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Effectiveness Between-Motor-Dual-Task-Specific Training and Task-Oriented-Circuit Training Along with Conventional Physiotherapeutic Intervention in Ambulation of Stroke Patients: A Quasi-Experimental study

Submitted by:

Khandokar Sadman Rakib

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Department of Physiotherapy

CRP, Savar, Dhaka-1343, Bangladesh

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We the undersigned, certify that we have carefully read and recommended to the **Faculty of Medicine**, **University of Dhaka**, for acceptance of this thesis entitled, "**Effectiveness Between-Motor-Dual-Task-Specific Training and Task-Oriented-Circuit Training Along with Conventional Physiotherapeutic Intervention in Ambulation of Stroke Patients: A Quasi-Experimental study**" Submitted by **Khandokar Sadman Rakib**, for the partial fulfillment of the requirements for the degree of Bachelor of Science in Physiotherapy (B.Sc. in PT) .

……………………………………

Farjana Sharmin
Lecturer
Consultant and OPD In-charge
Department of Physiotherapy
BHPI, CRP.

……………………………………

Prof. Dr. Mohammad Sohrab Hossain, PhD
Professor of Physiotherapy, BHPI
Executive Director, CRP.

……………………………………

Mohammad Habibur Rahman
Assistant Professor of Physiotherapy
School of Science and Technology
Bangladesh Open University, Gazipur-1750.

……………………………………

Prof. Md. Obaidul Haque
Vice Principal
BHPI, CRP.

……………………………………

Dr. Shazal Kumar Das, PhD
Assistant Professor and Head
Department of Physiotherapy
BHPI, CRP.

Approved Date:

Declaration

I hereby declare that the research work entitled "**Effectiveness Between-Motor-Dual-Task-Specific Training and Task-Oriented-Circuit Training Along with Conventional Physiotherapeutic Intervention in Ambulation of Stroke Patients: A Quasi-Experimental study**" has been carried out by me as a part of my academic requirements.

This study is original and has not been submitted in any form to any other university or institution for any degree or diploma. All sources of information and data have been duly acknowledged and referenced.

I also declare that ethical approval was obtained and all participants gave informed consent before taking part in the study.

Signature: ______________________________ Date; _______________________

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BHPI, CRP, Savar, Dhaka-1343

Bangladesh

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Acronyms

CRP	Centre for the Rehabilitation of the Paralyzed
BHPI	Bangladesh Health Professions Institute
ADL	Activities of Daily Living
AFO	Ankle Foot Orthosis
CT	Circuit Training
DMT	Dual Motor Task
MDTT	Motor-dual-Task Training
FAC	Functional Ambulation Category
FIM	Functional Independence Measure
IRB	Institutional Review Board
ICF	International Classification of Functioning, Disability and Health
MBI	Modified Barthel Index
MMSE	Mini-Mental State Examination
mmHg	Millimeters of Mercury
MAS	Modified Ashworth Scale
MT	Motor Task
OT	Occupational Therapy
PT	Physiotherapy
SPSS	Statistical Package for the Social Sciences
ST	Stroke
TIA	Transient Ischemic Attack
TOCT	Task-Oriented Circuit Training
VAS	Visual Analogue Scale
10MWT	10 Meter Walk Test
BBS	Burg Balance Scale
BI	Barthel Index
TUG	Time Up and Go
CVA	Cerebrovascular Accident

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Abstract

Introduction: As a leading cause of disability, motor control, balance and gait are often afflicted by stroke. Although rehabilitation strategies such as Motor-Dual-Task-Specific Training (MDTT) and Task-Oriented Circuit Training (TOCT) promise to enhance ambulation, few studies have compared them to conventional physiotherapy. **Aim**: The purpose of this study was to determine if either MDTT or TOCT is more effective than the other in increasing gait speed, balance and functional mobility (ambulatory functions) in persons post stroke. **Objectives**: To compare the impact of MDTT and TOCT on gait speed, balance and functional mobility and ambulatory ability, assessed by means of the Timed Up and Go Test (TUG), Berg Balance Scale (BBS) and Barthel Index (BI). **Methodology**: Forth patients were recruited in this quasi-experimental study from the Centre for Rehabilitation of the Paralyzed (CRP), Savar, Dhaka. We randomly assigned participants to the MDTT group (n=20) or TOCT group (n=20). Each group received their intervention over a 6-week period, 4 sessions per week. The 10MWT, TUG, BBS and BI were used to assess ambulation outcomes before and after the intervention. We used non-parametric tests (the Mann-Whitney U and Wilcoxon Signed-Rank) using a standard level of significance, defined as $p < 0.05$. **Result:** All MDTT and TOCT groups demonstrated significant improvement at 6 weeks. Gait speed (10MWT) improved in the MDTT group from 3.53 ± 3.36 m/s, TUG time decreased from 40.03 ± 35.17 sec, BBS score increased from 42.60 ± 4.48 and BI from 68.25 ± 13.60 ($p < 0.05$ for all). The TOCT group also improved in gait speed (from 2.79 ± 1.73 m/s), TUG (from 31.71 ± 18.65 sec), BBS (from 42.55 ± 4.15) and BI (from 69.75 ± 10.94) ($p < 0.05$, for all). TOCT had slightly better 10MWT, TUG, balance and BI scores than between groups (not statistically significant, $p > 0.05$). **Conclusion:** There is strong evidence to show that when MDTT or TOCT are combined with conventional physiotherapy, both MDTT and TOCT are effective at improving ambulatory outcomes for stroke rehabilitation. The results suggest that MDTT & TOCT is more effective than either endurance training or flexibility training in improving gait speed, balance and functional mobility. These findings lend support to the use of task-specific strategies relevant to a particular patient's needs in stroke rehabilitation.

Keywords: *Stroke, rehabilitation, ambulation, motor-dual-task training, task-oriented circuit training, gait, balance and physiotherapy*.

CHAPTER-I	INTRODUCTION

1.1 Background

Stroke, also called cerebrovascular accident, is a medical emergency that occurs when blood flow to an area of the brain is stopped either through a blockage or a bleeding vessel. This causes injury to the brain tissue and potentially permanent brain damage or death if blood flow is not restored within a short period of time (Shamshiev et al., 2024). Two kinds of stroke are ischemic, occurring as a result of an arterial blockage caused by thrombosis or embolism and accounting for 84% of all cases and hemorrhagic derived from the rupture of blood vessels (Joseph, 2023). Conditions that can contribute to an ischemic stroke, including atherosclerosis and carotid artery stenosis, cause most strokes while conditions that can give rise to a hemorrhagic stroke include macrovascular lesions, vascular malformations, aneurysms, etc (Diontama et al., 2025). Stroke is the second leading cause of death and the morbid state, across the world, but more prevalent in the low to middle income regions (Shamshiev et al., 2024).

Certain risk factors of stroke include - hypertension, diabetes, smoking & unhealthy lifestyles (but hypertension poses a major risk for both ischemic and hemorrhagic stroke) (Diontama et al., 2025). These risk factors can be controlled by preventing with lifestyle changes such as eating well, exercising regularly and controlling of blood pressure (Moini et al., 2023). A wide range of motor function, balance and ambulation deficits are caused by stroke that severely limit patient's independence and quality of life. After a stroke, muscle weakness, spasticity and abnormal neuromotor coordination which are all of great significance to the development of gait and balance dysfunction, can occur post stroke (Filippov et al., 2025). These impairments are also attributable to proprioceptive deficits since proprioception is important for stable balance and gait and coordinated movement (Takahashi et al., 2024). Stroke survivors have a balance problem and are at increased fall risk due to the deficits in postural control and dynamic balance (Karunakaran et al., 2024).

A variety of impairments in stroke survivors can greatly reduce their quality of life and their functional independence. However, proprioceptive impairments of the upper limbs are common and may be important in causing loss of integration of relevant sensory information for movements including eye movements (Tulimieri et al., 2024).

Stroke rehabilitation has multidimensionality for achieving the most common clinical goals: a multidimensional spectrum of complex and diverse needs of stroke survivors. Stroke rehabilitation essentially aims to maximise individuals' functioning by promoting physical and emotional, behavioural and cognitive functioning in order to improve quality of life and functional independence (Tigga & Kumar, 2024). This includes reducing disability by restoring impairments, activities and participation often confounded by neurological impairments caused by stroke (e.g., muscle weakness, sensory deficits, spasticity, balance problems and cognitive impairment) (Pizov, 2023).

Lower limb rehabilitation in stroke patients has included a wide range of conventional physiotherapy of motor function, balance and gait. Routine rehabilitation treatments such as stretching, muscle strength training, joint mobility exercises, motor control training and functional mobility training which are administered daily over several weeks in a traditional approach, are well documented for use with cervical spine disorders (Liu et al., 2024). A second approach is modified Constraint Induced Movement Therapy (mCIMT) in which the nonparetic limb is constrained in order to facilitate better use of the affected limb, balance and gait parameters (Chavan & Raghuveer, 2024). Furthermore, motor relearning programmes (MRP) with which activities of daily living such as walking and standing can be relearned have increased functional mobility and balance (Chavan & Raghuveer, 2024).

Patients following stroke have significantly greater dual-task interference compared with healthy older adults, resulting in severely degraded movement which is further degraded because it occurs in the presence of motor and cognitive deficits. The results suggest that stroke survivors show greater dual task interference of upper limb movements than age matched healthy controls (19% greater interference), consistent with sub clinical impairments in divided attention that may impede motor recovery (Lindberg et al., 2024). The presence of this interference is shown in functional tasks including Timed Up and Go (TUG), Sit-to-Stand (STS) and 10 Metre Walk (10MWT) tests, wherein dual task conditions result in greater sway and increased times for stroke survivor performance, indicating exaggerated mobility deficits (Abdollahi et al., 2024). Stroke patients' ambulation in the recovery course is to be dramatically disrupted by the interference from motor dual task specific training. Individuals with neurological disorders such as stroke, often experience increased dual-task interference, thereby worsened gait disturbances when a secondary task is performed in combination with walking (Plummer & Eskes, 2015). Both cognitive and motor dual task training have been shown to improve dual task gait performance in stroke patients but, to the extent that they do, improvements vary depending on the task type. As an example, cognitive dual-task gait training (CDTT) has been shown to enhance cognitive motion dual-task gait performance; while motor dual-task gait training (MDTT) improves motor dual-task gait performance, for instance gait speed, stride length etc (Liu et al., 2017). However, these effects can be mitigated by targeted dual tasking, with the goal of improving patients' abilities to manage dual task situations which are important for everyday ambulation (Evans et al., 2009).

Several mechanisms by which motor dual task training (MDTT) improves balance, coordination and ambulation in stroke patients have been demonstrated. In the case of MDTT, the motor task is performed in conjunction with the execution of another cognitive task and the exposure to performance of two tasks concurrently inherently challenges the brain in terms of its ability to multi task, so may in addition to helping optimise motor performance, also promote neural plasticity and improve motor control. In studies, MDTT has been shown to yield dramatic improvements in balance as measured on the Berg Balance Scale and a decrease in fall rates of stroke survivors (Zhang et al., 2024). Additionally, increased gait parameters of step length, cadence and stride length are improved which are needed for good ambulation (Zhang et al., 2022). MDTT offers a holistic means to treat the motor and cognitive deficits leading to stroke patients' improved balance, coordination and ambulation essential to improved quality of life and independence (Pang et al., 2018) (Park & Lee, 2019).

Task Oriented Circuit Training (TOCT) for stroke patients is a rehabilitation approach to stroke motor function and daily living activities using repetitive, functional and client centred activities for clients with stroke. This is a high intensity based practised individually to suit needs using the principle of neuroplasticity (Halford et al., 2024). TOCT resulted in dramatic increases of aerobic capacity, balance and functional mobility as measured by VO2 max, Timed Up and Go (TUG) and Timed Up and Down Stair test (TUDS) (Ayn & N., 2024). For stroke patients, task-oriented circuit training (TOCT) has been shown to improve functional mobility and endurance by combining repetitive, goal directed tasks that look just like activities of daily living, promoting motor learning and neuroplasticity. Several studies exist that show that TOCT can improve balance, trunk control and functional ambulation. That is; a study that compared TOCT to trunk rehabilitation in chronic stroke patients, TOCT was found to be much better in improving balance, while both interventions were equally good in improving functional ambulation (Kundnani & Satralkar, 2023). In addition, task-oriented activities have been demonstrated to improve considerably the 6-minute walking distance endurance but had less impact on dependency level in functional activities (Shohe et al., 2022). Task oriented approaches improved gait and balance in hemiplegic patients as patients realized improvement in the Berg Balance Scale (BBS), Timed Up and Go test (TUG) and the 10 meter walk test (10MWT) resulting in reestablishment of functional independence (Kesidou et al., 2022).

Instead of conventional physiotherapy for stroke patients, task-oriented circuit training (TOCT) is repetitive, functional, client centered, relevant to the patient and increases neuroplasticity and motor recovery. In contrast to common practice that finds support in the biological and physical sciences, TOCT stresses the performance of particular tasks which are closely linked to activities carried out in everyday living, to achieve better motor function as well as quality of life for stroke survivors (Halford et al., 2024). However, studies have demonstrated that TOCT (especially when combined with sensorimotor training) leads to large gains in balance, gait, increased postural sway area and increased walking velocity (Kim & Kang, 2016). Moreover, it is demonstrated that TOCT is a more effective strategy to increase lower extremity function and quality of life than treadmill training in hemiplegia patients (Cha et al., 2014). In addition, TOCT's inclusion of dual task training which involves simultaneous practice of cognitive and motor task, demonstrates contrary to intuition an obvious improvement in gait variables, thus indicating its multimodal rehabilitation approach (Kim & Seo, 2013).

Optimizing the motor rehabilitation strategy for individuals with motor impairments such as those following stroke, requires comparing motor dual task training (MDTT) and task-oriented circuit training (TOCT). Stroke patients can improve balance and gait by engaging multiple neural pathways at the same time while performing a motor task combined with another task – for example maintaining postural control in MDTT (Sukala, 2021). Additionally, dynamic balance and gait parameter outcomes during chronic stroke patients in this approach has been shown to improve significantly more than the traditional motor relearning programmes (Valecha et al., 2024). However, TOCT emphasizes practicing functional tasks in a circuit manner that may enhance walking function and pleasantness of life by making use of task specific motor learning and modification (Youn & Oh, 2016). Results have shown that TOCT training may be more effective than dual task training in improving speed and cadence of gait in chronic stroke patients (Singh et al., 2019). Both of these training modalities need to be compared because this will allow clinicians to identify which method may be more appropriate for certain rehabilitation goals (i.e. improving balance, gait or general motor function). Moreover, the ability to learn the differential impacts of these training methods can provide clinicians with potential guidance of treatment customization specific to the patient's individual needs which might ultimately lead to more efficient and more effective rehabilitation outcomes (Kim & Seo, 2013). So, by comparing MDTT and TOCT, we can fine tune rehabilitation protocols and gain a much better understanding of how multiple training modalities can be used to give those with motor impairments the best chance of motor impairment recovery and attainment of functional independence.

Several studies address the multifaceted effectiveness of motor dual tasking specific training, task-oriented circuit training and conventional physiotherapeutic intervention for improving ambulation in a stroke patient population. While task-oriented training improves walking endurance in stroke patients considerably, its influence on functional dependency is negligible (Shohe et al., 2022). Dual task gait performance improved following cognitive-motor dual-task training (CMDT) and resulted in improvements in stride length and dual task cost of gait speed which may enhance motor performance in persons with stroke (Liu et al., 2017) (Zhang et al., 2024). In contrast, CMDT effects on other parameters such as Timed Up and Go test and single task walking speed seem inconclusive and warrant further study (Zhang et al., 2024). As a result, it is necessary to begin comparing the two methods of MDTT and TOCT in order to enhance stroke rehabilitation so that the stroke patients will get the best and most suitable rehabilitation treatment.

1.2 Rationale

Stroke is the most common source of disability worldwide and impairs motor control, balance and gait function. The exact problems of impaired motor function and cognitive deficits that impact on their ability to walk reliably and safely affect many stroke survivors. And effective rehabilitation strategies result overall functional recovery and ambulation. Physiotherapy techniques used today are largely isolated to the single tusk motor learning which will not transfer to sufficient walking between different varieties of motor or cognitively based tasks in real life. Simultaneous motor combined with dual task (Motor-Dual-Task-Specific Training; MDTT) has recently been described as a promising intervention aimed at improvement coordination, gait stability and adaptation. Alternatively, Task Oriented Circuit Training (TOCT) is a circuit based, force and strength enhancing programmed designed to promote repetitious functional movement patterns that are of functional value in improving the strength, endurance and walking ability. Although, increasing evidence has prompted use of MDTT and TOCT in stroke rehabilitation, there is no studies have directly compared their efficacy in combination with conventional physiotherapy for improvement in ambulation. However, the long-term benefits and best practices for implementation are unclear. The purpose of this study is to fill this gap through comparative effectiveness between MDTT and TOCT in stroke patients who are undergoing conventional rehabilitation. The findings of this study could serve as evidence to inform which approach to stroke rehabilitation results in better improvements in ambulation, balance and functional independence providing a basis for evidence based clinical decision making and enhancement of stroke rehabilitation protocols.

1.3 Aim

The purpose of this study is to explore the effectiveness of motor-dual-task specific training and task-oriented circuit training along with conventional physiotherapy on ambulatory abilities for patients with stroke.

1.4 Objectives of the study

1.4.1 General objective

To evaluate the effectiveness of motor dual task specific training and task oriented circuit training along with conventional physiotherapy treatment, at improving ambulation in stroke patients.

1.4.2 Specific objectives

- ✓ To assess the effects of motor dual task-specific training and conventional physiotherapy treatment on walking speed, balance and functional mobility in stroke survivors.
- ✓ To assess the impacts of task-oriented circuit training and conventional physiotherapy intervention on walking speed, balance and functional mobility in patients with stroke.
- ✓ To compare the effectiveness of motor dual task specific training and task-oriented circuit training along with conventional physiotherapeutic intervention on over all ambulatory function in stroke survivors.
- ✓ To find out the sociodemographic status and medical information of participants.

1.5 Hypothesis

1.5.1 Alternative Hypothesis

There is a significant difference between motor dual-task specific training and task-oriented circuit training, along with conventional physiotherapy treatment, in improving ambulation in stroke patients.

1.5.2 Null Hypothesis

There is no significant difference between motor dual-task specific training and task-oriented circuit training, along with conventional physiotherapy treatment, in improving ambulation of stroke patients.

1.6 Variable

Independent variable	Dependent variable
Motor Dual Task Training (MDTT)	Ambulation
Task-Oriented Circuit Training (TOCT)	Gait speed
Conventional Physiotherapeutic Intervention	Functional mobility
	Balance

1.7 Operational Definitions

Stroke

Stroke is a clinically defined syndrome characterized by an acute, focal neurological deficit that is caused by vascular injury (infarction, hemorrhage) to the central nervous system.

Ischemic stroke

An ischemic stroke is a rapid and localized neurological impairment resulting from a blockage in a blood vessel, characterized by symptoms that last for more than 24 hours.

Motor control

The process of learning a skill by which the learner, via repetition and absorption, refines and generates automatic the intended movement.

Task-oriented circuit training

Task-oriented training is a therapeutic method in clinical settings that is centred on the concepts of motor learning, motor control, and neuroplasticity, as established in rehabilitation research.

Specific Motor Dual-Task Training

Specific Motor Dual-Task Training involves combining movements to help a person recover from stroke. Patients do multiple task at once and the difficulty grows as the tasks become more complicated, faster or harder to concentrate on. With this evidence-based treatment, patients can work on using and understanding simultaneous information which often becomes a challenge for stroke survivors.

Ambulation

Ambulation is the ability to walk independently with or with support and to adjust one's walking pattern for secure and convenient travel anywhere.

CHAPTER-II LITERATURE REVIEW

Gait impairments in stroke patients, due to muscle weakness, altered neuromotor coordination and proprioception and stability deficits extensively affect their balance and ambulation (Filippov et al., 2025). Disruption of many neural networks, most often corticospinal pathways, results in these impairments and increases in energy expenditure during walking (Kesar, 2023). Almost 83% of stroke survivors have balance impairments which are important for functional independence and community participation (Zhang et al., 2023). Patients suffering from chronic stroke have also found to benefit from Constraint-Induced Movement Therapy (CIMT) of the lower extremities improving balance and gait capacity (Menezes-Oliveira et al., 2024). Other effective interventions include body-weight supported treadmill training with either external stimulation of individual leg motions or bilateral weight load or dual task balance and gait training (Zhang et al., 2023).

The importance of using personalized and technology-based strategies for rehabilitation of such multifaceted gait impairments in stroke patients is highlighted and the use of these strategies is shown to lead to improvement in the gait impairments as well as in the quality of life and functional independence of the patients (Filippov et al., 2025). Previous studies have shown that Motor dual task specific training (MDTT) could have a large effect in modulating gait, balance and cognitive motor coordination in patients that have suffered a stroke. While static balance function improvements have been demonstrated using cognitive motor dual task training, there is weak evidence of BBS posttest score improvement which supports a recommendation for further research (Zhang et al., 2024). Compared to single task training, dual task training improves walking speed, step length, gait cadence, cycle time and stride length, especially in those with chronic stroke and left hemiplegia (Valecha et al., 2024).

Finally, dual task training has been demonstrated to improve walking speed with no cost of cognitive motor tradeoffs, indicating that improvements are not simply artefacts of compensatory mechanisms (Chuang et al., 2024). While stroke survivors walk slower on the Timed Up and Go (TUG) and 10Meter Walk Test (10MWT) under dual-task conditions compared with single task situations, however, dual-task conditions worsen mobility deficits (Abdollahi et al., 2024). However, although face significant challenges, the utilization of dual task training has shown promise in decreasing risk of falls and increasing walking balance, gait and walking endurance in patients with a variety of neurological diseases, including stroke (Spanò et al., 2022). Previous studies have demonstrated that dual-task specific training (MDTT) is a promising (and practical) strategy to enhance ambulation in stroke patients. For example, more recently, MDTT has been shown to improve motor dual-task gait performance (e.g., increase gait speed, stride length and decrease dual-task cost for gait speed) making it a promising adjunct to meet specific aims of enhancing motor components of dual-task performance in stroke rehabilitation (Liu et al., 2017).

Significantly, balance and functional outcomes improved in BBS and Barthel Index scores following backward walking training (Khan, 2023). These results in part demonstrate that dual-task training may improve both cognitive and motor functions key to functional ambulation. In addition, dual task exercise has been shown to reduce cognitive motor interference during walking and decrease fall risk, an important problem for stroke patients (Pang et al., 2018). But there is some research, but it is very limited and those findings are conflicting. For example, although dual task training benefits certain elements of gait performance, benefits are not always transformed into greater difference with other dual task training modalities (ex. CDTT) (Liu et al., 2017). In addition, some stroke patients can have physical and cognitive impairments that make dual task gait training not feasible in all individuals (Plummer et al., 2014). Moreover, while dual task training can enhance dual task walking speed, individual differences of attention allocation between tasks necessitate the attention of personalized approach (Plummer et al., 2014). In general, dual task specific training seems likely to have a role in improving ambulation in stroke patients, but its limitations require further research and its application in a clinical setting still needs optimising.

In stroke rehab, Task Oriented Circuit Training (TOCT) is based on having patients repeat functional tasks that imitate real world activities, to facilitate motor recovery and functional performance. The theory behind this approach is that practicing certain tasks will improve one's motor skills, so to the extent one can practice improved motor function will follow after a stroke. TOCT is highly intensive and structured, with patients rotating through circuit training setups which focus on different motor skills: walking, balance and upper limb function (Port et al., 2012). A few studies have indicated that TOCT is effective in increasing walking distance, gait speed and upper extremity function but those results were variable and in part dependent upon the particular implementation and patient (Thant et al., 2019). For example, TOCT has proven that it improves walking competency and gait related activities in patients through transition from inpatient to the outpatient setting (Port et al., 2012). Furthermore, including motor imagery in TOCT is a promising way to combine cognitive processes with physical practice to improve gait rehabilitation (Verma et al., 2011). Task oriented circuit training (TOCT) has been shown to significantly improve functional mobility and gait performance of stroke patients through the performance of specific, goal directed activities using circuit training that mimic daily life tasks.

Positive functional recovery of daily life activities and neuromuscular movement is achieved with this approach in stroke patients (Song et al., 2019). In addition, TOCT was found to be more efficacious than proprioceptive training for balance, gait and quality of life (based on the Berg Balance Scale and Motor Assessment scale) (Maqbool et al., 2024). In addition, circuit training, a type of TOCT, has been shown to increase muscle strength, endurance and work capacity of the paretic and nonparetic legs of stroke survivors and has been used in rehabilitation where make these findings applicable (Sunnerhagen, 2007).

Despite benefits in stroke patients' balance and gait rehabilitation, Task oriented circuit training has few limitations. TOCT offers one of the primary benefits of improving walking endurance and gait parameters (velocity, cadence and stride length) that are key to mobility in stroke survivor (Shohe et al., 2022). Combines task specific activities with conventional physiotherapy and is associated with improved walking endurance, but lesser effect in reducing dependency of normal daily functional activities (Shohe et al., 2022).

