heartbeat, blood pressure, and breathing. It also helps to regulate the nerves that control eye movement, hearing, speaking, eating, and swallowing.

2.11. The following is a list of some of the most common symptoms that are associated with a brainstem stroke: (Pope, 2017; Compagnat, *et al.*, 2020).

a. Breathing and heart functions

b. Body temperature control

c. Balance and coordination

d. Weakness or paralysis

e. Chewing, swallowing, and speaking

f. Vision

g. Coma

h. Unfortunately, death is possible with brainstem strokes

2.12. Effect of Stroke on Quality of Life:

Stroke is a potentially fatal condition that may leave survivors permanently disabled in their physical, psychological, and social functions. Patients who have had a stroke may experience a decrease in their quality of life (QOL) as a result of dependence in daily life activities, living, emotional and psychological shift status, and degradation in their ability to communicate with others. A lack of autonomy brought on by challenges in the execution of daily life tasks alters the function that experience plays in the learning process. On a daily basis, in addition to issues that are associated with personal relationships, individuals also endure psychological maladjustment as a result of long-term stress and tension. That makes it harder for them to conduct an honest assessment of their quality of life (Mohammed, 2019).

2.12. 1. Energy:

No symptoms of fatigue by patients are reported in the early stages, whether acute or chronic of recovery after the CVA. There is abundant data suggesting that the infarct precipitates inflammatory cascades and cytokine signaling, both of which cause tiredness. Furthermore, these pathways may include therapeutic targets for the treatment of fatigue (Lanctôt *et al*., 2020).

A post-stroke phase of at least two weeks during which the patient experiences exhaustion, loss of power, or an increased daily need to rest is typical for individuals who have had a cerebrovascular accident. This leads to weariness, which makes it difficult to participate in activities of daily living. When a patient in the hospital has experienced a lack of energy or an increased need to rest on a daily or practically daily basis, they are said to be suffering from tiredness after a stroke (Al-Ibraheemi and AL-Bayati, 2018).

2.12. 2. Family Role:

Stroke is a serious public health problem that may have a catastrophic effect on an individual's overall health and wellbeing, especially in developing countries.

Upon discharge, stroke survivors are often cared for by their families who ensure that the home environment is conducive enough to support the recovery process (Whitiana *et al.* 2017). When first receiving the stroke diagnosis, the family is often confused and worried about the life of their family member. An acute state of distress is typically followed by feelings of shock, disbelief, fear and anxiety because of uncertainties about the future. Although this is the case, helping the stroke survivor to achieve ADL becomes a priority to families of stroke survivors. Activities of daily living include the everyday activities such as bathing, eating, dressing, toileting, bladder and bowel control, mobility, transfers and the ability to climb stairs these activities are often identified as self-care. An additional noteworthy point is that the process of caring for the stroke survivor is very demanding and can take a physical and psychological toll on the caregiver, leading to burnout. Caring for the person with stroke also has a detrimental impact on the well-being and overall quality of life of family members (Gawulayo, *et al*., 2021).

2.12. 3. Language:

People who have had a CVA will have some degree of difficulty communicating, which is referred to as aphasia or occasionally dysphasia. At the very beginning, swallowing will be difficult for at least forty percent of people who survive a CVA; nevertheless, many people recover their ability to swallow relatively rapidly. Speech, including uttering any word or saying the proper words, which is referred to as expressive aphasia,

forming words and speech sounds due to weakness in the muscles of the mouth are also experienced (Al-Ibraheemi and AL-Bayati, 2018).

In addition, Sihvonen et al., (2021) discovered that poststroke aphasia, which is an impairment of speech production and/or comprehension, occurs in up to forty percent of stroke patients. This condition has a devastating effect on the individual, lowering their quality of life more than any other stroke-induced impairment. A left-lateralized network that includes frontal, temporal, and parietal brain areas as well as the white matter pathways that link them is responsible for the functions of language. Language deficits after a stroke are caused by a disruption in the language network, which occurs as a result of hypoperfusion and the subsequent damage to brain tissue. Recovery from these impairments depends on the capacity of the spared neurons to reconstruct the damaged network (Hula, *et al*., 2020).

2.12. 4. Mobility:

After suffering a CVA, one of the consequences or health concerns that manifests itself the most commonly is motor disability. Featuring deficit hemiplegia or hemiparesis of the motor system on the contralateral side of the hemisphere. In most cases, hypotonia will present itself shortly after a stroke and will only last for a brief period of time. In very rare cases, the state of low tension may last for an extended amount of time. Cramping happens in around 90% of cases that are reported in reaction to a decline in mobility, which makes active movement impossible and difficult voluntary motor activity with a deficiency in the amplitude of movement and muscle strength (Tosi, *et al*., 2018).

Lack of control on the legs particularly disabling because it means the CVA survivor may lose the ability to walk, and even confine him to a wheelchair. In many situations, there were indications that the family had

adjusted to the new living conditions and had left behind some remnants of themselves at home (Tosi, *et al*., 2018).

2.12. 5. Mood:

After a CVA, the majority of patients have unexpected shifts in their mood; they may feel very happy then suddenly feel very sad; some individuals may cry or laugh at inappropriate moments, which is only seen in persons who have depression. These mood trapezes can occur when there is an injury to a specific region of the brain (Ahmed, *et al.*, 2020).

2.12. 6. Personality:

Personality changes after a stroke are common due to the subsequent neural tissue damage. Because different parts of the brain regulate and control different parts of our bodies and personalities, the location and severity of the stroke will determine the types of personality changes or impairments experienced by the stroke survivor. For example, many of our emotional responses, decision-making processes, and judgment abilities are controlled and regulated by the frontal lobes. If an individual has suffered a stroke affecting this portion of the brain, he or she may exhibit depressive symptoms and general apathy, or even lash out unexpected (Knapp *et al*., 2020).

2.12. 7. Self-Care:

A disability is defined as the inability to do an activity that is considered to be a typical element of one's day-to-day activities. Patients who have had a CVA may have difficulty doing a variety of tasks that were simple for them before the incident, such as walking, talking, and performing self-care tasks. These fundamental components include things like dressing oneself (putting on clothes), consuming food or liquids, bathing oneself, and using the restroom, in addition to more complex

activities known as instrumental activities of daily living (IADLs), which include things like managing one's family, using the telephone, driving, and writing. Some impairments are immediately noticeable after a CVA. You may not be noticed until the other person is home and try to do something for the first time since stroke (Dorriyal V, *et al.*, 2020).

After a CVA, a person may experience a loss of autonomy and control over their living circumstances, even if alternatives remain and chances to work on them may be gone. You have the opportunity to make decisions and appear to be closely linked to a sense of control. When someone is stabbing of disability, there is a sudden need to think about the performance of the grant taken such as self-care activities for (Dorriyal V, *et al.*, 2020).

2.12. 8. Social Role:

The psychological and physical effects of CVA can lead to major changes in the survivor's social role and identity. Almost two-thirds of respondents felt that the family or their social life was affected in some way. This was particularly evident for those people who was restricted seriously for patients who have suffered from difficulties in pronunciation or movement. Some of the survivors felt that their condition had undermined relations and wider social activities and also led to social isolation. Prevent physical disability sometimes previous forms of movement such as driving (Tang, *et al*., 2020).

2.12. 9. Thinking:

Stroke has long been recognized as a significant independent risk factor for dementia. In reality, around 10% of people will get dementia shortly after their first stroke, and a third will be impacted after a second stroke (Pendlebury and Rothwell, 2009).

Compared to the general population, the incidence of dementia is nearly 50 times higher in the year after a major stroke. Most people have some problems with memory after a CVA; they might have difficulty with certain types of memory. It is very common for short-term memory to be affected. Remembering new information can also be very difficult for many people (Tang, *et al*. 2020).

2.12. 10. Vision:

Vision loss is one of the numerous issues that may arise after a stroke, and it affects up to 60 percent of people who survive a stroke. After suffering a stroke, a person may have a number of visual impairments (VIs), such as a loss of visual field, abnormalities of eye movement, a loss of central vision, and perceptual issues. An abrupt loss of vision, double vision, reading problems, impaired balance or movement, clumsiness, or inattention to visual information are some of the symptoms of visual loss. (Falkenberg, *et al*., 2020).

Vision loss may last a lifetime and are linked to tiredness, mental anguish, increased falls, and decreased rehabilitative and daily living activities. They may cause you to stop driving. Reading problems and a rise in the number of falls. Failure to detect vision loss after a stroke may have a significant detrimental influence on the patient's ability to cope, heal, and live a good life (Hepworth and Rowe, 2016).

Furthermore, Al-Ibraheemi and AL-Bayati (2018) discovered that the brain stem is the origin of three pairs of nerves that govern eye movements. Due to changes in the current covenant, one eye may move correctly while the other does not. This may cause double vision or make it impossible for both eyes to gaze in the same direction.

2.12. 11. Work / Productivity:

A lot of studies demonstrate a wide range in the proportion of persons who are unable to work after a CVA. As a consequence of the rehabilitation efforts, the quality of life has improved, as has the usage of personal well-being and life satisfaction. Work that meets basic human requirements, such as financial and communal needs, and the ability to return to work following the CVA are critical. Rehabilitation, according to the United Nations General Assembly's general rule, should be considered as a process aimed at enabling people with impairments to attain more independence. When a CVA happens late in life, it is critical that the recovery process involves addressing professional aspirations, even if the stroke is minor. (Anand, 2016).

2.13. Effect of Stroke on Muscle Strength:

Hemiparesis (muscle weakness on the opposite side of the brain lesion), increased aberrant muscle tone, and a loss of coordination are all common symptoms of stroke. On the paretic side, muscle impairments are linked to limits in ADL such as walking and sit-to-stand (Ju, 2020).

Strength deficits, sensory-motor impairment, stiffness, incoordination, and postural dysfunction are all symptoms of a stroke. After a stroke, impaired motor control and weakness in the extremities diminish muscle force output while also affecting interlimb coordination of functional motions. In patients who have had a stroke, muscle strength in the afflicted lower limb is frequently decreased by 34% to 62% when compared to healthy people (Darak and Karthikbabu, 2019).

Muscle weakness is the most noticeable deficit in many people who have had a stroke. One common and severe consequence of stroke is the loss of strength. The average strength of the upper and lower limbs affected

by a major stroke ranges from 30 to 50% of age-matched controls. This loss of strength might result in serious restrictions on participation and activities (Sousa, *et al.*, 2018).

Increased muscular tone and stiffness after a stroke may have a significant influence on health-related quality of life (Persson, *et al*., 2020). In stroke patients, skeletal muscle weakness and muscle atrophy are elements that contribute to disability. Stroke-related muscular abnormalities have recently been demonstrated to be caused by a combination of denervation, disuse, remodeling, and spasticity (Nozoe, *et al*., 2020).

There is a correlation between aberrant muscle tone and impaired motor performance. Abnormal muscle tone may cause difficulties in utilizing muscles, which can lead to greater postural sway, which in turn can raise the risk of falling. It has been shown that muscle weakness has a larger link with physical disability than any other kind of motor impairment in upper limb activities, stair climbing, and walking. As a result, recovering one's strength is of utmost significance for the purpose of resuming normal activity, given that muscular action depends on it (Kwana, *et al*., 2019).

2.13.1. Upper Extremity:

Stroke, which is a primary cause of long-term impairment, is often linked to chronic upper-extremity involvement. The severity of paresis, the degree of spasticity, and the level of motor and sensory loss all influence upper extremity function in stroke patients. After a stroke, upper extremity paresis is a common cause of significant and long-term hand dysfunction (Teasell, *et al*., 2015). Patients with a stroke have a complicated pattern of upper extremity motor deficits that result in the loss of functional capacities such as grip and grasp causing pain, joint rigidity, and discomfort, which

may lead to limb disuse and impede long-term functional recovery (Ahn, *et al*., 2019).

Restore mobility in the upper extremities is often more difficult than it was in the lower extremities, which can seriously affect the progress of rehabilitation. There is a wide range of existing research on the complications of upper extremity but the debate on the timing of treatment and prognostic factors is still insufficient. This provides current information on interventions upper extremity review (Teasell, *et al*., 2015).

2.13.2. Lower Extremity:

Different degrees of analysis are performed on the effect that a stroke has on motor functioning. The term impairment refers to the inability to perform fundamental aspects of voluntary movement. Loss of the usual ability for the autonomous performance of day-to-day tasks is what is meant by the term activity restriction. Recovery from activity restriction is performed via the combined impact of restitution and compensation, whereas recovery from impairment is accomplished solely through the process of restitution. (Frenkel-Toledo, *et al*., 2021).

In addition, stroke is one of the primary causes of long-term disability, and the majority of post-stroke patients have motor impairment as a result of their condition. The functions of the lower extremities are often compromised following a stroke. Although it has been reported that 85% of post-stroke patients are still capable of independent ambulation. The majority cannot achieve the speed and strength of ambulation required to continue daily living activities. Independent ambulation is of great importance and after stroke; the most frequently asked question is the probability of regaining ambulation. Therefore, the recovery of motor functions and ambulation is an important goal in the rehabilitation program. (May, *et al*., 2020).

2.14. Rehabilitation of Patients with Stroke:

The rehabilitation process for stroke patients can be lengthy, and requires tolerance and insistence from both patient and their family (Smeltzer, *et al*., 2010). The primary objectives of the rehabilitation are, in order of priority, the prevention of complications, the reduction of impairments, and the improvement of activities of self-care. The result of functions may be improved with effective rehabilitation. The promising change in the functional independence measures is the indicator of improvement (Grotta, *et al.*, 2016).

After this phase of stroke, care change to detect of any residual physical and mental impairment, and reparations for these deficits are to be emphasized. In addition, it is highly advised that rehabilitation begins, as soon as possible, as medical constancy is achieved. Furthermore, it is highly advised that patients must receive the required therapy needed for adjustment, improvement, and restoration the functional level of independence (Al-Ibraheemi and AL-Bayati, 2018).

The adaptive plasticity of the brain is reflected in the fact that the majority of stroke patients have a spontaneous improvement in their neurologic function between three and six months following their stroke. Training and practice may help speed up the recovery process of mobility and limb function after an injury. Rehabilitation techniques that are shown to be effective include strength and fitness training, training performed over ground, Speech and language therapy, pharmacological spasticity modulation, constraint-induced mobility treatment, or direct current stimulation. It is advised that patients begin their rehabilitation treatment as soon as possible and that they participate in high-intensity regimens. Additionally, patient motivation is an essential component (Di Girolamo *et al*., 2018). As a result, the restoration of motor functions as well as the

ability to walk is a significant objective of the rehabilitation program**.**

Nurses frequently plan care in the patient's home and consider the necessary directions to the patient and family based on the individual neurologic impairment that occurs as a result of stroke. When it comes to delivering care, they need both directions and assistance. Caregivers may need to be reminded to pay attention to their own health and well-being (Hinkle and Cheever, 2018).

2.14.1. The role of the nurse in stroke rehabilitation:

Stroke is the main cause of adult disability in the UK, emphasising the importance of effective rehabilitation to aid the patient in reaching their optimum level of independence. Stroke therapy focuses mostly on helping patients regain their ability to walk alone.

Stroke rehabilitation aims to:

a. Assist in physical rehabilitation after a stroke

b. Facilitate independence in activities of daily living

c. Lower the chances of subsequent problems and other complications.

d. Promote holistic adaptation to stroke related disability.

Through rehabilitation, nurses are playing an important role in the management of stroke patients. They able are to decrease complications after stroke and to improve the patient health status. Also, they are able to improve the patient's self-management through translating the skills in therapy into meaningful activities.

2.15. Regular Resistance Exercise for Improve Muscle Strength:

Resistance training, which includes the regular use of free weights, weight machines, body weight, elastic bands, and other forms of equipment to improve muscular strength, muscular power, and muscular endurance, has become an increasingly popular form of physical activity. Resistance exercise is the preeminent way to gain strength and muscle mass. The work of Delorme demonstrated the need for progressive resistive loads to be constantly adjusted in order to gain strength. Progressive overload refers to the increasing stress placed on the muscle via resistive exercise. Resistance exercise can be modified by altering load, repetitions, type or intensity. (Picha, *et al*. 2019).

Additionally, in recent years there has been a rise in the number of people participating in resistance training, which also known as strength is training and workout. The word "resistance training" refers to a kind of physical activity that has traditionally been considered to be a part of training regimens that are only accessible to athletes and competitive weightlifters who are aiming to improve their performance. Having said that, this perception is no longer true. Research shows that resistance training is not only a very effective way to increase physical strength, endurance, and power, but also a highly effective way to raise most people's health statuses, not just competitive athletes. This is true because resistance exercise enhances muscle blood flow, which enhances cardiovascular health (Hongu, *et al.*, 2015).

2.15.1. There are primarily two distinct categories of resistance training exercises, which are as follows:

a. Isotonic exercise includes any activity involving the use of your body's own weight, such as pushups and sit-ups, or any movement

of your muscles (legs, arms, stomach, back, etc.) while being subjected to resistance.

b. Isometric exercise - Examples of this kind of exercise include maintaining a plank position, sitting on the wall, holding shopping bags, and other similar activities. There is no joint movement involved in these types of exercises; rather, the focus is on keeping a muscle group still while working against resistance.

Both aerobic and anaerobic resistance training is effective ways to tone and develop muscle. When a muscle becomes stronger, the amount of force it can withstand may also go higher, which encourages additional muscle growing and strength. Exercises that focus on using resistance may be beneficial for any muscle group (Hongu et al., 2015).

Table 2-3: Guidelines for Resistance Exercise Recommendations:

Frequency (Days\ WeeK)	Intensity	Repetitions	Type	Comments
For each major muscle group, 2-3 days per week	In order to increase strength, elderly or inactive people should start with extremely mild intensity: for beginners, intermediate to hard intensity, and for experts, hard to very hard intensity a modest amount of resistance for enhancing endurance	For the majority of individuals, particularly those in middle age and older adults, strength improvement 10–15 reps total for 1 set. 6–8 reps over 1–3 sets are recommended for bone strength. for most adult people to increase their endurance 2 sets of 15-20 repetitions each.	Variety of exercise equipment (free weight resistance machine resistance band resistance tube) can be used through the range of motion of the joint using proper and lifting technique	Rest for up to three minutes to increase your concentration on building strength. With more time to recuperate, the muscle may exert more effort in the next session. When starting resistance training, allow less than a minute between sets to build endurance.

Adapted From (Zhao, et al., 2015).

Fitness and healthcare experts often employ elastic resistance as a kind of resistive training to build strength. The benefit of elastic resistive bands is that resistance may emerge in whichever direction the band is stretched. On the other hand, using free weights as the preferred form of resistance requires lifting the weights against gravity in order to achieve the appropriate level of resistance. By stretching the elastic band, elastic resistance is produced linearly and is inversely proportional to the band's stiffness and length **(Ramos, et al., 2014).**

The present technique of progression with elastic resistance is often based on the person's assessment of the felt effort of the exercise difficulty or successful completion of the intended number of repetitions that has been proven to be helpful for enhancing strength (Picha et al. 2019).

2.15.2. Application the Regular Resistance Exercise:

Regular resistance exercise was based on the principle that muscles of the body will work to overcome a resistance force when they are required to do so. The resistance exercise training was conducted following previously published guidelines. Resistance exercise training is set based on the Borg Rating of Perceived Exertion (RPE) scale, and rating between 11 and 13 (somewhat hard) was set as the targeted strength throughout the study (Alkhaqani and Ali, 2021).

a. Training protocol: It is consists of three sets of ten repetitions of (Upper Extremity Theraband Exercises–Sitting and Lower Extremity Theraband Exercises).

b. Upper Extremity include five type of resistance exercise: Chest Pull, Shoulder Flexion, Shoulder Diagonals, Elbow Flexion and Elbow Extension (Aurora BayCare Medical Center; Picha *et al.* 2019).

c. Lower Extremity include three types of resistance exercise: Depending on the patient's desire or capacity, three sessions per week of knee extension, hip abduction, and hip flexion utilizing an elastic band (TheraBand Resistance Band Loops, THERABAND, Ohio, USA) around both ankles or above the knees in a sitting or supine posture (Alkhaqani and Ali, 2021).

d. Upper Extremity Theraband Exercises – Sitting

1. Chest Pull

- Place your feet shoulder width apart whether you stand or sit.
- Loop theraband around each palm. Put your arms in front of your body with elbows slightly bent.
- Pull theraband outwards, across your chest.
- Hold for 3 seconds.
- Slowly return to starting position.
- Repeat 10 times.

2. Shoulder Flexion

- Hold the theraband at hip or waist height whether sitting or standing.
- Point your thumb toward the ceiling.
- Raise your hand toward the ceiling with your elbow straight.
- Hold for three seconds.

- Retrace your steps to the beginning place.
- Repeat 10 times.

