PREVALENCE OF BALANCE IMPAIRMENT AMONG STROKE SURVIVORS

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ABSTRACT

Background: Balance impairment is characterized by inability to maintain balance, reduced mobility and is associated with physical limitations and reduced quality of life. The main cause of stroke is associated with ischemia or hemorrhage. The risk factors include gender, age, race/ethnicity, genetics, diabetes, hypertension, high cholesterol, alcohol use, coronary artery disease, myocardial infarction etc.

Objective of the study: The main objective of my study was to find out prevalence of balance impairment among stroke survivors in Lahore.

Materials & Methods: It was a cross-sectional study which was conducted among stroke survivors with age ranging from 29-89 years. In this study, 365 participants were included. Data was gathered by using Berg Balance scale (BBS) to evaluate the prevalence of balance impairment among stroke survivors in Lahore from those individuals who can follow movement instructions given in Berg Balance Scale (BBS). Patient with orthopedic problems, neurological problems and bilateral stroke were excluded.

Results: Out of 365 stroke survivors, balance impairment was present in 119 (32.6%) of stroke survivors, 186 (51.0%) of people had acceptable balance, while 60 (16.4%) had good balance.

Conclusion: I concluded that about one-third stroke survivors exhibited balance impairment and more than half of patients had acceptable balance when assessed with Berg Balance scale (BBS).

Keywords: Activities of Daily Living (ADL), Balance impairment, Berg Balance scale (BBS), Timed Up and Go (TUG), Get Up and Go (GUG), and Quality of life scale (QOLs).

CHAPTER 1

INTRODUCTION

Balance impairment is characterized by inability to maintain balance, reduced mobility and is associated with physical limitations and reduced quality of life. This condition causes patients to develop muscle weakness, weight shifting difficulties and coordination issues. Balance impairment is most common factor among stroke survivors. Balance impairment leads to decreased participation in activities, increased chances of fall injuries and fractures. The contributing factors to impaired balance combine with stroke severity include age, gender, post-stroke duration and reduced activity and absence of physiotherapy care (Gobezie et al., 2024).

Stroke is defined as focal injury to the central nervous system caused by the rapid rupture or blockage of a blood vessel, preventing blood flow to the brain and resulting in neurological dysfunction (Li et al., 2024). Stroke is the second most common cause of death globally, and post-stroke balance impairment is associated with muscle weakness, weight shifting difficulties and coordination issues. The age, gender, and duration of post-stroke recovery all appear to have significant effects on post-stroke balance impairment. Although various studies on stroke rehabilitation have been conducted, there are still gaps in our understanding of balance impairments and associated factors (Kossi et al., 2021).

Hemorrhagic and ischemic stroke are the two forms of stroke. Ischemic stroke occur due to reduced blood supply to brain and accounts for almost 80% of cases (Zhao et al., 2023). About 20% of strokes are hemorrhagic stroke (Montaño et al., 2021). A ruptured blood vessel serves as the primary cause of hemorrhagic stroke. The two types of hemorrhagic stroke include subarachnoid hemorrhage (SAH) and intracerebral hemorrhage (Unnithan and Mehta, 2020).

The pathophysiology of stroke is characterized by a sudden disturbance of neurological activity due to compromised blood vessel that supplies the brain with oxygen. Ischemic occlusion within the brain creates either thrombotic or embolic pathological events. Blood vessel constriction because of atherosclerosis leads to decreased blood flow during the thrombosis process. Plaque accumulation eventually causes a clot formation along with blood vessel narrowing which leads to thrombotic

stroke. In hemorrhagic stroke blood vessels burst due to the combination of internal trauma and brain tissue stress. As a result, tissue infarction occurs which causes vascular system to become toxic (Kuriakose and Xiao, 2020).

According to recent studies the incidence of ischemic stroke and hemorrhagic stroke across the globe were 11.6 million. In which 63% of ischemic stroke and 80% of hemorrhagic stroke were reported. In 2016, the incidence of new stroke cases increased to 13.7 million. Worldwide stroke caused over 5.5 million patient deaths in that particular year (Saini et al., 2021). Furthermore, from 2020 to 2030, there will be an increase in the incidence of ischemic stroke in all age groups and sexes according to the global trend project (Lee et al., 2023).

The main cause of stroke is associated with ischemia or hemorrhage. The onset of an ischemic stroke is a common event that can result in thrombosis, thromboembolism, or atherosclerotic plaque formation. Atherosclerosis is the cause of stroke or cerebral infarction in 60% of cases. High blood pressure is one of the main cause of hemorrhagic stroke. The permeability of artery walls changes as a result of arterial hypertension leading to bleeding, necrosis and infarction. A cavity filled with blood or swelling of the brain tissue that develops into a cyst could be present (Gavrilyuk et al., 2018).