TOCT is a valuable component in a stroke rehabilitation programme and has shown substantial benefit for balance and gait, yet meaningful treatment effects occur only when gastrocnemius loads are elevated over those achieved by training alone. The papers provided are not comparing directly the Task Oriented Circuit Training (TOCT) and motor dual task specific training (MDTT) in stroke patients. Yet, they provide clues into the efficacy of training with a task and training with dual tasks separately. Several studies have shown that functional recovery in stroke patients improved by using task oriented training (TOT), increasing gait and balance by improving neuromuscular movement and daily life activities (Song et al., 2019). However, task oriented circuit training (TOCT) is effective at enhancing walking endurance and mobility in patients with multiple sclerosis (Coelho, Freitas, & Maylor, 2010) and may also be beneficial, in a similar manner, for stroke patients (transferred learning) (Straudi et al., 2022). Conversely, dual task training, especially coupled with virtual reality, has also produced improvements in gait and balance for chronic post stroke survivors suggesting its use in stroke rehabilitation (Fishbein et al., 2019).

Both Motor-Dual-Task-Specific Training (MDTT) and Task-Oriented-Circuit Training (TOCT) are rehabilitation strategies designed to improve balance, gait and ambulation; however their mechanisms and their outcomes are different. MDTT aims to improve performance of dual-task by combining cognitive or motor task during walking that has been proven to enhance motor dual-task gait performance including gait speed and stride length, despite failing to produce significant group difference to cognitive dual-task training (Liu et al., 2017). In contrast, TOCT includes structured, repetitive, task oriented, tasks largely resembling activities of daily life that are shown to markedly increase walking endurance and balance in stroke patients (Shohe et al., 2022). Although MDTT aims to improve function associated with the ability of dual tasks, TOCT focuses on the repetition of performance of everyday functional tasks as an overall means of mobility and balance. Improvement in gait and balance with both methods have been observed, with TOCT use specifically associated with improvements in walking endurance and reduced fatigue as measured by improvements with the Six Minute Walk Test (6MWT) and other mobility scales (Straudi et al., 2022).

Several studies give insight into superior methods for ambulation, balance and independence in evaluating training methods using the Berg Balance Scale (BBS), the Timed Up and Go (TUG) test, 10-meter walk test (10MWT) and the Barthel Index. Altered sensory input during task-oriented balance training has been shown to improve BBS and 10MWT scores in older adults, proposed to improve sensorimotor integration and postural control (Ravindran et al., 2022). Moreover, we also showed that TOCT worked better to enhance balance and gait than proprioceptive training, for instance, as demonstrated by higher scores on the Berg Balance Scale (BBS) and Motor Assessment Scale (MAS) (Maqbool et al., 2024). One approach to comparison between Motor Dual Task Specific Training (MDTT) versus Task Oriented Circuit Training (TOCT) in stroke patients is to compare their ability to result in improvements in different aspects of mobility, but with an emphasis on what part of rehabilitation they target. We have demonstrated that task-oriented training (TOCT) which is a part of TOCT improves functional recovery such as walking speed and balance in stroke patients. It is a neuromuscular movement approach for use in the daily life activities of patients, suggesting general application in increasing functional independence (Shohe et al., 2022) (Song et al., 2019). In particular, task-oriented training with added manual therapy has led to improved balance, mobility and health related quality of life suggesting its potential for comprehensive rehabilitation (Traxler et al., 2023). Contrastingly, MDTT which involves training motor tasks while walking, was able to improve dual task gait motor performance (e.g. gait speed and stride length). However there were no significant group differences for improved performance from other training methods (Liu et al., 2017).

The limitation in existing studies with Motor-Dual-Task-Specific Training (MDTT) and Task-Oriented-Circuit Training (TOCT) for enhancing ambulation in stroke patients are revealed. In the first place, the results of many studies which are conducted by shohe et al and kim et al are based on small numbers of samples and lack generalizability (Shohe et al., 2022) (Kim et al., 2016). Moreover, although task-oriented training has been shown to be effective at improving a number of functional outcomes including gait and balance, these studies do not assess a broader number of long term effects impacting functional independence (Shohe et al., 2022) (Song et al., 2019). However, further complicates understanding of the efficacy of dual task interventions in that higher cortical activation does not always translate to improved functional outcomes (Jung & An, 2024).

In addition, Liu et al. suggest that whereas MDTT may boost those dual task gait performances that an individual MDTT condition enhances, the improvements are not always robust enough to yield group differences (Liu et al., 2017). In many cases, the studies do not take into consideration the individual variability of the neurophysiological and functional capacities required to tailor effective rehabilitation programmes (Jung & An, 2024). The sample size, long-term outcomes assessment, individual variation and complexity of dual task training and TOCT for stroke rehabilitation were limited. More robust, large scale studies are required to further understand and optimize MDTT and TOCT for stroke rehab. Despite progress producing significant improvements in balance, gait speed and ambulation with Motor-

Dual-Task-Specific Training (MDTT) and Task Oriented Circuit Training (TOCT) with stroke patients, a number of questions regarding their effectiveness remain unanswered. A very big area of uncertainty is how sustainable are these improvements over the long term with these interventions? Previous studies have demonstrated that task-oriented activities can considerably improve walking endurance and balance in the short term, but whether these are maintained through long duration is unknown (Shohe et al., 2022) .

Furthermore, the specific mechanisms by which these training modalities achieve their effects are not known. However, the specific contribution of cognitive and motor components to dual task balance and mobility is not well understood and does not appear to have been systematically studied (Zhang et al., 2024). Furthermore, the specific mechanisms by which these training modalities achieve their effects are not known. However, the specific contribution of cognitive and motor components to dual task balance and mobility is not well understood and does not appear to have been systematically studied (Traxler et al., 2023). Additionally, the contribution of individual patient characteristics, including the degree of stroke severity and baseline functional status, to the response to MDTT and TOCT is not defined. The variability of these patients suggests the need for personalized patient rehabilitation approaches (Maqbool et al., 2024). Well designed, large scale, randomized controlled trials could provide substantial clinical value for these training methods in stroke rehabilitation if they were to answer these questions.

CHAPTER-III	METHODOLOGY

3.1 Study design

This thesis aimed to examine the intervention effects of motor dual task training (MDTT) and task-oriented circuit training (TOCT) on ambulatory functions in an individual post stroke. The design of this study was quasi-experimental. This study consisted of two groups, and an intervention was provided during the experiment. We were divided into two individual groups: one, called the motor dual task training (MDTT) group, and another, the task-oriented circuit training (TOCT) group. All the groups have an individual treatment plan to perform the study. To measure the effectiveness of both treatment protocols in stroke patients, a pre-test (before intervention) and post-test (After intervention) were administered to each subject of both groups. Conventional physiotherapy treatment, applied with motor dual task training (MDTT) and task-oriented circuit training (TOCT), was applied to the patient with stroke here.

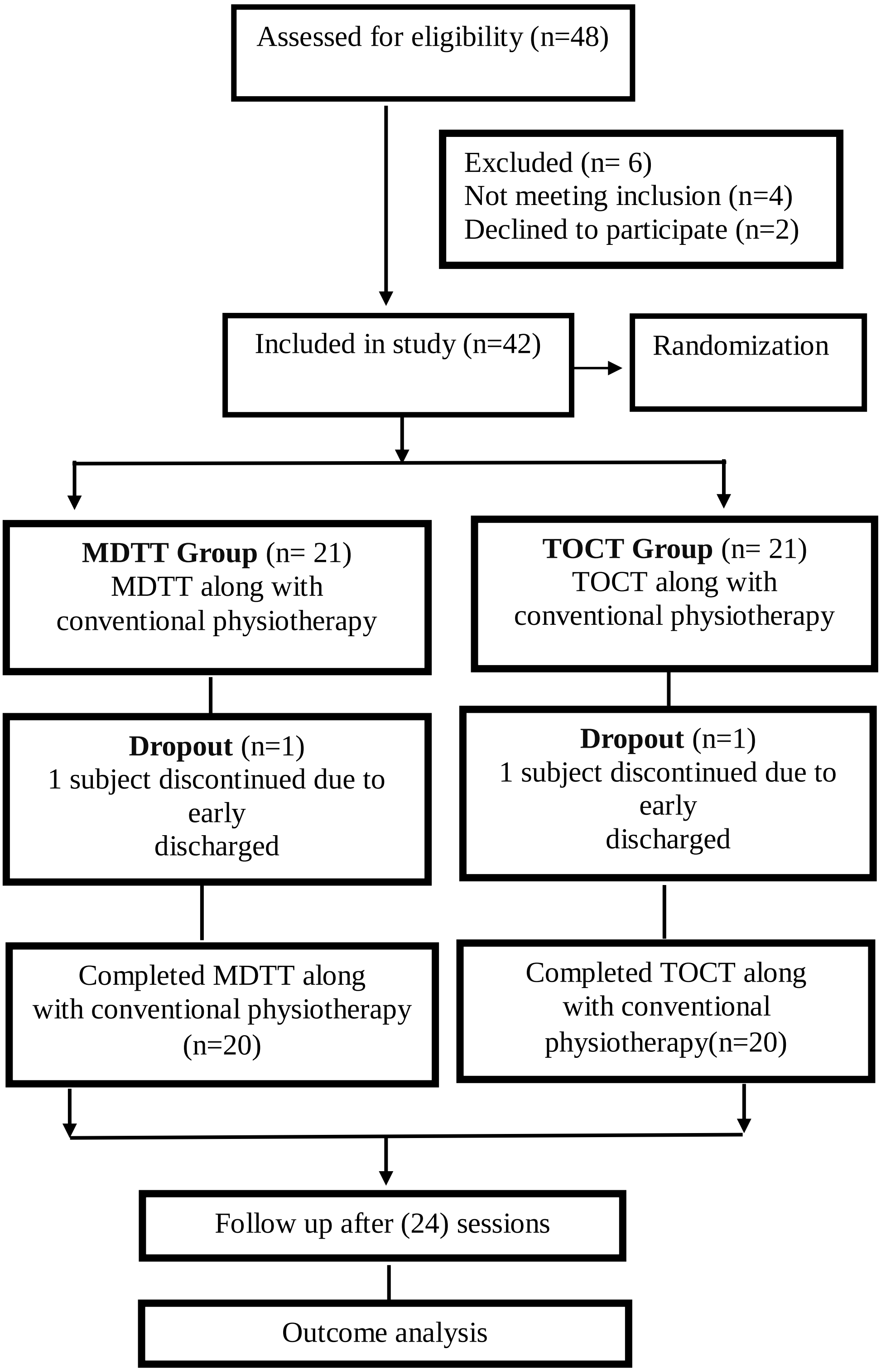
3.2 Study area

The researcher collected data from the Neurology Unit and Stroke Rehabilitation Unit (SRU) of the Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka.

3.3 Study population

A population means the entire group of people or items that meet or fulfil the criteria set by the researcher. The populations of this study will be diagnosed with stroke and ambulatory issues in the Neurology Unit and Stroke Rehabilitation Unit (SRU) of Centre for the Rehabilitation of the Paralysed (CRP), Savar, Dhaka.

3.4 Consort framework



3.5 Sample size

This quasi-experimental study entitled Effectiveness Between Motor dual task specific training (MDTT) and task-oriented circuit training (TOCT) along with conventional physiotherapeutic interventions in ambulation of stroke patients consists of two independent intervention groups. Using the following formula for comparing two independent means (Hulley et al., 2013). We calculated a sample size to detect a clinically meaningful difference in ambulation outcomes between the two groups.

$$n = \frac{2.\left(Z\,1 - \frac{\alpha}{2} + Z\frac{1}{\beta}\right)^2 .\sigma^2}{\delta^2}$$

Where:

n = Sample size per group.

$Z1-\alpha/2$ = Standard normal deviate for a 95% confidence level (1.96)

$Z1-\beta$ = Standard normal deviate for 80% power (0.84)

σ = Assumed standard deviation of the outcome measure

δ = Expected mean difference between groups

Based on relevant literature and expert clinical assumptions:

- ✓ The expected standard deviation (σ) was set at 10 units.
- ✓ The minimum detectable difference (δ) was considered 5 units.
- ✓ The significance level (α) was 0.05, and power (1−β) was 0.80.

The values for standard deviation and mean difference were derived based on prior studies evaluating gait and ambulation outcomes following dual-task and task-oriented training in stroke rehabilitation (Ahmed et al., 2019) and (Liu et al., 2022), which reported moderate-to-large effect sizes in gait speed and balance performance.

Substituting the values into the formula:

$$n = \frac{2.(1.96 + 0.84)^2 .10^2}{5^2}$$

$$= \frac{2.7.84.100}{25}$$

$$= \frac{1568}{25}$$

$$= 62.72$$

Therefore, the minimum required sample size was approximately 63 participants per group, totalling 126 participants. Accounting for an anticipated dropout rate of 10% (Machin et al., 2018), the adjusted final sample size was determined to be 140 participants (70 per group). Due to time limitations and the patient's unavailability according to my inclusion and exclusion criteria, I took 40 samples. There are 20 samples in the MDTT group and 20 samples in the TOCT group.

3.6Selection criteria

3.6.1 Inclusion criteria:

- Both male and female participants will be included (Sharmin et al., 2025)
- Age of patient ranging from 35 to 70 years (Sharmin et al., 2025)
- Patients who are willing to participate (Sharmin et al., 2025)
- Can walk 10 meters independently or using an aid or orthotic with or without supervision or aid (Kim et al., 2017).
- Limited arm motor function, yet able to reach and grip (Sharmin et al., 2025)
- Who are medically stable (Iqbal M et al., 2017)
- An ability to understand instructions and follow any commands (Yang et al., 2007)

3.6.2 Exclusion criteria:

- A patient suffering from unstable cardiac condition, severe hypertension, congestive heart failure, aphasia and cognitive impairments for which exercises are contraindicated (Sharmin et al., 2025).
- Patients with progressing neurological illness and other health issues affecting walking abilities (Sharmin et al., 2025).

3.7 Study Period

The duration of the study period was from 1st June 2024 to 31st May 2025.

3.8 Sampling Technique

This study used a hospital-based random sampling technique. There was only one blinded (assessor) randomized clinical trial that included both pre- and post-measurements. Before and six weeks after being randomly assigned and receiving an intervention, participants were measured by a blinded assessor. After determining that every participant fulfilled the requirements for inclusion and gathering demographic data, the assessor was responsible for conducting the baseline assessments. A secure random allocation schedule had been created by an individual before the trial began. A block (1:1) randomization schedule was used to ensure that the task-oriented circuit training (TOCT) and motor dual task specific training (MDTT) groups had an equal number of participants.

3.9 Data collection procedure

Written consent was obtained from the patients. A questionnaire was used to accumulate data through face-to-face conversations. 10-meter walk test (10MWT), Time up and go (TUG), Berg balance scale (BBS), and Barthel Index (BI) were used in the study, which will take about 20 to 30 minutes. Other related information was collected from the stroke and participant-related socio-demographic questionnaire.

3.10 Data collection tools

- Information and consent form
- Questionnaire.

3.11 Outcome measurement tools:

3.11.1 Ten-meter Walk test (10MWT)

The procedure to perform the 10-Metre Walk test is described by Tilson et al., (2010).

Procedure:

Description: Gait speed is a measure of the 10 meter walk test.

Equipment: Measure with a digital stopwatch, masking tape, measuring tape, a quiet hallway or open space measuring at least 14 m long.

Note: In addition, the participant should be wearing flat shoes or shoes with a heel less than 1⁄2 inch.

1. To have skiing on natural snow, an indoors course that is 14 meters long was built. At 0, 2, 12 and 14 meters, tape is placed along the line.

2. Take a participant's resting heart rate and blood pressure while they are sitting. Do not start the test if the participant's blood pressure is 180/100 mm Hg or their heart rate is more than 100 beats per minute or 80% of their listed heart rate. The formula is 220 minus age as a key measure for heart rate.

3. Tell the participant they will have to walk a distance closer to 40 feet. We'll travel it twice in total. You may work whenever you want to do so during the two sessions. Do you want to ask me anything?

4. Make sure the participant stands on the line at 0 m. At the beginning, tell the participant to walk at a speed that feels right until they get to their chair. Be sure to name where the person is sitting and where the camera is, but do not describe the tape. Keep walking until you notice the word 'STOP.' The first command you're given will be "Ready and go."

5. As soon as you and the participant have everything ready, shout "Ready and Go." If someone starts the activity before it's supposed to begin, tell them to begin from the beginning.

6. Hit the stopwatch when the participant's feet cross the 2-meter line and stop it once they go over the 12-meter line. Allow the individual to go on walking until he or she gets to the chair after passing the 14-meter line.

7. Record how long the participant walked the 10 meters, from the 2-meter line to the 12-meter line.

8. Ask the participant to stay in the chair placed at 14 meters if they need to rest.

9. After warming up, the person will walk as indicated during the test, but use the 14-meter and 0-meter lines as their markers. Begin the stopwatch when you reach the 12-meter mark and stop when you are at the 2-metre position.

10. Make a second measurement to see your result, but try to move briskly this time. When required, the participant is allowed to sit in the upright chair placed at the 0-m line.

11. Average the results of your first and second timings for walking.

12. After putting the participant into the chair, measure her pulse and blood pressure right away.

3.11.2 Time up and go (TUG)

General instruction:

Purpose - In order to test mobility.

Equipment- Stopwatch

Direction- The patient can use a walking aid and wears their normal footwear. If needed. First, have the elevated patient return to a standard and have the patient sit back line meters or 10 fit, away on the floor.

1. Any adult who requires >/12 seconds for TUG is at risk of fall.
2. Tell the patient, I want you to go when I say Go:

- ✓ Rise up from the chair.
- ✓ Walk to a line on the floor that someone will tell you to walk to – it should be at your normal pace.
- ✓ Turn.
- ✓ Walking back to the chair over your normal pace.
- ✓ Again, sit down.

3. On the word “Go,” begin timing.

4. Stop timing after the patient sits back down.
5. Record Time.

3.11.3 Berg balance scale (BBS)

The Berg balance scale objectifies a patient's ability (or inability) to safely balance while completing a series of predetermined tasks. The instrument is a 14-item list with 18 items each and each of the 18 items consists of a five-point ordinal scale ranging from 0 to 4, 0 being the lowest level of function and 4 the highest level of function and takes approximately 20 minutes to complete.

3.11.4 Barthel Index (BI)

Activity of daily living is measured by Barthel index. The 10 items are closely related to current ability of the patients. Every activity exists 2,3 or 4 category and the scores 0, 5, 10 and 15.the maximum points (100) of Barthel index.

3.12 Questionnaire

Under the advice and with the permission from the supervisor according to certain guidelines, the questionnaire was developed. The evaluation included 10MWT, TUG, BBS with fourteen (14) censored questions and BI with ten (10) censored questions, measured by an examiner and each question formulated to determine the impact of ambulatory function on stroke patients.

3.13 Treatment regime:

Motor-dual-task-specific training group:

Motor-Dual task-specific training	Descriptions	Dosage and intensity	Progressions
Dual Task-1 (Lui et al., 2017)	Walking while holding one or two balls on both hands.	(2) minutes per session continue to (6) weeks; (4) times a week.	Progress is made by gradually increasing walking speed and walking on an S-shaped route.
Dual Task-2 (Kim H et al., 2013)	Slowly walking forward, sideways, and backwards on a flat surface while holding a 100g sandbag.	(2) minutes per session continue to (6) weeks; (4) times a week.	Progression criteria will be established by gradually increasing the walking speed in different directions.
Dual Task-3 (Rai et al., 2020)	Object transfers during walking.	(2) minutes per session continue to (6) weeks; (4) times a week.	Make progress by progressively extending the object's transfer distance while walking.
Dual Task-4 (Lui et al., 2017)	Walking while kicking a basketball	(2) minutes per session continue to (6) weeks; (4) times a week.	Progress to walking on a circle course while kicking a basketball in various directions.

Dual Task-5 (Iqbal M et al., 2017)	Picking up plastic cups that lay in front of the feet while rising from a chair.	(2) minutes per session continue to (6) weeks; (4) times a week.	Progress by gradually increasing the distance of plastic cups that lay in front of the feet.
Dual Task-6 (Lui et al., 2017)	Walking while raising an umbrella using both hands.	(2) minutes per session continue to (6) weeks; (4) times a week.	Progress to walking forward, backwards, and sideways while raising an umbrella. And gradually increase the walking speed.
Dual Task-7 (Lui et al., 2017)	Walking while bouncing a basketball.	(2) minutes per session continue to (6) weeks; (4) times a week.	Progress by gradually increasing the distance of walking and walking on an S-shaped route while bouncing a basketball.

Allow 2 minutes for seven dual tasks, a total of 14 minutes and 1-minute rest period for each workstation to avoid fatigue.

Task-oriented-circuit training group:

Work station	Descriptions	Dosage and intensity	Progression
Station-1 Sit to stand (Mudge, stand Barber and Stott, 2009	Sit from various chair heights (gradually high level to floor level).	2 minutes per session, around 6 weeks: 4 times a week	1. Increase speed until can complete 30, then decrease seat height. 2. Increase the complexity of the workstation.
Station-2 Swiss ball squats (Mudge, Barber and Stott, 2009	Initially start by standing and squatting for the desired level.	2 minutes per session, around 6 weeks: 4 times a week	Progress the depth of the squat until the thighs are parallel with the ground. Add hold, which can be progressed by increasing time. Progress further by adding weight to hands
Station-3 Steeping (Dean, Richards and Malouin, 2000)	Stepping forward, backwards and sideways onto floor level.	2 minutes per session, around 6 weeks: 4 times a week	Progress to stepping forward, backwards and sideways onto blocks of various heights. Gradually increase the height of block.
Station-4	Start with double calf raise and lowering while	2 minutes per session, around	Progress speed. Progress to single

Calf raise (Mudge, Barber and Stott, 2009)	maintaining a standing posture.	6 weeks: 4 times a week	calf raise. Progress to jumps.
Station-5 Self-sway (Mudge, Barber and Stott, 2009).	Start near the wall for support, and sway from ankles, forward and backward.	2 minutes per session, around 6 weeks: 4 times a week	Progress to standing away from the wall.
Station-6 Tandem walk (Mudge, Barber and Stott, 2009)	Walk with feet touching the line on the floor.	2 minutes per session, around 6 weeks: 4 times a week	Progress to heel-toe Progress further by decreasing speed, looking forward, and crossing arms.
Station-7 Walking in different directions and different surfaces (rough surface, carpet and foam) (Stephens and Goldie, 1999)	Start forward and sideway walking Start with an even surface.	2 minutes per session, around 6 weeks: 4 times a week	Progress to backwards walking Progress walk on carpet, foam and rough surfaces.

Allow 2 minutes for seven workstations, a total of 14 minutes and 1 minute rest period for each workstation to avoid fatigue.

Conventional physiotherapy treatment:

Study was done in the clinical department of Physiotherapy which practices treatment of patients suffering from chronic stroke followed by different manual therapy and home advice. How the treatment strategy changes depend on the patient's condition and advancing disease progress. The researcher gathered the opinions of staff with at least the level of Clinical Physiotherapist. Conventional Physiotherapy was regarded as follows:

For ambulation:

- Postural correction
- Trunk and pelvic control exercise
- Strengthening exercise for balance
- Foot mobilization and preparation
- Reaching practice in standing
- Ball throwing
- Standing with different surface
- Core muscle stabilization
- Sensory stimulation and integration
- Coordination and functional training
- Forward weight bearing
- Sit to stand practice
- Trunk and pelvic stabilization exercise
- Controlled weight shifting
- Stepping practice
- Proprioceptor and sensory integration
- Weight transferring
- Functional training
- Walking on even and uneven surfaces
- Walking on parallel bar
- Assisted device (gait aids, orthotics)

3.14 Data analysis procedure

Statistical package of social science (SPSS) version 20 and Microsoft excel worksheet 22 will be used in analyzing data. A descriptive and inferential statistical test will be done. The data shall be used to conduct statistical decision on the basis of nature of data, objective and expert opinion.

3.15 Statistical test

The researcher used two statistical tests based on the type of data he used. The analysis of inference requires a nonparametric test because hat region data is ordinal not normally distributed. As the data were not normally distributed for between group analysis researcher did Mann Whitney U test additionally, for within group analysis was used Wilcoxon Signed rank test.

Mann Whitney U test

Two of the non-parametric tests are Mann Whitney U test. Used to compare two sample means taken from the same population used to determine whether two sample means are equal or not. The Mann-Whitney U test is usually used when you don't meet the assumptions of the t-test. Researchers in this study used this test in analyzing the mean of between the two groups of TUG test (seconds), 10MWT (m/s), BBS and BI total score.

Wilcoxon Signed-rank test

The non-parametric statistical hypothesis test Wilcoxon signed-rank test is used to compare two related samples. This test was used for analysis of 10MWT (m/s), TUG (seconds), BBS and BI total score within each group.

3.16 Level of Significance

The level of significance was fixed at $\alpha = 0.05$ in this study. The value selected for this was to set the threshold for the statistical significance in determining differences in the ambulation outcomes between the Motor Dual Task Specific Training (MDTT) and Task Oriented Circuit Training (TOCT) groups in combination with conventional physiotherapeutic interventions. Finally, the results are regarded to be significant if the p value ($p < 0.05$) is equal to or less than the pre-assigned significance threshold.

Statistical tests were interpreted and the study hypotheses were evaluated according to this criterion.