3. Shoulder Diagonals

- Place the theraband at hip or waist level whether sitting or standing.
- Pull theraband from opposite hip up toward the ceiling on a diagonal.
- Hold for three seconds.
- Retrace your steps to the beginning place.
- Repeat 10 times.

4. Elbow Flexion

- Sit in a chair.
- Firmly tread on the theraband's one end.
- Raise your elbow so it points toward your shoulder.
- Hold for three seconds.
- Slowly return to starting position.

- Repeat 10 times.

5. Elbow Extension

- Sit in a chair without arm rests.
- Elbow is bent with your palm downward.
- Hold theraband at waist level.
- Straighten your elbow.
- Hold for 3 seconds.
- Slowly return to starting position.
- Repeat 10 times.

2.15.3. Lower Extremity Theraband Exercises

1. Knee extension (leg extension):

Sit in a chair or supine position. Place one end of your resistance band arounds your right ankle and have the other end securely fastened around the left leg. Lift and straighten your right leg and hold for a few seconds. Lower your knee. Repeat using your left leg. 10 to 12 times with each leg. You should feel all the muscles in the front of your thigh working. It will feel harder the higher you lift your foot (Adler *et al.*, 2017; Holden, 2020).

Compensation: Pull the band away from your ankle if it is sliding, then cross the bands to create a loop. Put your toes through the loop to secure the band to your ankle (Alkhaqani and Ali, 2021).

Figure 2-6: Knee extension with Resistance Band Adapted from (Waehner, 2020).

2. Hip abduction:

According to the patient's desire or capacity, sit in a chair or supine. Wrap a resistance band around your knees or ankle, with your knees hip-width apart. Slowly push your knees out to the side and then bring them back, in a control motion, keeping feet together. Hold and slowly return. Repeat 10 to 12 times (Holden, 2020; TheraBand, 2019).

Figure 2-7: Hip abduction with Resistance Band Adapted from (Kohavi *et al.*, 2020)

3. Hip flexion:

First, to perform the lying hip flexion, wrap one end of the resistance band around your right ankle or knee and wrap the other end to the left ankle. Lift your right foot slightly off the ground and bend your right knee, bringing it toward your stomach. Extend your right knee until you reach the beginning position. Repeat the exercise with your left leg after you complete the target number of reps with your right leg. Repeat 10 to 12 times (Moriyama *et al*., 2019).

Figure 2-8: Supine hip Flexion with Resistance Bands adapted from (Alkhaqani and Ali, 2021).

Progression was performed by increasing contraction time up to 6 seconds, and patients performed 1 set of 10 repetitions. Proper breathing technique was emphasized during all exercises to avoid the Valsalva manoeuvre, as recommended by previous research (Alkhaqani and Ali, 2021).

2.16. Previous Studies:

First study:

Barbosa et al., (2018), they conducted a study entitled: (Strength training protocols in hemiparetic individuals post stroke: a systematic review) Introduction: Hemiparesis is one of the main sequels of stroke. Evidence suggests that muscle strength exercises are important in rehabilitation programs for hemiparetic patients, but wide variation in previously studied protocols makes the most suitable choice difficult in clinical practice. Objective: The aim of this study was to investigate strength training protocols for people with hemiparesis after stroke. Methods: A systematic review of literature was performed in the PubMed, PEDro (Physiotherapy Evidence Database), SciELO (Scientific Electronic Library Online), and LILACS (Latin American and Caribbean Literature in Health Science) databases. Only controlled clinical studies that contained strength training protocols for hemiparesis after stroke were selected. Results: In total, 562 articles were found. Of them, 12 were accepted for the systematic review. Although strength training protocols are effective in hemiparetic patients, we did not found a standard method for strength training. Conclusion: This systematic revision highlights the lack of a standard protocol for strength training, considering the following training parameters: volume, intensity, frequency, series, and repetitions. Isotonic exercises are most commonly used.

Second study:

Persson et al., (2020), they conducted a study entitled: (Increased muscle tone and contracture late after ischemic stroke) Systematic studies on increased muscle tone and spasticity late after ischemic stroke, without any selection, are limited. Therefore, we aimed to determine the prevalence of increased muscle tone, classical spasticity and contracture and predictors

of increased muscle tone seven years after stroke. Methods: Consecutive patients with acute ischemic stroke Conclusions: One-third of patients with ischemic stroke before 70 years of age showed increased muscle tone at 7-year follow-up. Half of them also had classical spasticity. Age, arm paresis, aphasia, and facial palsy at index stroke were predictors of increased muscle tone poststroke.

Third study:

Tole et al., (2020), they conducted a study entitled: (Strength training to improve walking after stroke: how physiotherapist, patient and workplace factors influence exercise prescription)Muscle weakness is well established as the primary impairment that affects walking after stroke and strength training is an effective intervention to improve this muscle weakness. Observation of clinical practice however has highlighted an evidence-practice gap in the implementation of evidence-based strength training guidelines. Objective: To explore perceived barriers and facilitators that influence Australian physiotherapy practices when prescribing strength training with stroke survivors undergoing gait rehabilitation. Methods: Semi-structured interviews were conducted with a convenience sample of physiotherapists currently providing rehabilitation services to patients following stroke in Australia. Interviews were transcribed verbatim and line-by line thematic analysis was undertaken to create themes and sub-themes. Results: Participants were 16 physiotherapists (12 females) with 3 months – 42 years' experience working with people after stroke. Major themes identified were 1) patient factors influence the approach to strength training; 2) interpretation and implementation of strength training principles is diverse; and 3) work place context affects the treatment delivered. Physiotherapists displayed wide variation in their knowledge, interpretation and implementation of strength training principles and strength training

exercise prescription was seldom evidence or guideline based. Workplace factors included the clinical preference of colleagues, and the need to modify practice to align with workforce resources. Conclusions: Implementation of strength training to improve walking after stroke was diverse. Therapist-related barriers to the implementation of effective strength training programs highlight the need for improved knowledge, training and research engagement. Limited resourcing demonstrates the need for organizational prioritization of stroke education and skill development. Narrowing the evidence-practice gap remains a challenge.

Fourth Study:

Veldema and Jansen, (2020), they conducted a study entitled: (Resistance training in stroke rehabilitation: systematic review and meta-analysis) This systematic review and meta-analysis investigates the effects of resistance training in supporting the recovery in stroke patients. Data sources: PubMed, the Cochrane Central Register of Controlled Trials and the PEDro databases were reviewed up to 30 April 2020. Review methods: Randomized controlled trials were included, who compared: (i) resistance training with no intervention, (ii) resistance training with other interventions and (iii) different resistance training protocols in stroke rehabilitation. Results: Overall 30 trials (n=1051) were enrolled. The parameters evaluated were: (1) gait, (2) muscular force and motor function, (3) mobility, balance and postural control, (4) health related quality of life, independence and reintegration, (5) spasticity and hypertonia, (6) cardiorespiratory fitness, (7) cognitive abilities and emotional state and (8) other health-relevant physiological indicators. The data indicates that: (i) resistance training is beneficial for the majority of parameters observed, (ii) resistance training is superior to other therapies on muscular force and motor function of lower and upper limbs, health related quality of life, independence and reintegration and other health-relevant physiological

indicators, not significantly different from other therapies on walking ability, mobility balance and postural control and spasticity and hypertonia, and inferior to ergometer training on cardiorespiratory fitness and (iii) the type of resistance training protocol significantly impacts its effect; leg press is more efficient than knee extension and high intensity training is superior than low intensity training. Conclusion: Current data indicates that resistance training may be beneficial in supporting the recovery of stroke patients.

Fifth Study:

Beckwée et al., (2021), they conducted a study entitled: (Muscle changes after stroke and their impact on recovery: time for a paradigm shift? Review and commentary) In stroke rehabilitation there is a growing body of evidence that not all patients have the same potential to recover. Understanding the processes that give rise to the heterogeneous treatment responses in stroke survivors will lay foundations for any conceivable advance in future rehabilitation interventions. This review was set out to shine new light on the debate of biomarkers in stroke rehabilitation by linking fundamental insights from biogerontological sciences to neurorehabilitation sciences. In particular, skeletal muscle changes and inflammation are addressed as two potential constructs from which biomarkers for stroke rehabilitation can be derived. Understanding the interplay between these constructs as well as their relation to recovery could enhance stroke rehabilitation in the future. The rationale for the selection of these constructs is three-fold: first, recent stroke literature emphasizes the importance of identifying muscle wasting (also called stroke-induced muscle wasting) in stroke patients, a concept that is widely investigated in geriatrics but less in the stroke population. Second, insights from transdisciplinary research domains such as gerontology have shown that inflammation has severe catabolic effects on muscles, which may

impede rehabilitation outcomes such as gait recovery. Last, it has been proven that (high-intensity) muscle strengthening exercises have strong anti-inflammatory effects in a non-stroke population. Therefore, an evidence-based rationale is presented for developing research on individual changes of muscle and inflammation after a stroke.

2-17. Literature Synthesis:

Based on the analyzed previous studies, the study concludes that the muscle weakness is a major problem affects on the quality of life and activity of daily living among patients with stroke. The management of the muscle weakness basically depends on rehabilitation. Furthermore, the nurse should assess the levels of muscle weakness and try to improve it through using rehabilitation technique. Therefore, the researcher found, through previous studies, that regular resistance exercises are highly effective in improving muscle strength after weakening as a result of stroke. Although the previous studies provide a general overview about the effectiveness of regular exercises on muscle strength with an application guidelines, these studies focused on specific cultures and not mentioned to the another cultures such as Iraqi culture. Therefore, the present study focused on determination of the effectiveness of the regular exercises on muscle strength within the Iraqi culture.

Chapter Three

Methodology

Chapter Three

Methodology

The research methodology generally includes three steps, which are designing, organizing, and finally implementing certain procedures in order to collect accurate and reliable data about the problem under study. Moreover, this chapter describes and explains the methodology employed in the present study. The tools and methods have been taken to accomplish the present study and are organized according to the following manner:

3.1. Design of the Study:

A quasi-experimental design was implemented in the current study by which the patients are assigned into two groups (experimental & control group) to determine the effectiveness of regular resistance exercise on muscle strength of patients with stroke. The study has been carried out during the period 7th November 2021 to 2nd April 2023.

3.2. Administrative Agreements and Ethical Considerations:

The administrative agreements and ethical considerations involve official permissions are obtained from:

1- The regular resistance exercise, and questionnaire was presented to the Ethics Committee formed within the College of Nursing, which reviewed the study tools (Regular resistance exercise and questionnaire), and therefore agreed to conduct the study. Official letter provided in 9th July 2022 to conduct a study (Appendix B.1).

2- The administrative arrangements, an agreement was obtained from Al-Najaf Al-Ashraf Health Directorate; Middle Euphrates Neuroscience

Center (Appendix B.2 and B.3) to interview each study subjects and to implement the study program.

3- Patient consent form (Form No.3): after the researcher explains the study's purpose and provides the participants with confidentiality as well as voluntary cooperation according to the person's consent form to participate in research (Appendix B.4).

3.3. The Setting of the Study:

The study was conducted at Middle Euphrates Neuroscience Center in Al-Najaf City. This center is a specialized in all neuromedical diseases like stroke, epilepsy, movement disorder, neuropathy, multiple sclerosis, etc…It offers many health services including: Nursing services, laboratory service, pharmacy, electrophysiology unit, multiple sclerosis clinic, video EEG unit and plasmapharesis. The center was chosen for the following reasons:

1. These centers are receiving all adult patients with neuromedical disease (Including stroke patients), who attend the clinics for treatment and follow-up.

2. To obtain a large number of patients within a limited time this can helpfully represent the target population.

3.4. Study Sample:

A non-probability (purposive sample) technique that utilized in selected (100) patients admitted to Middle Euphrates Neuroscience Center for treatment. Ten patients chosen for pilot study and exclude from original sample. Ninety patients participate in current study and divided into two groups (45) patients for experimental group and (45) patients for control group. After pre-test among the experimental group two patients were lost

one patient died and one patient dropout. While, in control group six participants, withdrawn (refused to continue) in the study. Final number complete the training exercise were (82) patients divided into (43) experimental group and (39) for control group. The study sample was selected based on the following criteria:

3.4.1. Inclusion Criteria:

1- Patients are medically diagnosed with stroke and have muscle weakness.

2. Patient able to perform regular resistance exercise within a score (1-4), according to the muscle strength scale.

3. Patients who were described verbally by the attending physician as being in a stable condition.

4. All of the participants' ages range from 18 years old and above; this is due to the fact that the current research focused on adult patients, since adult patients are the most likely to have a stroke.

5. Patients who are alert and who have not experienced any shift in their state of awareness are needed for the investigation since objective measures are required.

6. Patients are free from psychiatric (according to physician report); because the patient's involvement is required for the researcher to explain and clarify the program's procedures.

3.4.2. Exclusion Criteria:

Conditions that lead to contraindications to the exercise test. These conditions include:

1. The study excludes the patients with zero score because they are out of the criteria of the target population. The muscle strength of those patients may be initiated and improved through electrical stimulation not by exercise. Additionally, they required a long time for management.

2. Patients with a systematic or chronic disease that cause complications when they perform an exercise such as (Cardiovascular conditions like angina while at rest or when exerting oneself, as well as chronic lung conditions that cause considerable oxygen desaturation when exercising or pulmonary congestion).

3.5. Sample Size and Power Analysis:

Before starting the current study, the researcher determined the appropriate sample size needed to reach a reliable conclusion. Therefore, the most important part of a study is the sample size. Several methods are used to calculate the sample size depending on the type of data or study design. The sample size is calculated in the present study based on the power analysis, the G-Power program version 3.1.9.7, was used to determine the sample size as adopted by Grove and Gray, (2019).

Statistical Power: In clinical trials, statistical power is customarily set to a number greater than or equal to 0.80, with many experts in clinical trials now advocating a power of 0.90. Power is the capacity of the study to discover differences or relationships that actually exist in the population. Power analysis is conducted before the data collection.

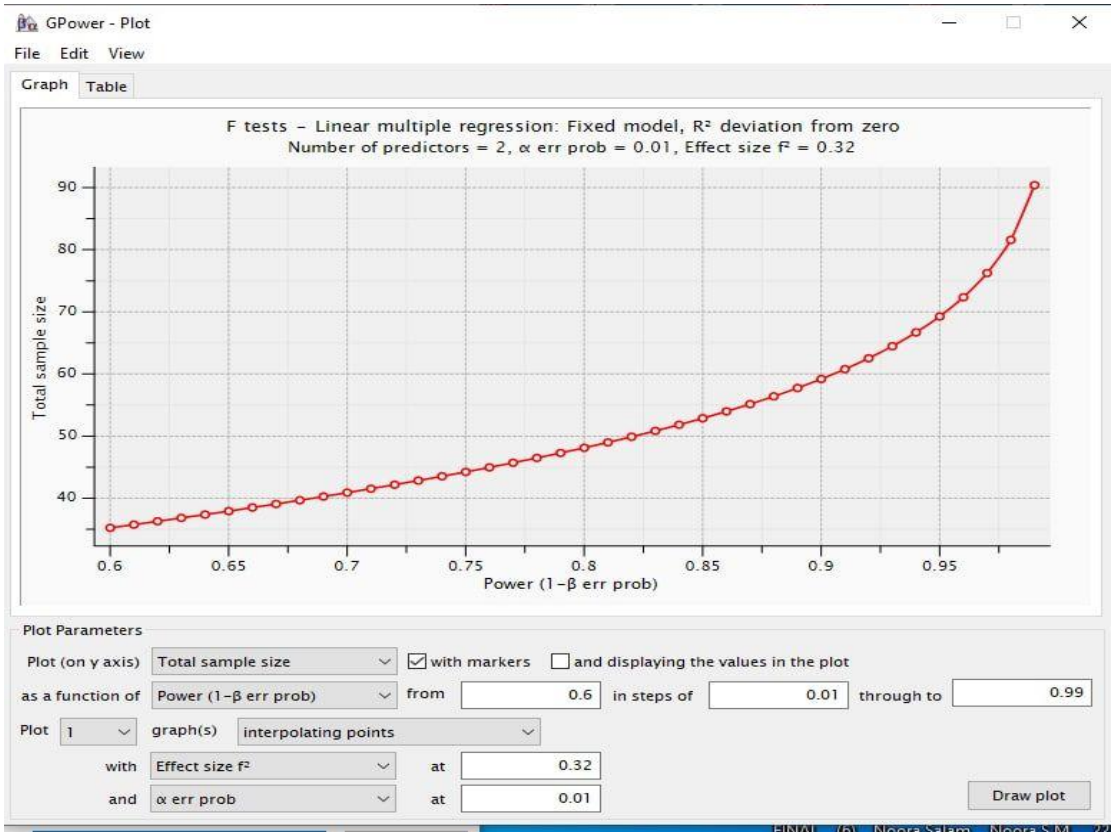


Figure 3.1: Appropriate sample size according to the G-power program

The goal is to help the researcher determine the smallest sample size that is suitable to detect the effect of a given test at the desired level of significance. This method can be used through its factors which include: power, effect size, and level of significance (Grove et al., 2013). The researcher uses the following factors to determine the adequate sample size through the G power program in the present study. Can be shown clearly in (figure 3.1); power (99%), significant 0.01, and middle effect size (0.32). Therefore, the sample size is equal to (90).

3.5.1. Sample Attrition and Retention Rates in Studies:

Systematic variation can also occur in studies with high sample attrition. Sample attrition is the withdrawal or loss of subjects from a study. Systematic variation is greatest when a high number of subjects withdraw from the study before the data have been collected or when a large number of subjects withdraw from one group but not the other in the study

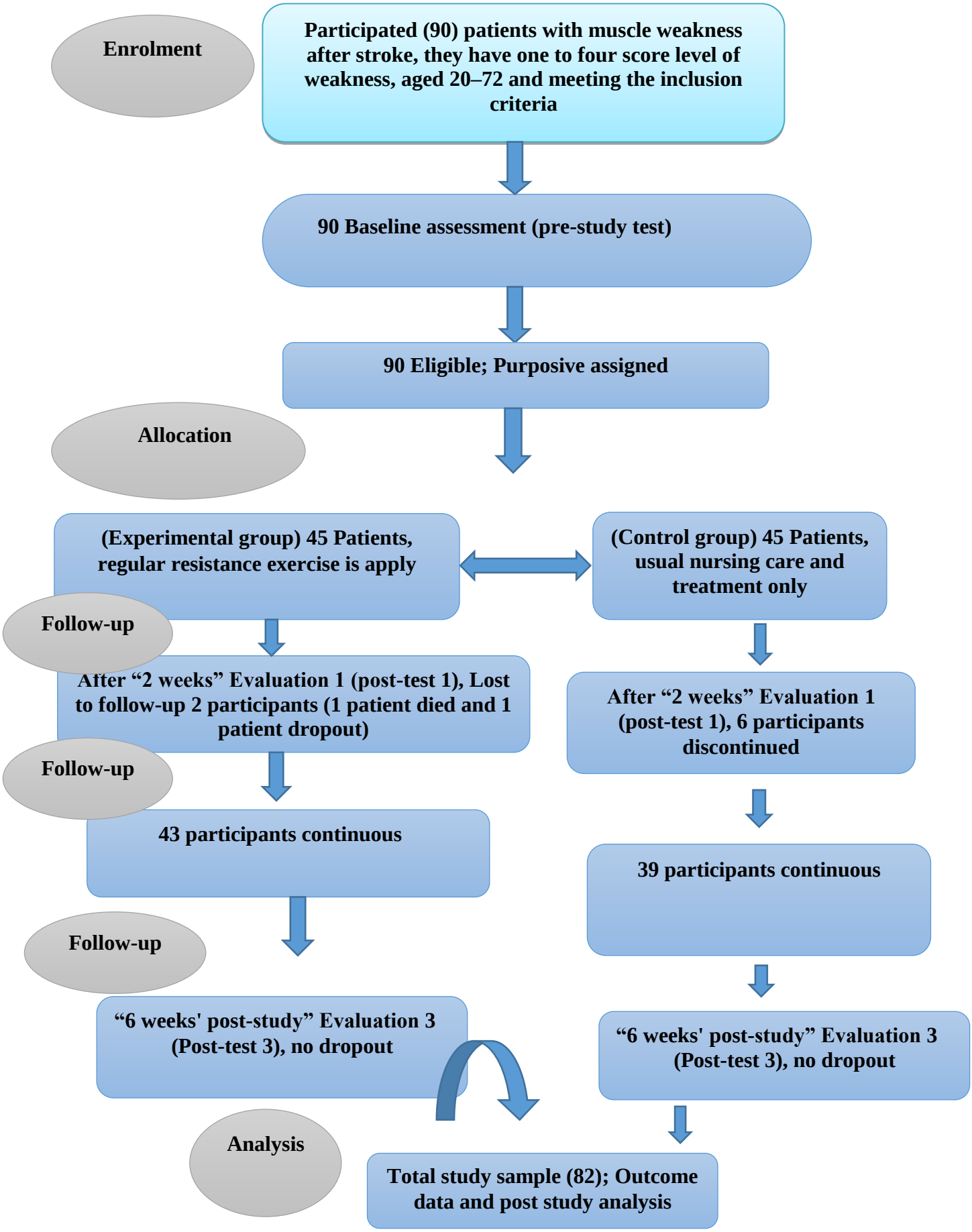
(Thompson, 2002; Grove, et al., 2013). In studies involving a treatment, subjects in the control group who do not receive the treatment may be more likely to withdraw from the study. Sample attrition should be reported in the published study to determine if the final sample represents the target population. Researchers also need to provide a rationale for subjects withdrawing from the study and to determine if they are different from the subjects who complete the study.