Stroke risk factors are categorized in two groups that include modifiable and non-modifiable factors. The non-modifiable risk factors for stroke include gender, age, race\ethnicity or genetics, Diabetes, hypertension, high cholesterol, alcohol use, coronary artery disease, myocardial infarction, thrombus formation, cigarette smoking, and obesity are all modifiable risk factors (Murphy and Werring, 2020).

The symptoms of stroke include motor deficits, mental status changes, generalized weakness, lack of coordination, speech difficulty, loss of consciousness, dizziness, gait disturbance, balance impairment and one sided sensory loss. These patients also face other problems like difficulty in performing activities of daily living (Shajahan et al., 2023). They face difficulty in performing daily tasks including eating, dressing, bathing, cooking and cleaning. They may find it more difficult to move around and reintegrate into society as a result, which increases the likelihood that they won't engage in physical activity (Honado et al., 2023).

The prevalence of physical inactivity is high among stroke survivors thus exercise

training produces favorable outcomes. Thus, it is proven that stroke patients often experience environmental obstacles that could interrupt their ability to properly integrate into their communities (Atigossou et al., 2023). Patients who have a stroke face issues related to quality of life, mental and physical health, and limitations in motor, sensory, and communication abilities. Patients who have cognitive dysfunction face challenges in balance control along with an increased possibility of sustained falls. Cognitive disorder also have effects on balance (Khan and Chevidikunnan, 2021).

Disabilities of balance are common in stroke victims. Berg Balance Scale (BBS) is helpful to assess balance impairment among stroke survivors (Tamura et al., 2022). Balance impairment is frequently present in stroke survivors, which has a major influence on their quality of life, employment and rehabilitation care. Their balance impairment is often assessed using the Berg Balance Scale (BBS) to determine their estimated recovery and create a rehabilitation strategy (WANG et al., 2024).

Treatment options include medical treatment and rehabilitation. In medical treatment, anti-thrombotic, anti-platelet therapy and arteriovenous thrombectomy are the principal treatments for stroke. The short therapeutic window and high risk of hemorrhagic transformation mean that only a small number of patients may receive successful treatment,and most of them develop neurological impairment, which puts a significant burden on families and society (Zhao et al., 2023).

Rehabilitation can be approached in a variety of ways. Standard interdisciplinary teams in stroke care hospitals include doctors with registered nurses as well as physiotherapists, occupational therapists, speech therapists and nutritionists. Physiotherapists concentrate on correct positioning and early mobilization for stroke patients, whereas occupational therapists focus on gaining daily tasks like grooming and dressing with the help of assistive devices. The goal of post-stroke rehabilitation is to help patients to deal with limitations associated with stroke. The regular and effective communication of team members with the patient is essential for appropriate recovery. Professionals can utilize their individual knowledge to ensure efficient communication within the team. Reducing stroke risk factors is a main aim for stroke rehabilitation (e.g., by treating and managing comorbidities like hypertension). The prevention and treatment of problems frequently associated with strokes is another objective. It is important to educate family about risk factors, effects and

rehabilitation of strokes. Patients who experience malnourishment due to swallowing difficulties may be unable to properly express their dietary requirements. Engaging with all aspects of therapeutic activities are proven to be difficult for patients who suffer from malnutrition because they lack sufficient energy and mental clarity (Whitehead and Baalbergen, 2019).

1.1 Rationale of the study:

The rationale of my study was to create awareness among stroke survivors regarding balance impairment so they can prevent themselves from risk of fall and can perform their Activities of daily living.

1.2 Objective of the study:

The objective of my study was to find out the prevalence of balance impairment among stroke survivors.

CHAPTER 2

LITERATURE REVIEW

Gobezie et al. 2024 did a cross-sectional study on balance impairment and associated factors among stroke survivors in public hospitals of Amhara regional state. They took 400 stroke survivors and found that 51.5% of them had balance impairment (Gobezie et al., 2024).

Saraiva et al. carried out a study in 2023 on balance rehabilitation for stroke survivors and used extensive scoping assessment of experimental research. The literature research conducted in PubMed, Scopus,and Web of Science yielded 25 articles between 2013 and 2023 were included. The Timed Up and Go test together with the Berg Balance Scale were widely used instruments for balance impairment assessment. The study revealed that balance impairment develops frequently after stroke while also increasing fall risks and generating both falling fears and degraded lifestyle quality. Balance impairment affected around half of stroke survivors. The study provided evidence that balance training programs were an effective rehabilitation strategy, in addition to highlighting the need for treating balance impairment in post-stroke rehabilitation (Saraiva et al., 2023).