3.17 Ethical consideration

The ethical guideline of WHO (World Health Organization), IRB (Institutional Review Board) & BMRC (Bangladesh Medical Research Council) was strictly followed. The research proposal was submitted to the ethical review committee of Bangladesh Health Professions Institute (BHPI) for approval and to CRP's ethical committee for getting permission for data collection. After the proposal was approved to carry on with the study, the researcher had moved the study. Researcher takes concern of participants prior to collect interview who are interested to participate in the study. Before starting the interview, signatures obtained from each participant on a Bangla consent form It is clearly explained to the participants that their information may be publishing, but their name and address not be connecting with the research study. It informed that the participant has the right to withdraw the study any time if he or she would want to. In that consent form, the researcher committed to the participant about confidentiality, participant's right and potential benefits of the study that is all informed to the participant during interview. All the participants gave their consent to participate in the interview. Before participating in the study, the researcher had provided them a written consent form to sign. The researcher had also signed in the consent form. Only the investigator had access of that information. The raw data destroyed after the completion of the research & all the data on computer file were deleted. Considering all those ethical norms & values no ethical problems arises as there were some personal & sensitive questions. The participants were informed that they have the right to withdraw consent & discontinue participation at any time without any prejudice.

4.1. Base Line characteristics

Table.4.1. Base Line characteristics

Variable	(MDTT) Group		(TOCT) Group	
	Mean±SD	**Min-Max**	**Mean±SD**	**Min-Max**
Age	48.30(±9.091)	38-70	52.05(±8.982)	37-70
Gait speed (10MWT), m^{-s}	3.53(±3.364)	0.81-15.00	2.79(±1.727)	1.14-7.20
Mobility, (TUG), Second	40.03(±35.167)	12.33-160.00	31.71(±18.648)	13.39-81.00
Balance, (BBS), Total	42.60(±4.477)	37-54	42.55(±4.148)	35-49
Functional mobility, (BI), Total	68.25(±13.599)	40-95	69.75(±10.939)	40-85

This quasi-experimental study included 40 participants with 20 in the Motor-Dual-Task-Specific Training (MDTT) group and 20 in the Task-Oriented-Circuit Training (TOCT) group. Data on each group before the intervention were analyzed and are shared below to confirm that the groups were similar. Participants in the MDTT group were a mean age of 48.30 ± 9.091, between 38 to 70 years; mean age of the TOCT group was 52.05 ± 8.982, between 37 to 70 years. Thus it seems that the two groups were fairly similar in terms of age. The MDTT group recorded a mean speed of 3.53±3.364 m/s (min 0.81, max 15.00) m/s using the 10MWT, based on gait speed, whilst the TOCT group recorded a mean speed of 2.79± 1.727 m/s (min 1.14, max 7.20) m/s. Although there was some variability in the data, particularly in the MDTT group, both groups began on fairly equivalent functional capacity for walking. Timed Up and Go Test (TUG) mean score for the MDTT group was 40.03 ± 35.167 seconds (minimum 12.33, maximum 160.00 seconds), for the TOCT group 31.71 ± 18.648 seconds (range: 13.39 – 81.00 seconds). The heterogeneity between initial mobility performance in the MDTT group is evidenced by the wide range in the MDTT group. When compared using the Berg Balance Scale (BBS), the mean for the MDTT group was 42.60 ± 4.477

(range: 37–54) and, for the TOCT group, the mean for the TOCT group was 42.55 ± 4.148 (range: 35–49). At baseline, the balance profiles were very similar between both groups. For functional mobility, assessed by Barthel Index (BI), MDTT received a mean score of 68.25 ± 13.599 (range 40–95) and TOCT received a mean score of 69.75 ± 10.939 (range 40–85). These results show near independence before intervention.

4.2. Analysis of socio-demographic information

4.2.1 Age of participant

The age distribution of the study participants is illustrated in the bar chart and detailed in the accompanying frequency table. A total of 40 individuals participated in the study, with ages ranging from 37 to 70 years. The most frequently observed age was 50 years, with 5 participants, constituting 12.5% of the sample. This was followed by age 38, with 4 participants (10.0%). Age groups 42, 47, 49, 55, and 70 each included 3 participants, representing 7.5% of the sample per age. Ages 45, 51, and 61 were each represented by 2 participants (5.0%). The remaining ages 37, 40, 41, 44, 48, 52, 53, 59, 63, and 65 were each represented by a single participant, making up 2.5% per age group.

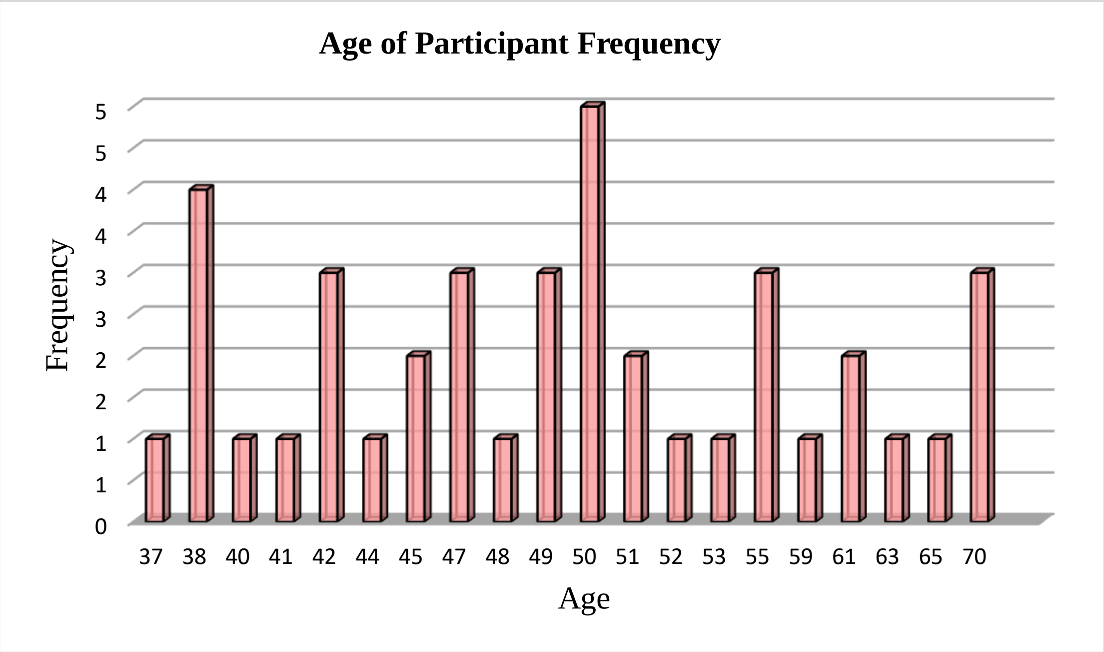


Figure 1: Age of Participant Frequency

4.2.2 Sex of Participant

The pie chart shows the sex distribution of the 40 study participants**.** Males made up 87.5% of the sample (35 participants), while females comprised only 12.5% (5 participants). This clear male predominance is visually reflected in the chart, indicating a gender imbalance in the study.

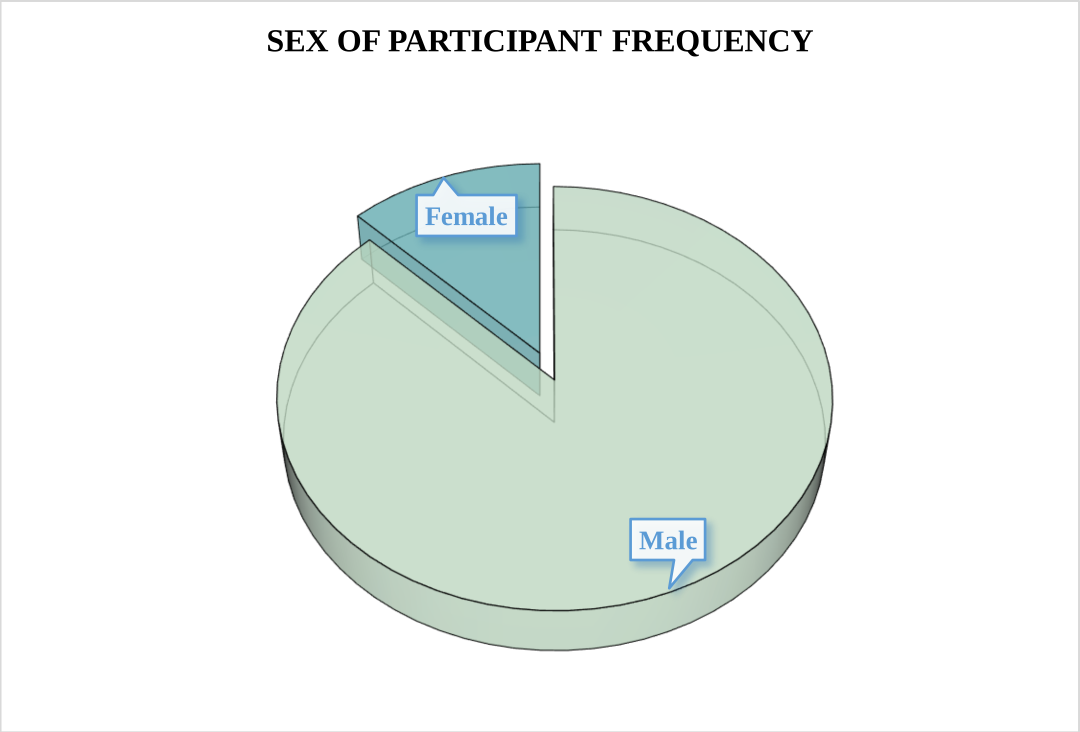


Figure 2: Sex of Participant Frequency

4.2.3 Marital Status

The bar chart displays the marital status distribution of the study participants. Out of (n=40) participants, (n=39) (97.5%) were married, while only (n=1) participant (2.5%) fell into the "others" category, which may include single, divorced, or widowed individuals. This indicates a strong predominance of married individuals in the sample, suggesting that most participants likely had spousal support during rehabilitation.

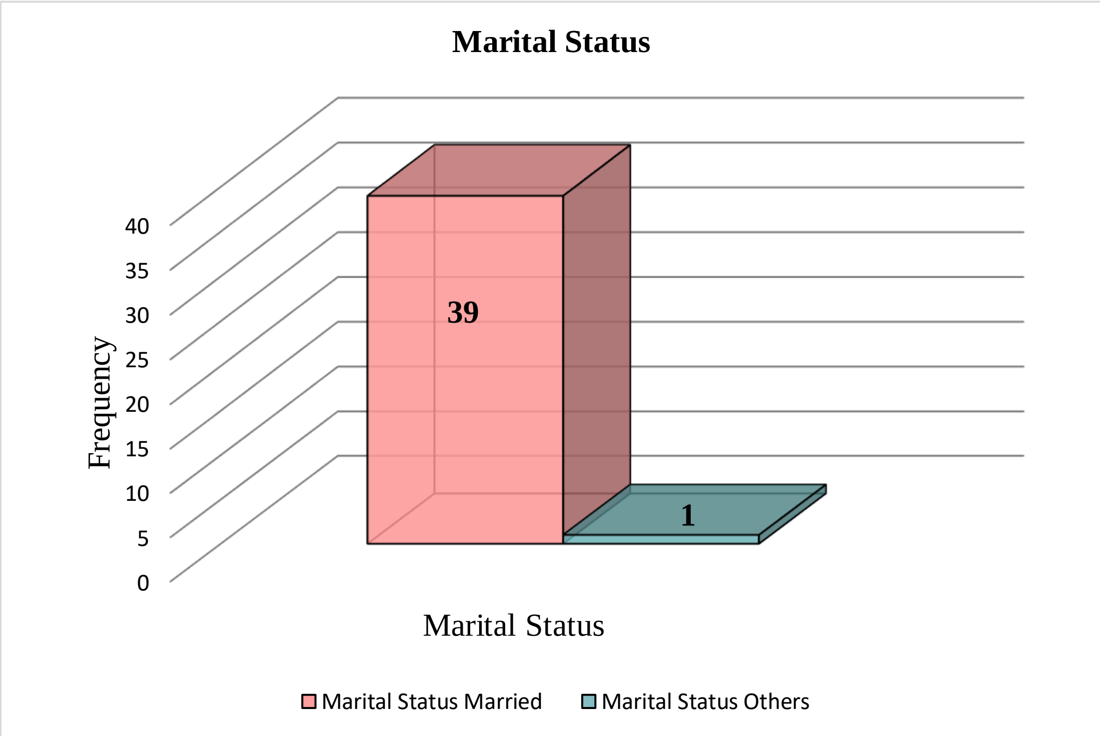


Figure 3: Marital Status of Participant Frequency

4.2.4 Level of Education

The bar chart illustrates the distribution of participants based on their highest level of education. Among the (n=40) participants, the largest group had completed S.S.C (Secondary School Certificate), accounting for 30% (n=12) participants. This was followed by equal proportions of participants who were illiterate, completed H.S.C (Higher Secondary), or were graduates, each representing 15% (n=6) participants. Additionally, 12.5% (n=5) participants had only primary education, and another 12.5% (n=5) participants had achieved a master's degree or higher. This distribution shows a wide range of educational backgrounds, with a concentration at the secondary school level.

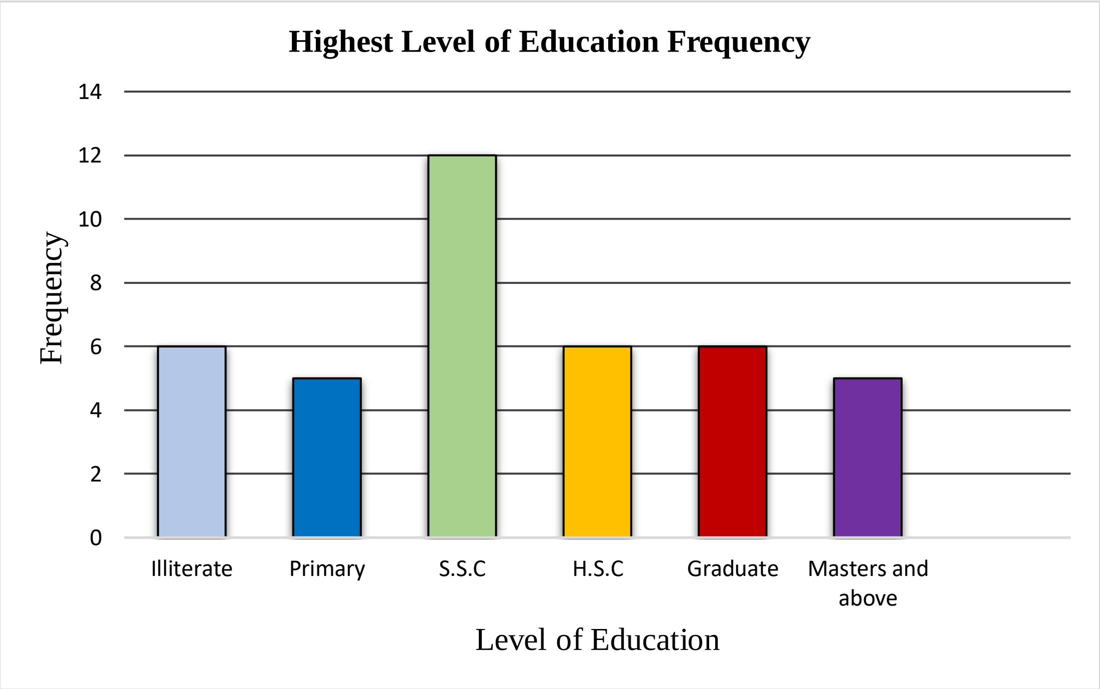


Figure 4: Level of Education of Participant Frequency

4.2.5 Place of Residence

The pie chart shows the distribution of participants based on their place of residence. Out of (n=40) participants, the majority (n=21) individuals (52.5%) were from rural areas. Semi-urban residents accounted for 30% (n=12) participants, while only 17.5% (n=7) participants were from urban areas. This indicates that more than half of the study population came from rural settings, suggesting that the findings may be particularly relevant to stroke patients in less urbanized communities.

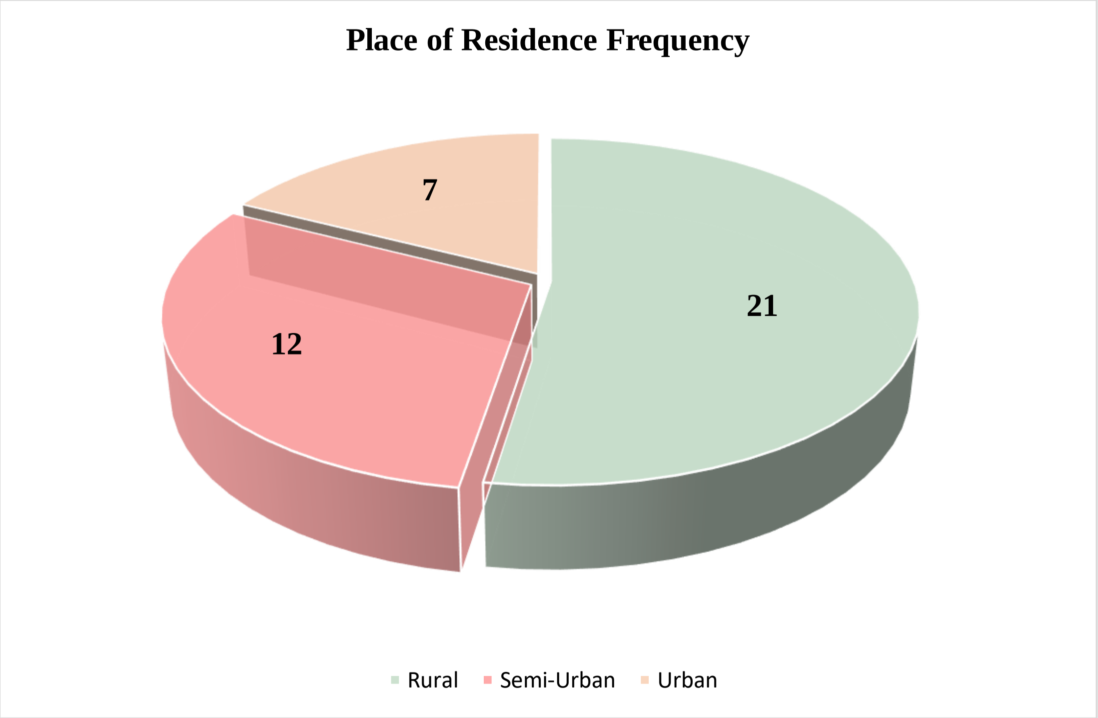


Figure 5: Place of Residence of Participant Frequency

4.2.6 Occupational status of participants

The bar chart illustrates the occupational distribution of the study participants. Among the (n=40) participants, the largest groups were government employees and businessmen, each comprising 27.5% (n=11) participants. This was followed by the "others" category, which accounted for 22.5% (n=9) participants and may include unemployed individuals, retirees, or non-categorized jobs. Housewives made up 10% (n=4) participants, while farmers represented 7.5% (n=3) participants. A small number of participants were shopkeepers and garment workers, each comprising 2.5% (n=1) participant. This distribution reflects a mix of formal and informal employment backgrounds among the study group.

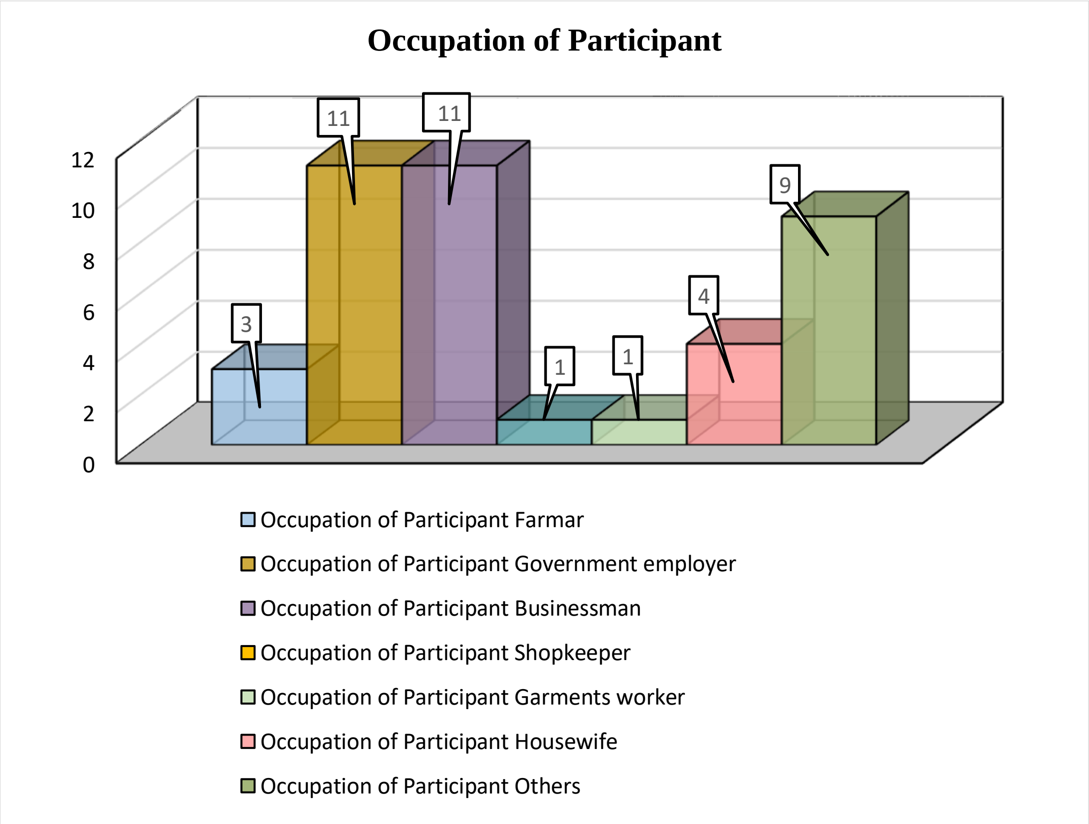


Figure 6: Occupational status of Participant Frequency

4.2.7 Type of Family

The pie chart illustrates the distribution of participants based on their family structure. Out of (n=40) participants, (n=22) individuals (55%) lived in nuclear families, while (n=18) participants (45%) belonged to joint families. The chart shows a relatively balanced distribution, with a slight predominance of nuclear family settings.

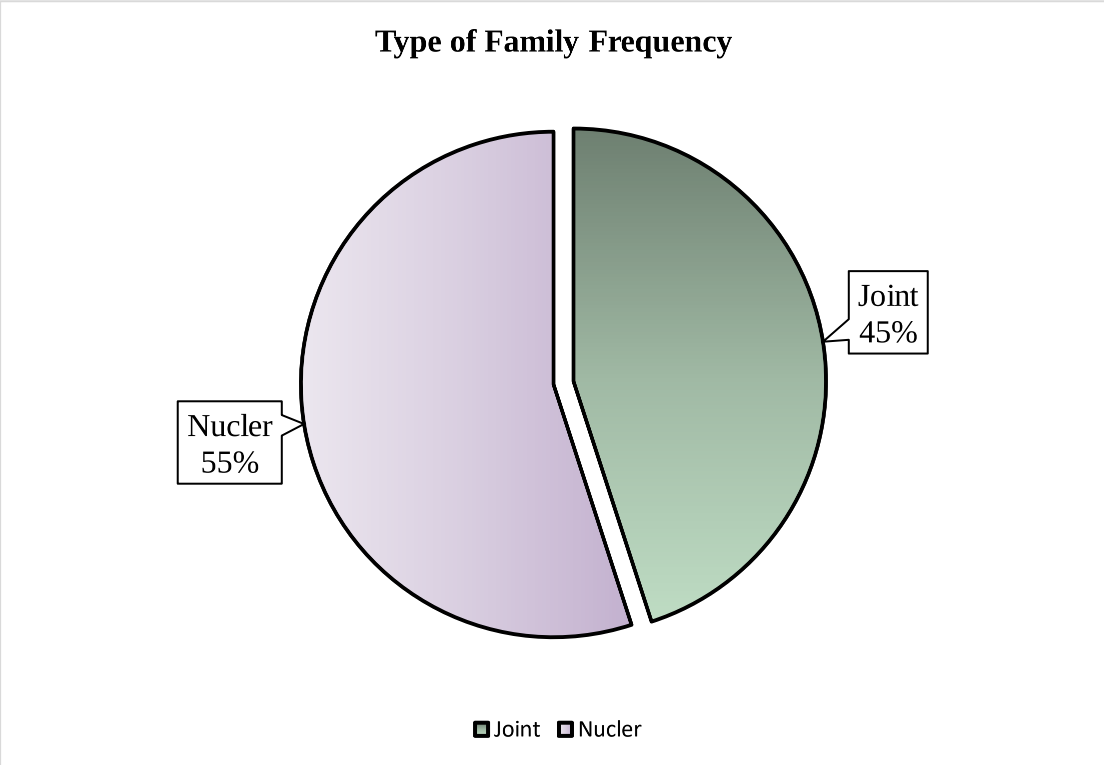


Figure 7: Type of Family of Participant Frequency

4.2.8 Number of Family Members

The bar chart presents the distribution of participants based on the number of family members in their household. Among the (n=40) participants the most common family size was 4 members, reported by (n=11) participants (27.5%). This was followed by families with 3 and 9 members, each accounting for 17.5% (n=7) participants. 8-member households were also notable, making up 15% (n=6) participants. Smaller family sizes, such as 2, 5, and 6 members, were less common, ranging from 2.5% to 7.5%. Very large families, including those with 10 or 11 members, were the least frequent, each reported by only (n=1) participant (2.5%). This variation indicates a wide range of household sizes among participants, with a slight tendency toward medium-sized families.