If the attrition rate is low (between 10% and 20%) and the participants who drop out of the research are comparable to the subjects who stay in the study, the sample will be the most representative of the target population. Calculating the sample attrition rate involves dividing the number of participants who drop out of a study by the sample size, then multiplying the findings by 100%.

Sample attrition rate formula = number subjects withdrawing ÷ sample size × 100%

In the present study, the acceptance rate according to the above formula is (91.12%), the attrition rate is (8.88%)**.**

The opposite of the attrition rate is the retention rate or the number and percentage of subjects completing the study. The higher the retention rate, the more representative the sample is of the target population, and the more likely the study results are an accurate reflection of reality. Often researchers identify either the attrition rate or the retention rate but not both. It is better to provide a rate in addition to the number of subjects withdrawing or completing a study. In the example just presented with a sample size of 160, if 40 subjects withdrew from the study, then 120 subjects were retained or completed the study. The retention rate is calculated by dividing the number of subjects completing the study by the initial sample size and multiplying by 100% (Grove, et al., 2013).



Flowchart 3.2: Study Process

3.6. Groups Assignment:

The study sample of (90) patients has been divided randomly into two groups. After pre-test (43) patients stay in experimental group (one patient died and one patient dropout), while, (39) patients in control group (six participants, withdrawn from the study). Experimental group patient's patients were exposed to a regular resistance exercise by the researcher. The control group that did not expose to the regular resistance exercise by the researcher. See flowchart 3.2.

3.7. The Steps of the Study

The study steps include the following:

3.7.1. The developed of the Regular Resistance Exercise:

The program was developed based on the information gained from reviewing the relative scientific literature and, previous studies. The contents of the exercise program are evaluated by experts in different fields (Appendix-A). The revision was made to the contents of the exercise program based on the experts' recommendations and suggestions they have agreed. The exercise program was designed to provide the patients with information and improved the muscle strength (Appendix-C).

3.7.2. The Study Instrument:

The study instrument and tools adapted to determine the effectiveness of regular resistance exercise on muscles strength of patients with stroke and consists of the following:

3.7.2. a. Part I: Socio-demographic Questionnaire for Patient with Stroke:

The first part of the questionnaire involved patients' socio-demographic data obtained from the patients with muscle weakness after stroke using an interview. This part included (6) items, which included age, gender, residency, level of education, marital status, and occupational status before the stroke (Appendix-D.1).

3.7.2. b. Part II: Clinical Features Questionnaire for Patient with Stroke:

The second part of the questionnaire: This section is focused with gathering clinical characteristics. Data collected from stroke victims through interviews. This part is comprised of two subparts, which include present and past medical history (Appendix D.2).

Present history: Investigated present medical history to elicit information about the presenting complaint. The present history form has stroke diseases related problems and complications.

Past history: A full account of the presenting complaint has been ascertained, and information about the patient’s past medical history be gathered to provide essential background information such as associated diseases and smoking.

3.7.3. c. Part III: Muscle Strength Testing (MST):

This part of the checklist focuses on measuring muscle strength, in which a special scale consisting of six degrees was used, as shown in the following table:

Rating Muscle Strength		
Rating	**Description of Function**	**Classification**
0	No muscle contraction	Zero
1	Palpable or visible contraction	Trace activity
2	Active movement, gravity eliminated	Poor
3	Active movement, against gravity	Fair
4	Active movement, against some resistance	Good
5	Active movement, against full resistance	Normal

Adopted from (Kozier et al., 2018).

This scale adapted from (Kozier et al., 2018). MST most widely used and recognized measure for determining the muscular strength of an individual. This approach involves testing major muscles in the patient's upper and lower limbs against the examiner's resistance and then rating the patient's strength on a scale of Zero (0) to Five (5) based on the results of those test. See 3.3.

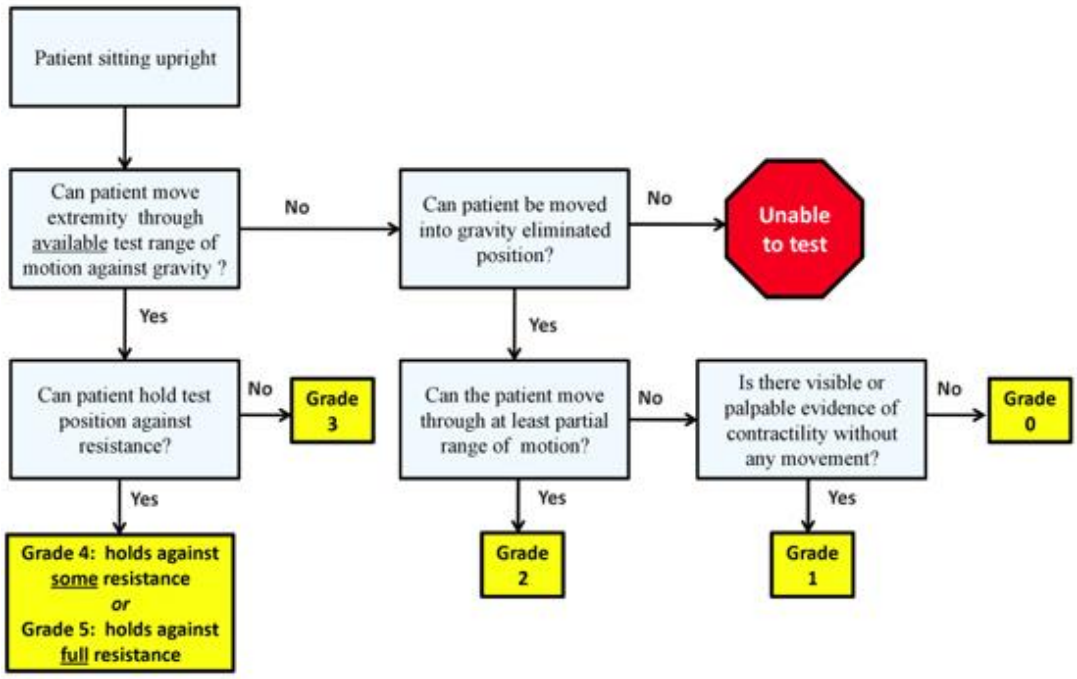


Figure 3-3: Muscle Strength Grading algorithm. Adopted from (Ciesla et al., 2011).

3.8. Validity of Study Instrument:

The validity of an instrument concerns its ability to gather the data that it is intended to collect. The face validity of the nursing intervention program and the study instrument is determined through the use of a panel of (14) experts, who had more than ten years of experience in their field to review the regular resistance exercise for the content and investigate clarity, relevancy, and adequacy of the questionnaire to measure the concepts of interest. Moreover, the mean of experience years for an expert panel is (22.3) years. Some demographic and clinical items were deleted, and others were added after a face-to-face or by e-mail discussion with each expert and after the instrument was considered valid after taking all the comments and recommendations into consideration.

3.9. Pilot Study:

In this study, the pilot study was conducted on a purposive sample of ten stroke patients, who have been selected from the Middle Euphrates Neuroscience Center. The pilot study sample is excluded from the original sample of the study.

3.9.1. Purpose of the pilot study:

1. To ensure that the exercises are easy to apply for both the researcher and patients.
2. To determine the average time required during each session to implement the program in each subject.
3. To evaluate the subject's responses to the data collection method.
4. Determine the problems that the researcher will face in collecting data and develop strategies to solve those problems.

3.9.2. Pilot Study Results:

The results of pilot study indicate the following:

1. Regular resistance exercise is clear.
2. The time required for demographic questionnaire was (4-5) minutes.
3. The time required for clinical was (3-5) minutes.
4. The time required for MST (5-10) minutes.

3.10. Reliability of the Study Instrument:

Reliability has not been calculated for the study instrument of the present study because the Muscle Strength Testing Scale (MST) is a global and stable standard, and there are no suggested modifications made by the experts. Reliability aims to study the phenomenon on the same population at any time in the future (Crwswell, 2018).

According to Florence, et al, 1992, the muscle strength testing scale is a suitable and accurate scale for measuring the muscle strength with a reliability ranging from 0.80-0.99. Additionally, the Noreau and Vachon, 1998, studied the "Comparison of three methods to assess muscular strength in individuals with spinal cord injury" they stated that the muscle strength testing scale is an accurate and suitable scale for measuring the muscle strength.

Muscle Strength Testing was used by many previous studies due to an important component of the physical exam that can reveal information about neurologic deficits. It is used to evaluate weakness and can be effective in differentiating true weakness from imbalance or poor endurance. It may be referred to as motor testing, muscle strength grading, manual muscle testing, or many other synonyms. The muscle strength

evaluation may be performed by nurses, physicians, physical therapists, occupational therapists, chiropractors, and other practitioners (Williams, 1956; Wintz, 1959; Brandsma et al., 1995; Compston, 2010; Ciesla et al., 2011; Kozier et al., 2018; Naqvi, 2021).

3.11. Method of Data Collection:

Face-to-face interviews used to collect socio-demographic and clinical data from patients. As for muscle strength testing after stroke, the researcher used the (MST) scale to assess the weakness of upper and lower extremities muscles for all participants before dividing them into experimental and control groups, and after the application of the program. The data collection started from 17th July 2022 to 15th January 2023.

In addition, after applying the program to the experimental group, the researcher evaluated the muscle strength every two weeks for six weeks. After the end of the period, the researcher compared the results of the experimental group with the control group. By following established guidelines for the control group, the researcher uses a pre-test and three post-test evaluations without the application of the regular resistance exercises. They still receive management routinely.

3.12. Materials Used in the Regular Resistance Exercises:

- **Resistance elastic bands loop exercises.**

There are two types of elastic bands (Straight and Loop bands), (figure **3-3**), which are used to exercise all areas of the body. They can be good for people with limited mobility, as many of the exercises can be done while seated “muscle-strengthening exercises should be done at least twice a week,” (Australia’s physical activity and sedentary behavior guidelines, 2021).

TheraBand Resistance (The tool used in the exercises): Band Loops are continuous 3" wide loop elastic bands used for various applications, particularly upper and lower body exercise, to increase balance and strength. Indications: "The band loops are efficient, and an effective way to strengthen muscles and have the added benefits of convenience, portability, and eliminates the need to tie traditional bands, thus prolonging life and reducing additional wear." Resistance Level: "The band loops come in four resistance levels, including Yellow - Thin (3.0 lbs.), Red - Medium (3.7 lbs.), Green - Heavy (4.6 lbs.), and Blue - X-Heavy (5.8 lbs.), and are available in three sizes 8", 12" and 18" Inch, so can increase the resistance as you progress (TheraBand, 2019).

The reasons for selected this band due to rehabilitate muscles and increase flexibility through simple yet effective workouts to increase strength and improve motion and portable and handy item that is appropriate for use at home, at the office, or when traveling.

3.13. Implementation of the Program:

The researcher chose the 6-week protocol because studying patients with stroke have a high degree of limitations, and some of them may discontinue the program.

Because the program is designed within the context of nursing, its application should be made through the Nursing process as follow:

1- The assessment step includes determining the patient's characteristics (socio-demographic and clinical data). In addition, the researcher assesses the muscle strength grade.

2- Then, the researcher determine the problem, etiology, and the defining characteristics for risk diagnosis such as (Impaired physical

mobility related to hemiparesis and Ineffective exercises related to impaired physical performance).

3- After that, the researcher introduced himself and application the regular resistance exercise to the patients, and after obtaining their agreement to participate in the study program. The program is applied according to the self-care deficit theory.

4- Finally, the process is done throughout three post-tests. The first post-test is conducted after two weeks after applying for the program, the second post-test is conducted after four weeks and finally, the third post-test is conducted after six weeks after implementing the program. The third post-test is conducted to ensure that the change in the patient's muscle strength is valid and consistent. The evaluation process involved a re-assessment of the patients' muscle strength using the scale and then compared the collected results with the results collected in the pre-test.

Exercises training involves of 3 circles of 10 recurrences of the Upper Extremity including five types of resistance exercise: Chest Pull, Shoulder Flexion, Shoulder Diagonals, Elbow Flexion, and Elbow Extension while, the Lower Extremity include three types of resistance exercise: Knee extension (Left), Hip abduction (Middle), and Right hip flexion is achieved by wrapping an elastic band around the ankles or above the knees in a sitting or lying posture, depending on the patient's desire or capacity. Training resistance exercises were carried out in slow motion.

3.14. Rating and Scoring:

The assessment of muscle strength will be classified into five grade are (0 Grade) =0% of normal strength; complete paralysis; (1 Grade) =10% of normal strength; no movement, contraction of muscle is palpable or

visible; (2 Grade) = 25% of normal strength; full muscle movement against gravity, with support; (3 Grade) =50% of normal strength; normal movement against gravity; (4 Grade) =75% of normal strength; normal full movement against gravity and against minimal resistance; (5 Grade) =100% of normal strength; normal full movement against gravity and against full resistance.

3.15. Statistical Analysis:

After the data are prepared for statistical analysis, the descriptive and inferential statistics employ for data analysis using the statistical Package of the Social Sciences (SPSS), version (IBM 22) as follows:

1. **Descriptive statistics:**
   - Frequency and percentage tables.
   - Mean and SD.
   - Bar chart and line
2. **Inferential statistics**
   - Mann-Whitney U test, to test the difference between two independent groups.
   - Pearson chi-square, to determine the impact of the study sample demographic and clinical data on the effectiveness of the study program.
   - Friedman Test, to investigate the difference between the muscle strength at different periods of measurement.

Chapter Four

Results

Chapter Four

Results and Findings

Chapter four focuses on the statistical analysis techniques used to achieve the objectives of the study and testing the null hypothesis related to the study phenomena. The purpose of this chapter is to present, describe, and interpret the result of the study in a systematic and detailed way.

Table (4.1) Study Sample Demographic Data with a Comparison Significance:

Demographic Data	Rating and Intervals	Statistics	Groups	
			Experimental Group	Control Group
Age	<= 29	Freq.	0	1
		%	0.0%	2.6%
	30 - 39	Freq.	4	1
		%	9.3%	2.6%
	40 - 49	Freq.	4	4
		%	9.3%	10.3%
	50 - 59	Freq.	15	8
		%	34.9%	20.5%
	60+	Freq.	20	25
		%	46.5%	64.0%
Gender	Male	Freq.	28	24
		%	65.1%	61.5%
	Female	Freq.	15	15
		%	34.9%	38.5%
Residency	Rural	Freq.	12	15
		%	27.9%	38.5%
	Urban	Freq.	31	24
		%	72.1%	61.5%
Marital Status	Single	Freq.	2	0
		%	4.7%	0.0%
	Married	Freq.	33	30
		%	76.7%	76.9%
	Widowed/widow	Freq.	8	9
		%	18.6%	23.1%

Occupational status before the stroke	Governmental employee	Freq.	8	2
		%	18.6%	5.1%
	Private or self-employed	Freq.	6	6
		%	14.0%	15.4%
	Retired	Freq.	6	8
		%	14.0%	20.5%
	Housewife	Freq.	8	11
		%	18.6%	28.2%
	Jobless	Freq.	15	12
		%	34.8%	30.8%
Total		Freq.	43	39
		%	100.0%	100.0%

Table (4.1) show the statistical distribution of the study sample according to their socio-demographic data. Regarding the Experimental group, the study result indicates that the majority of the Experimental group participants are 60 and more years old (46.5%), male (65.1%), urban residents (72.1%), married (76.7%), and a high percentage of the study group are jobless (34.9%) in related to their occupational status before the stroke.

While the control group, the study results indicate that the majority of participants are 60 and more years old (64.1%), male (61.5%), urban residents (61.5%), married (76.9%), and there jobless (30.8%) in related to the occupational status before the stroke.

Finally in this table , the study results indicate that there is a non-significant difference between the experimental and control group socio-demographic data at p-value more than 0.05.

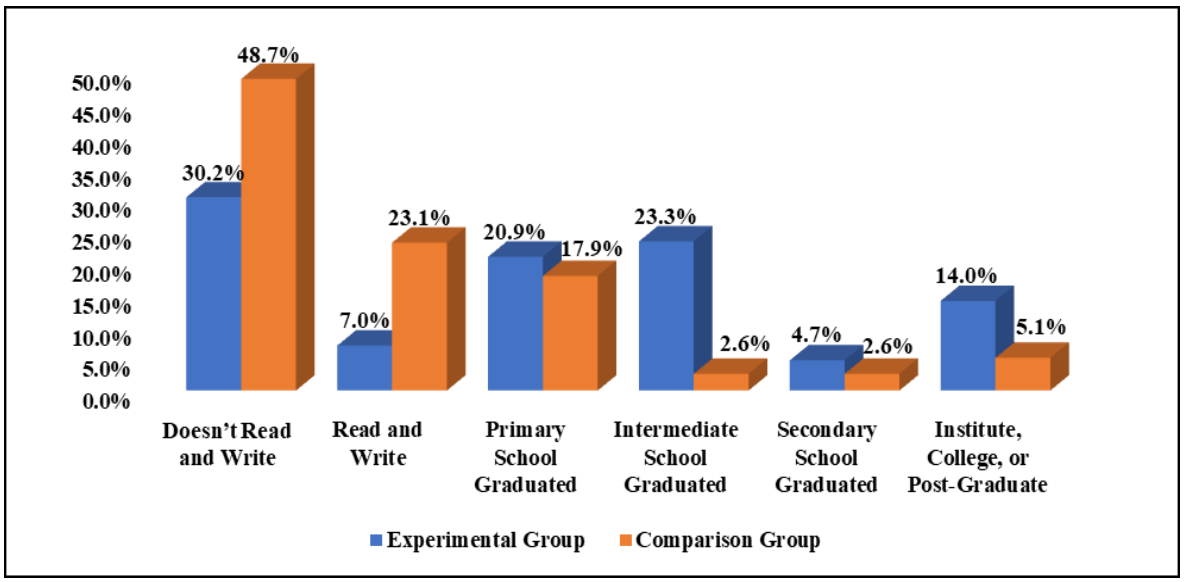


Figure (4.2) Distribution of the Study Sample According to their Levels of Education

Table (4.2) Study Sample Present Medical History:

Present Medical History	Rating and Intervals	Statistics	Groups	
			Experimental Group	Control Group
Type of Stroke	Ischemic	Freq.	31	22
		%	72.1%	56.4%
	Hemorrhagic	Freq.	12	17
		%	27.9%	43.6%
Bodyside that is affected by stroke	Right side	Freq.	24	22
		%	55.8%	56.4%
	Left side	Freq.	19	17
		%	44.2%	43.6%
Recurrence of stroke	Yes	Freq.	19	18
		%	44.2%	46.2%
	No	Freq.	24	21
		%	55.8%	53.8%
How many strokes is recurrent	No recurrence	Freq.	24	20
		%	55.8%	51.3%
	1.00 - 2.00	Freq.	14	11
		%	32.6%	28.2%
	3.00+	Freq.	5	8
		%	11.6%	20.5%
Duration of stroke/months	6 and less	Freq.	33	27
		%	76.7%	69.2%
	7 – 12	Freq.	3	6
		%	7.0%	15.4%
	13 – 18	Freq.	6	3
		%	14.0%	7.7%
	19 – 24	Freq.	1	3
		%	2.3%	7.7%

Total	**Freq.**	**43**	**39**
	%	**100.0%**	**100.0%**

Table (4.2): this table illustrates the present history of experimental and control groups. The result of the study indicate that the majority of both groups are ischemic stroke experimental group (72.1%) and control group (56.4%), both groups are right side affected by stroke, experimental group (55.8%) and control group (56.4%), the majority of experimental and control groups have no recurrence of stroke (55.8%) and (53.8%). Finally, concerning the duration of stroke by months, the majority of the experimental and control group have 6 months and less than duration (76.7%), (69.2%).

Table (4.3) Summary Statistics of the Experimental and Control Groups according to the stroke-related problems and complications:

Complications	Rating and Intervals	Statistics	Groups	
			Experimental Group	Control Group
Pneumonia	**Yes**	**Freq.**	**1**	**0**
		%	**2.3%**	**0.0%**
	No	**Freq.**	**42**	**39**
		%	**97.7%**	**100.0%**
Epilepsy	**Yes**	**Freq.**	**1**	**0**
		%	**2.3%**	**0.0%**
	No	**Freq.**	**42**	**39**
		%	**97.7%**	**100.0%**
DVT	**No**	**Freq.**	**43**	**39**
		%	**100.0%**	**100.0%**
Painful shoulder	**Yes**	**Freq.**	**10**	**6**
		%	**23.3%**	**15.4%**
	No	**Freq.**	**33**	**33**
		%	**76.7%**	**84.6%**
Pressure sore	**Yes**	**Freq.**	**0**	**1**
		%	**0.0%**	**2.6%**
	No	**Freq.**	**43**	**38**

		%	100.0%	97.4%
Joint contractures	No	Freq.	43	39
		%	100.0%	100.0%
Dysphagia	Yes	Freq.	13	8
		%	30.2%	20.5%
	No	Freq.	30	31
		%	69.8%	79.5%
Constipation	Yes	Freq.	8	9
		%	18.6%	23.1%
	No	Freq.	35	30
		%	81.4%	76.9%
Total		Freq.	43	39
		%	100.0%	100.0%

Table (4.3): shows the present history (stroke-related problems and complications) of experimental and control groups. The majority of both groups have no complications for experimental and control groups: no pneumonia (97.7%) (100%), no epilepsy (97.7%) (00%), no deep vein thrombosis (100%) for both groups, no painful shoulder (76.7%) (84.6%), no pressure sore (100%) (97.4%), both groups have no joint contracture (100%), no dysphagia (69.8%) (79.5%), and no constipation (81.4%) (76.9%).

Table (4.4) Study Sample Past Medical History:

Present Medical History	Rating and Intervals	Statistics	Groups	
			Experimental Group	Control Group
Diabetes Mellitus	Yes	Freq.	20	23
		%	46.5%	59.0%
	No	Freq.	23	16
		%	53.5%	41.0%
Ischemic Heart Diseases	Yes	Freq.	5	6
		%	11.6%	15.4%
	No	Freq.	38	33
		%	88.4%	84.6%
Hypertension	Yes	Freq.	36	36
		%	83.7%	92.3%
	No	Freq.	7	3
		%	16.3%	7.7%

Heart Failure	No	Freq.	43	39
		%	100.0%	100.0%
Renal Diseases	Yes	Freq.	1	0
		%	2.3%	0.0%
	No	Freq.	42	39
		%	97.7%	100.0%
Smoking	Yes	Freq.	24	16
		%	55.8%	41.0%
	No	Freq.	19	23
		%	44.2%	59.0%
Total		Freq.	43	39
		%	100.0%	100.0%

Table (4.4): illustrates the past medical history of experimental and control groups. The study results indicate that the patients in the study group have no (ischemic heart disease 88.4%, heart failure 100%, and renal disease 97.7%). They have (diabetes mellitus 46.5%, hypertension 83.7%, and the majority of patients are smoking 55.8%).

Regarding the control group, the study results indicate that the majority of them have no (ischemic heart disease 84.6%, heart failure 100%, renal disease 100% and smoking 59.0%). They have (diabetes mellitus 59.0% and hypertension 92.3%).

Table (4.5) Assessment of Muscle Strength at the Pre-test for both Experimental and Control Groups:

Muscle strength assessment	Statistics	Groups	
		Experimental group	Control group
No muscle contraction	Freq.	0	0
	%	0.0%	0.0%
Trace Activity	Freq.	21	14
	%	48.8%	35.9%
Poor Muscle Contraction	Freq.	21	22
	%	48.8%	56.4%
Fair Muscle Contraction	Freq.	1	3
	%	2.3%	7.7%
Good Muscle Contraction	Freq.	0	0
	%	0.0%	0.0%

Normal Muscle Contraction	Freq.	0	0
	%	0.0%	0.0%
Total	Freq.	43	39
	%	100.0%	100.0%

Table (4.5): shows the score of muscle strength for experimental and control groups at pre-test. The study result indicates that the patients in the experimental group distributed between palpable or visible contraction (Trace Activity) and Active movement, gravity eliminated (Poor Muscle Contraction) 48.8% according to muscle strength testing.

While the majority of the control group have active movement, gravity eliminated (Poor Muscle Contraction) 56.4% according to muscle strength testing.

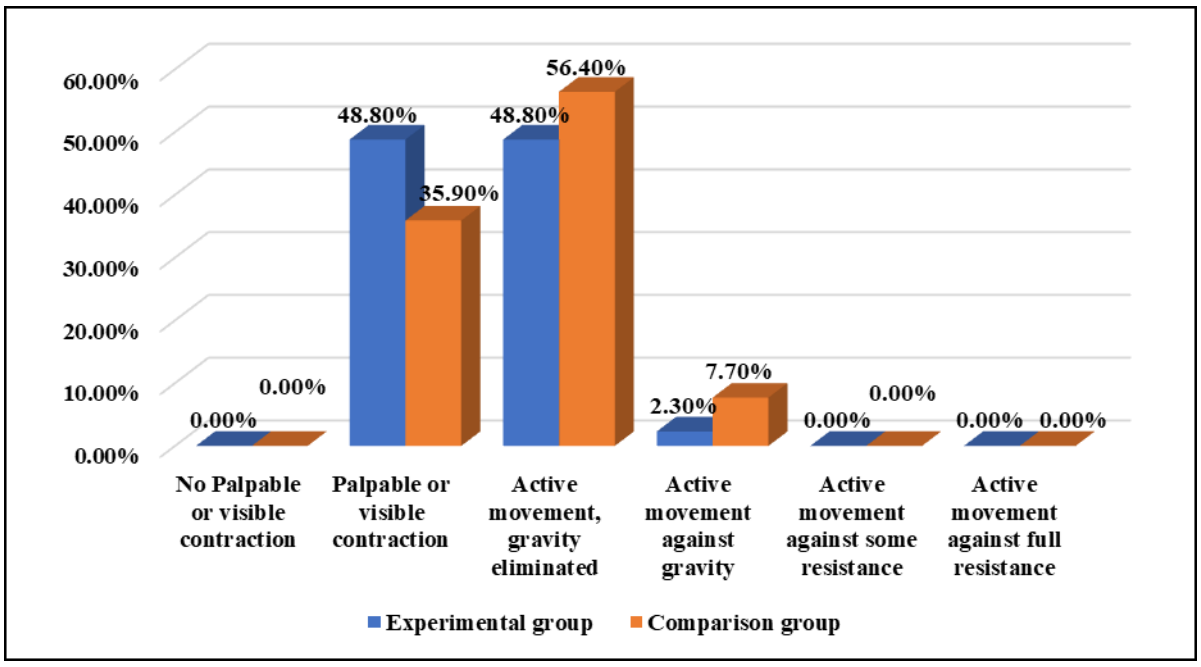


Figure (4.3) Assessment of Muscle Strength at the Pre-test for both Experimental and Control Groups

Table (4.6) Assessment of Muscle Strength at the Post-test 1 for both Experimental and Control Groups:

Assessment of muscle strength	Statistics	Groups	
		Experimental group	Control group
No muscle contraction	Freq.	0	0
	%	0.0%	0.0%
Trace Activity	Freq.	0	20
	%	0.0%	51.3%
Poor Muscle Contraction	Freq.	15	18
	%	34.9%	46.2%
Fair Muscle Contraction	Freq.	12	1
	%	27.9%	2.6%
Good Muscle Contraction	Freq.	16	0
	%	37.2%	0.0%
Normal Muscle Contraction	Freq.	0	0
	%	0.0%	0.0%
Total	Freq.	43	39
	%	100.0%	100.0%

Table (4.6): this table shows the score of muscle strength for experimental and control groups in post-test 1. The results indicate that a high percentage of the study group have active movement against some resistance (Good Muscle Contraction) 37.2% in post-test 1 after receiving a regular resistance exercise.

While the majority of the control group remains at level one of muscle strength testing (Trace Activity) at 51.3%. at post-test 1.

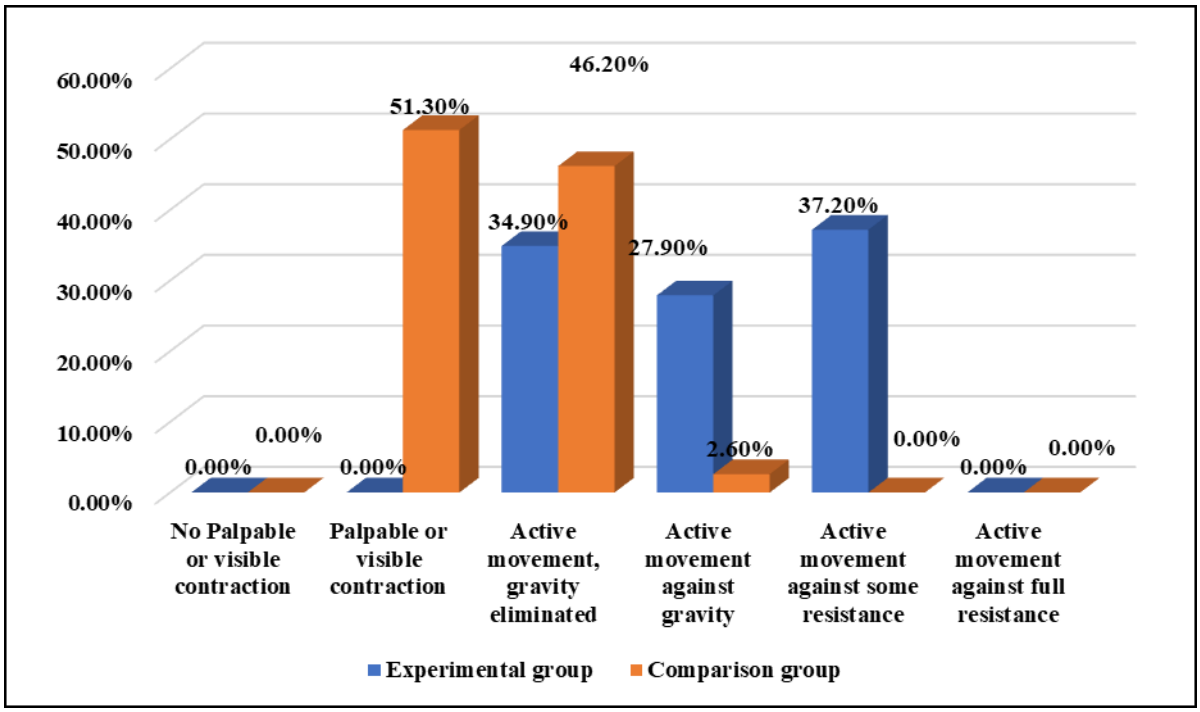


Figure (4.4) Assessment of Muscle Strength at the Post-test1 for both Study and Control Groups

Table (4.7) Assessment of Muscle Strength at the Post-test 2 for both Experimental and Control Groups:

Assessment of muscle strength	Statistics	Groups	
		Experimental group	Control group
No muscle contraction	Freq.	0	1
	%	0.0%	2.6%
Trace Activity	Freq.	0	31
	%	0.0%	79.5%
Poor Muscle Contraction	Freq.	0	5
	%	0.0%	12.8%
Fair Muscle Contraction	Freq.	11	1
	%	25.6%	2.6%
Good Muscle Contraction	Freq.	24	1
	%	55.8%	2.6%
Normal Muscle Contraction	Freq.	8	0
	%	18.6%	0.0%
Total	Freq.	43	39
	%	100.0%	100.0%

Table (4.7): illustrates the score of muscle strength for experimental and control groups at the post-test 2. The results indicate that the most of patients in the experimental group have (Good Muscle Contraction) according to muscle strength testing.

While the majority of the patient in the control group deteriorated and their muscle strength returned to level one (Trace Activity), the percentage of patients in this group changed from 51.3% at post-test 1 to 79.5% at post-test 2.

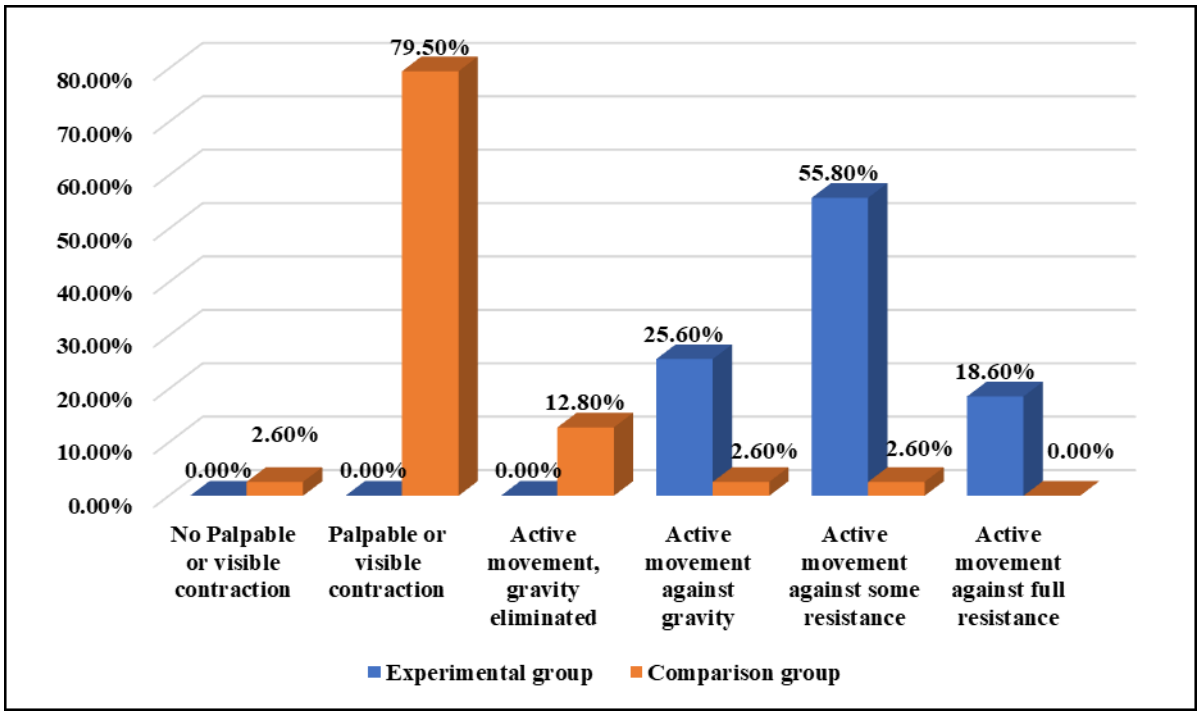


Figure (4.5) Assessment of Muscle Strength at the Post-test2 for both Study and Control Groups

Table (4.8) Assessment of Muscle Strength at the Post-test 3 for both Experimental and Control Groups:

Assessment of muscle strength	Statistics	Groups	
		Experimental group	Control group
No muscle contraction	Freq.	0	5
	%	0.0%	12.8%
Trace Activity	Freq.	0	32
	%	0.0%	82.1%
Poor Muscle Contraction	Freq.	0	0
	%	0.0%	0.0%
Fair Muscle Contraction	Freq.	0	0
	%	0.0%	0.0%
Good Muscle Contraction	Freq.	14	1
	%	32.6%	2.6%
Normal Muscle Contraction	Freq.	29	1
	%	67.4%	2.6%
Total	Freq.	43	39
	%	100.0%	100.0%

Table (4.8): illustrates the score of muscle strength for experimental and control groups at the post-test 3. The study results indicate that the majority of patients in the experimental group improve muscle strength and have active movement against full resistance (Normal Muscle Contraction) 67.4% according to muscle strength testing.

While the majority of patients in the control group remain at level one (Trace Activity) according to muscle strength testing 82.1% and some patients deteriorated to score zero (No muscle contraction) at post-test 3.

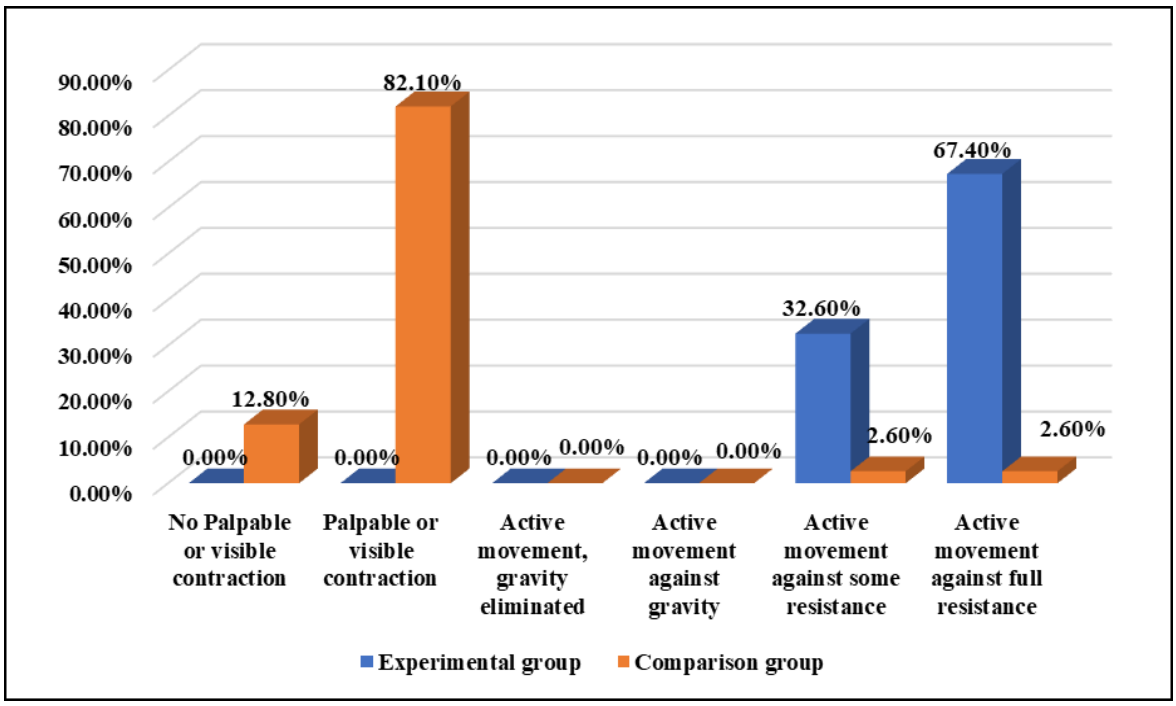


Figure (4.6) Assessment of Muscle Strength at the Post-test3 for both Experimental and Control Groups

Table (4.9) Comparison of the Experimental Group Participants' Muscle Strength at different Periods of Measurements using Friedman's Test:

Periods of Measurements	N	Mean	Std. Deviation	Mean Rank	Friedman's Statistics
Pre-test	43	1.53	.550	1.00	Chi-Square (122.956) Df (3) p-value (0.001) S
Post-test 1	43	3.02	.859	2.09	
Post-test 2	43	3.93	.669	3.08	
Post-test 3	43	4.67	.474	3.83	

Table (4.9): shows the score of muscle strength for an experimental group at different Periods of Measurement. The results indicate that significant differences in muscle strength at different Periods of Measurement (Pre-test, Post-test 1, Post-test 2, and Post-test 3) at a p-value

less than 0.01 (i. e. the exercise used for patients in the experimental group is an effective way to improve muscle strength after stroke.

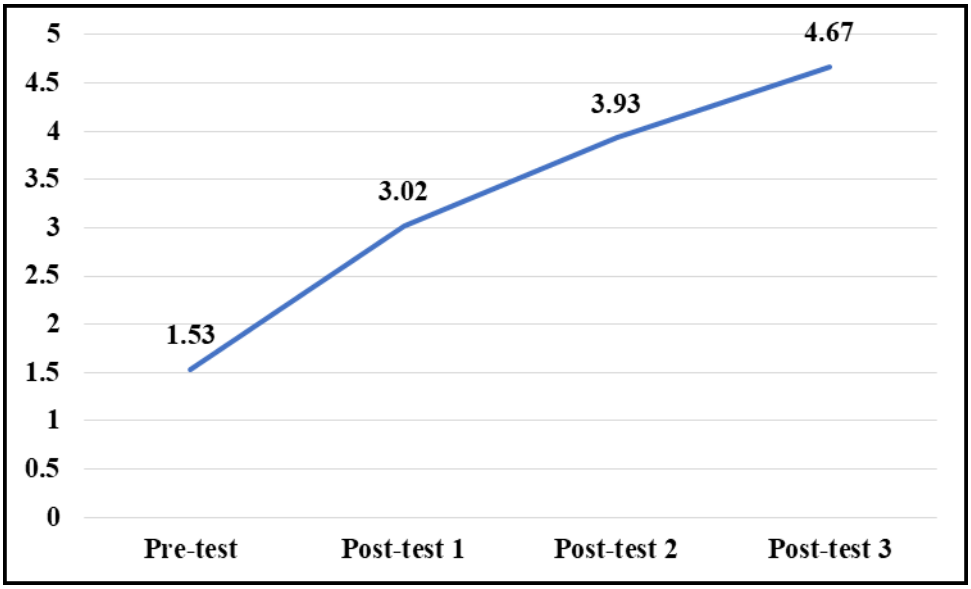


Figure (4.7) Comparison of the Study Group Participants' Muscle Strength at different Periods of Measurements

Table (4.10) Comparison of the Control Group Participants' Muscle Strength at different Periods of Measurements using Friedman's Test:

Periods of Measurements	N	Mean	Std. Deviation	Mean Rank	Friedman's Statistics
Pre-test	39	1.72	0.60	3.17	Chi-Square (45.535) Df (3) p-value (0.001) S
Post-test 1	39	1.51	0.56	2.79	
Post-test 2	39	1.23	0.67	2.21	
Post-test 3	39	1.05	0.89	1.83	

Table (4.10): shows the score of muscle strength for the control group at different Periods of Measurement. The study results indicate that

there is a significant difference in muscle strength at different Periods of Measurements (Pre-test, Post-test 1, Post-test 2, and Post-test 3) at a p-value less than 0.01.