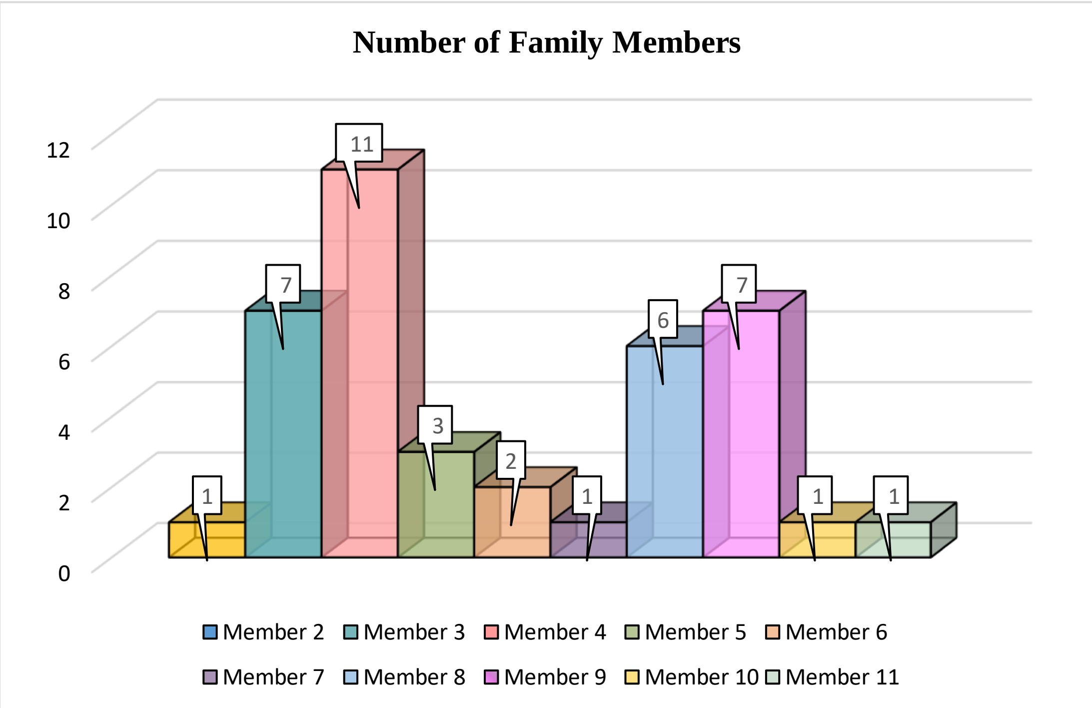


Figure 8: Number of Family Members of Participant Frequency

4.2.9 Number of Earning Members

The bar chart depicts the number of earning members in the households of study participants. Out of the (n=40) participants half of the participants **(**50%, or n=20 individuals**)** reported having one earning member in their family. Two earning members were reported by (n=18) participants (45%), while only (n=2) participants (5%) had three earning members.

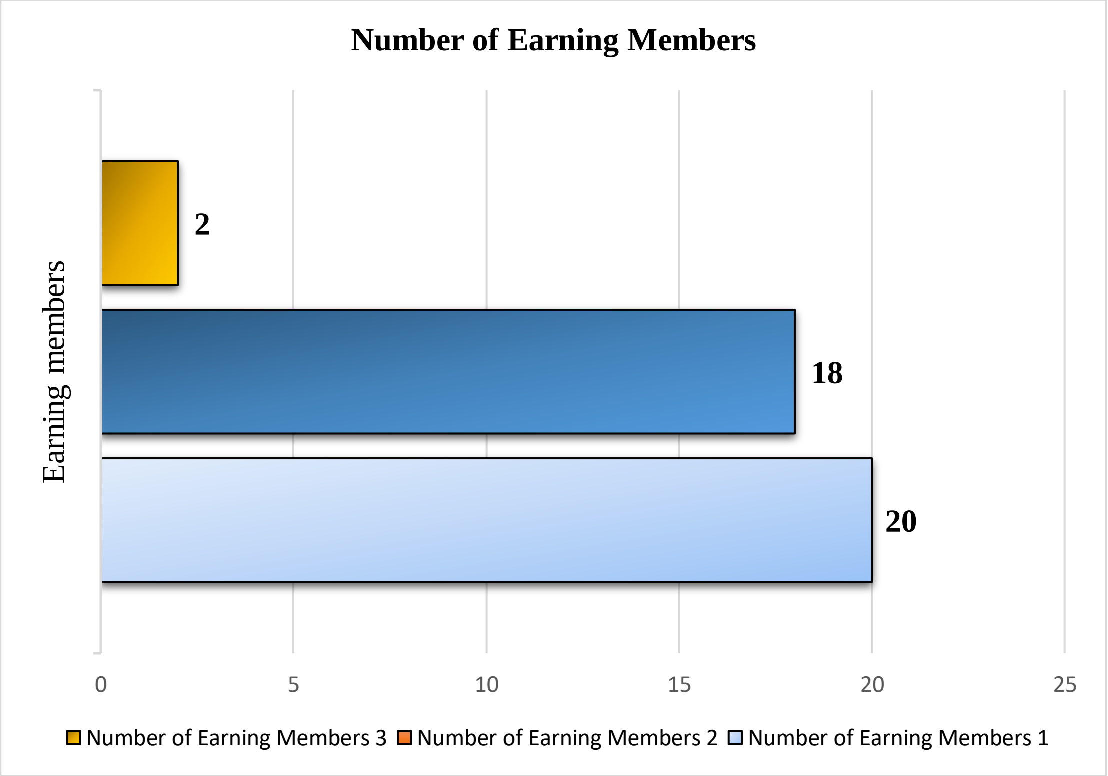


Figure 9: Number of Earning Members of Participant Frequency

4.2.10 General Health Status Frequency

The pie chart shows the self-reported general health status of the (n=40) participants. The majority, (n=26) individuals (65%), rated their health as fair, indicating moderate well-being with some health concerns. An equal number of participants (n=7) each (17.5%) rated their health as either good or poor. This distribution suggests that while a small proportion of participants perceived themselves as being in good or poor health, the majority experienced a moderate level of health, which may reflect the common post-stroke recovery condition among the sample group.

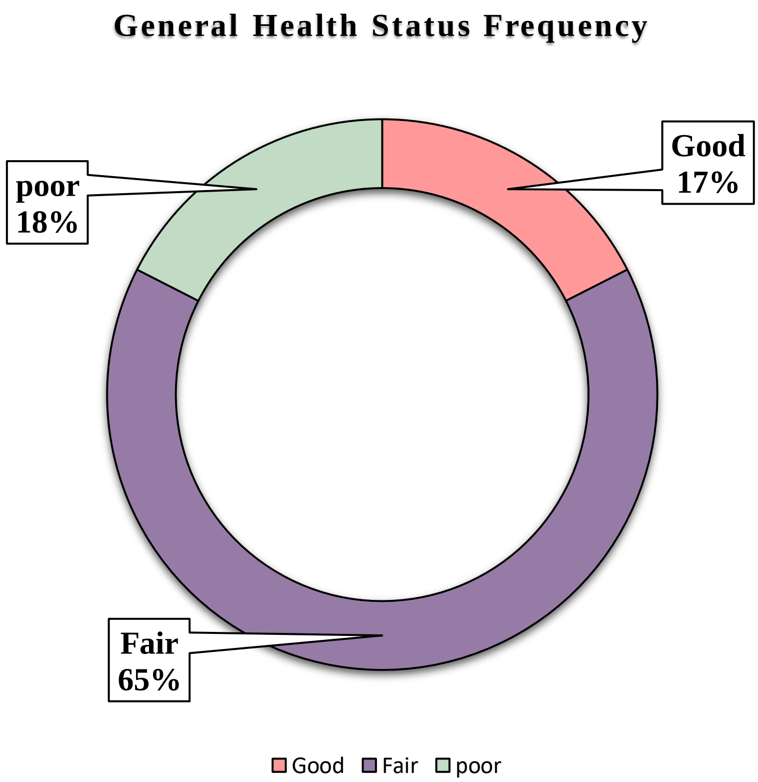


Figure 10: General Health Status of Participant Frequency

4.3. Analysis of Co-morbid diseases

Table 4.2. Analysis of Co-morbid diseases

Variable	**(MDTT) Group n (%)**	**(TOCT) Group n (%)**
Type of stroke	Ischemic, n=95% (19)	Ischemic, n=95% (19)
	Hemorrhagic, n=5% (1)	Hemorrhagic, n=5% (1)
Affected side	Right, n=50% (10)	Right, n=20% (4)
	Left, n=50% (10)	Left, n=80% (16)
Number of strokes	First stroke, n=90% (18)	First stroke, n=85% (17)
	Second stroke, n=5% (1)	Second stroke, n=10% (2)
	Multiple stroke, n=5% (1)	Multiple stroke, n=5% (1)

This table shows several important clinical patterns of comorbidities and stroke characteristics were analyzed. In both MDTT & TOCT groups, n = 95% (1) ischemic strokes was predominant. The right vs left hemispheric involvement was markedly different: the MDTT was equiprobable left: right, whereas the TOCT was strongly left dominant left 80% (16) vs right 20% (4). In the Fisrt time of stroke they were more common in line with both groups where MDTT group n=90 % (18) and TOCT group n=85 % (17); Second stroke is higher in TOCT group n=10 % (2) while MDTT group n=5 % (1) and multiple stroke are equal in both groups n=5 % (1).

4.3.1 Heart Diseases

The bar chart titled "Heart Diseases" illustrates the prevalence of heart conditions among (n=40) participants. The majority, (n=33) individuals (82.5%), reported not having any heart disease, while (n=7) participants (17.5%) indicated that they do suffer from heart disease. This suggests that although most participants are free from cardiac conditions, a noteworthy minority is affected by heart-related health issues.

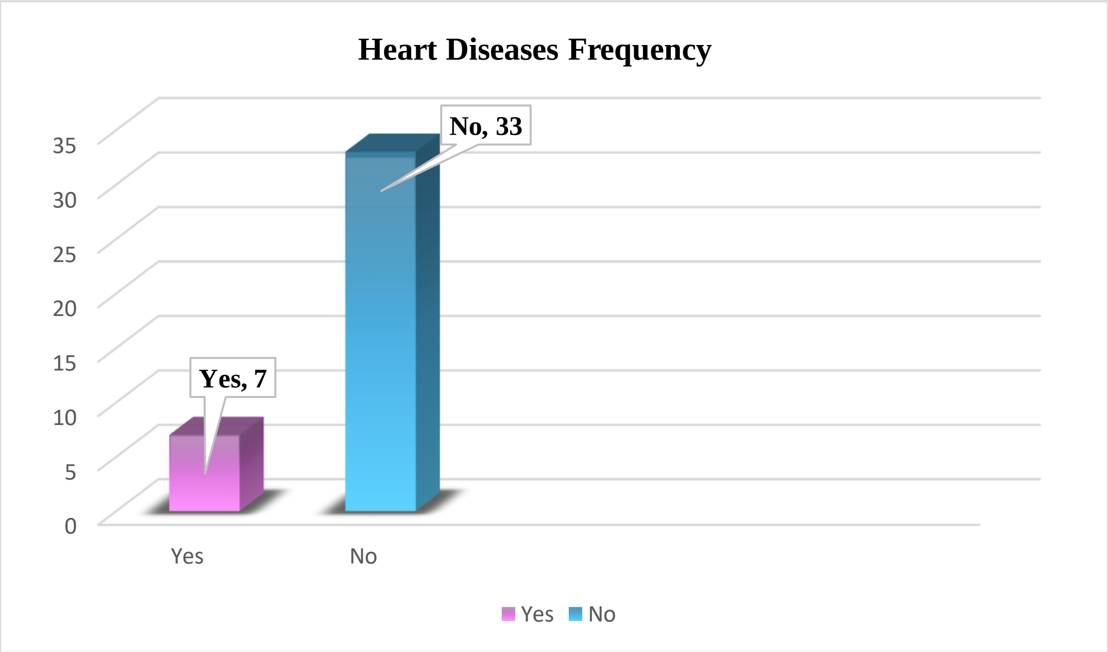


Figure 11: Heart Diseases Frequency

4.3.2 Diabetes Mellitus

The pie chart titled "Diabetes Mellitus" displays the distribution of diabetes among (n=40) participants. A slight majority, (n=22) individuals (55.0%), reported not having diabetes, while (n=18) participants (45.0%) indicated that they have been diagnosed with diabetes mellitus. This reveals that nearly half of the study population is affected by diabetes, indicating a high prevalence of the condition among the participants.

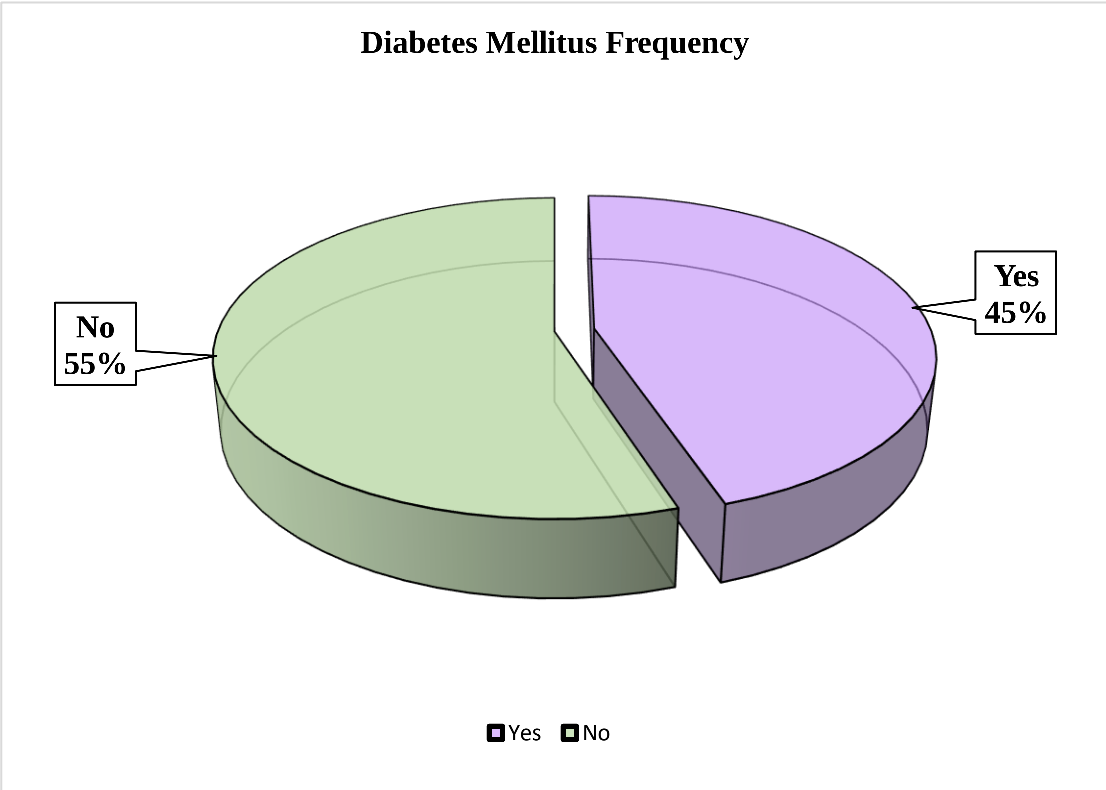


Figure 12: Diabetes Mellitus Frequency

4.3.3 High Blood Pressure

The bar chart titled "High Blood Pressure" illustrates the prevalence of hypertension among (n=40) participants. A majority of (n=23) individuals (57.5%) reported having high blood pressure, while (n=17) participants (42.5%) stated that they do not have the condition. This indicates that more than half of the study population is affected by hypertension, highlighting a significant burden of high blood pressure within the group.

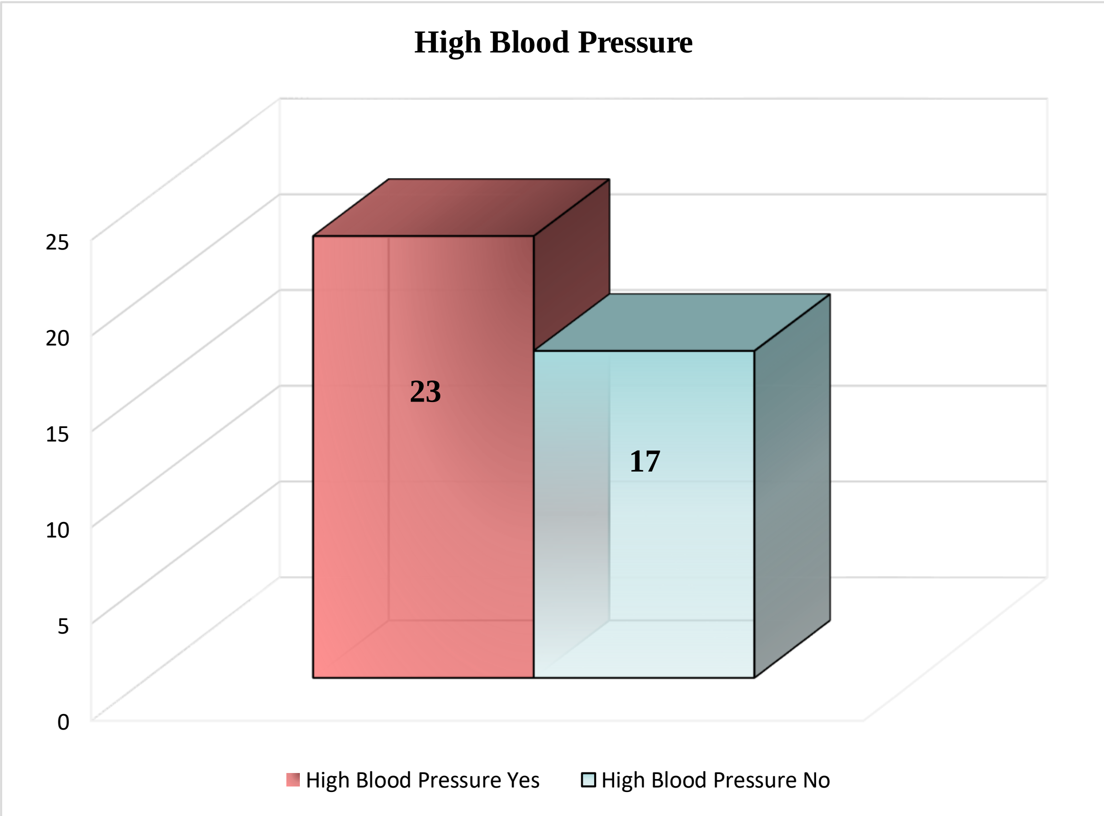


Figure 13: High Blood Pressure Frequency

4.3.4 Asthma Diseases

The pie chart titled "Asthma Diseases" presents the occurrence of asthma among (n=40) participants. The vast majority, (n=36) individuals (90.0%), reported not having asthma, while only (n=4) participants (10.0%) indicated that they suffer from the condition. This suggests that asthma is relatively uncommon in the study population, with only a small proportion affected.

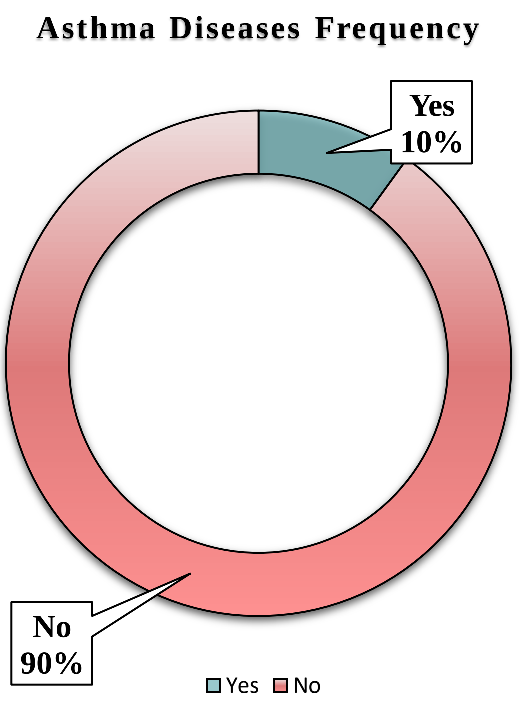


Figure 16: Asthma Diseases Frequency

Table 4.3. Duration of stroke

Variable	(MDTT) Group		(TOCT) Group	
	Mean±SD	**Min-Max**	**Mean±SD**	**Min-Max**
Duration of stroke (days)	313.90(±301.062)	17-1381	383.75(±406.483)	97-1907

This table shows (n=40) participants were enrolled at baseline with stroke duration measured in days to enable understanding of chronicity of disease in both groups. In the Motor Dual-Task Training group (n=20) participants had a mean duration since stroke onset of 313.90 ± 301.06 days (mim-17, max-1381) days. In contrast, participants in the Task Oriented Circuit Training (TOCT) group (n=20) had a mean stroke duration of 383.75 ± 406.48 days (mim-97, max-1907 days).

4.4. Analysis of Life style data

4.4.1 Smoking status of participants

The bar chart titled "Ever Smoked" illustrates the distribution of participants based on their smoking history. The data show that out of a total of (n=40) participants, (n=20) individuals (50.0%) reported that they had smoked at some point, while the remaining (n=20) individuals (50.0%) reported that they had never smoked. This indicates a perfectly balanced distribution between those who have ever smoked and those who have not. In the chart, the blue bars represent the frequency of responses, with both "Yes" and "No" categories showing a frequency of (n=20). The orange bars represent the percentage, with both categories showing an equal value of 50.0%. This visual presentation clearly conveys that half of the study population had a history of smoking, while the other half did not, suggesting no significant variation in smoking behavior among the participants.

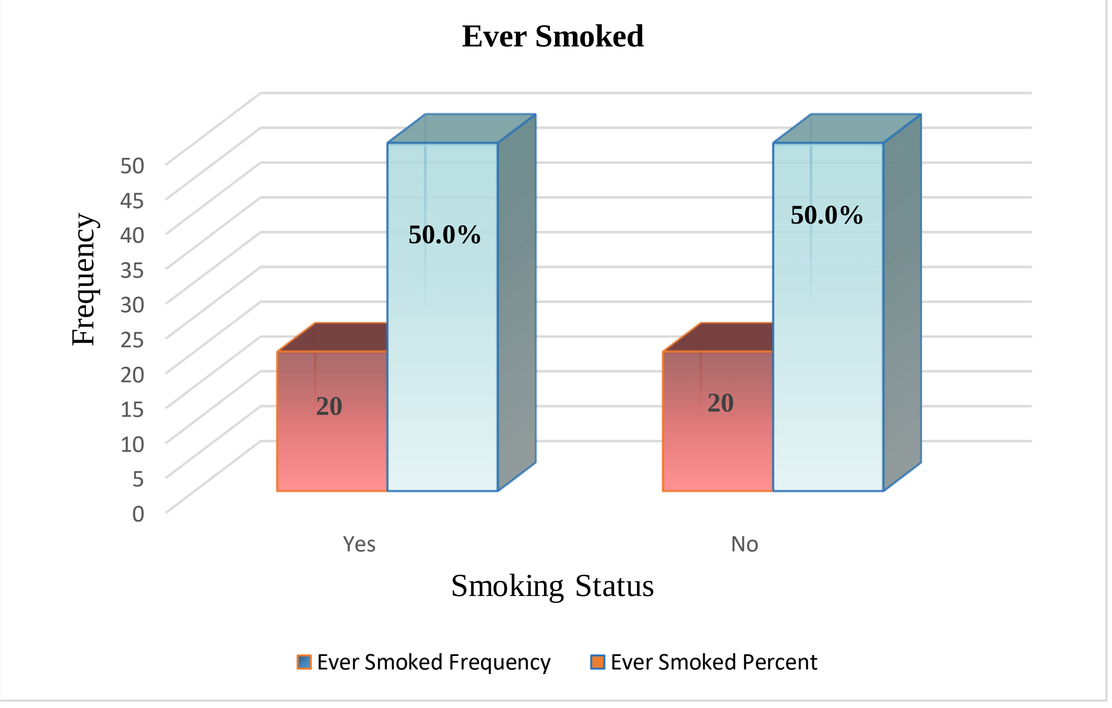


Figure 15: Smoking Frequency

4.4.2 Type of Smoker

The bar chart titled "Type of Smoker" shows the smoking status of (n=40) participants using color-coded bars: blue for current smokers, orange for occasional smokers, gray for ex-smokers, and yellow for non-smokers. Among them, (n=4) participants (10.0%) were current smokers, (n=5) (12.5%) were occasional smokers, (n=12) (30.0%) were ex-smokers, and (n=19) (47.5%) reported not smoking. The chart highlights that nearly half of the participants do not smoke, while a smaller portion currently smokes.