Based on the statistical mean, the study result indicates that there is a deterioration in muscle strength among patients in the control group.

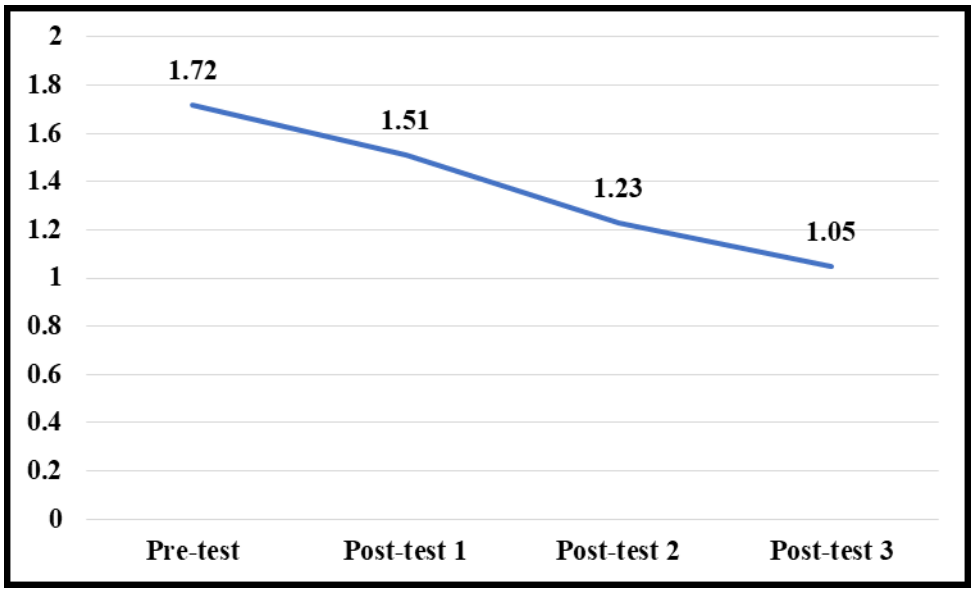


Figure (4.8) Comparison of the Control Group Participants' Muscle Strength at different Periods of Measurements

Table (4.11) Comparison of the Experimental and Control Groups Participants' Muscle Strength at different Periods of Measurement using the Mann-Whitney Test:

Periods of Measurements	Groups	N	Mean Rank	Sum of Ranks	Mann-Whitney U	p-value
Pre-test	Experimental group	43	38.50	1655.50	709.5	.177 NS
	Control group	39	44.81	1747.50		
	Total	82				
Post-test 1	Experimental group	43	57.37	2467.00	156.0	0.001 S
	Control group	39	24.00	936.00		
	Total	82				
Post-test 2	Experimental group	43	60.34	2594.50	28.5	0.001 S
	Control group	39	20.73	808.50		
	Total	82				
Post-test 3	Experimental group	43	60.17	2587.50	35.5	0.001 S
	Control group	39	20.91	815.50		
	Total	82				

Table (4.11) shows the comparison of the experimental and control groups' participants' muscle strength at different Periods of Measurement. The study results indicate there is a non-significant difference in muscle strength between experimental and control groups at pre-test.

While the results indicate a significant difference between both groups at the different periods of measurement (Post-test 1, Post-test 2, and Post-test 3) at a p-value less than 0.01.

In addition, to that, the mean difference indicates an improvement in muscle strength of patients in the experimental group compared with patients in the control group as a response to the study program.

Table (4.12) Relationship between the Experimental Group Participants' Muscle Strength and their Demographic Data:

Demographic Data	Chi-Square Value	df	p-value
Age / Years	3.992	3	.262 NS
Gender	.891	1	.345 NS
Residency	.000	1	1.00 NS
Levels of Education	2.250	5	.814 NS
Marital Status	3.207	2	.201 NS
Occupational Status before the Stroke	5.440	4	.245 NS

Table (4.12): this table shows there is a non-significant association between the experimental group and their socio-demographic data at a p-value of more than 0.05.

Table (4.13) Relationship between the Experimental Group Participants' Muscle Strength and their Present Medical History:

Present Medical History	Chi-Square Value	df	p-value
Type of Stroke	1.013	1	.314 NS
Bodyside that is affected by stroke	4.179	1	.041 S
Recurrence of stroke	2.596	1	.107 NS
How many strokes is recurrent	3.747	2	.154 NS
Duration of stroke/months	1.875	2	.392 NS
Pneumonia	2.053	1	.152 NS
Epilepsy	.513	1	.474 NS
Painful shoulder	.067	1	.795 NS

Dysphagia	**.231**	**1**	**.631 NS**
Constipation	**1.966**	**1**	**.161 NS**

Table (4.13): illustrates the association between the experimental group's muscle strength and their present medical history. The study results indicate that a significant association between the experimental group participant's muscle strength and body side that is affected by stroke. While there is a non-significant association with other items in the present medical history (Type of Stroke, Recurrence of stroke, How many strokes is recurrent, Duration of stroke/months, Pneumonia, Epilepsy, Painful shoulder, Dysphagia, and Constipation).

Table (4.14) Relationship between the Experimental Group Participants' Muscle Strength and their Past Medical History:

Past Medical History	Chi-Square Value	df	p-value
DM	**.000**	**1**	**1.00 NS**
IHD	**2.229**	**1**	**.135 NS**
HTN	**.000**	**1**	**1.00 NS**
Renal disease	**2.053**	**1**	**.152 NS**
Smoking	**.052**	**1**	**.819 NS**

Table (4.14): the results presented in this table indicate a non-significant association between experimental group participant and their past medical history.

Chapter Five

Discussion of the Study Results

Chapter Five

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Chapter five introduces a discussion of the study findings with an appropriate rationale and support based on previous articles, as follows:

Part One: Discussion for Patients' Socio-Demographic Data: table (4.1).

Stroke is becoming a serious health issue in developing countries. It is a disorder that affects millions of individuals around the globe, and its incidence is influenced by patients' socio-demographic information.

The results of the present study indicated that the ages of most of the study members are of advanced age. This confirms that the incidence of stroke disease rises with age and vice versa.

Lai *et al.,* (2021) They found that patients aged 67 and older are the most common vulnerable age group for stroke. In addition, Dehno, et al., (2021) they have studied the "Unilateral Strength Training of the Less Affected Hand Improves Cortical Excitability and Clinical Outcomes in Patients With Subacute Stroke: A Randomized Controlled Trial" They discovered that the majority of patients are elderly (53 years old and more).

The prevalence of stroke disease increases markedly with old age. The reason for this is because elderly individuals may suffer from systemic conditions and stress. Moreover, aged individuals are afflicted with atherosclerosis, which causes ailments that are exacerbated by the aging process, such as hypertension.

The present study also describes gender. The findings indicate that male is the dominant gender for the study sample. This validates the incidence of stroke increased in males compared with females. Kim, (2021), They constitute that males made up the bulk of the research sample. Additionally, substantial research has been done on gender disparities in a wide range of health and illness, and nursing is now paying more attention to these issues. The male is more prone to stroke than the female due to the action of the sex hormone, the naturalness of the employment, stress displaying, and chronic illness distribution. Additionally, lifestyle variations like drinking and smoking may also contribute to the explanation of this gender disparity.

Regarding the study subjects marital status and residency, "the present study results indicate that the majority of the study subjects are married and are urban residents. This may be because the urban environment is more stressful, noisy, and polluted compared with the rural environment. So the incidence of a stroke may increase in urban residents compared with rural residents. In addition, these results might occur because the stroke refers to a modern scourge of industrialized society. Moreover, stroke may increase in incidence among those persons in an urban residential area, than in those from rural areas. Also, those persons in the rural residential area often experience physical exercises every day as compared with those in urban, which makes them less risky to get a stroke. Furthermore, individuals in rural residential areas are less prone to get stroke due to the risk factors that are more focused in urban than in rural areas such as the psychological stress. Regarding the marital status, with respect to the eastern population, they tend to marry early as compared with

other populations. So, we may see that the majority of the study subjects are married" (Al-Ibraheemi and AL-Bayati, 2018).

With respect to the study sample, the level of education in the present study results shows that the majority of the study sample doesn't read and write. Pandit, (2020) in their study "Health Related Quality of Life of Cerebrovascular Accident Patient: A Descriptive Study" they found in their results that the majority of the study samples were unable to read and write only. This might be because the majority of the people who participated in the research are of advanced age, and the living, social, and cultural situations in which they were raised did not let them to attend a school or finish their education. In addition, this conclusion may have been brought about as a consequence of the ongoing economic and political problems as well as conflicts that our nation has been experiencing ever since the beginning of the eighties.

Regards to occupational status, the study result indicates that a high percentage of study participants were jobless. These results are similar to other studies done by Ribeiro Lima, *et al.*, (2020), the study entitled "Socio-demographic factors associated with quality of life after a multicomponent aphasia group therapy in people with sub-acute and chronic post-stroke aphasia" they mentioned that most of the study sample were unable to work.

When compared to patients of a younger age, this outcome may have occurred because more than one-third of the patients who participated in the study are at an elderly age for which they are unable to work. And this may be because the sickness and its treatment for other chronic

diseases have an influence on the lifestyle and everyday activities of the patients.

Part Two: Discussion of the Patients' Medical History:

According to the Present Medical History, table (4.2), The study results indicate that the majority of the study sample (both groups) are diagnosed with an ischemic stroke. This result comes because many scientific studies indicate that the ischemic stroke is more incidence compared with hemorrhagic stroke. Wu, *et al.,* (2020), In their study "Collaborative Care Model Based Telerehabilitation Exercise Training Program for Acute Stroke Patients in China: A Randomized Controlled Trial" they found that the majority of patients in the research were diagnosed with ischemic stroke. Also, Baig *et al.,* (2020) have studied the "Exercise referral to promote cardiovascular health in stroke and TIA patients: a pilot feasibility study" they found that the majority of patients with a present history of the ischemic type of stroke. Al-Ibraheemi and AL-Bayati, (2018), they stated that ischemic stroke is the most common type among stroke patients.

Regarding the body side that affected by stroke, the majority of a participant in the present study were suffered from right side affected compared with left side. These results are similar to the study that was conducted by Kwan *et al*. (2019), who studied the "Relationship between lower limb coordination and walking speed after stroke: an observational study" in which he emphasized that most patients in the sample suffer from influence on the right side of the body than the left side after a stroke.

In addition, Choi *et al*., (2020), they study "Changes in Lower Limb Muscle Activation and Degree of Weight Support according to Types of Cane-Supported Gait in Hemiparetic Stroke Patients" they found that the most study sample affected right side by stroke more than left side.

Concerning to the recurrence of stroke and how many stroke is recurrent, the study results indicate that the majority of participant exhibit no recurrent stroke. This result is consistent with a study that is conducted by Al-Ibraheemi and AL-Bayati, (2018), they found that the majority of the study subjects have no recurrent stroke. In addition, Smeltzer *et al*. (2010) found that the majority of stroke patients do not have a recurrence of their condition, which was supported by data from scientific studies.

Relative to the duration of stroke, according to the findings of the study, a significant proportion of the people who participated in the study had been given a stroke diagnosis over the last few days. This might be due to the fact that the patients who participated in the study sample were in the acute stage of the stroke when they were brought to the hospital, and hospitals try to have patients admitted as quickly as possible to reduce the risk of complications related to strokes (Hastrup, *et al*.,2018).

According to the Present Medical History/stroke-related problem and complication, table (4.3), the study results indicate that less than a quarter of the study subjects have pneumonia, epileptic seizures, deep vein thrombosis, painful shoulder, pressure sores, joint contracture, constipation, and dysphagia. These results may appear because of impaired brain functions due to stroke or because of the immobility resulting from the

hemiplegia or the hemiparesis. Because the brain is responsible for coordinating and controlling all the body functions

Also, this result in fact is because most of the participating patients are in the acute phase of the disease and there was no long period for complications as a result of a stroke. It was also mentioned previously that most patients when interviewed were in the first days of the disease, and most injuries were less than a month.

So if there is an impairment in its functions, all the related functions are also impaired, this evidence is supported by (Okawara & Usuda, 2015; Al-Ibraheemi and AL-Bayati, 2018).

Part Three: Discussion of the Patients' Past Medical History: table (4.5).

Regarding the past history among patients with stroke, the finding of the current study show that a high percentage of study subjects have diabetes mellitus and hypertension. In addition, most of them were smoking. This result come along with (Alamri, et al. 2019), they studied "Effectiveness of an early mobility protocol for stroke patients in Intensive Care Unit" found that the high percentage of a patient with stroke suffer from diabetes mellitus and hypertension.

Persson *et al.,* (2020), in their study "Increased muscle tone and contracture late after ischemic stroke" mentioned that most of the patients in the study suffer from high blood pressure and diabetes mellitus, in addition to that, most of them are smokers.

Al-Ibraheemi and AL-Bayati, (2018) they found that many study subjects have hypertensive and diabetes. Also, mentioned hypertension and diabetes mellitus are the factors that contributes to strokes the most often. Therefore, it is not surprising to discover that the majority of the people who participated in the research had hypertension and diabetes.

The results that were mentioned in the current study are in fact identical to scientific studies, because blood pressure, diabetes, smoking, and other risk factors are basically one of the most important causes of stroke because of its direct impact on the blood vessels in the body, including the brain, so it is not surprising that the most stroke patients suffer from the aforementioned factors.

Part Four: Discussion of the Effectiveness of the Regular Resistance Exercise on Patients' Muscle Strength table (4.6-4.12).

The majority of stroke patients will face restrictions on their ability to do activities, which will result in a loss of muscle and joint strength. Along with the rise in stroke cases, hemiparesis incidence is also rising. Every year, there is a rise in the number of stroke victims. This is not only a problem for the elderly; strokes may also happen to persons who are young and active (Oktraningsih, 2017). Patients recovering from stroke sometimes struggle with movement issues. Due to injuries in the motor cortex, movement problems are caused by a loss of strength in the muscles of the extremities. Stroke patients may have interruptions or challenges with walking and other activities due to muscular strength and balance issues

(Abdillah, *et al.*, 2022). Because their limb muscles can no longer move as easily, stroke sufferers experience weakness on one side of their bodies.

Alkhaqani and AL-Bayati, (2021), they stated that the promotion of resistance exercise training should assume a more prominent position in exercise guidelines especially for older patients with chronic disease. In a scoping review of previous studies, Asadzadeh *et al.*, (2021) concluded that there is an evidence of the effectiveness of exercise therapy to improve patients' health status.

The primary proposed outcome for the present study is to examine the effectiveness of regular resistance exercise on muscle strength of patients with stroke. The results of this study indicated that the muscle strength of patients in both groups was very low at the pre-test. After implementation of the regular resistance exercise through the present study, the results of the study indicated that there is an improvement in the experimental group muscle strength compared with those participants in the control group (i.e., the applied method is an effective way to improve the muscle strength of patients diagnosed with muscle weakness as a result of stroke disease).

Barbosa *et al*., (2018), studied the "Strength training protocols in hemiparetic individuals post-stroke: a systematic review" they reported that the strength training protocols are effective in hemiparetic patients post-stroke.

Moreover, Ivey, *et al.*, (2017), in a study entitled "Strength Training for Skeletal Muscle Endurance after Stroke" they mentioned that the ability

to maintain a submaximal level of muscular contraction was significantly improved by the strength training program.

Also, Bastola, *et al.*, (2022), they mentioned that when compared to the control group, resistance training was responsible for a considerable rise in the targeted muscle groups' levels of strength. In addition, demonstrated that a systematic RT program lasting eight weeks may safely enhance motor function, motor recovery, and quality of life in individuals who have had a subacute stroke.

Abdillah, *et al.*, (2022), they explained the distribution of muscle strength evaluation following range of motion exercise demonstrates that the average muscle strength after the ROM exercise intervention improves from a scale of 2 to a scale of 3, where muscle strength with a scale of 3 can endure movements against gravity.

Moreover, regular resistance exercise can improve muscle strength and enhance endurance by increasing the delivery of oxygen and nutrients to tissues and help the cardiovascular system and musculoskeletal system work more and more efficiently and when heart and lung function improves, that increases energy for daily activity. Therefore, muscle performance will be increased.

Part Five: Discussion the Association of Socio-Demographic and Clinical Characteristics on the Effectiveness of the Regular Resistance Exercise: table (4.13-4.15).

The study result indicates that there is an association between muscle strength and the body side that is affected by stroke in experimental group participants. This result comes because of the muscle strength in the right side handers is strong compared with the muscle strength on the left side and vice versa. Abe and Loenneke, (2015), mentioned that the right hand was stronger when compared side by side, with a 10.2% difference in handgrip strength for the right-handed group. The left hand of the left-handed group, however, was 7.8% stronger than the right. The connection between side-by-side differences in handgrip strength and forearm-ulna muscle thickness (r = 0.765) and forearm-radius muscle thickness (r = 0.622) was statistically significant. In addition, Jeon et al., (2016), they stated that asymmetrical muscular strength in the ankle joint may result in counter balancing muscle strength in the knee joint in order to preserve the body's center of mass. Therefore, the body side that is affected by stroke affects the muscle strength.

Chapter Six

Conclusions and Recommendation

Chapter Six
Conclusions and Recommendations

Conclusions:

Based on the study's findings, discussion, and evidences, the study concludes the following:

Main conclusions:

As the study hypothesis was formulated to predict an improvement in muscle strength in patients after they attend a regular resistance exercise program, and as this effect is proved. (i.e., the regular resistance exercise implement for at least for six weeks is an effective approach to improving the muscle strength of patients with stroke compared to the control group). Therefore, the alternative hypothesis is supported.

Specific. conclusions:

1. The occurrence of stroke is increases as the age group advance.
2. The occurrence of stroke is increased in male patients, compared with female patients.
3. The ischemic strokes is the dominant type of stroke.
4. People who live in urban are more likely to suffer from strokes than people who live in rural areas.
5. Right-side strokes is most common than left-side stroke.
6. Diabetic Mellitus and high blood pressure are the comorbidities associated with stroke that occur most often.

6.2. Reccommendations:

Based on the study conclusions, the study recommends the following:

1. A nursing rehabilitation guideline should be prepared and up to date under the supervision of nursing experts to use by the health staff in the ministry of health as a standard in the management of patients with stroke.

2. Encouraged nurses working at neurosurgery centers to using the regular resistance exercises for stroke patients who suffer from muscle weakness.

3. It is necessary to conduct further studies to prove the efficacy of alternative nursing rehabilitation techniques in minimizing stroke-related problems.

References

References:

Abdillah, A., Istiqomah, I. N., Kurnianto, S., & Khovifah, N. (2022). The effectiveness of range of motion (ROM) on increasing muscle strength in stroke patients: Literature review. *Nursing and Health Sciences Journal (NHSJ)*, *2*(2), 137-142.

Abe, T., & Loenneke, J. P. (2015). Handgrip strength dominance is associated with difference in forearm muscle size. *Journal of physical therapy science*, *27*(7), 2147-2149.

Abel, N. A., Bauer, C., Hann, S., & Manwaring, J. Mark S. Greenberg-Handbook of Neurosurgery (2019, Thieme)-1-965 PDF.

Adler, A., Hindieh, W., Weissler-Snir, A., Fourey, D., Harris, S., & Rakowski, H. (2017). Exercise in patients with hypertrophic cardiomyopathy: a review of current evidence, national guideline recommendations and a proposal for a new direction to fitness. *Journal of science and medicine in sport*, *20*(4), 333-338.

Ahmed, Z. M., Khalil, M. F., Kohail, A. M., Eldesouky, I. F., Elkady, A., & Shuaib, A. (2020). The prevalence and predictors of post-stroke depression and anxiety during COVID-19 pandemic. *Journal of Stroke and Cerebrovascular Diseases*, *29*(12), 105315.

Ahn, J. Y., Kim, H., & Park, C. B. (2019). Effects of whole-body vibration on upper extremity function and grip strength in patients with

subacute stroke: a randomised single-blind controlled trial. *Occupational therapy international*, *2019*.

Aidar, F. J., de Oliveira, R. J., de Matos, D. G., Mazini Filho, M. L., Moreira, O. C., de Oliveira, C. E. P., ... & Reis, V. M. (2016). A randomized trial investigating the influence of strength training on quality of life in ischemic stroke. *Topics in stroke rehabilitation*, *23*(2), 84-89.

Alamri, M. S., Waked, I. S., Amin, F. M., Al-Quliti, K. W., & Manzar, M. D. (2019). Effectiveness of an early mobility protocol for stroke patients in Intensive Care Unit. *Neurosciences Journal*, *24*(2), 81-88.

AL-Bayati, D.: Assessment of Factors Affecting on Patients' Adherence to Therapeutic Recommendations after Ischemic Heart Diseases in Al Najaf City, kufa journal for nursing sciences, (2015) , Vol 5, No 2, P.p. 1-11

Al-Ibraheemi, H., AL-Bayati, D., (2018). Impact of Buteyko Method as a Respiratory Rehabilitation Technique on Patients' Lungs Capacities post Stroke. *International Journal of Psychosocial Rehabilitation*, 24(4), 5733-5743.

Alkhaqani, A. L., & Ali, D. K. A. (2021). Improving Physical Performance Through Resistance Exercise Training on Patients Undergoing Hemodialysis: A Randomized Clinical Trial. *Annals of the Romanian Society for Cell Biology*, *25*(6), 13639-13653.

Allen, M., Pearn, K., Ford, G. A., White, P., Rudd, A., McMeekin, P., ... & James, M. (2021). Implementing the NHS England Long Term Plan for stroke: how should reperfusion services be configured? A modelling study.

Alligood, M. R. (2017). Nursing theorists and their work-e-book (8th ed, Vol. 53, Issues 148–125). Elsevier Health Sciences.

Al-Senani, F., Al-Johani, M., Salawati, M., Alhazzani, A., Morgenstern, L. B., Ravest, V. S., ... & Eggington, S. (2020). An epidemiological model for first stroke in Saudi Arabia. *Journal of Stroke and Cerebrovascular Diseases*, *29*(1), 104465.

Aminoff, M.; Greenberg, D.; Simon, R.: Clinical Neurology, 9th edition, 2015, McGraw-Hill Education, U.S., p.367, 373.

Anand, P. (2016). Happiness, well-being and human development: The case for subjective measures.

Asadzadeh, A., Samad-Soltani, T., Salahzadeh, Z., & Rezaei-Hachesu, P. (2021). Effectiveness of Virtual Reality-Based Exercise Therapy in Rehabilitation: A Scoping Review. Informatics in Medicine Unlocked, 100–562. https://doi.org/10.1016/j.imu.2021.100562.

Ashton, R. E., Tew, G. A., Aning, J. J., Gilbert, S. E., Lewis, L., & Saxton, J. M. (2020). Effects of short-term, medium-term and long-term resistance exercise training on cardiometabolic health outcomes in adults: systematic review with meta-analysis. British journal of sports medicine, 54(6), 341-348.

Australian Government Department of Health. (2021). Australia's physical activity and sedentary behaviour guidelines. *Dep Heal Website*.

Baig, S., Moyle, B., Redgrave, J., Majid, A., & Ali, A. (2020). Exercise referral to promote cardiovascular health in stroke and TIA patients: a pilot feasibility study. *BMJ open sport & exercise medicine*, *6*(1), e000929.

Barbosa, D. D., Trojahn, M. R., Porto, D. V. G., Hentschke, G. S., & Hentschke, V. S. (2018). Strength training protocols in hemiparetic individuals post stroke: a systematic review. *Fisioterapia em Movimento*, *31*.

Bastola, P., Singh, P., & Pinto, D. (2021). A Comparison of the effect of resistance training on upper extremity motor function, motor recovery, and quality of life in sub-acute stroke participants. *Medical Journal of Dr. DY Patil Vidyapeeth*, *14*(2), 219.

Beckwée, D., Lefeber, N., Bautmans, I., Cuypers, L., De Keersmaecker, E., De Raedt, S., ... & Swinnen, E. (2021). Muscle changes after stroke and their impact on recovery: time for a paradigm shift? Review and commentary. *Topics in Stroke Rehabilitation*, *28*(2), 104-111.

Benjamin, E. J., Blaha, M. J., Chiuve, S. E., Cushman, M., Das, S. R., Deo, R., ... & Muntner, P. (2017). Heart disease and stroke statistics—

2017 update: a report from the American Heart Association. circulation, 135(10), e146-e603.

Berbiglia, V. A., & Banfield, B. (2013). Self-care deficit theory of nursing. Nursing Theorists and Their Work-E-Book, 30(1), 240.

Bhushan, R., Ravichandiran, V., & Kumar, N. (2022). An overview of the anatomy and physiology of the brain. *Nanocarriers for Drug-Targeting Brain Tumors*, 3-29.

Bhuvaneshwari, G., & Somiya, C. (2020). Effectiveness of dysphagia exercises on swallowing ability among patients with Cerebrovascular Accidents.

Bicakci, I., Turgut, S. T., Turgut, B., Icagasioglu, A., Egilmez, Z., & Yumusakhuylu, Y. (2015). Adherence to foot self-care in diabetes mellitus patients. Pan African Medical Journal, 18(1), 103–108. https://doi.org/10.11604/pamj.2014.18.92.3683.

Boccardi, E., Cenzato, M., Curto, F., Longoni, M., Motto, C., Oppo, V., ... & Vidale, S. (2017). *Hemorrhagic stroke*. Springer International Publishing.

Brandsma, J. W., Schreuders, T. A., Birke, J. A., Piefer, A., & Oostendorp, R. (1995). Manual muscle strength testing: intraobserver and interobserver reliabilities for the intrinsic muscles of the hand. Journal of Hand therapy, 8(3), 185-190.

Bruton, M., & O'Dwyer, N. (2018). Synergies in coordination: a comprehensive overview of neural, computational, and behavioral approaches. *Journal of Neurophysiology*, *120*(6), 2761-2774.

Burke, K Burke. M. (2018). *Dissociable Neural Circuits Underlie Competition During Task Switching, with a Novel Role for the Posterior Cingulate Cortex* (Doctoral dissertation, Yeshiva University).

Cai, W., Mueller, C., Li, Y. J., Shen, W. D., & Stewart, R. (2019). Post stroke depression and risk of stroke recurrence and mortality: a systematic review and meta-analysis. *Ageing Research Reviews*, *50*, 102-109.

Carpenito, L. J. (2013). Nursing Diagnosis: Application to Clinical Practice. In Home Healthcare Nurse: The Journal for the Home Care and Hospice Professional (14th ed, Vol. 10, Issue 2). Wolters Kluwer Health and Lippincott Williams & Wilkins. https://doi.org/10.1097/00004045- 199203000-00012.

Chattanooga, T. U. of T. at. (2016). Theory Based Nursing Practice (TBNP) A working document. 4–8.

Ciesla, N., Dinglas, V., Fan, E., Kho, M., Kuramoto, J., & Needham, D. (2011). Manual muscle testing: a method of measuring extremity muscle strength applied to critically ill patients. *JoVE (Journal of Visualized Experiments)*, (50), e2632.

Clancy, L., Povey, R., & Rodham, K. (2020). "Living in a foreign country": experiences of staff–patient communication in inpatient stroke settings for people with post-stroke aphasia and those supporting them. *Disability and rehabilitation*, *42*(3), 324-334.

Compagnat, M., Daviet, J. C., Batcho, C., Vuillerme, N., Salle, J. Y., David, R., & Mandigout, S. (2020). Oxygen Cost During Walking in Individuals With Stroke: Hemiparesis Versus Cerebellar Ataxia. Neurorehabilitation and neural repair, 34(4), 289-298.

Compston, A. (2010). Aids to the investigation of peripheral nerve injuries. Medical Research Council: Nerve Injuries Research Committee. His Majesty's Stationery Office: 1942; pp. 48 (iii) and 74 figures and 7 diagrams; with aids to the examination of the peripheral nervous system. By Michael O'Brien for the Guarantors of Brain. Saunders Elsevier: 2010; pp.[8] 64 and 94 Figures. *Brain*, *133*(10), 2838-2844.

Crichton, S. L., Bray, B. D., McKevitt, C., Rudd, A. G., & Wolfe, C. D. (2016). Patient outcomes up to 15 years after stroke: survival, disability, quality of life, cognition and mental health. *Journal of Neurology, Neurosurgery & Psychiatry*, *87*(10), 1091-1098.

Crwswell, J. W. (2018). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches (5th ed). Sage Publications Ltd.

Darak, V., & Karthikbabu, S. (2020). Lower limb motor function and hip muscle weakness in stroke survivors and their relationship with pelvic tilt, weight-bearing asymmetry, and gait speed: A cross-sectional study. *Current Journal of Neurology*, *19*(1), 1.

Dehno, N. S., Kamali, F., Shariat, A., & Jaberzadeh, S. (2021). Unilateral strength training of the less affected hand improves cortical excitability and clinical outcomes in patients with subacute stroke: A randomized controlled trial. *Archives of Physical Medicine and Rehabilitation*, *102*(5), 914-924.

Department of Health. (2021). Australia's physical activity and sedentary behaviour guidelines.

Di Girolamo, M., Pirri, C. F., Ajmone, M. G., & Ariano, P. (2018). Post-stroke rehabilitation of hand function based on electromyography biofeedback. *PhD Thes. Politecnico di Torino*.

Dorriyal, V., Mattu, S., & Tomar, U. S. (2020). Effect of Stroke on Stroke Survivor's and their Disability Pattern: A Survey Questionnaire.

Dorsch S, Ada L, Alloggia D. (2018). Progressive resistance training increases strength after stroke but this may not carry over to activity: A systematic review. Journal of Physiotherapy 64: 84–90. doi:10.1016/j.jphys.2018.02.012.

Falkenberg, H. K., Mathisen, T. S., Ormstad, H., & Eilertsen, G. (2020). "Invisible" visual impairments. A qualitative study of stroke survivorsexperience of vision symptoms, health services and

impact of visual impairments. *BMC Health Services Research*, *20*(1), 1-12.

Fini, N. A., Holland, A. E., Keating, J., Simek, J., & Bernhardt, J. (2017). How physically active are people following stroke? Systematic review and quantitative synthesis. Physical therapy, 97(7), 707-717.

Florence, J. M., Pandya, S., King, W. M., Robison, J. D., Baty, J., Miller, J. P., ... & Signore, L. C. (1992). Intrarater reliability of manual muscle test (Medical Research Council scale) grades in Duchenne's muscular dystrophy. *Physical therapy*, *72*(2), 115-122.

Flynn, D., Francis, R., Halvorsrud, K., Gonzalo-Almorox, E., Craig, D., Robalino, S., ... & White, P. (2017). Intra-arterial mechanical thrombectomy stent retrievers and aspiration devices in the treatment of acute ischaemic stroke: a systematic review and meta-analysis with trial sequential analysis. European stroke journal, 2(4), 308-318.

Frenkel-Toledo, S., Ofir-Geva, S., Mansano, L., Granot, O., & Soroker, N. (2021). Stroke lesion impact on lower limb function. *Frontiers in human neuroscience*, *15*, 592975.

Gainotti, G. (2021). The relations between cognitive and motivational components of anosognosia for left-sided hemiplegia and the

right hemisphere dominance for emotions: A historical survey. *Consciousness and Cognition*, *94*, 103180.

Geng, J., Zhang, Y., Li, S., Li, S., Wang, J., Wang, H., ... & Wang, G. (2018). Metabolomic profiling reveals that reprogramming of cerebral glucose metabolism is involved in ischemic preconditioning-induced neuroprotection in a rodent model of ischemic stroke. *Journal of proteome research*, *18*(1), 57-68.

George, J. B. (2014). Nursing Theories: The Base for Professional Nursing Practice. In British Library Cataloguing-in-Publication Data (6th ed). Pearson.

Gonsalves, C. A., McGannon, K. R., & Schinke, R. J. (2020). Social media for health promotion: What messages are women receiving about cardiovascular disease risk by the Canadian Heart and Stroke Foundation?. *Journal of Health Psychology*, *25*(8), 1017-1029.

Grossman, S.; Porth, C.: Porth's Pathophysiology/ Concepts of Altered Health States, Lippincott Williams & Wilkins, 9th edition, (2014), p.507.

Grove, S. K., & Gray, J. R. (2019). Understanding Nursing Research: Building an Evidence-Based Practice. In Journal of Clinical Nursing (7ed). Elsevier Health Sciences. https://doi.org/10.1111/j.1365-2702.2006.01913.x.

Grove, S. K., Gray, J. R., & Burns, N. (2013). *The practice of nursing research-E-book: Appraisal, synthesis, and generation of evidence*. Elsevier Health Sciences.

Hastrup, S., Johnsen, S. P., Terkelsen, T., Hundborg, H. H., von Weitzel-Mudersbach, P., Simonsen, C. Z. & de Morales Ayudarte, N. R.; Effects of centralizing acute stroke services: A prospective cohort study. Neurology, (2018), 10-1212.

Health Grove (2017). Global Health Statistics. Graphiq Inc. from http://global-health.healthgrove.com/ March 31.

Hepworth, L., & Rowe, F. (2016). Visual impairment following stroke-the impact on quality of life: a systematic review. *Ophthalmology Research: an international journal*, *5*(2), 1-15.

Hinkle, J. L., & Cheever, K. H. (2018). *Brunner and Suddarth's textbook of medical-surgical nursing*. Wolters kluwer india Pvt Ltd.

Holden, M. A., Bailey, D. L., Foster, N. E., Quicke, J. G., Haywood, K. L., & Bishop, A. (2020). Defining adherence to therapeutic exercise for musculoskeletal pain: a systematic review. *British journal of sports medicine*, *54*(6), 326-331.

Hongu, N., Wells, M. J., Gallaway, P. J., & Bilgic, P. (2015). Resistance training: health benefits and recommendations. *Univ Arizona Coop Ext*, *21*(2), 718-728.

Hu, X., De Silva, T. M., Chen, J., & Faraci, F. M. (2017). Cerebral vascular disease and neurovascular injury in ischemic stroke. *Circulation research*, *120*(3), 449-471.

Hula WD, Panesar S, Gravier ML, Yeh FC, Dresang HC, Dickey MW, Fernandez-Miranda JC (2020) Structural white matter connectometry of word production in aphasia: an observational study. Brain 143:2532–2544.

Ivey, F. M., Prior, S. J., Hafer-Macko, C. E., Katzel, L. I., Macko, R. F., & Ryan, A. S. (2017). Strength training for skeletal muscle endurance after stroke. *Journal of Stroke and Cerebrovascular Diseases*, *26*(4), 787-794.

Jeon, K., Chun, S., & Seo, B. (2016). Effects of muscle strength asymmetry between left and right on isokinetic strength of the knee and ankle joints depending on athletic performance level. *Journal of physical therapy science*, *28*(4), 1289-1293.

Johnson, B. M., & Webber, P. B. (2015). An Introduction to Reasoning and Nursing Theory (4th ed). Wolters Kluwer Health and Lippincott Williams & Wilkins.

Joshi, P., Leitão, J. P., Maurer, M., & Bach, P. M. (2021). Not all SuDS are created equal: Impact of different approaches on combined sewer overflows. *Water Research*, *191*, 116780.

Ju, S. (2020). Correlation between lower limb muscle asymmetry during the sit-to-stand task and spatiotemporal gait asymmetry in subjects with stroke. *Journal of exercise rehabilitation*, *16*(1), 64.

Kang, D. W., Lee, M. K., Kim, J. Y., Kim, D. I., Park, J. H., Ahn, K. Y., ... & Jeon, J. Y. (2017). Effect of home-based exercise intervention on fasting insulin and adipocytokines in colorectal cancer survivors: a randomized controlled trial. *Metabolism*, *76*, 23-31.

Kemal, O. (2020). Power Analysis and Sample Size, When and Why? Turkish Archives of Otorhinolaryngology, 58(1), 3–4. https://doi.org/10.5152/tao.2020.0330.

Khajehgoodari, M., Lotfi, M., Zamanzadeh, V., Valizadeh, L., & Khalilzad, P. (2020). Nursing diagnosis identification by nurses in burn wards: A descriptive cross-sectional study. *Nursing Open*, *7*(4), 980-987.

Kim, M. H. (2021). The Effect of Trunk Stabilization Posture Wearing Spiral Elastic Band on Upper Extremity Function in Stroke Patients. *Journal of The Korean Society of Integrative Medicine*, *9*(2), 93-103.

Kirkevold, M., Bronken, B. A., Martinsen, R., & Kvigne, K. (2012). Promoting psychosocial well-being following a stroke: developing a theoretically and empirically sound complex intervention. International journal of nursing studies, 49(4), 386-397.

Kleindorfer, D. O., Towfighi, A., Chaturvedi, S., Cockroft, K. M., Gutierrez, J., Lombardi-Hill, D., ... & Williams, L. S. (2021). 2021 guideline for the prevention of stroke in patients with stroke and transient ischemic attack: a guideline from the American Heart Association/American Stroke Association. Stroke, 52(7), e364-e467.

Knapp, P., Dunn-Roberts, A., Sahib, N., Cook, L., Astin, F., Kontou, E., & Thomas, S. A. (2020). Frequency of anxiety after stroke: An updated systematic review and meta-analysis of observational studies. International Journal of Stroke, 15(3), 244-255.

Kohavi, B., Beato, M., Laver, L., Freitas, T. T., Chung, L. H., & Iacono, A. D. (2020). Effectiveness of field-based resistance training protocols on hip muscle strength among young elite football players. Clinical Journal of Sport Medicine, 30(5), 470-477.

Kotecki, J. & B. (2018). Physical Activity & Health in internal activity approch (5th ed). Jones & Bartlett Learning. https://books.google.iq/books?id=WF HDQAAQBAJ.

Kozier, B. J., Erb, G., Berman, A. T., Snyder, S., Frandsen, G., Buck, M., ... & Stamler, L. L. (2018). Fundamentals of canadian nursing: Concepts. *Process, and Practice (4th ed.). Pearson Canada Inc*.

Kramer, S. F., Hung, S. H., & Brodtmann, A. (2019). The impact of physical activity before and after stroke on stroke risk and

recovery: a narrative review. *Current neurology and neuroscience reports*, *19*(6), 1-9.

Kwan, M. S. M., Hassett, L. M., Ada, L., & Canning, C. G. (2019). Relationship between lower limb coordination and walking speed after stroke: an observational study. *Brazilian journal of physical therapy*, *23*(6), 527-531.

Lai, X., Bo, L., Zhu, H., Chen, B., Wu, Z., Du, H., & Huo, X. (2021). Effects of lower limb resistance exercise on muscle strength, physical fitness, and metabolism in pre-frail elderly patients: a randomized controlled trial. BMC geriatrics, 21(1), 1-9.

Lanctôt, K. L., Lindsay, M. P., Smith, E. E., Sahlas, D. J., Foley, N., Gubitz, G., ... & Management of Mood, Cognition and Fatigue Following Stroke Best Practice Writing Group, the Heart & Stroke Canadian Stroke Best Practices and Quality Advisory Committee; in collaboration with the Canadian Stroke Consortium. (2020). Canadian stroke best practice recommendations: mood, cognition and fatigue following stroke, update 2019. *International Journal of Stroke*, *15*(6), 668-688.

Lapchak, P. A., & Zhang, J. H. (2017). The high cost of stroke and stroke cytoprotection research. *Translational stroke research*, *8*(4), 307-317.

Laver, K. E., Adey-Wakeling, Z., Crotty, M., Lannin, N. A., George, S., & Sherrington, C. (2020). Telerehabilitation services for stroke. *Cochrane Database of Systematic Reviews*, (1).

Leary, M. C., & Yacoub, H. A. (2017). The Heart and Stroke. In Primer on Cerebrovascular Diseases (pp. 413-419). Academic Press.

Lee, K., Park, D., & Lee, G. (2019). Progressive respiratory muscle training for improving trunk stability in chronic stroke survivors: a pilot randomized controlled trial. Journal of Stroke and Cerebrovascular Diseases, 28(5), 1200-1211.

Lee, S. Y., Im, S. H., Kim, B. R., & Han, E. Y. (2018). The effects of a motorized aquatic treadmill exercise program on muscle strength, cardiorespiratory fitness, and clinical function in subacute stroke patients: a randomized controlled pilot trial. American journal of physical medicine & rehabilitation, 97(8), 533-540.