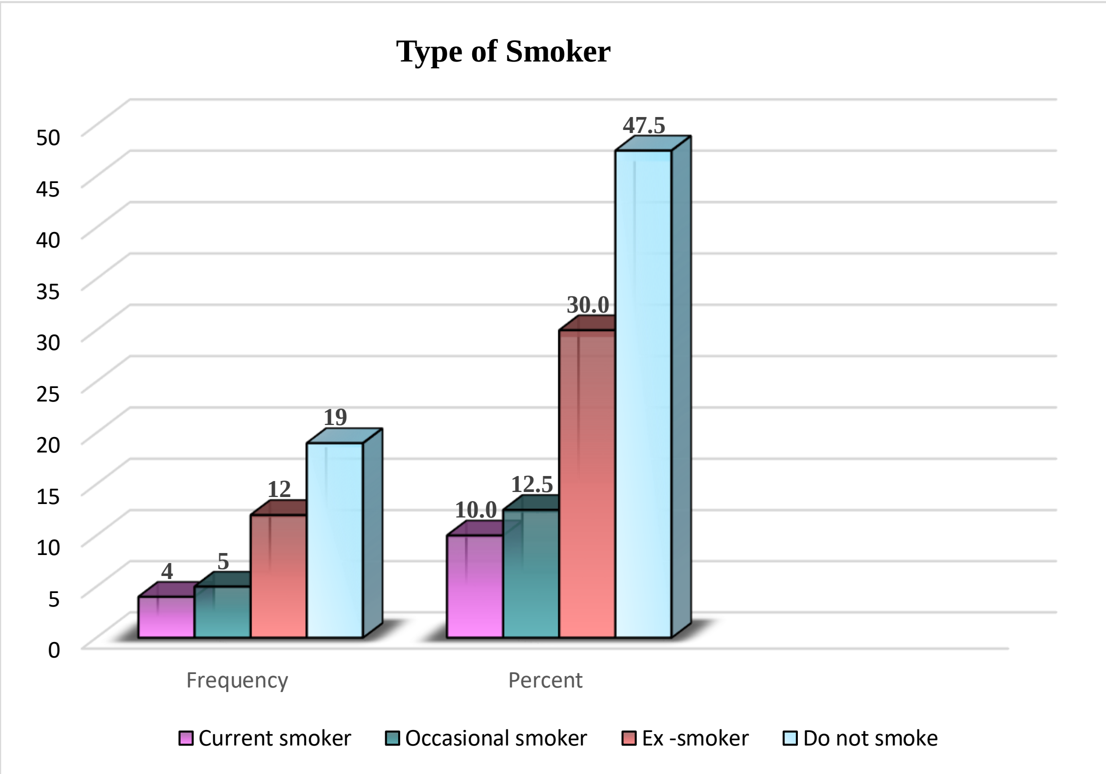


Figure 16: Type of Smoker of Participants Frequency

4.4.3 Types of smoke Item to be Consumed

The pie chart titled "Consume Item" illustrates the smoking habits of (n=40) participants, divided into three categories. The green segment represents participants who do not smoke, accounting for (n=20) individuals (50.0%), which forms the largest portion of the chart. The brown segment represents those who smoke cigarettes, totaling (n=18) participants (45.0%). A small light blue segment represents biri smokers, with only (n=2) participants (5.0%). This chart highlights that half of the participants are non-smokers, while cigarette use is more common than biri use among smokers.

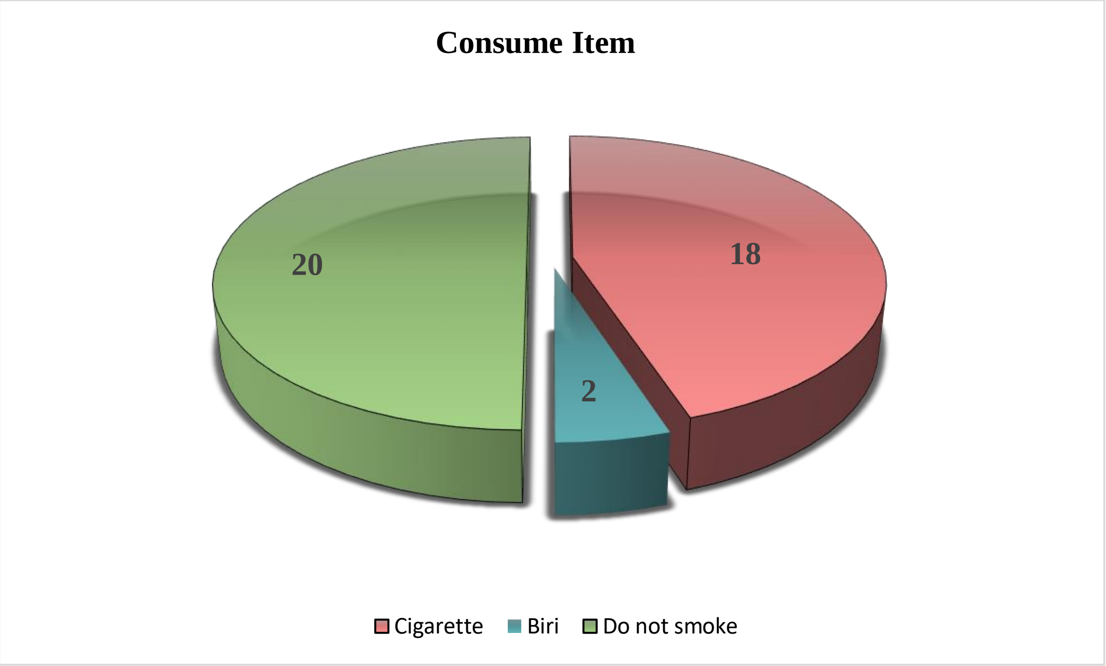


Figure 17: Consume Item of Smoke of Participants (Frequency)

4.4.4 Number of Sticks Smoked per Day

The bar chart titled "Average Number of Sticks Smoked per Day" illustrates the smoking intensity among (n=40) participants. The largest group, consisting of (n=19) participants (47.5%), reported that they do not smoke. Among the smokers (n=6) participants (15.0%) consumed 5-10 sticks per day, and another (n=6) participants (15.0%) smoked 20-30 sticks daily, indicating higher levels of tobacco use. Smaller proportions were observed in other categories: (n=4) participants (10.0%) smoked 1-5 sticks, (n=3) participants (7.5%) smoked 10-15 sticks, and (n=2) participants (5.0%) smoked 15-20 sticks per day. This distribution shows that while nearly half of the participants are non-smokers, those who do smoke exhibit varied levels of tobacco consumption, with a notable portion engaging in moderate to heavy smoking.

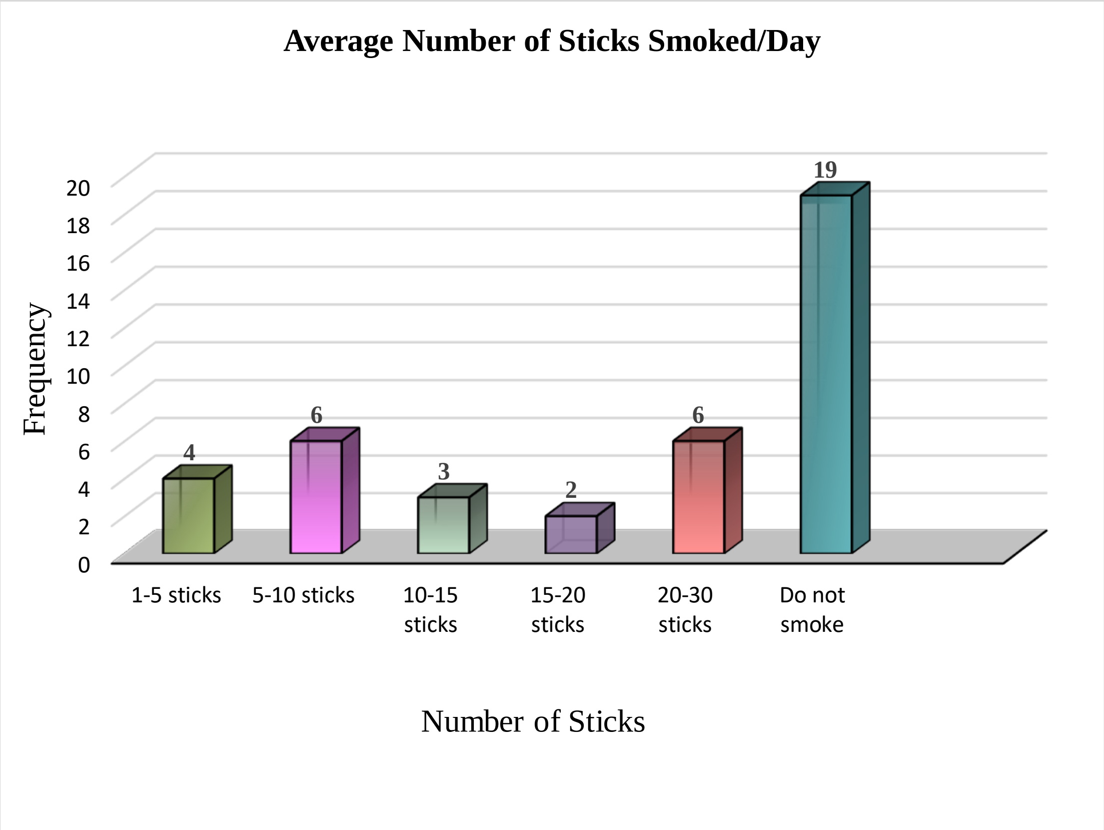


Figure 18: Number of Sticks Smoked per Day of Participants (Frequency)

4.4.5 Types of Smokers

The pie chart titled "Regular Smoker Type" displays the distribution of smoking habits among (n=40) participants. The largest segment comprises (n=20) participants (50.0%) who reported that they do not smoke, making up half of the total sample. Among the smokers (n=15) participants (37.5%) were identified as chain smokers, indicating frequent and heavy tobacco use, while (n=5) participants (12.5%) were categorized as light smokers, representing occasional or less intense smoking behavior. This chart highlights that although half of the participants are non-smokers, a considerable proportion engage in regular smoking, with chain smoking being more prevalent than light smoking.

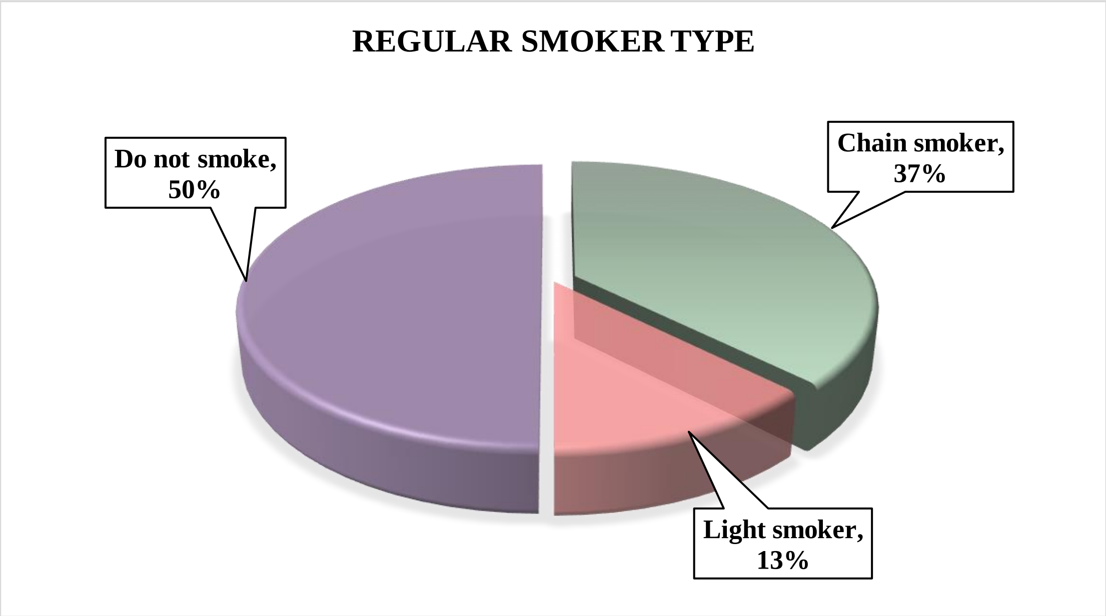


Figure 19: Types of Smokers of Participants (Frequency)

4.4.6 Used Smokeless Tobacco

The bar chart titled "Used Smokeless Tobacco" illustrates the prevalence of smokeless tobacco use among (n=40) participants. The majority (n=34) of individuals (85.0%) reported that they do not use smokeless tobacco, while only (n=6) participants (15.0%) indicated **yes** to its use. This indicates that smokeless tobacco consumption is relatively low in the study population, with most participants abstaining from such habits.

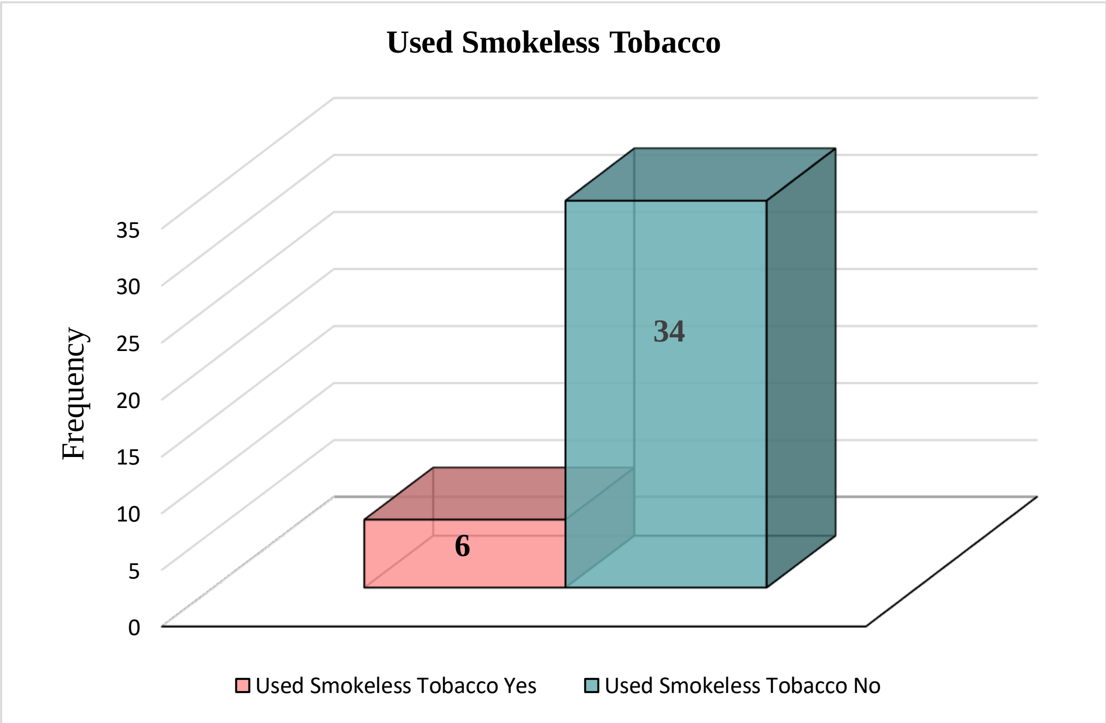


Figure 20: Used Smokeless Tobacco of Participants (Frequency)

4.4.7 Alcohol Consumer Status

The pie chart titled "Ever Consumed Alcohol" shows the alcohol consumption history of (n=40) participants. A vast majority (n=39) of individuals (97.5%) reported that they have never consumed alcohol, while only (n=1) participant (2.5%) indicated having consumed alcohol. This data highlights that alcohol consumption is extremely rare among the study population, with nearly all participants abstaining from it.

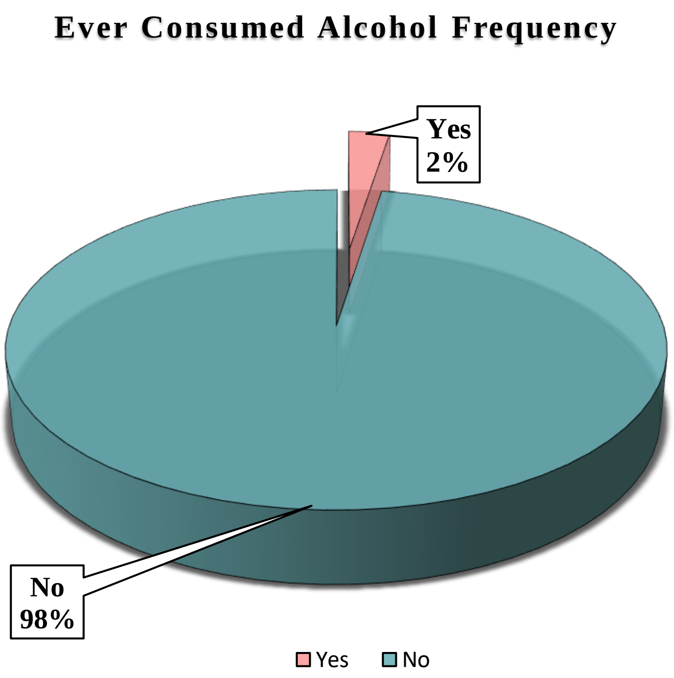


Figure 21: Alcohol Consumption of Participants (Frequency)

4.4.8 Performed Physical Exercise

The bar chart titled "Performed Physical Exercise" illustrates the physical activity habits of (n=40) participants. The majority, (n=33) individuals (82.5%), reported that they do not engage in physical exercise, while only (n=7) participants (17.5%) stated that they do perform physical exercise. This indicates a low level of physical activity among the study population, with most participants leading a sedentary lifestyle.

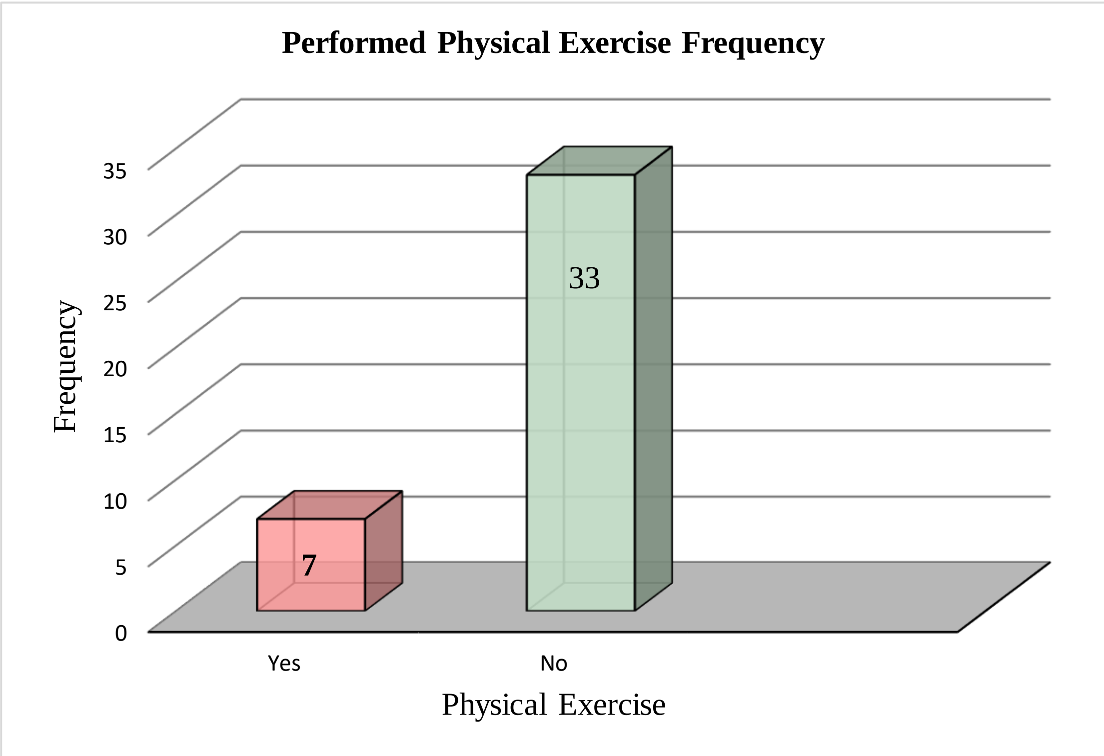


Figure 22: Performed Physical Exercise of Participants (Frequency)

4.4.9 Duration of Exercise per Week to be performed

The bar chart titled "Hours of Exercise per Week" shows the weekly physical activity levels of (n=40) participants. A significant majority, (n=32) individuals (80.0%), reported that they do not perform any exercise, while only (n=8) participants (20.0%) engaged in less than 5 hours of exercise per week. This highlights a predominantly inactive lifestyle among the participants, with only a small portion incorporating minimal physical activity into their routine.

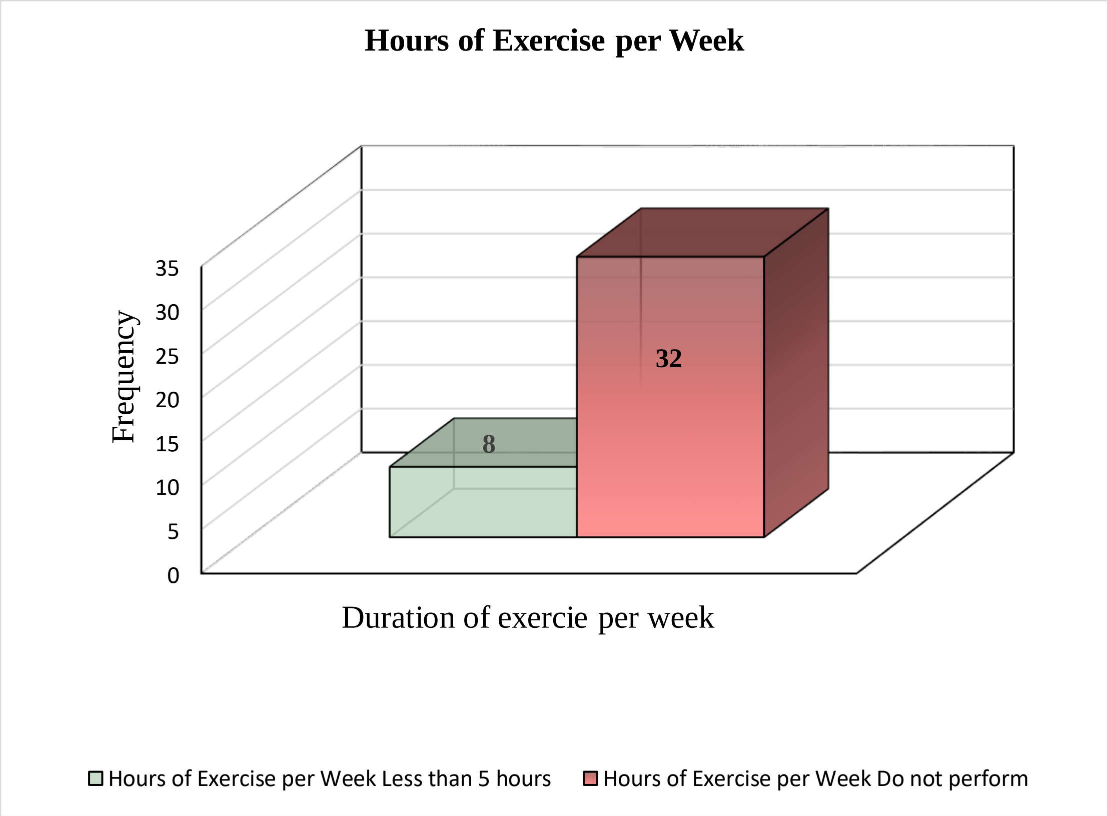


Figure 23: Duration of Exercise per Week of Participants (Frequency)

4.4.10 Type of Exercise

The pie chart titled "Type of Exercise" presents the exercise habits of (n=40) participants. The majority, (n=32) individuals (80.0%), reported that they do not perform any type of exercise, while only (n=8) participants (20.0%) engaged in aerobic exercise. This indicates that physical inactivity is highly prevalent in the study population, with only a small portion participating in regular aerobic activity.

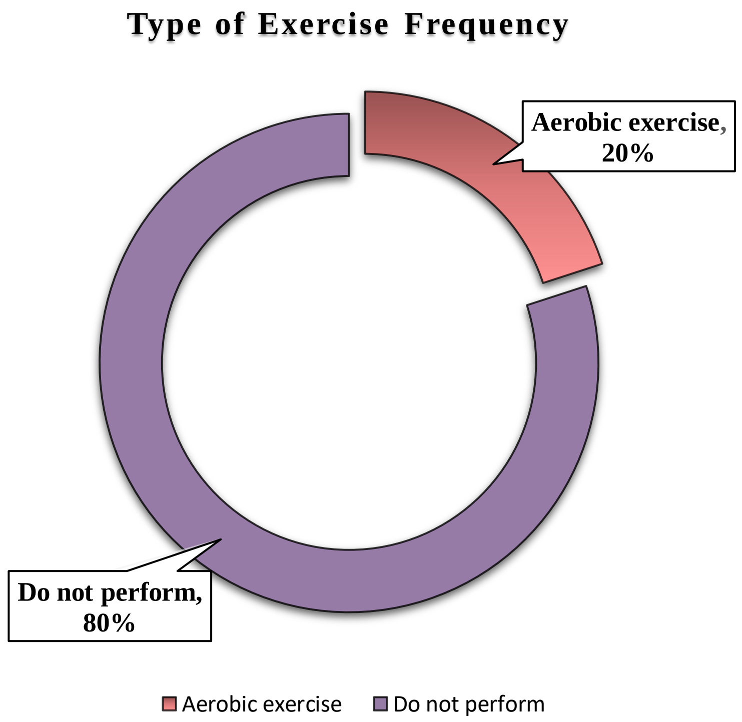


Figure 24: Type of Exercise (Frequency)

4.5. Within group analyses of gait speed (m/s) by 10 Meter Walk Test (10MWT).

Table 4.4. Rank and test statistics of gait speed (m/s) measured by 10 Meter Walk Test (10MWT) for Motor Dual Task Training (MDTT) group.

Pre-test and Post-test of (MDTT) Group			
10 Meter Walk Test (10MWT)	N	Test Statistics (Wilcoxon Signed Rank Test)	
		Z value	p-value
Positive ranks	20	-3.920	0.000
Negative ranks	0		
Ties	0		
Total	20		

In the MDTT group the Wilcoxon Signed-Rank test showed a statistically significant improvement in gait speed after the intervention. For all 20 participants, we observed improvement (negative rank=0), with (positive rank=20) and (ties=0), suggestive of a pattern of gait speed increase after the intervention. p value=0.000 and Z value was -3.920. The result found P value = 0.000 that mean result also it is significant, though from probability table $P \leq 0.05$ is significant P value. The result revealed that motor dual task specific trainings had a significant positive effect to stroke patients ambulation ability by increased gait speed.

Table 4.5. Rank and test statistics of gait speed (m/s) measured by 10 Meter Walk Test (10MWT) for Task Oriented Circuit Training (TOCT) group.

Pre-test and Post-test of (TOCT) Group			
10 Meter Walk Test (10MWT)	N	Test Statistics (Wilcoxon Signed Rank Test)	
		Z value	p-value
Positive ranks	20	-3.920	0.000
Negative ranks	0		
Ties	0		
Total	20		

Wilcoxon Signed Rank test was used to compare the within group effectiveness of Task Oriented Circuit Training (TOCT) on gait performance by comparing pre-test & post-test 10MWT gait speed (m/s). The gains for gait speed were apparent in all 20 participants (negative rank=0), with (positive rank=20) and (ties=0). To add to this: Z= -3.920, p value=0.000. On the basis of the probability table the $P \leq 0.05$ is significant but the result which shows P = 0.000 that constitutes a significant result. However, these result show that Task Oriented Circuit Training (TOCT) improved ambulation ability in stroke patients by increasing gait speed.

4.6. Between group analyses of gait speed (m/s) by 10 Meter Walk Test (10MWT).

Table 4.6. Mann-Whitney U test of gait speed (m/s) measured by 10 Meter Walk Test (10MWT) between of motor dual task training group and task-oriented circuit training group

Between group analysis				
Category of patient	N	Test Statistics (Mann-Whitney U Score)		
		Mean Rank	Z value	p-value
(MDTT) Group	20	22.13	-0.879	0.379
(TOCT) Group	20	18.88		
Total	40			

A Mann–Whitney U test was done to determine if there was a statistically significant difference in gait speed (in meters per second) in favor of the Motor Dual Task Training (MDTT) group compared to the Task Oriented Circuit Training (TOCT) group following the intervention. A non-parametric test was compared between the two independent groups on the post-test 10-Metre Walk Test (10MWT). The mean rank for the MDTT group (22.13) was lower than the mean rank of the TOCT group (18.88). The Z value was -0.879 and p value of 0.379 (2-tailed). Because the p value was less than the conventionally accepted level of statistical significance ($p > 0.05$), there was not a statistically significant difference in post intervention gait speed between the two groups. We fail to reject the null hypothesis (H_0) that ambulatory outcome benefits of MDTT and TOCT groups combined with conventional physiotherapy ($\mu_1 - \mu_2 = 0$) are not statistically significant. The finding is that there was an improved gait speed in both interventions following stroke, but neither the MDTT nor the TOCT group utilized a more effective post-stroke ambulation per the 10MWT. However, a lack of significant between group difference suggests that both of the intervention protocols might be also effective in increasing gait speed in stroke patients.

4.7 Within group analysis of mobility by Time up and Go Test (TUG)

Table 4.7. Wilcoxon Signed Rank Test of mobility measured by Time up and Go Test (TUG) for Motor Dual Task Training (MDTT) group

Pre-test and Post-test of (MDTT) Group			
Time up and Go Test (TUG)	N	Test Statistics (Wilcoxon Signed Rank Test)	
		Z value	p-value
Positive ranks	20	-3.920	0.000
Negative ranks	0		
Ties	0		
Total	20		

Using Wilcoxon Signed Rank test in MDTT group showed statistically significant improvement in mobility after intervention. But for all 20 participants, there was improvement (negative rank=0), (positive rank=20), (ties=0) and a pattern of consistently increasing mobility after intervention. The p value =0.000, the Z value = -3.920. $P \leq 0.05$ is significant from probability table but the result found P = 0.000 that mean result is significant. Results from this study showed that motor dual task specific training can have a positive and significant effect on ambulation ability in stroke patients increasing their mobility.

Table 4.8. Wilcoxon Signed Rank Test of mobility measured by Time up and Go Test (TUG) for Task Oriented Circuit Training (TOCT) group**.**

Pre-test and Post-test of (TOCT) Group			
Time up and Go Test (TUG)	N	Test Statistics (Wilcoxon Signed Rank Test)	
		Z value	p-value
Positive ranks	20	-3.920	0.000
Negative ranks	0		
Ties	0		
Total	20		

A statistically significant improvement in mobility was seen in the TOCT group after the intervention when using the Wilcoxon Signed-Rank Test. Results showed that all 20 participants improved in mobility (negative rank=0), with (positive rank=20) and (tied=0), indicating a coherent trend of increased mobility after intervention. p value = 0.000, the Z value = -3.920. Based from probability table, $P \leq 0.05$ is significant but the result is $P=0.000$ which means result is significant. These results may indicate that the positive effect of Task Oriented Circuit Training (TOCT) on ambulation ability, under functional tasks in stroke patients, is to increase their mobility.

4.8. Between group analyses of mobility by Time up and Go Test (TUG) in seconds.

Table 4.9. Mann-Whitney U test of measured by Time up and Go Test (TUG) in seconds between (post-score) of motor dual task training mobility group and task-oriented circuit training group

Between group analysis (post-test)				
Category of patient	N	Test Statistics (Mann-Whitney U Score)		
		Mean Rank	Z value	p-value
(MDTT) Group	20	22.30	-0.974	0.330
(TOCT) Group	20	18.17		
Total	40			

The Mann-Whitney U test was then administered to evaluate if there was a statistically significant difference in mobility (measured in second) between the Motor Dual Task Training group and Task Oriented Circuit Training group following the intervention. The two independent groups were compared on the post-test scores of Time up and Go Test (TUG) using a nonparametric test. Mean rank for MDTT group is (22.30) and TOCT group is (18.17). That test generated a p value of 0.330 (2 tailed) and a Z value of -0.974. The difference in post intervention gait speed between both groups was not statistically significant, as the p value was greater than the conventional level of statistical significance ($p > 0.05$). Hence, we reject the null hypothesis that there is a significant difference in ambulatory outcome between the MDTT TOCT groups combined with conventional physiotherapy ($\mu_1 - \mu_2 = 0$). This finding indicates that both interventions improved mobility, but neither the MDTT group nor the TOCT group had better efficacy than the other for enhancing poststroke ambulation, as measured by (TUG). Though there was no significant difference between the groups, both types of intervention protocols seem effective to improve mobility of stroke patients.

4.9. Within group analyses of balance by Berg Balance Scale (BBS)

Table 4.10. Rank and test statistics of balance measured by Berg Balance Scale (BBS) for motor dual task training (MDTT) group

Pre-test and Post-test of (MDTT) Group			
Berg Balance Scale (BBS)	N	Test Statistics (Wilcoxon Signed Rank Test)	
		Z value	p-value
Positive ranks	20	-3.931	0.000
Negative ranks	0		
Ties	0		
Total	20		

Wilcoxon Signed Rank test showed significant improvement on balance after the intervention in MDTT group. 20 out of all 20 participants improved (negative rank=0) on (positive rank=20) with (ties=0) demonstrating consistent increasing mobility following intervention. p value =0.000, Z value = -3.931. Since, from the probability table the $P \leq 0.05$ is significant but the result P = 0.000 this signify result is significant. From these results, motor dual task specific training appears to provide a beneficial positive effect on ambulation ability in stroke patients as measured by increased balance.

Table 4.11. Wilcoxon Signed Rank Test of balance measured by Berg Balance Scale (BBS) for Task Oriented Circuit Training (TOCT) group.

Pre-test and Post-test of (TOCT) Group			
Berg Balance Scale (BBS)	N	Test Statistics (Wilcoxon Signed Rank Test)	
		Z value	p-value
Positive ranks	20	-3.940	0.000
Negative ranks	0		
Ties	0		
Total	20		

Further, the Wilcoxon signed rank test showed statistically significant improvement of balance after the intervention in the TOCT group. All 20 participants improved, with (ties=0), of these 20 participants had (positive rank=20) and (negative rank=0), indicating a consistent pattern of improvement in balance after intervention. P-value=0.000, Z-value= - 3.940. And from the probability table $P \leq 0.05$ is significant but hence result found P = 0.000 which means result is significant. The result indicates that Task Oriented Circuit Training (TOCT) had, significant, positive effect on ambulation ability of stroke patients in which showed increase balance.

4.10. Between group analyses of balance by Berg Balance Scale (BBS).

Table 4.12. Mann-Whitney U test of measured by Berg Balance Scale (BBS) between of motor dual task training group and task-oriented circuit training group

Between group analysis				
Category of patient	N	Test Statistics (Mann-Whitney U Score)		
		Mean Rank	Z value	p-value
(MDTT) Group	20	18.78	-0.938	0.348
(TOCT) Group	20	22.23		
Total	40			

A between group analysis was performed comparing the effects of Motor Dual Task Training and Task Oriented Circuit Training on balance outcomes assessed by the Berg Balance Scale (BBS) after the intervention period. However, due to the nonparametric distribution of the data, the Mann–Whitney U test was used to test statistical differences from post intervention BBS scores between the two groups. This analysis reported that the mean rank of the MDTT group (N = 20) was 18.78 and that the mean rank of the TOCT group (N = 20) was 22.23. We got a Z-value of -0.938 and a p-value of 0.348. The results suggest that the difference between post-test BBS scores for the two intervention groups were not statistically significant, since the p value is greater than the conventional level of significance ($p > 0.05$). According to these findings, this justifies only a slightly higher mean rank among the TOCT group, meaning marginally better balance ability which was not sufficiently compelling to demonstrate a meaningful advantage of one intervention over the other in terms of balance improvement. Based on the result, the null hypothesis (H_0) of the study was supported whereby there was no significant difference in balance outcomes among stroke patients who received Motor Dual Task Specific Training and those who received Task Oriented Circuit Training with conventional physiotherapy intervention. Similarly, then both interventions seem equally efficacious in improving post-stroke balance based on the BBS.

4.11. Within group analyses of functional mobility by total score of Barthel Index (BI)

Table 4.13. Mann-Whitney U test of measured by Berg Balance Scale (BBS) between of motor dual task training group and task-oriented circuit training group

Pre-test and Post-test of (MDTT) Group			
Barthel Index (BI)	N	Test Statistics (Wilcoxon Signed Rank Test)	
		Z value	p-value
Positive ranks	18	-3.753	0.000
Negative ranks	0		
Ties	2		
Total	20		

The Wilcoxon Signed-Rank test showed that the MDTT group, statistically significantly ($p \leq .05$) improved functional mobility after the intervention. Of the total 20 participants, 18 showed (positive rank) and 2 showed (ties), while all showed improvement (negative rank=0) meaning functional mobility became improved (increased) as a result of the intervention which indicates a recurring pattern in increasing functional mobility after intervention. P value =0.000, Z value was -3.753. The $P \leq 0.05$ is significant from probability table but result found P=0.000 which was the significant result. This suggested that motor dual task specific training had a significant positive effect on functional mobility measures, as ambulation in stroke patients showed increased functional mobility.

Table 4.14. Wilcoxon Signed Rank Test of functional mobility measured by total score of Barthel Index (BI) for Task Oriented Circuit Training (TOCT) group**.**

Pre-test and Post-test of (TOCT) Group			
Barthel Index (BI)	N	Test Statistics (Wilcoxon Signed Rank Test)	
		Z value	p-value
Positive ranks	20	-3.965	0.000
Negative ranks	0		
Ties	0		
Total	20		

Functional mobility improved following treatment in the TOCT group, as determined by a statistically significant result from the Wilcoxon test. All the participants improved (negative rank=0), with (positive rank=20) and (ties=0) proving that their functional mobility increased steadily following intervention. Results showed that the Z value was -3.965 and that p value was 0.000. The probability table indicates $P \leq 0.05$ is significant, while the obtained p-value $P = 0.000$ proves the result is significant too. The findings show that circuit training to improve tasks helped stroke patients' ability to walk or move around by increasing how well they got around.

4.17. Between group analyses of functional mobility by total score of Barthel Index (BI)

Table 4.15. Mann-Whitney U test of measured by Barthel Index (BI) between of motor dual task training group and task-oriented circuit training group

Between group analysis				
Category of patient	N	Test Statistics (Mann-Whitney U Score)		
		Mean Rank	Z value	p-value
(MDTT) Group	20	17.10	-1.884	0.059
(TOCT) Group	20	23.90		

Total	40

A comparison was made between the two types of training—Motor Dual-Task Training (MDTT) and Task-Oriented Circuit Training (TOCT)—using the Barthel Index (BI) and assessing functional mobility. Because the data were non-parametric, the Mann–Whitney U test was carried out to understand if there were any statistical differences in BI scores following the intervention between the two groups. The MDTT group (n = 20) had a mean rank of 17.10 whereas the TOCT group (n = 20) had a mean rank of 23.90. We ended up with a Z-value of -1.884 and a corresponding p-value of 0.059. The results do not show a statistically significant difference in the post test BBS scores between the two intervention groups as the p-value was greater than the conventional threshold of significance ($p > 0.05$). Although the mean TOCT rank was slightly higher, indicating marginally better balance, these results suggest that both interventions had favorable effects on functional mobility improvement and the existing difference was not sufficient to conclude the superiority of one intervention over the other. These results enable us to fail to reject the null hypothesis (H_0): there is no significant clinical difference in ambulatory outcome between stroke patients undergoing Motor-Dual-Task-Specific Training, compared with Task-Oriented-Circuit Training with conventional physiotherapy. Descriptive statistics showed a possibly larger improvement in scores with TOCT, but these differences were not confirmed statistically at the 5% level.

CHAPTER-V	DISCUSSION

The purpose of this quasi-experimental study was to examine and compare the effectiveness of two physiotherapeutic interventions, Motor Dual Task Specific Training (MDTT) and Task Oriented Circuit Training (TOCT), in combination with conventional physiotherapy on the ambulation of stroke patients. Gait speed (10MWT), mobility (TUG), balance (BBS) and functional independence (BI) were all assessed with robust outcome measures for change. Both interventions produced within group improvements on all outcome measures that were statistically significant. However, there were no statistically significant between – group differences, reflecting comparable efficacy. Context for the interpretation of the outcomes is given by the demographic and baseline clinical characteristics. The mean age of MDTT was 48.30 ± 9.091 years, whereas TOCT mean age was 52.05 ± 8.982 years showing that TOCT was marginally older in being.

The gender distribution was similar for both groups with predominance of the males in MDTT (90%) and TOCT (85%) presumably due to gender specific health seeking behavior or stroke incidence rate in this population. The proportion of married persons was high in both groups, 100% in MDTT and 95% in TOCT group. TOCT group members had slightly higher levels of education and literacy and level of academic attainment were also higher in TOCT than OAT group members. They also found that compared to participants from the TOCT group, participants in the MDTT group were more likely to be self-employed and work in agriculture (10% vs 4%) and had lower rates in government service (15% vs 40%). The TOCT group was more rural in residence and the MDTT group was more equally distributed across rural, semi urban and urban residence. Patterns can be important determinants of compliance, access to care and social support.

Over 95% of stroke type was ischemic in both groups. A notable exception was found for hemispheric involvement with the MDTT group having an equal number of left (50%) and right (50%) sided strokes whereas the TOCT group was 80% left sided. Left hemisphere difference may interfere with cognitive recovery trajectories because that hemisphere damage may be more likely to impair language and executive function. Comorbidities were similar between both study groups, with regard to diabetes mellitus

45% of patients in both groups, hypertension a slightly higher proportion in MDTT (60% vs. 55%) and heart disease more prevalent within MDTT (20% vs. 15%). The rates of asthma were low (10%) in both groups (p less than 0.05) and no cases of epilepsy or thyroid dysfunction or other complicating illnesses were found among either group. Internal validity is affirmed by these comparable distributions and fair comparisons can made between interventions. Results showed that levels of physical activity were uniformly low, with 80% of MDTT and 85% of TOCT participants scoring as sedentary. Both groups both smoked (50% history of tobacco use). There was little alcohol use to minimize confounding variables. Chronicity of the stroke was variable and the MDTT group had a mean duration time from onset of 313.90 ± 301.06 days and TOCT 383.75 ± 406.48 days. Chronicity in these cases shows great variability and this variability in chronicity could influence neuroplastic potential and responsiveness to interventions. Validated outcome tools were applied in CRP, Savar to assess the participants. Within group comparisons were conducted using the Wilcoxon Signed-Rank test since data was non-parametric and between group comparisons were performed with the Mann–Whitney U test. Analysis was with SPSS version 20. Non-parametric tests ensure valid use in the small sample size and ordinal scales nature of functional assessment scales. Gait speed improved significantly post intervention in participants in both groups (Z = -3.920; p = 0.000 for both groups). This was evident prior to the intervention with excessive variability noted, particularly in the MDTT (range: 0.81 – 15.00 m/s), hence heterogeneity in baseline gait performance. This is consistent with results by Liu et al. (2017) and Zhang et al. (2024) that indicated dual-task training of lower limb movements enhanced motor planning and gait adaptability. Similarly, in line with Straudi et al. (2022), benefit of TOCT is improved walking efficiency via circuit-based repetition. In this between group comparison (p= 0.379), neither of the approaches has statistical superiority.

Both groups (MDTT and TOCT) also demonstrated significant improvement in mobility post intervention (Z = -3.920; p = 0.000). Variability of the TUG times among the MDTT group was first greater, ranging from 12.33 to 160 seconds. The wide range may be due to differential levels of disability or cognitive impairment. However, scores within the TOCT group were more homogenous pretraining, possibly diluting a more uniform response to training. Again, no statistically significant between group difference (p = 0.330) indicated equivalent efficacy. Both groups (MDTT: Z = -3.931, TOCT: Z = -3.940, p = 0.000), however, confirmed gain in balance. Post-test comparison was made between the groups which both started with similar BBS scores (MDTT: 42.60 ± 4.477; TOCT: 42.55 ± 4.148). The difference in post intervention mean rank between the TOCT group and the control group was not significant (p = 0.348), although the TOCT group had a slightly higher post intervention mean rank. These findings corroborate Maqbool et al. (2024) who demonstrated that both intervention effectively utilize proprioceptive feedback mechanisms and vestibular training. Indeed, the MDTT (Z = -3.753; p = 0.000) group improved in 18 out of 20 and the TOCT (Z=.3.965; p=.000) group improved in all 20 who participated. The TOCT group also had a higher mean rank in post-test scores (23.90 vs. 17.10), although the p value (.059) did not approach statistical significance.

The borderline result of slight advantage of TOCT in activities of daily living may be attributed to its emphasis on task mimicry and repetition. Traxler et al. (2023) describe similar outcomes about the importance of functional training to improve independence. However, in this study, we find that while the models attend to different functional aspects in the training environment, the models' outcome was convergent. This cognitive motor benefit of MDTT relates to increased performance of executive function, attention and motor sequencing, all of which are highly desirable in novel, real world multitasking. Through repetitive circuits, TOCT will give the athlete or weight lifter muscle memory, endurance and functional coordination. All four functional domains showed improved combined effects with conventional physiotherapy without significantly favoring either intervention. These results indicate that we cannot implement a one size fits all approach, but we will need individualized treatment. For example, patients that have dual task interference or cognitive deficits may do better with MDTT and patients who have physical endurance limitations may benefit more with TOCT. Further optimization could be achieved by hybrid protocols that combined elements of both.

This study fits and supplements the existing works (Shohe et al., 2022; Liu et al., 2017; Zhang et al., 2024) with directly comparable data. It is one of only a few studies in South Asia that examine these modalities concurrently with conventional therapy. In addition to supporting global recommendations for integrated, task specific stroke rehabilitation, these findings contextualise the recommendations for resource limited set up. The findings also support the notion that TOCT may be a more viable option than MDTT to enhance total functional mobility, probably because it entails performance of repetitive task specific movements, each of which directly impacts the individual's functional ability. The results of this study are consistent with and extend previous MDTT and TOCT research. MDTT was found by Liu et al. (2017) and Zhang et al. (2024) to improve gait speed and balance, in particular, while performing a secondary task of standing and stepping on a force plate. These findings support ours, by observing statistically significant improvements in gait speed and balance in the MDTT group. Furthermore, Shohe et al. (2022) and Halford et al. (2024) reported that TOCT enhances functional mobility, endurance and balance, consistent with the results of the present study, that the TOCT group demonstrated greater gains in functional mobility over the 10 weeks.

Such improvement was significantly noticeable for the TOCT group in terms of the improvement in functional mobility, as assessed by the Barthel Index (BI). Halford at al. (2024) support this finding by showcasing that TOCT is more effective than MDTT in improving daily functional tasks based on the task specific nature of the exercises and addressing strength, endurance and balance. While both MDTT and TOCT have huge benefits for stroke rehabilitation, with different outcomes. MDTT is especially helpful for patients needing to improve gait speed and balance under dual task conditions, as patients who experience cognitive motor interference present with. However, TOCT is more effective at improving function controlling mobility, walking endurance and balance, making it appropriate for those who need improvement with daily tasks and overall mobility. MDTT is suggested as a rehabilitation approach to be applied for patients with cognitive motor difficulties and TOCT for patients focusing on functional mobility and strength.

Limitation of the study

The study was performed on 40 patients with stroke which was too few samples for this study to be able to generalize the population of this condition outwardly. Time limitation led to decreased external validity of the study, but with maintained internal validity during data collection. In this study time is not constraint on the participant and he only get six weeks treatment session. Result was significant in this research but if time had been increased result might have been the same or non-significant. The time was limited and the places to find patients who would fulfil the inclusion criteria was not so accessible. If we had data from Mirpur or other branch of CRP, result would have been more specific. For time limitation, only data was collected from CRP. But the treatment was successful, but it could not guard long term effect hence keeping the objectives of study behind the blinding procedure was difficult. Consequently, it is for this reason that single blinding method was used in this study and physiotherapist's bias has not been absolutely minimized when offering treatment.

CHAPTER-V1 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The most conventional problem after stroke is ambulatory issues, which consist of gait problems, balance problems and functional mobility problems. Walking smoothly was impaired by loss of gait speed, balance and functional mobility. The factors causing loss of ambulatory function, following stroke, include motor impairment, spasticity, sensory deficits, loss of coordination and muscle atrophy, balance and postural control impairments. Uniquely, the technique to recover ambulatory function of a stroke patient who lost their ambulatory ability is motor dual task training (MDTT) and task-oriented circuit training (TOCT). An attempt was made to explore both MDTT & TOCT training strategies that could improve the ambulatory function of stroke patients. Moreover, this study examined whether Motor-Dual-Task-Specific Training (MDTT) and Task-Oriented-Circuit Training (TOCT) combined with conventional physiotherapy would improve gait speed, balance and functional mobility in stroke patients. Both interventions resulted in statistically significant differences for functional mobility, gait speed and balance according to several standard measures (Barthel Index (BI), 10-metre walk test (10MWT), Berg Balance Scale (BBS)). In particular, both groups performed similarly with regard to marked improvements in functional mobility, but TOCT seemed to show slightly better results in the Barthel Index than MDTT, indicating a greater degree from greater functional independence. MDTT resulted in significantly greater improvement in dual task gait performance while highlighting the importance of cognitive–motor integration to clinical rehabilitation after stroke. Now, however, as contrary as it sounds, MDTT and TOCT can also help ambulation of those who have stroke, as our research has shown to have a tremendous effect. Thus, the treatment protocol demands has both treatments as very urgent for stroke patients.

6.2 Recommendation

Based on the findings, it is concluded, suitable, to say the least, that as MDTT and TOCT provide different benefits, both treatments should be integrated into stroke rehabilitation programs. The combination of MDTT and TOCT is especially effective at improving gait performance during dual task, and TOCT alone improves functional mobility, gait speed and balance. Maximizing stroke patients' rehabilitation outcomes can be obtained by combining the two methods, as the needs of these patients vary. In addition, the long-term effectiveness of these interventions should be further investigated in future studies with a potential for personalization of rehabilitation protocols with individual patient characteristics. Standardized treatment protocols for motor dual task training (MDTT) and task-oriented circuit training (TOCT) implementation should be developed to guarantee practice consistency. Finally, future work requires large and diverse patient populations to further develop and tailor these interventions in order to maximize recovery in stroke.