Li, S., Francisco, G. E., & Rymer, W. Z. (2021). A new definition of poststroke spasticity and the interference of spasticity with motor recovery from acute to chronic stages. *Neurorehabilitation and Neural Repair*, *35*(7), 601-610.

Lowe, N. K. (2019). What is a pilot study? Journal of Obstetric, Gynecologic & Neonatal Nursing, 48(2), 117-118. https://doi.org/10.1016/j.jogn.2019.01.005.

Lozano, R., Naghavi, M., Foreman, K., Lim, S., Shibuya, K., Aboyans, V., ... & Remuzzi, G. (2012). Global and regional mortality from 235

causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. *The lancet*, *380*(9859), 2095-2128.

Mary Â, Canuto O, LídyaTN, Telma ME. Health-related quality of life after stroke. Actapaul. enferm. vol.29 no.3, 2016; São Paulo mai./June 2016.

Masters, K. (2014). Nursing Theories: A Framework for Professional Practice (2nd ed). Jones & Bartlett Learning.

May, H. İ., Özdolap, Ş., Mengi, A., & Sarıkaya, S. (2020). The effect of mirror therapy on lower extremity motor function and ambulation in post-stroke patients: A prospective, randomized-controlled study. *Turkish journal of physical medicine and rehabilitation*, *66*(2), 154.

McEwen, M., & Wills, E. M. (2019). Theoretical basis for nursing (5th ed). Lippincott Williams & Wilkins.

Mehrholz, J., Pohl, M., Platz, T., Kugler, J., & Elsner, B. (2018). Electromechanical and robot-assisted arm training for improving activities of daily living, arm function, and arm muscle strength after stroke. Cochrane database of systematic reviews, (9).

Meleis, A. I. (2012). THEORETICAL NURSING Development and Progress. In ASHA Leader (5th ed, Vol. 14, Issue 6). Wolters Kluwer Health and Lippincott Williams. doi.org/10.1044/leader.FTR3.14062009.20.

Miller, J. J., Lianekhammy, J., Pope, N., Lee, J., & Grise-Owens, E. (2017). Self-care among healthcare social workers: An exploratory study. Social Work in Health Care, 56(10), 865-883.

Mohammed, R. H. (2019). Quality of Life For Patients with Cerebrovascular Stroke. *Port Said Scientific Journal of Nursing*, *6*(2), 94-111.

Moriyama, Y., Hara, M., Aratani, S., Ishikawa, H., Kono, K., & Tamaki, M. (2019). The association between six month intra-dialytic resistance training and muscle strength or physical performance in patients with maintenance hemodialysis: a multicenter retrospective observational study. *BMC nephrology*, *20*(1), 1-7.

Mozaffarian D, Benjamin EJ, Go AS, et al. Heart dis ease and stroke statistics – 2015 update: a report from the American Heart Association. Circulation 2015; 131(4): e29–322.

Murphy, S. J., & Werring, D. J. (2020). Stroke: causes and clinical features. *Medicine*, *48*(9), 561-566.

Naqvi U. Muscle strength grading. InStatpearls [Internet] 2019 May 29. StatPearls Publishing. Available from:https://www.ncbi.nlm.nih.gov/books/NBK436008/(last accessed 7.1.20).

Naqvi, U. (2021). Muscle strength grading. In *StatPearls [Internet]*. StatPearls Publishing.

Narva, A. S., Norton, J. M., & Boulware, L. E. (2016). Educating patients about CKD: the path to self-management and patient-centered care. *Clinical journal of the American Society of Nephrology*, *11*(4), 694-703.

Newman-Toker, D. E., Moy, E., Valente, E., Coffey, R., & Hines, A. L. (2014). Missed diagnosis of stroke in the emergency department: a cross-sectional analysis of a large population-based sample. Diagnosis, 1(2), 155-166.

Nieswiadomy, R. M., & Bailey, C. (2017). Foundations of nursing research (5th ed.). New York: Pearson.

Noreau, L., & Vachon, J. (1998). Comparison of three methods to assess muscular strength in individuals with spinal cord injury. Spinal cord, 36(10), 716-723.

Nozoe, M., Kubo, H., Kanai, M., Yamamoto, M., Shimada, S., & Mase, K. (2020). Peripheral motor nerve conduction abnormality, muscle strength, and muscle wasting in patients with acute stroke: A pilot study. *Journal of Clinical Neuroscience*, *75*, 80-84.

Okawara, N., & Usuda, S.; Influences of visual and supporting surface conditions on standing postural control and correlation with walking ability in patients with post-stroke hemiplegia. Journal of physical therapy science, (2015), 27(5), 1323-1327.

Oktraningsih, I. (2017). Gambaran Kekuatan Otot Pasien Stroke yang Immobilisasi di RSUP H. Adam Malik Medan.

Omofoye, O. A., Barnett, R., Lau, W., Trembath, D., Jordan, J. D., & Sasaki-Adams, D. M. (2018). Neoplastic cerebral aneurysm from metastatic nonsmall cell lung carcinoma: case report and literature review. *Neurosurgery*, *83*(6), E221-E225.

Pandit, R. B. (2020). Health Related Quality of Life of Cerebrovascular Accident Patient: A Descriptive Study. *International Journal of Health Sciences and Research*, *10*(1), 49-52.

Pane, D. N., Fikri, M. EL, Ritonga, H. M., & A. (2018). Nursing Theorists And Their work. In Journal of Chemical Information and Modeling (Vol. 53, Issue 9).

Pendlebury ST, Rothwell PM. Incidence and prevalence of dementia associated with transient ischaemic attack and stroke: analysis of the population-based Oxford Vascular Study. Lancet Neurol. (2019) 18:248–58. doi: 10.1016/S1474-4422(18)30442-3.

Persson, C. U., Holmegaard, L., Redfors, P., Jern, C., Blomstrand, C., & Jood, K. (2020). Increased muscle tone and contracture late after ischemic stroke. *Brain and Behavior*, *10*(2), e01509.

Picha, K. J., Almaddah, M. R., Barker, J., Ciochetty, T., Black, W. S., & Uhl, T. L. (2019). Elastic resistance effectiveness on increasing strength of shoulders and hips. *Journal of strength and conditioning research*, *33*(4), 931.

Pope, T. M. (2017). Brain death forsaken: growing conflict and new legal challenges. *Journal of Legal Medicine*, *37*(3-4), 265-324.

Qin, X., Akter, F., Qin, L., Cheng, J., Guo, M., Yao, S., ... & Wu, S. (2020). Adaptive immunity regulation and cerebral ischemia. Frontiers in Immunology, 11, 689.

Rabelo, M., Nunes, G. S., da Costa Amante, N. M., de Noronha, M., & Fachin-Martins, E. (2016). Reliability of muscle strength assessment in chronic post-stroke hemiparesis: a systematic review and meta-analysis. *Topics in stroke rehabilitation*, *23*(1), 26-35.

Rammos, S. K., Gardenghi, B., Bortolotti, C., Cloft, H. J., & Lanzino, G. (2016). Aneurysms associated with brain arteriovenous malformations. *American Journal of Neuroradiology*, *37*(11), 1966-1971.

Ramos, E. M. C., de Toledo-Arruda, A. C., Fosco, L. C., Bonfim, R., Bertolini, G. N., Guarnier, F. A., ... & Ramos, D. (2014). The effects of elastic tubing-based resistance training compared with conventional resistance training in patients with moderate chronic obstructive pulmonary disease: a randomized clinical trial. Clinical rehabilitation, 28(11), 1096-1106.

Rass, V., & Helbok, R. (2019). Early brain injury after poor-grade subarachnoid hemorrhage. Current neurology and neuroscience reports, 19(10), 1-9.

Raymond MJ, Bramley-Tzerefos RE, Jeffs KJ, et al. Systematic review of high intensity progressive resistance strength training of the

lower limb compared with other intensities of strength training in older adults. Arch Phys Med Rehabil 2013;94:1458–72.

Raza, L. D. M. S. (2020). Study of Mortality Rate of Brain Stroke in Erbil-Kurdistan Region of Iraq in 2016. *journal of kirkuk University For Administrative and Economic Sciences*, *10*(2).

Reinemeyer, N. E., Tadi, P., & Lui, F. (2021). Basilar artery thrombosis. StatPearls [Internet].

Ribeiro Lima, R., Rose, M. L., Lima, H. N., Guarinello, A. C., Santos, R. S., & Massi, G. A. (2021). Socio-demographic factors associated with quality of life after a multicomponent aphasia group therapy in people with sub-acute and chronic post-stroke aphasia. *Aphasiology*, *35*(5), 642-657.

Saudi Stroke Association (S.S.A), 2017.

Seikel, J. A., Drumright, D. G., & King, D. W. (2021). *Anatomy & physiology for speech, language, and hearing*. Cengage Learning.

Shah, F. A., Kury, L. A., Li, T., Zeb, A., Koh, P. O., Liu, F., ... & Li, S. (2019). Polydatin attenuates neuronal loss via reducing neuroinflammation and oxidative stress in rat MCAO models. *Frontiers in pharmacology*, *10*, 663.

Shewangizaw, Z. (2015). Determinants towards Implementation of Nursing Process. American Journal of Nursing Science, 4(3), 45. https://doi.org/10.11648/j.ajns.20150403.11.

Sihvonen, A. J., Ripollés, P., Leo, V., Saunavaara, J., Parkkola, R., Rodríguez-Fornells, A., ... & Särkämö, T. (2021). Vocal music listening enhances poststroke language network reorganization. *Eneuro*, *8*(4).

Skirtach, I., & Pokul, E. (2020). The problem of recovery of the patients with cerebrovascular accident (CVA): the capabilities of psychological techniques in the improvement of cognitive functions. In *E3S Web of Conferences* (Vol. 210, p. 17003). EDP Sciences.

Smeltzer, S.; Bare, B.; Hinkle, J.; Cheever, K. (2010). Brunner and Suddarth, Medical Surgical Nursing. Wolters Kluwer Health/ Lippincott Williams & Wilkins. 12th ed., p.1896.

Smith, M. C., & Marilyn, P. E. (2015). Nursing Theories and Nursing Practice. In FA Davis Company (4th ed, Vol. 66). F. A. Davis Company.

Sofer, D. (2016). Study assesses the global stroke burden. AJN The American Journal of Nursing, 116(9), 16.

Sommer, C. J. (2017). Ischemic stroke: experimental models and reality. *Acta neuropathologica*, *133*(2), 245-261.

Sousa, D. G., Harvey, L. A., Dorsch, S., & Glinsky, J. V. (2018). Interventions involving repetitive practice improve strength after stroke: a systematic review. *Journal of physiotherapy*, *64*(4), 210-221.

Suchomel, T. J., Nimphius, S., Bellon, C. R., & Stone, M. H. (2018). The importance of muscular strength: training considerations. Sports medicine, 48(4), 765-785.

Tang, E. Y., Price, C., Stephan, B. C., Robinson, L., & Exley, C. (2020). Impact of memory problems post-stroke on patients and their family carers: a qualitative study. *Frontiers in medicine*, *7*, 267.

Tanovic, E., Selimovic, S., & Tanovic, H. (2014). Assessment of the effects of rehabilitation after cerebrovascular accident in patients with diabetes mellitus and hypertension as risk factors. *Medical Archives*, *68*(2), 124.

Teasell, R., Foley, N., Pereira, S., Sequeira, K., & Miller, T. (2015). Evidence to practice: botulinum toxin in the treatment of spasticity post stroke. Topics in stroke rehabilitation, 19(2), 115-121.

TheraBand. (2019). TheraBand Resistance Band Loop Set. THERABAND PROFESSIONAL LATEX RESISTANCE BAND LOOP.http://www.theraband.com/products/resistance-bands-tubes/theraband professional-latex-resistance-band-loops.html.

Thompson, S. K. (2002). Sampling (2nd ed.). New York, NY: John Wiley & Sons.

Thrift, A. G., Saber, H., Kapral, M. K., Shoamanesh, A., Amiri, A., Farzadfard, M. T., ... & Azarpazhooh, M. R. (2017). Incidence, recurrence, and long-term survival of ischemic stroke subtypes: a population-based study in the Middle East. *International Journal of Stroke*, *12*(8), 835-843.

Tole, G., Raymond, M. J., Williams, G., Clark, R. A., & Holland, A. E. (2020). Strength training to improve walking after stroke: how physiotherapist, patient and workplace factors influence exercise prescription. *Physiotherapy Theory and Practice*, 1-9.

Tosi, G., Romano, D., & Maravita, A. (2018). Mirror box training in hemiplegic stroke patients affects body representation. *Frontiers in Human Neuroscience*, *11*, 617.

Valojerdi, A. E., Tanha, K., & Janani, L. (2017). Important considerations in calculating and reporting of sample size in randomized controlled trials. Medical Journal of the Islamic Republic of Iran, 31(1), 843–846.

Veldema, J., & Jansen, P. (2020). Resistance training in stroke rehabilitation: systematic review and meta-analysis. *Clinical Rehabilitation*, *34*(9), 1173-1197.

Virani, S. S., Alonso, A., Aparicio, H. J., Benjamin, E. J., Bittencourt, M. S., Callaway, C. W., ... & American Heart Association Council

on Epidemiology and Prevention Statistics Committee and Stroke Statistics Subcommittee. (2021). Heart disease and stroke statistics—2021 update: a report from the American Heart Association. Circulation, 143(8), e254-e743.

Waehner, P. (2020). Strength Training for Seniors: Increase Your Balance, Stability, and Stamina to Rewind the Aging Process. Simon and Schuster.

Wang, C., Redgrave, J., Shafizadeh, M., Majid, A., Kilner, K., & Ali, A. N. (2019). Aerobic exercise interventions reduce blood pressure in patients after stroke or transient ischaemic attack: a systematic review and meta-analysis. *British journal of sports medicine*, *53*(24), 1515-1525.

White, L., Duncan, G., Baumle, W., & A. (2013). Medical-Surgical Nursing : An Integrated Approach. International Journal of Chemical Information and Modeling (3th ed, Vol. 53, Issue 9). Delmar, Cengage Learning.

Williams, G., Mentiplay, B. F., Tan, D., Adair, B., Pua, Y. H., Bower, K. J., & Clark, R. A. (2018). Assessment of isometric muscle strength and rate of torque development with hand-held dynamometry: test-retest reliability and relationship with gait velocity after stroke. Journal of biomechanics, 75, 171-175.

Williams, J. G., Roberts, S. E., Thorne, K., Akbari, A., Samuel, D. G., &. (2015). Mortality following stroke, the weekend effect and

related factors: record linkage study. *PLoS One*, *10*(6), e0131836.

Williams, L. S., & Hopper, P. D. (2015). Medical Surgical Nursing Specialities. In Medical Surgical Nursing Specialities (5th ed). F. A. Davis Company. https://doi.org/10.5005/jp/books/1052.

Williams, M. (1956). Manual muscle testing, development and current use. *Physical Therapy*, *36*(12), 797-805.

Wintz, M. M. (1959). Variations in current manual muscle testing.

World Health Organization. (2017). *Global diffusion of eHealth: making universal health coverage achievable: report of the third global survey on eHealth*. World Health Organization.

World Health Organization. Saudi Arabia Country Statistics [Internet]. 2014[cited 2018 Jul 10]. Available from: http://www.who.int/countries/sau/en/.

World Heart Federation, Stroke, Geneva, Switzerland, 2016. Available from: http://www.world-heart.

Wu, Z., Xu, J., Yue, C., Li, Y., & Liang, Y. (2020). Collaborative care model based telerehabilitation exercise training program for acute stroke patients in China: a randomized controlled trial. *Journal of Stroke and Cerebrovascular Diseases*, *29*(12), 105328.

Zamanzadeh, V., Valizadeh, L., Tabrizi, F. J., Behshid, M., & Lotfi, M. (2015). Challenges associated with the implementation of the nursing process: A systematic review. Iranian Journal of Nursing and Midwifery Research, 20(4), 411–419. https://doi.org/10.4103/1735- 9066.161002.

Zhao, Z., Nelson, A. R., Betsholtz, C., & Zlokovic, B. V. (2015). Establishment and dysfunction of the blood-brain barrier. *Cell*, *163*(5), 1064-1078.

Appendices

خبراء تحكيم الاستبانة

ت	اسم الخبير	اللقب العلمي	مكان العمل	الاختصاص الدقيق	سنوات الخبرة
١.	د .راجحة عبد الحسن حمزة	أستاذ	جامعة الكوفة / كلية التمريض	تمريض بالغين	٣٨ سنة
٢.	د. حسين هادي عطية	استاذ	جامعة بغداد / كلية التمريض	تمريض بالغين	٣٦ سنة
٣.	د. وداد كامل محمد	استاذ	جامعة بغداد / كلية التمريض	تمريض بالغين	٣٥ سنة
٤.	د. هدى باقر حسن	استاذ	جامعة بغداد / كلية التمريض	تمريض بالغين	٣٤ سنة
٥.	د. صباح عباس احمد	استاذ	جامعة بغداد / كلية التمريض	تمريض بالغين	٣٤ سنة
٦.	د. سحر أدهم علي	استاذ	جامعة بابل / كلية التمريض	تمريض بالغين	٢٧ سنة
٧.	د. ضياء كريم عبد علي	استاذ مساعد	جامعة الكوفة / كلية التمريض	تمريض بالغين	١٨سنة
٨.	د. أبراهيم علوان	استاذ مساعد	جامعة الكوفة / كلية التمريض	تمريض بالغين	١٦ سنة
٩.	د. محمد عبد الكريم	استاذ مساعد	جامعة الكوفة / كلية التمريض	تمريض بالغين	١٣ سنة
١٠.	د. احمد سمير البو شبع	دكتوراه (بورد)	مركز الفرات الاوسط للعلوم العصبية	طب الجملة العصبية	١٣ سنة
١١.	د. محمد راضي رديف	استاذ مساعد	جامعة الكوفة / كلية الطب	طب الجملة العصبية	١٣ سنة
١٢.	د. حسنين عباس الخالدي	استاذ مساعد	جامعة الكوفة / كلية الطب مركز الفرات الاوسط للعلوم العصبية	طب الجملة العصبية	١٣ سنة
١٣.	د. صادق عبد الحسين حسن	استاذ مساعد	جامعة بغداد / كلية التمريض	تمريض بالغين	١٢ سنة
١٤.	د. محمد امين احمد	دكتوراه (بورد)	مستشفى جراحة الجملة العصبية/ مدينة الطب	طب جراحة جملة عصبية	١١ سنة

AppendiX B-1

University of Babylon
College of Nursing
Research Ethics Committee

جـامـعة بـابـل
كـلية التمريـض
لجنة اخلاقيات البحث العلمي

Issue No:

Date: / /2022

Approval Letter

To,
Mohammed Hakim Shamran

The Research Ethics committee at the **University of Babylon, College of Nursing** has reviewed and discussed your application to conduct the research study entitled **"Effectiveness of Regular Resistance Exercise on Muscle Strength of Patients with Stroke: Evidence-Based Practice"**

The Following documents have been reviewed and approved:

1. Research protocol
2. Research instrument/s
3. Participant informed consent

Committee Decision.

The committee approves the study to be conducted in the presented form. The Research Ethics committee expects to be informed about any changes occurring during the study, any revision in the protocol and participant informed consent.

Prof. Dr. Salma K. Jehad
Chair Committee
College of Nursing
Research Ethical Committee
/7/2022

UNIVERSITY OF BABYLON - FACULTY OF NURSING

Republic of Iraq

Najaf Governorate

Najaf Health Directorate

Training and Human Development Center

No.

جمهورية العراق

محافظة النجف الأشرف

مركز التدريب والتنمية البشرية

العدد : ٤٧٩٧

التاريخ : ١٧ / ٧ / ٢٠٢٢

إلى/ جامعة بابل / كلية التمريض

م / تسهيل مهمة

تحية طيبة ...

كتابكم ذي العدد ٢٣٧١في٦ /٧/ ٢٠٢٢ ، بخصوص تسهيل مهمة الباحث طالب الدراسات العليا /الدكتوراه (**محمد حاكم شمران حسن**) لإجراء البحث الموسوم .

Effectiveness of regular resistance exercise on muscle strength of patients with stroke : evidence – based practice

حصلت موافقة اللجنة العلمية للبحوث / مركز الدائرة على إجراء البحث في (مدينة الصدر الطبية/مركز الفرات الاوسط للعلوم العصبية) على أن لا تتحمل دائرتنا أية تبعات مادية ولا يسمح بإخراج العينات خارج المختبر..... مع الاحترام .

الدكتور حيدر خضير عباس

دائرة صحة النجف الاشرف

الدكتور

أ.د احمد عباس طاهر الاسدي

المدير العام/وكالة

٢٠٢٢/ ٧ /١٧

نسخة منه الى:

مركز التدريب والتنمية البشرية/ شعبة ادارة المعرفة والبحوث

مدينة الصدر الطبية / مركز الفرات الاوسط للعلوم العصبية / تسهيل مهمة الباحث.....مع الاحترام

HAK

Republic of Iraq
Najaf Governorate
Najaf Health Directorate
Training and Human Development Center
No.

جمهورية العراق
محافظة النجف الأشرف
مركز التدريب والتنمية البشرية
العدد : ٢٦٠
التاريخ : ١٧ / ٧ / ٢٠٢٠

إلى / مركز الفرات الاوسط للعلوم العصبية
م/ تسهيل مهمة

تحية طيبة ...

أشاره الى كتاب جامعة بابل /كلية التمريض ذي العدد ٢٣٧١ في٦/٧/ ٢٠٢٢ لتسهيل مهمة الباحث طالب الدراسات العليا / الدكتوراه **(محمد حاكم شمران حسن)**لإجراء بحثه في مؤسستكم والموسوم:

(effectiveness of regular resistance exercise on muscle strength of patients with stroke : evidence-based practice)

للتفضل بالاطلاع وبيان رأيكم مع الاحترام.

المرفقات :-
استمارة أجراء بحث توقع وتعاد الينا .

ع/ الدكتور
حيدر خضير عباس
مدير مركز التدريب والتنمية البشرية
١٧/ ٧/ ٢٠٢٢

نسخة منه إلى /
- مركز التدريب والتنمية البشرية / مع الأوليات .

HAK

رقم الاستمارة:
التاريخ

كلية التمريض – جامعة بابل
لجنة أخلاقيات البحوث العلمية

نموذج موافقة الاشخاص للمشاركة بالبحوث العلمية

استمارة رقم (٣)

السيد / السيدة .....

أنت مدعو للمشاركة بمشروع بحث علمي بعنوان:

(فعالية تمرينات المقاومة المنتظمة على قوة العضلات لدى مرضى السكتة الدماغية: ممارسة قائمة على الأدلة)

يرجى أن تأخذ الوقت المناسب لقراءة المعلومات الآتية بتأنٍ قبل أن تقرر إذا ما كنت راغباً بالمشاركة أم لا. وبإمكانك طلب مزيداً من الإيضاحات أو المعلومات الإضافية عن أي أمر مذكور بالاستمارة أو عن الدراسة من الباحث أو اي مختص أخر.

أولا : معلومات البحث	
اسم الباحث	**محمد حاكم شمران**
اسم المشرف	**أ.د. شذى سعدي محمد**
أهداف البحث	١. لتقييم قوة العضلات في الأطراف العلوية والسفلية باستخدام اختبار قوة العضلات: (مقياس أكسفورد). ٢. لبناء تمرين مقاومة منتظم يناسب احتياجات المرضى بعد السكتة الدماغية. ٣. لتحديد مدى فاعلية تمارين المقاومة المنتظمة على قوة العضلات بمقارنة قوة العضلات قبل وبعد استخدام تمارين المقاومة المنتظمة. ٤. لمعرفة العلاقة بين البيانات الديموغرافية والسريرية وفعالية تمرين المقاومة المنتظم.
الفترة المتوقعة لمشاركة الشخص في البحث	**٦ أسابيع**
الاجراءات المتبعة في جمع العينات	
المخاطر المتوقعة كنتيجة للمشاركة في البحث	لا يوجد
الفوائد التي ستعود على الشخص مقابل الاشتراك في البحث	**زيادة قوة العضلات لمرضى السكتة الدماغية مما يقلل الاعتماد على الاخرين**

ثانيا: معلومات للشخص المشارك بالبحث
١. ان المشاركة في هذا البحث طوعية
٢. بامكانك سَحب مشارَكتك من الدِراسة متى شئت ولأي سبب
٣. من حقك ان لا تجيب عن اي سؤال لا ترغب باجابته
٤. ان مشاركتك بالبحث لن تحملك اي نفقات مالية
٥. ان مشاركتك بالبحث لا يترتب عليها اي مسائلة قد تضر بك شخصيا أو بعملك.
٦. ان اسمك سيكون سريا و إن المعلومات الناتجة عن مشاركتك سوف تعامل بسرية تامة ولن يطلّع عليها أي شخص ما عدا الباحث والمشرف ولجنه الاخلاقيات عند الضرورة.
٧. وأن المعلومات التي ادليت بها والنتائج العلمية لهذا البحث هي للأغراض العلمية فقط ولن تكون هناك أية إشارة إلى لك أو لعائلتك في أي منشور عن هذه الدراسة.
٨. ان من حقك بمعرفة النتائج العامة للبحث، او اي نتائج تتعلق بك بصورة خاصة.

ثالثا: معلومات الاتصال
في حال وجود اي استفسار او شكوى من قبلك حول مشروع البحث بإمكانك الاتصال بالباحث أو لجنة اخلاقيات البحث في جامعة بابل – كلية التمريض
اسم الباحث محمد حاكم شمران **رقم الهاتف ٠٧٨٠٩٤١٧٨٤١** **البريد الالكتروني muhammedh.alhjem@uokufa.edu.iq**
لجنة أخلاقيات الابحاث العلمية – جامعة بابل – كلية التمريض: **رقم الهاتف** **البريد الالكتروني**

اسم المشترك بالبحث:

توقيعه :

التاريخ:٢٠٢٢/ /

Regular Resistance Exercise for Patients with Stroke

Application the Regular Resistance Exercise:

Regular resistance exercise was based on the principle that muscles of the body will work to overcome a resistance force when they are required to do so. The resistance exercise training was conducted following previously published guidelines. Resistance exercise training is set based on the Borg Rating of Perceived Exertion (RPE) scale, and rating between 11 and 13 (somewhat hard) was set as the targeted strength throughout the study (Alkhaqani and Ali, 2021).

Training protocol: It is consists of three sets of ten repetitions of (Upper Extremity Theraband Exercises–Sitting and Lower Extremity Theraband Exercises).

Upper Extremity include five type of resistance exercise: Chest Pull, Shoulder Flexion, Shoulder Diagonals, Elbow Flexion and Elbow Extension (Aurora BayCare Medical Center; Picha *et al.* 2019).

Lower Extremity include three types of resistance exercise: knee extension, hip abduction, and hip flexion using an elastic band (TheraBand Resistance Band Loops, THERABAND, Ohio, USA) encircling both ankles or above the knees, in a sitting or supine position depending on patient preference or the ability for three sessions per week (Alkhaqani and Ali, 2021).

Upper Extremity Theraband Exercises – Sitting

1. Chest Pull

- Sit or stand with your feet shoulder width apart.
- Loop theraband around each palm. Put your arms in front of your body with elbows slightly bent.
- Pull theraband outwards, across your chest.
- Hold for 3 seconds.
- Slowly return to starting position.
- Repeat 10 times.

2. Shoulder Flexion

- Sit or stand with theraband held at hip or waist height.
- Point your thumb toward the ceiling.
- With your elbow straight, raise hand toward ceiling.
- Hold for 3 seconds.
- Slowly return to starting position.
- Repeat 10 times.

3. Shoulder Diagonals

- Sit or stand with theraband at hip or waist level.
- Pull theraband from opposite hip up toward the ceiling on a diagonal.
- Hold for 3 seconds.
- Slowly return to starting position.
- Repeat 10 times.

4. Elbow Flexion

- Sit in a chair.
- Securely step on one end of the theraband.
- Bend your elbow up toward your shoulder.
- Hold for 3 seconds.
- Slowly return to starting position.
- Repeat 10 times.

5. Elbow Extension

- Sit in a chair without arm rests.
- Elbow is bent with your palm downward.
- Hold theraband at waist level.
- Straighten your elbow.
- Hold for 3 seconds.
- Slowly return to starting position.
- Repeat 10 times.

Lower Extremity Theraband Exercises

1. Knee extension (leg extension):

Sit in a chair or supine position. Place one end of your resistance band arounds your right ankle and have the other end securely fastened around the left leg. Lift and straighten your right leg and hold for a few seconds. Lower your knee. Repeat using your left leg. 10 to 12 times with each leg. You should feel all the muscles in the front of your thigh working. It will feel harder the higher you lift your foot (Adler *et al.*, 2014; Holden, 2020).

Compensation: If the band is slipping, pull the band away from your ankle and cross the bands to form a loop. Put your toes through the loop to secure the band to your ankle (Alkhaqani and Ali, 2021).

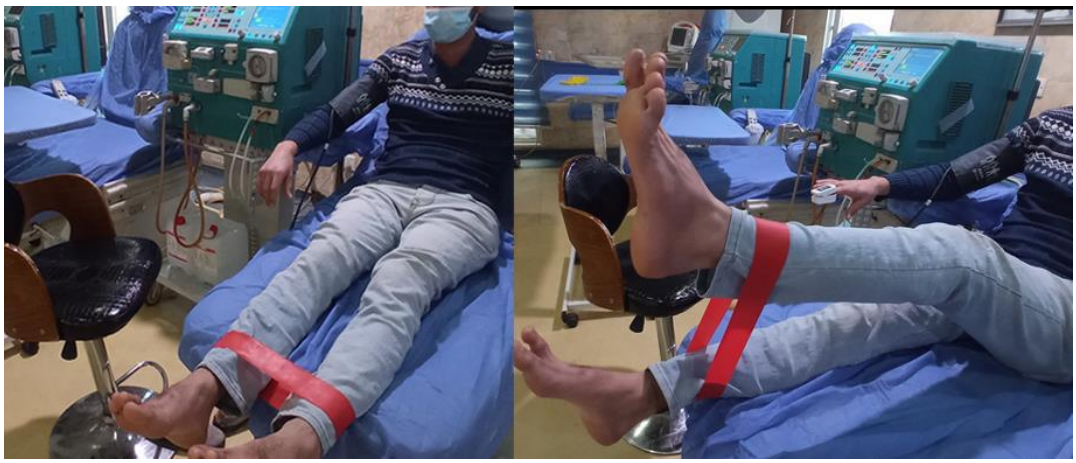

Figure: Knee extension with Resistance Band

2. Hip abduction:

Sit in a chair or supine position, depending on patient preference or ability. Wrap a resistance band around your knees or ankle, with your knees hip-width apart. Slowly push your knees out to the side and then bring them back, in a control motion, keeping feet together. Hold and slowly return. Repeat 10 to 12 times (Holden, 2020; TheraBand, 2019).

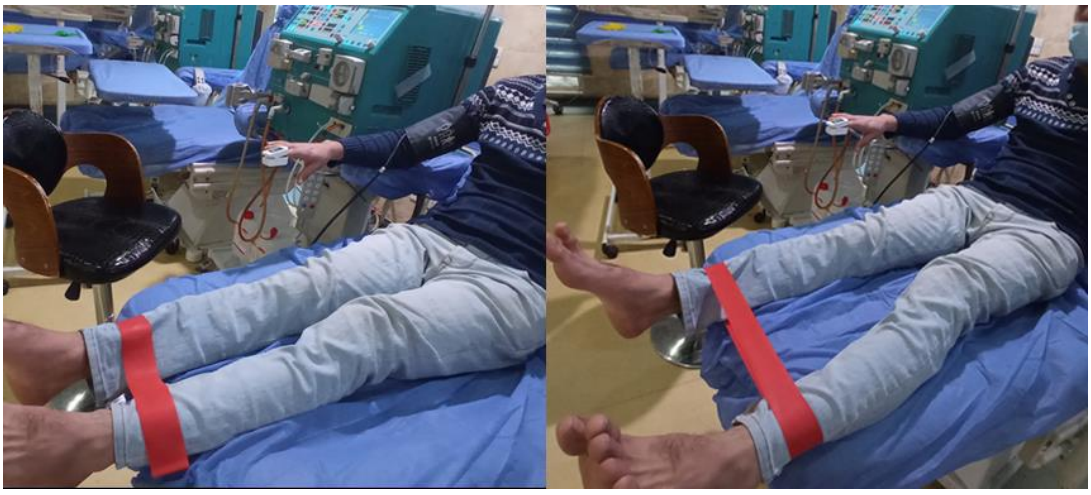

Figure: Hip abduction with Resistance Band

3. Hip flexion:

First, to perform the lying hip flexion, wrap one end of the resistance band around your right ankle or knee and wrap the other end to the left ankle. Lift your right foot slightly off the ground and bend your right knee, bringing it toward your stomach. Extend your right knee until you reach the beginning position. Repeat the exercise with your left leg after you complete the target number of reps with your right leg. Repeat 10 to 12 times (Moriyama *et al*., 2019).

Figure: Supine hip Flexion with Resistance Bands

Progression was performed by increasing contraction time up to 6 seconds, and patients performed 1 set of 10 repetitions. Proper breathing technique was emphasized during all exercises to avoid the Valsalva manoeuvre, as recommended by previous research (Alkhaqani and Ali, 2021).

AppendiX D

Questionnaire

Effectiveness of Regular Resistance Exercise on Muscles Strength of Patients with Stroke: Evidence-Based Practice.

Part I / Socio-demographic Characteristicss: -

1. Age ☐ Years

2. Gender : Male ☐ Female ☐

3. Residency: Rural ☐ Urban ☐

4. Level of Education:

-Doesn't read and write ☐

-Read and write ☐

-Primary school graduated ☐

-Intermediate school graduated ☐

-Secondary school graduated ☐

- Institutes, college, or postgraduate ☐

5. Marital status :

- Single ☐
- Married ☐
- Divorced ☐
- Widower \ Widow ☐
- Separated ☐

6. Occupational status before the stroke:

1- Employed

- Governmental Employee ☐
- Private or Self employed ☐

2- Unemployed

- Retired ☐
- Disable ☐
- Housewife ☐
- Jobless ☐

Part II: Medical History :

A-Present History:

1. **Type of stroke:**

Ischemic Stroke ☐ Hemorrhage Stroke ☐

2. **Body side that is affected by stroke :**

Right sided ☐ left sided ☐

3. **Recurrence of stroke :** Yes ☐ No ☐

If yes : how many the stroke is recurrent ☐

4. **Duration of Stroke/ Months** ☐

5. **Stroke related problem and complications:**

- Pneumonia Yes ☐ No ☐
- Epileptic seizure Yes ☐ No ☐
- Deep venous thrombosis Yes ☐ No ☐
- Painful shoulder Yes ☐ No ☐

- Pressure sore Yes ☐ No ☐
- Joint Contracture Yes ☐ No ☐
- Dysphagia Yes ☐ No ☐
- Constipation Yes ☐ No ☐

B-Past History:

1. Associated diseases:

- Diabetic Mellitus Yes ☐ No ☐
- Ischemic Heart Disease Yes ☐ No ☐
- Hypertension Yes ☐ No ☐
- Heart Failure Yes ☐ No ☐
- Renal diseases Yes ☐ No ☐
- Others , please specify ☐

2. Are you Smoker ? Yes ☐ No ☐

- **Ex. Smoker** ☐ when did you stop smokers ☐ years

Part III: Muscle Strength Testing: **(The Oxford Scale)***

Rating Muscle Strength		
Rating	**Description of Function**	**Classification**
1	Palpable or visible contraction	Trace activity
2	Active movement, gravity eliminated	Poor
3	Active movement, against gravity	Fair
4	Active movement, against some resistance	Good
5	Active movement, against full resistance	Normal

AppendiX E

Ministry of Higher Education and Scientific Research
University of Babylon
college of Basic Education

وزارة التعليم العالي والبحث العلمي
جامعة بابل
كلية التربية الاساسية

العدد : ٧٦٩٤
التاريخ: ٩ / ٥ / ٢٠٢٣

Ref. No.:
Date: / /

جامعة بابل / كلية التمريض
الصادرة
العدد / ١٤٠١

كلية التربية الاساسية
شعبة الموارد البشرية
الصادرة

الى/ جامعة بابل / كلية التمريض

م/ تقويم لغوي

نهديكم اطيب التحيات ...

كتابكم ذو العدد ١٥٧٧ في ٢٠٢٣/٤/٣ نعيد اليكم اطروحة طالب الدراسات العليا / الدكتوراه (**محمد حاكم شمران**) الموسومة بـ (**فعالية تمرينات المقاومة المنتظمة على قوة العضلات لدى مرضى السكتة الدماغية : ممارسة قائمة على الادلة**) بعد تقويمها لغوياً واسلوبياً من قبل (**أ.صبيحة حمزة دحام**) وهي صالحة للمناقشة بعد الاخذ بالملاحظات المثبتة على متنها.

...مع الاحترام ...

المرفقات/
- رسالة الماجستير
- إقرار المقوم اللغوي

أ.د.فراس سليم حياوي
معاون العميد للشؤون العلمية
٢٠٢٣/٥/٩

نسخة منه الى/
- مكتب السيد العميد المحترم .. للتفضل بالاطلاع مع الاحترام
- أ.صبيحة حمزة دحام.
- الشؤون العلمية.
- الصادرة.

زينب//

العراق - بابل - جامعة بابل
بدالة الجامعة ٠٠٩٦٤٧٢٣٠٠٣٥٧٤٤
مكتب العميد ١١٨٤
المعاون العلمي ١١٨٨
المعاون الاداري ١١٨٩
وطني ٠٧٢٣٠٠٣٥٧٤٤
امنية ٠٧٦٠١٢٨٨٥٦٦
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الخلاصـــــة

السكتة الدماغية هي أحد الأسباب الرئيسية التي تؤدي إلى زيادة الوفيات والمراضة في جميع أنحاء العالم. أيضًا هي أحد أكبر أسباب الإعاقة ويعاني نصف المرضى الناجين من السكتة الدماغية من تقيد في اداء الوظائف اليومية. يعد فقدان القوة في العضلات بعد السكتة الدماغية شائعًا ومهمًا، ينجم هذا الضعف بعد السكتة الدماغية بشكل رئيسي عن عدم استخدام عضلات أطراف الجسم وقلة النشاط.

هدفت الدراسة إلى تحديد مدى فعالية تمرينات المقاومة المنتظمة على قوة العضلات لدى مرضى السكتة الدماغية.

دراسة شبه تجريبية تم تقسيم المرضى فيها إلى مجموعتين (تجريبية ومقارنة) ، وتكونت الدراسة من أربعة تقييمات (تقييم قوة العضلات قبل اجراء تمارين المقاومة المنتظمة، وثلاثة تقييمات بعد تنفيذ تمارين المقاومة المنتظمة)، للمجموعتين. اشتملت الدراسة على عينة غير احتمالية (عينة غرضية) تكونت من (٨٢) مريضاً مقسمة على (٤٣ مريضاً للمجموعة التجريبية و ٣٩ مريضاً لمجموعة المقارنة). جميع المرضى تم تشخيصهم طبيا بمرض السكتة الدماغية. أجريت الدراسة في محافظة النجف الاشرف/ دائرة صحة محافظة النجف الاشرف/ مركز الفرات الاوسط للعلوم العصبية، للمدة من السابع من تشرين الثاني ٢٠٢١ ولغاية الثاني من نيسان ٢٠٢٣.

أظهرت نتائج الدراسة وجود فروق ذات دلالة معنوية في قوة العضلات في فترات القياس المختلفة (الاختبار البعدي الأول والثاني والثالث) بقيمة احتمالية أقل من (٠.٠١). حيث تغير متوسط درجة قوة العضلات من (٣.٠٢) في الاختبار البعدي الاول إلى (٤.٦٧) في الاختبار البعدي الثالث. (وهذا يعني أن التمرين المستخدم لمرضى المجموعة التجريبية هو وسيلة فعالة لتحسين قوة العضلات بعد السكتة الدماغية).

استنتجت الدراسة بان تنفيذ تمارين المقاومة المنتظمة لمدة ستة أسابيع على الأقل هو نهج فعال لتحسين قوة العضلات لدى مرضى السكتة الدماغية مقارنة بمجموعة المقارنة.

أوصت الدراسة بضرورة إعداد دليل خاص بالتأهيل التمريضي وتحديثه تحت إشراف خبراء التمريض لاستخدامه من قبل الطاقم الصحي في وزارة الصحة كمعيار أساسي في رعاية مرضى السكتة الدماغية.

جمهورية العراق
وزارة التعليم العالي والبحث العلمي
جامعة بابل- كلية التمريض

فاعلية تمرينات المقاومة المنتظمة على قوة العضلات لدى مرضى السكتة الدماغية: ممارسة قائمة على الأدلة

أطـــروحـــة مـــن قـبـل

محمد حاكم شمران الحجيمي

مـقـدمـة الـى مجـلـس كـلـيـة الـتـمـريـض/ جـامـعـة بـابـــل - جزء مـن مـتـطـلـبات نـيـل شهادة الـدكتوراه - فـلـسـفـة فـــي الـتـمـريـض

بأشراف

الأستاذ الدكتورة شذى سعدي محمد

أيار ٢٠٢٣ ميلادية **شوال١٤٤٤هجرية**