REFERENCES

Abdollahi, M., Kuber, P.M. and Rashedi, E., 2024. Dual tasking affects the outcomes of instrumented timed up and go, sit-to-stand, balance, and 10-meter walk tests in stroke survivors. *Sensors*, *24*(10), p.2996.

Ahmed, M.A., Abd El-Maksoud, G.M. and Elnaggar, R.K., 2019. Comparison of dual-task specific training and conventional physical therapy in ambulation of hemiplegic stroke patients: A randomized controlled trial. *Journal of Stroke and Cerebrovascular Diseases*, 28(12), p.104375.

Ayn, R. and BN, P.K. (2024) 'The Effect of Task Oriented Circuit Training on Aerobic Capacity During Stairclimbing in Patients with Stroke.,' *International Journal of Scientific Research*, pp. 77–80.

Bosch, J., O'Donnell, M.J., Barreca, S., Thabane, L. and Wishart, L., 2014. Does task-oriented practice improve upper extremity motor recovery after stroke? A systematic review. *International Scholarly Research Notices*, *2014*(1), p.504910.

Cha, H.G., Oh, D.W. and Ji, S.G., 2014. The Effects of Task Oriented Circuit Training on the Function of Lower Extremity and Quality of Life in Hemiplegic Patients. *Journal of the Korea Academia-Industrial cooperation Society*, *15*(1), pp.299-305.

Chavan, N.S. and Raghuveer, R., 2024. Lower limb rehabilitation using modified constraint-induced movement therapy and motor relearning program on balance and gait in sub-acute hemiplegic stroke: a comparative study. *F1000Research*, *12*, p.1098.

Chuang, L.L., Hsu, A.L., Lin, Y.H., Yu, M.H., Hu, G.C., Ou, Y.C. and Wong, A.M.K., 2024. Multimodal training with dual-task enhances immediate and retained effects on dual-task effects of gait speed not by cognitive-motor trade-offs in stroke survivors: a randomized controlled trial. *Disability and Rehabilitation*, pp.1-10.

Cohen, J., 2013. *Statistical power analysis for the behavioral sciences*. routledge.

Dafda Renuka, H., Patel Prital, P., Sheikh Safa, A. and Bhut Shivanee, S., 2021. A study to find out effect of circuit training on balance in stroke patients-an experimental study. *Int J Health Sci Res*, *11*, pp.339-44.

Dean, C.M., Richards, C.L. and Malouin, F., 2000. Task-related circuit training improves performance of locomotor tasks in chronic stroke: a randomized, controlled pilot trial. *Archives of physical medicine and rehabilitation*, *81*(4), pp.409-417.

Diontama, M.A., Larasati, T.A. and Jausal, A.N., 2025. Article Review: Peran Hipertensi terhadap Patomekanisme Stroke Iskemik dan Hemoragik. *Termometer: Jurnal Ilmiah Ilmu Kesehatan dan Kedokteran*, *3*(1), pp.183-191.

Elendu, C., Amaechi, D.C., Elendu, T.C., Ibhiedu, J.O., Egbunu, E.O., Ndam, A.R., Ogala, F., Ologunde, T., Peterson, J.C., Boluwatife, A.I. and Okongko, A.O., 2023. Stroke and cognitive impairment: Understanding the connection and managing symptoms. *Annals of Medicine and Surgery*, *85*(12), pp.6057-6066.

Evans, J.J., Greenfield, E., Wilson, B.A. and Bateman, A., 2009. Walking and talking therapy: Improving cognitive–motor dual-tasking in neurological illness. *Journal of the international Neuropsychological society*, *15*(1), pp.112-120.

Filippov, M.S. *et al.* (2025) 'Biomechanical aspects of gait impairments after stroke: an analytical review,' *Russian Journal of Physiotherapy Balneology and Rehabilitation*, 23(4), pp. 205–217.

Filippov, M.S., Pogonchenkova, I.V., Lutokhin, G.M. and Majorov, E.A., 2024. Biomechanical aspects of gait impairments after stroke: an analytical review. *Russian Journal of Physiotherapy, Balneology and Rehabilitation*, *23*(4), pp.205-217.

Fishbein, P., Hutzler, Y., Ratmansky, M., Treger, I. and Dunsky, A., 2019. A preliminary study of dual-task training using virtual reality: influence on walking and balance in chronic poststroke survivors. *Journal of Stroke and Cerebrovascular Diseases*, *28*(11), p.104343.

Halford, E., Jakubiszak, S., Krug, K. and Umphress, A., 2024. What is Task-Oriented Training? A Scoping Review. *Student Journal of Occupational Therapy*, *4*(1), pp.1-23.

Hulley, S.B., Cummings, S.R., Newman, T.B., Browner, W. and Grady, D., 2013. Designing cross-sectional and cohort studies. *Designing clinical research*, *4*, pp.85-96.

Iqbal, M., Arsh, A., Hammad, S.M., Haq, I.U. and Darain, H., 2020. Comparison of dual task specific training and conventional physical therapy in ambulation of hemiplegic stroke patients: Arandomized controlled trial. *JPMA. The Journal of the Pakistan Medical Association*, *70*(1).

Joseph, J.W. (2023) 'Ischemic strokes,' in *Cambridge University Press eBooks*, pp. 101–113.

kalyana, S., Lohar, D., Khan, J. and Rao, L.S., 2023. Effectiveness of Supplemented Backward Talking Training Along with Conventional Therapy on Balance and Functional Outcome in Patients with Stroke. *Int J Curr Pharm Res*, *15*(4), pp.108-110.

Karunakaran, K.K., Pamula, S., Tendolkar, P., Chen, P. and Suviseshamuthu, E.S., 2024, July. Preliminary Validation of an Objective Fall-Risk Assessment for Individuals with Stroke. In *2024 46th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)* (pp. 1-4). IEEE.

Kesar, T., 2023. The Effects of Stroke and Stroke Gait Rehabilitation on Behavioral and Neurophysiological Outcomes: Challenges and Opportunities for Future Research. *Delaware Journal of Public Health*, *9*(3), p.76.

Kesidou, M., Besios, T., Paras, G., Chandolias, K., Kyriakatis, G.M., Kouvelioti, V. and Stefas, E., 2023. The effect of task oriented approach on gait of hemiplegic patients: A case series study. *International Journal of Clinical Trials*, *10*(1), pp.1-6.

Kim, C.Y., Lee, J.S. and Kim, H.D., 2017. Comparison of the effect of lateral and backward walking training on walking function in patients with poststroke hemiplegia: a pilot randomized controlled trial. *American journal of physical medicine & rehabilitation*, *96*(2), pp.61-67.

Kim, G.Y., Han, M.R. and Lee, H.G., 2014. Effect of dual-task rehabilitative training on cognitive and motor function of stroke patients. *Journal of physical therapy science*, *26*(1), pp.1-6.

Kim, H. and Seo, K.C., 2013. The effects of task-related circuit training by type of dual task on the gait of chronic stroke patients. *Journal of The Korean Society of Physical Medicine*, *8*(3), pp.407-415.

Kim, H., Lee, H. and Seo, K., 2013. The effects of dual-motor task training on the gait ability of chronic stroke patients. *Journal of Physical Therapy Science*, *25*(3), pp.317-320.

Kim, S. and Kang, S., 2016. The effects of task-related circuit exercise program combined with sensorimotor training on balance and walking in persons with stroke: A pilot study. *Journal of The Korean Society of Integrative Medicine*, *4*(4), pp.21-32.

Kundnani, T. and Satralkar, A., Effect of Task Oriented Circuit Training Versus Trunk Rehabilitation on Balance, Trunk Control and Functional Ambulation in Chronic Stroke Patients: A Comparative Study.

Kwakkel, G., Veerbeek, J.M., van Wegen, E.E. and Wolf, S.L., 2015. Constraint-induced movement therapy after stroke. *The Lancet Neurology*, *14*(2), pp.224-234.

Lindberg, P.G., AmirShemiraniha, N., Krewer, C., Maier, M.A. and Hermsdörfer, J., 2024. Increased dual-task interference during upper limb movements in stroke exceeding that found in aging–a systematic review and meta-analysis. *Frontiers in Neurology*, *15*, p.1375152.

Liu, J. *et al.* (2024) 'Effect of Multi-Joint Functional Electrical Stimulation Combined with Conventional Rehabilitation Therapy on Lower Limb Motor Function of Patients with Stroke,' *Rehabilitation Medicine*, 34(4), pp. 349 354.

Liu, Y.C., Yang, Y.R., Tsai, Y.A. and Wang, R.Y., 2017. Cognitive and motor dual task gait training improve dual task gait performance after stroke-A randomized controlled pilot trial. *Scientific reports*, *7*(1), p.4070.

Machin, D., Campbell, M.J., Tan, S.B. and Tan, S.H., 2011. *Sample size tables for clinical studies*. John Wiley & Sons.

Maqbool, S. *et al.* (2024) 'Comparative Effects of Task-Oriented Program and Proprioceptive Training on Balance, Gait and Quality of Life in Patients with Hemiplegic Stroke,' *Biological and Clinical Sciences Research Journal*, 2024(1), p. 947.

Menezes-Oliveira, E., da Silva Matuti, G., de Oliveira, C.B., de Freitas, S.F., Miyuki Kawamura, C., Fernandes Lopes, J.A., Faber, J. and Arida, R.M., 2024. Improvement of gait and balance function in chronic post-stroke patients induced by Lower Extremity–Constraint Induced Movement Therapy: a randomized controlled clinical trial. *Brain Injury*, *38*(7), pp.559-568.

Moini, J., Gutierrez, A. and Avgeropoulos, N. (2023c) 'Stroke,' in *Elsevier eBooks*, pp. 153–168.

Moon, J.H., Park, K.Y., Kim, H.J. and Na, C.H., 2018. The effects of task-oriented circuit training using rehabilitation tools on the upper-extremity functions and daily activities of patients with acute stroke: a randomized controlled pilot trial. *Osong public health and research perspectives*, *9*(5), p.225.

Mudge, S., Barber, P.A. and Stott, N.S., 2009. Circuit-based rehabilitation improves gait endurance but not usual walking activity in chronic stroke: a randomized controlled trial. *Archives of physical medicine and rehabilitation*, *90*(12), pp.1989-1996.

Pang, M.Y.C., Yang, L., Ouyang, H., Lam, F.M.H., Huang, M. and Jehu, D.A., 2018. Dual-task exercise reduces cognitive-motor interference in walking and falls after stroke: a randomized controlled study. *Stroke*, *49*(12), pp.2990-2998.

Park, M.O. and Lee, S.H., 2019. Effect of a dual-task program with different cognitive tasks applied to stroke patients: a pilot randomized controlled trial. *NeuroRehabilitation*, *44*(2), pp.239-249.

Pizov, N.A. (2023) 'Rehabilitation after stroke,' *Meditsinskiy Sovet Medical Council*, (21), pp. 28–33.

Plummer, P. and Eskes, G., 2015. Measuring treatment effects on dual-task performance: a framework for research and clinical practice. *Frontiers in human neuroscience*, *9*, p.225.

Plummer, P., Villalobos, R.M., Vayda, M.S., Moser, M. and Johnson, E., 2014. Feasibility of dual-task gait training for community-dwelling adults after stroke: A case series. *Stroke research and treatment*, *2014*(1), p.538602.

Rai, S.S. and Ganvir, S.S., 2020. Effect of 2 Weeks of Dual Task Training on Balance and Gait in Patients with Stroke: Single Group Experimental Study. *Int J Health Sci Res*, *10*(2), pp.57-66.

Roshan, R. and Thamburaj, S., 2022. A Comparative Study on the Effects of Task Oriented Balance Training Program with or without Altered Sensory Input on Balance and Functional Performance in Older Adults: A Case Control Study. *Indian Journal of Physiotherapy & Occupational Therapy Print-(ISSN 0973-5666) and Electronic–(ISSN 0973-5674)*, *16*(2), pp.216-221.

Shahid, J., Kashif, A. and Shahid, M.K., 2023. A comprehensive review of physical therapy interventions for stroke rehabilitation: impairment-based approaches and functional goals. *Brain Sciences*, *13*(5), p.717.

Shamshiev Almas, S., Saduakas Yergaliuly, Y., Zhakubayev Manat, A., Zh, M.A., Demeuov Talgat, N., Ingkar, O., Makkamov Rustam, O., Yerkinbayev Nurlybek, N., Alisher, K., Appazov Daniyar, M. and Nursultan, B., 2024. 'Stroke: A Comprehensive Overview of Trends, Prevention, and Treatment (Literature Review),' *Bulletin of Surgery in Kazakhstan*, 20(3), pp. 71–81.

Sharmin, F., Hossain, M.F., Bari, M.U., Khan, A.H., Hossain, M.A., Ali, M.E., Datta, A., Sabrin, S.M., Sharmin, F., Rashid, H.O. and Karim, M.R., 2025. Effectiveness of task-oriented circuit training on the motor performance of ischaemic stroke patients: a study protocol for randomised clinical trial. *BMJ Open Sport & Exercise Medicine*, *11*(2).

Shohe, T.K. *et al.* (2022) 'A comparative study to check the effectiveness of task oriented activity on walking speed in Sub-Acute Stroke patients,' *International Journal of Life Science and Pharma Research*.

Shruthi, J., Alagesan, J. and Iswarya, S., 2024. Effect of Task Specific Circuit Training on Gait and Functional Mobility among Spastic Diplegic Cerebral Palsy. *Indian Journal of Physiotherapy & Occupational Therapy*, *18*.

Singh, A., Kaur, D., Sahni, R.K. and Grewal, S., Comparison of Dual Task and Task Oriented Training Programme on Gait in Chronic Stroke.

Song, B.K., Kim, A.R. and Kim, J.S., 2019. A Systematic Review on The Task Oriented Training Effect Applied to Hemiplegic Patients after Stroke. *J Korean Soc Neur Ther*, *23*(2), pp.35-43.

Spanò, B., De Tollis, M., Taglieri, S., Manzo, A., Ricci, C., Lombardi, M.G., Polidori, L., Griffini, I.A., Aloisi, M., Vinicola, V. and Formisano, R., 2022. The effect of dual-task motor-cognitive training in adults with neurological diseases who are at risk of falling. *Brain sciences*, *12*(9), p.1207.

Stephens, J.M. and Goldie, P.A., 1999. Walking speed on parquetry and carpet after stroke: effect of surface and retest reliability. *Clinical rehabilitation*, *13*(2), pp.171-181.

Straudi, S., De Marco, G., Martinuzzi, C., Baroni, A., Lamberti, N., Brondi, L., Da Roit, M., Pizzongolo, L.D.M., Basaglia, N. and Manfredini, F., 2022. Combining a supervised and home-based task-oriented circuit training improves walking endurance in patients with multiple sclerosis. The MS_TOCT randomized-controlled trial. *Multiple sclerosis and related disorders*, *60*, p.103721.

Sukala, N., 2021. Effect of Cognitive Dual Task Training versus Motor Dual Task Training on Balance in Post Stroke Patients. *INTI JOURNAL*, *2021*(07).

Sunnerhagen, K.S., 2007. Circuit training in community-living "younger" men after stroke. *Journal of Stroke and Cerebrovascular Diseases*, *16*(3), pp.122-129.

Takahashi, A., Kitsunai, S., Kawana, H., Saito, N., Yoshihara, A. and Furukawa, K., 2025. Physiotherapy management focusing on proprioceptive impairment in a patient with gait and balance impairments following stroke: A case report. *Physiotherapy Theory and Practice*, *41*(2), pp.432-446.

Tasseel-Ponche, S., Roussel, M., Toba, M.N., Sader, T., Barbier, V., Delafontaine, A., Meynier, J., Picard, C., Constans, J.M., Schnitzler, A. and Godefroy, O., 2023. Dual-task versus single-task gait rehabilitation after stroke: the protocol of the cognitive-motor synergy multicenter, randomized, controlled superiority trial (SYNCOMOT). *Trials*, *24*(1), p.172.

Thakur, K., Sohkhlet, G., David, S., Gangurde, S., Borah, N., Sandeep, N., Jadav, V., Verma, P., Johnson, S. and Palal, D., 2024. Challenges and Experiences Faced by Physiotherapists in Stroke Rehabilitation: A Qualitative Study. *Medical Journal of Dr. DY Patil University*, *17*(3), pp.547-552.

Thant, A.A., Wanpen, S., Nualnetr, N., Puntumetakul, R., Chatchawan, U., Hla, K.M. and Khin, M.T., 2019. Effects of task-oriented training on upper extremity functional performance in patients with sub-acute stroke: a randomized controlled trial. *Journal of physical therapy science*, *31*(1), pp.82-87.

Tigga, P. and Kumar, S. (2024) 'Stroke rehabilitation,' *International Journal of Science and Healthcare Research*, 9(3), pp. 332–343.

Traxler, K., Baum, E., Klotz, E., Reindl, M., Schinabeck, F. and Seebacher, B., 2024. Combining specific task-oriented training with manual therapy to improve balance and mobility in patients after stroke: a mixed methods pilot randomised controlled trial. *Disability and Rehabilitation*, *46*(7), pp.1318-1329.

Tulimieri, D.T., Decarie, A., Singh, T. and Semrau, J.A., 2025. Impairments in proprioceptively-referenced limb and eye movements in chronic stroke. *Neurorehabilitation and Neural Repair*, *39*(1), pp.47-57.

Valecha, J., Khalid, S., Pervez, R., Mumtaz, U., Khalid, I. and Talha, M., 2024. Optimizing Motor Recovery: Dual-Task Training versus Motor Relearning Program for Ambulatory Left-Hemiplegic Stroke Patients: Dual-Task Training vs. Motor Relearning Program in Stroke. *Allied Medical Research Journal*, *2*(2), pp.158-167.

van de Port, I.G., Wevers, L.E., Lindeman, E. and Kwakkel, G., 2012. Effects of circuit training as alternative to usual physiotherapy after stroke: randomised controlled trial. *Bmj*, *344*.

Verma, R., Narayan Arya, K., Garg, R.K. and Singh, T., 2011. Task-oriented circuit class training program with motor imagery for gait rehabilitation in poststroke patients: a randomized controlled trial. *Topics in stroke rehabilitation*, *18*(sup1), pp.620-632.

Youn, H.J. and Oh, D.W., 2016. Comparison of the effects of task-oriented circuit training and treadmill training on walking function and quality of life in patients with post-stroke hemiparesis: Randomized controlled pilot trial. *Physical Therapy Korea*, *23*(2), pp.1-10.

Yang, Y.R., Wang, R.Y., Chen, Y.C. and Kao, M.J., 2007. Dual-task exercise improves walking ability in chronic stroke: a randomized controlled trial. *Archives of physical medicine and rehabilitation*, *88*(10), pp.1236-1240.

Zhang, L., Ma, J., Liu, X., Jin, A., Wang, K. and Yin, X., 2024. Cognitive-motor dual-task training on gait and balance in stroke patients: meta-analytic report and trial sequential analysis of randomized clinical trials. *Journal of NeuroEngineering and Rehabilitation*, *21*(1), p.227.

Zhang, X., Xu, F., Shi, H., Liu, R. and Wan, X., 2022. Effects of dual-task training on gait and balance in stroke patients: a meta-analysis. *Clinical rehabilitation*, *36*(9), pp.1186-1198.

Appendix- A

Consent Form (English)

(Please read out to the participants)

Greeting!

My name is Khandokar Sadman Rakib, I am conducting this study which is part of my B.Sc. in physiotherapy program, and my thesis title **is "Effectiveness Between Motor-Dual-Task-Specific Training and Task-Oriented-Circuit Training Along with Conventional Physiotherapeutic Intervention in Ambulation of Stroke Patients: A Quasi-Experimental Study"**. at Bangladesh Health Profession Institute, under the Faculty of Medicine, University of Dhaka. For the fulfilment of my study, I would like to know some information about social, financial, behavioural, and lifestyle among the CVA suffered people. So, I need to ask you some questions in this regard and this will take approximately 20-30 minutes. I am ensuring you that this will not create any harmful or unpleasant experience for you. The information you will provide will be treated as confidential and in the event of any report or publication, the source of this information will be kept anonymous. I would like to inform you that your participation in this study will be considered voluntary and there will not be any kind of financial dealings.

"As a part of this study or by the rights of the participants you can withdraw yourself at any time from this study or if you will want to skip any question that you don't want to give answer. You can proceed. If you further have any kinds of questions on this study, please feel free to ask researcher Khandokar Sadman Rakib or my supervisor Farjana Sharmin, Consultant, Out-patient In-charge & Lecture of BHPI, CRP, Savar-1343

May I start the interview?

YES NO

Signature of Participants……………. Signature of Interviewers………………

Date…………………. Date………………….

Appendix- B

Questionnaire (English)

Patient Information

Patient Id:	☐☐☐
Date of interview:	☐☐☐☐☐☐
Name of the participant :	
Code:	☐☐☐
Address:	1. Village: 2. Post Office: 3. Upzilla: 4. Zilla:
Phone Number:	1. 2.

Research Questionnaire

Title: Effectiveness Between Motor-Dual-Task Specific Training & Task-Oriented-Circuit-Training Along with Conventional Physiotherapeutic Intervention in Ambulation of Stroke Patients: A Quasi-Experimental Study

Part-1: Socio-demographic Information

QN	Questions	Categories of response	Code no.
1.1	Age	Age in years	☐
1.2	Sex	1. Male 2. Female 3. Others	☐
1.3	Marital status	1. Married 2. Unmarried 3. Divorced 4. Others	☐
1.4	Level of Education	1. Illiterate 2. Primary 3. S.S.C 4. H.S.C 5. Graduate 6. Masters and above	☐
1.5	Place of residence	1. Rural 2. Semi-Urban 3. Urban	☐
1.6	Occupation	1. Farmar 2. Government employer 3. Businessman 4. Shopkeeper 5. Garments worker	☐

		6. Housewife 7. Unemployed 8. Others……………….	
1.7	Family Type	1. Joint 2. Nuclear	☐
1.8	Number of family members	Total number of family members	☐
1.9	Number of earning members	Total number of earners	☐
1.10	General Health of the participant	1. Good 2. Fair 3. Poor	☐

Part 2: Co-morbid condition Data

QN	Questions	Questions Categories of Response	Code no.
2.1	Type of stroke	1. Ischemic 2. Hemorrhagic	☐
2.2	Affected side	1. Right 2. Left	☐
2.3	Duration of stroke?	How many days/months/year ago did you have the stroke?	……………..

2.4	Number of strokes	1. First stroke 2. Second stroke 3. Multiple stroke	☐
2.5	Have you ever been diagnosed with any of the following conditions? (more than one answer possible	1. Heart disease 2. Diabetes mellitus 3. High blood pressure 4. Asthma disease 5. Epilepsy 6. Hypothyroidism 7. Other related diseases (Specify).................	☐

Part-3: Lifestyle Data

QN	Questions	Questions Categories of Response	Code No.
3.1	Did you ever smoke in your life?	1. Yes 2. No	☐
3.2	What type of smoker you are?	1. Current smoker 2. Occasional smoker 3. Ex-smoker	☐
3.3	What do/did you smoke?	1. Cigarette 2. Biri 3. Other (Specify) 4. E-cigarette (Vape)	☐
3.4	How many sticks do/did you smoke (on average) per day?	Number of sticks per day	…………

3.5	What types of regular smokers you are?	1. Chain smoker 2. Light smoker	☐
3.6	How old were you when you first started smoking?	Age in years	………
3.7	Did you smoke after stroke?	1. Yes 2. No	☐
3.8	When did you stop smoking? (only for ex-smoker)	Number of days ago	………
3.9	Do/did you use any chewable/smokeless tobacco?	1. Yes 2. No	☐
3.10	If yes, then which smokeless tobacco did you use?	1. Betel leaf 2. Zorda 3. Gull 4. Sadapata/Alapata 5. Other (Specify)	☐
3.11	Have you ever consumed a drink that contains alcohol?	1. Yes 2. No	☐
3.12	If yes, then which one (more than one answer possible)	1. Wine 2. Beer 3. Energy drinks 4. Liquor 5. Not applicable 6. Other (Specify)	☐
3.13	Did you perform physical exercise?	1. Yes 2. No	☐
3.14	If yes, then how many hours in a week perform physical exercise (Approximately)	1. Less than 5 hours 2. Above 5 hours	☐

3.15	Which type of exercise did you perform?	1. Aerobic exercise 2. Anaerobic exercise	☐

Part 4: Walking speed measured by Ten Meters Walk Test

Instruction: The individual is instructed to walk a set distance (10 meters). Time is measured while the individual walks the set distance often the individual is given space to accelerate to his/her preferred walking speed (this distance is not included when determining speed). The distance covered is divided by the time it took the individual to walk that distance. Please put the time which is needed for ten meter walk-

Set of distance (10 meters)	**Time for comfortable walking speed**	**Average time for comfortable walking speed**	**Gait speed m/s**
(10 meters)	**Trail-1:**		
	Trail-2:		
	Trail-3:		

Part-5: Functional ability is measured by the Time Up and Go test (TUG):

The objects were required to stand up from an arm wheelchair, walk forward 3m, turn around, return to the chair, and sit down. The time taken to complete this task was measured with a stopwatch. No physical assistance is given.

Stand up from an armchair, walk forward 3m, turn around, return to the chair, and sit down	**Time taken by stopwatch**

Part-6: Balance related information. Balance was measured by Berg balance scale

General instructions:

Please document each task and/or give instructions as written. When scoring please record the lowest response category that applies for each item

QN	**Question**	**Response**
1.	Sitting to sanding	
2.	Standing unsupported	
3.	Sitting with back unsupported but feet supported or on a tool	

4.	Standing to sitting	
5.	Transfer	
6.	Standing unsupported with eyes closed	
7.	Standing unsupported with feet together	
8.	Reaching forward with outstretched arm while standing	
9.	Pick up object from the floor from a standing position	
10.	Turning to look behind over left and right shoulder while standing	
11.	Turn 360 degrees	
12.	Place alternate foot on step or tool while standing unsupported	
13.	Standing unsupported one foot in front	
14.	Standing on one leg	
	Total score of berg balance test	

Part-7: Activities of daily living are assessed by the Barthel Index

Choose the scoring points for the statement that most closely corresponds to the patient's current level of ability for each of the following 10 items. Record actual, not potential, functioning Information can be obtained from the patient's self-report, from a separate party who is familiar with the patient's abilities (Such as a relative), or from observation.

Activity	Score
FEEDING 0-Unable 5-Needs help cutting, spreading butter, etc. or require modified diet 10 = Independent	
BATHING 0- Dependent 5-Independent (or in shower)	
GROOMING 0-Needs to help with personal care 5-Independent face/hair/teeth/shaving (implements provided)	
DRESSING 0 - Dependent 5-Needs help but can do about half unaided 10-Independent (including buttons, zips, laces, etc.)	
BOWELS 0-Incontinent (or needs to be given enemas) 5-Occasional accident 10-Continent	
BLADDER 0-Incontinent, or catheterized and unable to manage alone 5 Occasional accident 10-Continent	

TOILET USE 0 = Dependent 5-Needs some help, but can do something alone 10-Independent (on and off, dressing, wiping)	
TRANSFERS (BED TO CHAIR AND BACK) 0Unable, no sitting balance 5-Major help (one or two people, physical), can sit 10- Minor help (verbal or physical) 15 = Independent	
MOBILITY (ON LEVEL SURFACES) 0 = Immobile or < 50 yards 5- Wheelchair independent, including corners, >50 yards 10-Walks with help of one person (verbal or physical)> 50 yards 15- Independent (but may use any aid; for example, stick)> 50 yards	
STAIRS 0-Unable 5-Needs help (verbal, physical, carrying aid) 10- Independent	
Total (0-100)	

Date………………….

Signature of Examiner………………….

Appendix- C

অনুমতি ফর্ম (বাংলা)

(অংশগ্রহণকারীদের উদ্দেশ্যে পড়ে শোনানো হবে)

অভিবাদন!

আমার নাম **খন্দকার সাদমান রাকিব**। আমি আমার **ব্যাচেলর অব সায়েন্স (বিএসসি) ইন ফিজিওথেরাপি** প্রোগ্রামের অংশ হিসেবে একটি গবেষণা পরিচালনা করছি। এই প্রোগ্রামটি **বাংলাদেশ হেলথ প্রফেশনস ইনস্টিটিউট (বিএইচপিআই)**, **মেডিসিন অনুষদ**, **ঢাকা বিশ্ববিদ্যালয়** এর অধীনে পরিচালিত। আমার গবেষণার শিরোনাম হলো: **"স্ট্রোক রোগীদের চলাচলে মোটর-ডুয়াল-টাস্ক-নির্দিষ্ট প্রশিক্ষণ এবং টাস্ক-ভিত্তিক-সার্কিট প্রশিক্ষণ প্রচলিত ফিজিওথেরাপির সাথে মিলিয়ে কার্যকারিতা নিরুপণ: একটি কোয়াসি-এক্সপেরিমেন্টাল স্টাডি"**

এই গবেষণার অংশ হিসেবে, আমি স্ট্রোক (CVA) আক্রান্ত ব্যক্তিদের **সামাজিক, আর্থিক, আচরণগত এবং জীবনযাপন সংক্রান্ত** কিছু তথ্য জানতে আগ্রহী। এ জন্য আমি আপনাকে কিছু প্রশ্ন করব। পুরো প্রক্রিয়াটি আনুমানিক **২০ থেকে ৩০ মিনিট** সময় নিতে পারে। আমি আপনাকে নিশ্চিত করছি যে, এই প্রশ্নোত্তর আপনার জন্য কোনো ক্ষতিকর বা অস্বস্তিকর পরিস্থিতি সৃষ্টি করবে না। আপনি যেসব তথ্য দেবেন সেগুলো **সম্পূর্ণ গোপনীয়ভাবে** সংরক্ষণ করা হবে এবং কোনো রিপোর্ট বা প্রকাশনায় আপনার নাম বা পরিচয় প্রকাশ করা হবে না। এই গবেষণায় অংশগ্রহণ করা **সম্পূর্ণ স্বেচ্ছামূলক**। আপনি যেকোনো সময় গবেষণা থেকে **নিজেকে প্রত্যাহার করতে পারবেন**, বা কোনো প্রশ্নের উত্তর **না-ও দিতে পারেন**। এর জন্য আপনাকে কোনো ধরণের ক্ষতির সম্মুখীন হতে হবে না। এই গবেষণায় **কোনো আর্থিক লেনদেন জড়িত নেই**।

যদি গবেষণা সম্পর্কে আপনার কোনো প্রশ্ন থাকে, তাহলে আপনি যোগাযোগ করতে পারেন: **গবেষক**: খন্দকার সাদমান রাকিব এবং আমার **সুপারভাইজার**: ফারজানা শারমিন, কনসালটেন্ট, আউট-পেশেন্ট ইনচার্জ ও প্রভাষক, বিএইচপিআই, সিআরপি, সাভার-১৩৪৩ আপনার মূল্যবান সময় এবং সহযোগিতার জন্য ধন্যবাদ।

আমার কি সাক্ষাৎকার শুরু করা যেতে পারে?

হ্যাঁ	না

অংশগ্রহণকারীর স্বাক্ষর: ....

তারিখ: ....

সাক্ষাৎকার গ্রহণকারীর স্বাক্ষর: ....

তারিখ: ....

Appendix- D

Questionnaire (বাংলা)

রোগীর তথ্য

রোগী আইডি:	☐☐☐
সাক্ষাৎকারের তারিখ:	☐☐☐☐☐☐
অংশগ্রহণকারীর নাম:	
কোড:	☐☐☐
ঠিকানা:	গ্রাম: ………………………. ডাকঘর: …………………… উপজেলা: ………………………. জেলা: ……………………….
ফোন নম্বর:	1. 2.

গবেষণা প্রশ্নমালা

গবেষণার শিরোনাম হলো:

“স্ট্রোক রোগীদের চলাচলে মোটর-ডুয়াল-টাস্ক-নির্দিষ্ট প্রশিক্ষণ এবং টাস্ক-ভিত্তিক-সার্কিট প্রশিক্ষণ প্রচলিত ফিজিওথেরাপির সাথে মিলিয়ে কার্যকারিতা নিরুপণ: একটি কোয়াসি-এক্সপেরিমেন্টাল স্টাডি”

পর্ব-১: সামাজিক ও জনসংখ্যাতাত্ত্বিক তথ্য

QN	Questions	Categories of response	Code no.
১.১	বয়স:	বছর অনুযায়ী বয়স:	☐
১.২	লিঙ্গ:	1. পুরুষ 2. নারী 3. অন্যান্য	☐
১.৩	বৈবাহিক অবস্থা:	1. বিবাহিত 2. অবিবাহিত 3. তালাকপ্রাপ্ত 4. অন্যান্য	☐
১.৪	শিক্ষার স্তর:	1. নিরক্ষর 2. প্রাথমিক 3. এস.এস.সি 4. এইচ.এস.সি 5. স্নাতক 6. স্নাতকোত্তর বা তার বেশি	☐
১.৫	বাসস্থান:	1. গ্রাম 2. আধা-শহুরে 3. শহুরে	☐
১.৬	পেশা:	1. কৃষক 2. সরকারি চাকরিজীবী 3. ব্যবসায়ী 4. দোকানদার	☐

		5. গার্মেন্টস কর্মী 6. গৃহিণী 7. বেকার 8. অন্যান্য ……………………..	
১.৭	পরিবারের ধরণ:	1. যৌথ 2. একক	☐
১.৮	পরিবারের মোট সদস্য সংখ্যা:	মোট সদস্য সংখ্যা:	☐
১.৯	উপার্জনকারী সদস্য সংখ্যা:	মোট উপার্জনকারীর সংখ্যা:	☐
১.১০	অংশগ্রহণকারীর সাধারণ স্বাস্থ্য:	1. ভালো 2. মাঝারি 3. খারাপ	☐

<u>পর্ব ২: সহ-রোগসংক্রান্ত তথ্য</u>

QN	Questions	Categories of Response	Code no.
২.১	স্ট্রোকের ধরণ:	1. ইস্কেমিক 2. হেমোরেজিক	☐
২.২	প্রভাবিত অংশ:	1. ডান 2. বাম	☐
২.৩	স্ট্রোক সময়কাল:	স্ট্রোক কত দিন/মাস/বছর আগে হয়েছে?	………
২.৪	স্ট্রোকের সংখ্যা:	1. প্রথম স্ট্রোক 2. দ্বিতীয় স্ট্রোক 3. একাধিক স্ট্রোক	☐

২.৫	নিম্নলিখিত অবস্থাগুলোর কোনটিতে আপনাকে কখনো নির্ণয় করা হয়েছে? (একাধিক উত্তর হতে পারে):	1. হৃদরোগ 2. ডায়াবেটিস মেলিটাস 3. উচ্চ রক্তচাপ 4. অ্যাজমা 5. মৃগীরোগ 6. হাইপোথাইরয়েডিজম 7. অন্যান্য ……………………….	☐

পর্ব-৩: জীবনধারার তথ্য

QN	Questions	Categories of Response	Code No.
৩.১	আপনি কি কখনো ধূমপান করেছেন?	1. হ্যাঁ 2. না	☐
৩.২	আপনি কোন ধরনের ধূমপায়ী?	1. বর্তমান ধূমপায়ী 2. মাঝে মাঝে ধূমপানকারী 3. প্রাক্তন ধূমপায়ী	☐
৩.৩	আপনি কী ধূমপান করেন/করতেন?	1. সিগারেট 2. বিড়ি 3. অন্যান্য (নির্দিষ্ট করুন) 4. ই-সিগারেট (ভ্যাপ)	☐
৩.৪	দিনে গড়ে কত স্টিক ধূমপান করেন/করতেন?	সংখ্যা:	……………
৩.৫	আপনি কোন ধরনের নিয়মিত ধূমপায়ী?	1. চেইন স্মোকার 2. লাইট স্মোকার	☐

৩. ৬	আপনি কি কোনো চিবানো/ধোঁয়াবিহীন তামাক ব্যবহার করেন/করতেন?	1. হ্যাঁ 2. না	☐
৩. ৭	যদি হ্যাঁ হয়, তাহলে কোন ধরণের তামাক ব্যবহার করেছেন?	1. পান 2. জর্দা 3. গুল 4. সাদাপাতা/আলাপাতা 5. অন্যান্য (নির্দিষ্ট করুন)	☐
৩. ৮	আপনি কি কখনো অ্যালকোহল পান করেছেন?	1. হ্যাঁ 2. না	☐
৩. ৯	যদি হ্যাঁ হয়, তাহলে কোন ধরণের পানীয় (একাধিক উত্তর হতে পারে)?	1. ওয়াইন 2. বিয়ার 3. এনার্জি ড্রিঙ্কস 4. মদ 5. প্রযোজ্য নয় 6. অন্যান্য (নির্দিষ্ট করুন)	☐
৩. ১০	আপনি কি শারীরিক ব্যায়াম করতেন?	1. হ্যাঁ 2. না	☐
৩.১১	যদি হ্যাঁ হয়, সপ্তাহে কত ঘণ্টা ব্যায়াম করতেন (প্রায়)?	1. ৫ ঘণ্টার কম 2. ৫ ঘণ্টার বেশি	☐
৩.১ ২	আপনি কোন ধরনের ব্যায়াম করতেন?	1. অ্যারোবিক ব্যায়াম 2. অ্যানেরোবিক ব্যায়াম	☐

পর্ব-৪: হাঁটার গতি – ১০ মিটার হাঁটা পরীক্ষা

নির্দেশনা:

ব্যক্তিকে নির্ধারিত দূরত্ব (১০ মিটার) হাঁটার জন্য বলা হবে। সময় পরিমাপ করা হবে যখন ব্যক্তি এই দূরত্ব অতিক্রম করবেন। হাঁটার গতির পরিমাপের আগে ব্যক্তি তার আরামদায়ক গতিতে চলা শুরু করতে পারেন, তবে সেই দূরত্ব গতি নির্ধারণে অন্তর্ভুক্ত করা হবে না।

দূরত্ব:১০ মিটার	**আরামদায়ক হাঁটার সময়:**	**গড় সময় (আরামদায়ক হাঁটার):**	**হাঁটার গতির হার (মিটার/সেকেন্ড):**
১০ মিটার	1. প্রথম পরীক্ষা : 2. দ্বিতীয় পরীক্ষা: 3. তৃতীয় পরীক্ষা:		

পর্ব-৫: কার্যকরী সক্ষমতা নিরূপণ – টাইমড আপ অ্যান্ড গো (TUG) টেস্ট

নির্দেশনা:

ব্যক্তিকে একটি আর্ম চেয়ার থেকে দাঁড়াতে বলা হবে, সামনে ৩ মিটার হাঁটতে, ঘুরে আসতে এবং চেয়ারে আবার বসতে বলা হবে। এই পুরো কাজটি সম্পন্ন করতে যত সময় লাগবে তা স্টপওয়াচ দিয়ে মাপা হবে। শারীরিক সাহায্য দেওয়া যাবে না।

চেয়ার থেকে দাঁড়ান, ৩ মিটার সামনে হাঁটুন, ঘুরুন, চেয়ারে ফিরে বসুন।	**পরিমাপ: সেকেন্ড**

পর্ব-৬: ভারসাম্য সংক্রান্ত তথ্য – বার্গ ব্যালেন্স স্কেল দ্বারা পরিমাপ

সাধারণ নির্দেশনা:

প্রতিটি কাজ ডকুমেন্ট করুন এবং/অথবা নির্ধারিত নির্দেশনা দিন। স্কোর করার সময় প্রতিটি আইটেমের জন্য প্রযোজ্য সর্বনিম্ন প্রতিক্রিয়া ক্যাটাগরি রেকর্ড করুন।

QN	Question	Response
1.	বসা থেকে দাঁড়ানো	
2.	দাঁড়িয়ে থাকা (সাপোর্ট ছাড়া)	
3.	পিছনে সাপোর্ট ছাড়া বসা, পা মাটিতে রাখা	
4.	দাঁড়ানো থেকে বসা	
5.	স্থানান্তর (চেয়ার থেকে অন্য জায়গায় যাওয়া)	
6.	চোখ বন্ধ অবস্থায় দাঁড়িয়ে থাকা	
7.	পা একসঙ্গে রেখে দাঁড়িয়ে থাকা	
8.	সামনে হাত বাড়িয়ে বস্তু ধরা (দাঁড়ানো অবস্থায়)	
9.	ফ্লোর থেকে বস্তু তুলুন (দাঁড়ানো অবস্থায়)	
10.	বাঁ ও ডান কাঁধের উপর ঘুরে তাকানো (দাঁড়ানো অবস্থায়)	
11.	৩৬০ ডিগ্রি ঘুরুন	
12.	পায়ের সাপোর্ট ছাড়াই বিকল্পভাবে স্টেপে পা রাখা	
13.	এক পা অন্য পায়ের সামনে রেখে দাঁড়ানো	

14.	এক পায়ে দাঁড়ানো	
	মোট স্কোর:	

পর্ব-৭: দৈনন্দিন জীবন কার্যকলাপ নিরূপণ – বার্থেল ইনডেক্স দ্বারা

নির্দেশনা:

রোগীর বর্তমান ক্ষমতার ভিত্তিতে নীচের বিবৃতি থেকে সবচেয়ে প্রাসঙ্গিক স্কোর নির্বাচন করুন। তথ্য রোগীর আত্মপ্রতিবেদন, পরিচিত ব্যক্তির সাক্ষ্য, বা পর্যবেক্ষণ থেকে নেওয়া যেতে পারে।

Activity	Score
খাওয়া: ০ = অক্ষম ৫ = সহায়তা প্রয়োজন ১০ = স্বাধীন	
গোসল করা: ০ = নির্ভরশীল ৫ = স্বাধীন	
পরিচ্ছন্নতা: ০ = ব্যক্তিগত যত্নে সাহায্য প্রয়োজন ৫ = স্বাধীন	
পোশাক পরা: ০ = নির্ভরশীল ৫ = কিছুটা সাহায্য প্রয়োজন ১০ = স্বাধীন	
মলত্যাগ: ০ = অক্ষম ৫ = মাঝে মাঝে দুর্ঘটনা ঘটে ১০ = নিয়ন্ত্রণে	

মূত্রত্যাগ: ০ = অক্ষম ৫ = মাঝে মাঝে দুর্ঘটনা ঘটে ১০ = নিয়ন্ত্রণে	
টয়লেট ব্যবহার: ০ = নির্ভরশীল ৫ = আংশিক সাহায্য প্রয়োজন ১০ = স্বাধীন	
স্থানান্তর (বিছানা থেকে চেয়ারে): ০ = অসম্ভব ৫ = বড় সাহায্যের প্রয়োজন ১০ = সামান্য সাহায্যের প্রয়োজন **১৫ = স্বাধীন**	
মোবিলিটি (সমতল পৃষ্ঠে): ০ = স্থবির ৫ = হুইলচেয়ার স্বাধীন ১০ = সাহায্য নিয়ে হাঁটা ১৫ = স্বাধীন	
সিঁড়ি বেয়ে ওঠা: ০ = অসম্ভব ৫ = সাহায্য প্রয়োজন ১০ = স্বাধীন	
মোট স্কোর: (০-১০০)	

তারিখ………………….

পরীক্ষকের স্বাক্ষর: ……………………….

Appendix – E

IRB Approval Letter

SERVICE IS A VIRTUE · BHPI

BANGLADESH HEALTH PROFESSIONS INSTITUTE

বাংলাদেশ হেলথ্ প্রফেশন্স ইনস্টিটিউট (বিএইচপিআই)

Bangladesh Health Professions Institute (BHPI)

(The Academic Institute of CRP)

Ref: CRP-BHPI/IRB/12/2024/1046 *Date:* 15/12/2024

To
Khandokar Sadman Rakib
4th Year B.Sc. in Physiotherapy
Session: 2019-2020, Student ID: **112190526**
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: Approval of the thesis proposal "Effectiveness Between Motor-Dual-Task-Specific Training and Task-Oriented-Circuit Training Along with Conventional Physiotherapeutic Intervention in Ambulation of Stroke Patients: A Quasi-Experimental Study" by ethics committee.

Dear Sadman,
Congratulations!
The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application to conduct the above-mentioned thesis, with yourself, as the principal investigator and Farjana Sharmin Lecturer of BHPI, Consultant & OPD In-charge Department of Physiotherapy, CRP, Savar, Dhaka-1343, as thesis supervisor. The following documents have been reviewed and approved:

Sl. No.	Name of the Documents
1	Thesis Proposal
2	Questionnaire (English & Bengali version)
3	Information sheet & consent form.

The purpose of the study is to explore the effectiveness of motor-dual-task specific training and task-oriented circuit training along with conventional physiotherapy on ambulatory abilities for patients with stroke. The study involves the use of a 10-meter walk test (10MWT), Time up and go (TUG) and Berg balance scale (BBS) Other related information will be collected from the stroke and participant-related socio-demographic questionnaire that may take 20 to 30 minutes to answer. Any instruction or precaution for the collection of specimens and there is no likelihood of any harm to the participants and participation in the study may benefit the participants. The members of the Ethics Committee have approved the study to be conducted in the presented form at the meeting held at 9 AM on 15th July 2024 at BHPI (44th IRB Meeting).

The institutional Ethics committee expects to be informed about the progress of the study, any changes occurring in the course of the study, any revision in the protocol and student information or informed consent and ask to be provided with a copy of the final report. This Ethics committee is working in accordance with the Nuremberg Code 1947, the World Medical Association Declaration of Helsinki, 1964 - 2013 and other applicable regulations.

Best regards,

Muhammad Millat Hossain
Associate Professor & Course Coordinator, MRS
Member Secretary, Institutional Review Board (IRB)
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

সিআরপি-চাপাইন, সাভার, ঢাকা-১৩৪৩, বাংলাদেশ। ফোন: +৮৮ ০২ ২২৪৪৪৫৪৬৪-৫, +৮৮ ০২ ২২৪৪৪১৪০৪, মোবাইল: +৮৮ ০১৭৩০ ০৫৯৬৪৭
CRP-Chapain, Savar, Dhaka-1343, Bangladesh. Tel: +88 02 224445464-5, +88 02 224441404, Mobile: +88 01730059647
E-mail : principal-bhpi@crp-bangladesh.org, Web: bhpi.edu.bd

Appendix- F

IRB Application form

Date: 03·10·2024

The Chairman

Institutional Review Board (IRB)

Bangladesh Health Professions Institute (BHPI)

CRP-Savar, Dhaka-1343, Bangladesh

Subject: Application for review and ethical approval.

Sir,

With due respect, I would like to state that I am a student of 4th professional, B. Sc in Physiotherapy at Bangladesh Health Professions Institute. I want to conduct a dissertation titled, **"Effectiveness Between Motor-Dual-Task-Specific Training and Task-Oriented-circuit Training Along with Conventional Physiotherapeutic Intervention in Ambulation of Stroke Patients: A Quasi-Experimental Study"** with myself, as the principal investigator and Farjana Sharmin, Lecturer of BHPI, Consultant & OPD In-charge Department of Physiotherapy BHPI, CRP, Savar, Dhaka-1343, Bangladesh, as my supervisor. The purpose of this study is to explore the effectiveness of motor-dual-task specific training and task-oriented circuit training along with conventional physiotherapy on ambulatory abilities for patients with stroke.

10-meter walk test (10MWT), Time up and go (TUG), Berg balance scale (BBS), will be used in the study which will take about 20 to 30 minutes. Other related information will be collected from the stroke and participant-related socio-demographic questionnaire. Data collectors will receive informed consent from all participants. Any data collected will be kept confidential.

Therefore, I look forward to having your approval for the thesis proposal and to start data collection. I also assure you that I will meet all the requirements for my study.

Sincerely yours,

Sadman Rakib

Khandokar Sadman Rakib

4th Year B.Sc. in Physiotherapy

Session: 19-20 Student ID: 112190526

Recommendation from the thesis supervisor:

Farjana Sharmin

Farjana Sharmin

Lecturer of BHPI, Consultant & OPD In-charge

Department of Physiotherapy

BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Appendix- G

Permission letter

Date: 19-01-2025

Head

Department of Physiotherapy

Centre for the Rehabilitation of the Paralyzed (CRP)

Chapain, Savar, Dhaka-1343

Through: Head, Department of Physiotherapy, BHPI.

Subject: Prayer for seeking permission to collect data for conducting a research project.

Sir,

With due respect and humble submission, I state that I am Khandokar Sadman Rakib, a student in the 4th year B.Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI). The Ethical committee has approved my research project entitled: **"Effectiveness Between Motor-Dual-Task-Specific Training and Task-Oriented-circuit Training Along with Conventional Physiotherapeutic Intervention in Ambulation of Stroke Patients: A Quasi-Experimental Study"** under the supervision of Farjana Sharmin, Lecturer of BHPI, Consultant & OPD In-charge Department of Physiotherapy BHPI, CRP, Savar, Dhaka-1343, Bangladesh. I want to collect data for my research project from the Department of Physiotherapy at CRP. So, I need permission for data collection from the Neurology and SRU Unit of the Physiotherapy Department at CRP-Savar, Dhaka-1343. I would like to assure you that nothing in the study will be harmful to the participants or the department itself.

I, therefore pray and hope that you would be kind enough to grant my application and give me permission for data collection and oblige thereby.

Forwarded

Dr. Shazal Kumar Das, PhD
Assistant Professor and Head
Department of Physiotherapy
BHPI, CRP, Savar, Dhaka-1343.

Yours faithfully,

Sadman Rakib

Khandokar Sadman Rakib

4th Year B.Sc. in Physiotherapy

Class Roll: 39; Session: 2019-20

Bangladesh Health Professions Institute (BHPI)

(An academic Institution of CRP)

CRP-Chapain, Savar, Dhaka-1343.

Prof. Dr. Mohammad Anwar Hossain, PhD
Professor Physiotherapy Department BHPI
Senior Consultant & Head
Physiotherapy Department
CRP, Savar, Dhaka-1343

19/01/25

Rumana

Farjana Sharmin
Consultant- Physiotherapy & OPD In-charge
Physiotherapy Department
CRP Savar, Dhaka-1343