Nindorera et al. conducted a research in 2022 on the relationship between walking speed, activities and participation in people with chronic stroke survivors were included in this cross-sectional study. Quantitative assessments included the Berg balance scale together with the activity limitation stroke scale and the participation measurement scale and the 10-meter walk test and walking speed for measuring walking speed and balance as well as activities of daily living and social involvement. Research participants received Perry classification to establish their walking speed ability using three distinctive groups: household ambulation and full-community ambulation and limited ambulation. It was concluded that our study included fifty-eight people who had suffered persistent stroke. The majority of subjects suffered from severe imbalance. Walking pace have a weak correlation with activity of daily living and a substantial correlation with balance, but not with participation level (Nindorera et al., 2022).

Armat et al. conducted a mirror therapy using randomized clinical trial study was

performed for post stroke balance impairment treatment optimization in older adults during 2022.Two groups were selected the control and the intervention group. Balance exercises using mirror treatment were given to the intervention group while the control group performed the identical exercises using a non-reflective plate in place of motion therapy. The Berg balance scale was used to measure the balance score. The findings demonstrated that balance exercises in conjunction with mirror treatment were considerably more successful in restoring balance in stroke patients than balance exercises alone (Armat et al., 2022).

Khan and Chevidikunnan et al. conducted a longitudinal analysis by the researcher was conducted in 2021 to examine both incidence and associated factors among patients. The research investigates balance impairment and its associated factors among stroke patients. Eighty-one stroke patients participated and Kelsey's approach was used to determine the sample. The Berg balance scale (BBS) was utilized to evaluate the patients for other characteristics, such as balance.Participants' age ranged from 25 to 94 years old. Approximately half of stroke patients also hadbalance issues; female patients are more likely to require walking assistance and have strength issues. Stroke patients demonstrated that the combination of ankle dorsiflexion strength with knee flexion strength and knee extension strength as well as speed alongside depression levels and activities of daily living and walking assistance prove crucial for their balance function (Khan and Chevidikunnan, 2021).

Kossi et al. conducted a cross-sectional study on adult stroke survivors in 2021. After being discharged, stroke survivors were enrolled in the University Hospital of Parakou from January 1, 2020, until September 30, 2020. The Timed Up and Go (TUG), Get Up and Go (GUG), and Berg Balance Scale (BBS) tests were used to measure deficits in balance. There were 54 stroke survivors in total. They concluded that balance problems affected nearly one fourth of stroke survivors at the University Hospital of Parakou following their discharge. Balance impairments had a strong correlation with the length of time after the stroke, the degree of disability, and the number of physiotherapy sessions (Kossi et al., 2021).

Kossi et al. 2021 did a cross-sectional investigation on balance impairment among stroke survivors in northern Benin. In this study, they concluded that balance issues impacted roughly one-fourth of stroke survivors at the university hospital of Parakou after their discharge (Kossi et al., 2021).

Deshmuk and Chitra et al. carried out randomized control trial study in 2020 on major research evaluated the impact of Libra Balance Board physical activities compared to Pilates exercises for stroke patients on dynamic balance performance together with gait ability and quality of life quality. This study included 34 participants, 17 in each group, who had subacute and chronic strokes and were between the ages of 40 and 65. The Berg Balance Scale (BBS), Researchers utilized Dynamic Gait Index together with Activity-specific Balance Confidence Scale and Stroke-specific Quality of Life Scale to assess patients before and after four weeks of measurement. Throughout the course of four weeks, the intervention consisted of five sessions per week of thirty-minute Pilates and Libra balancing board exercises. The study found that improving dynamic balance, gait, and quality of life in individuals with subacute and chronic stroke may be achieved by the use of both Pilates exercises and Libra balancing board exercises (Deshmuk and Chitra, 2020).

Madhuranga et al. conducted a randomized control study in 2019 on stroke victims who improved balance with wobble board activities. Thirty patients were assigned at random to the interventionand control groups. One patient withdraw from the research, leaving 29 individuals fit for analysis. Following a six-week period, a reassessment demonstrated a distinction in balance between the two research groups. Compared to the control group, the mean balance score of the intervention group increased more. No one was hurt in any group. They concluded that when combined with conventional physiotherapy, wobble board exercises were a safe and effective technique to regain functional balance in people who have hemiplegia following ischemic stroke (Madhuranga et al., 2019).

Gorst et al. conducted a survey in 2019 to analyze somatosensory impairment effects on walking performance and balance together with fall statistics using incident and efficacy scales to evaluate lower limb somatosensory impairments in individuals who suffered a stroke. They concluded that the majority of chronic stroke patients had somatosensory impairments in their lower limbs that variedwidely between modalities. Although they were not predictive, proprioception impairments in the feet and ankles were most strongly associated with reported falls. In chronic stroke survivors, lower limb somatosensory impairments appeared to have an effect on mobility. Particularly in light of falls and community mobility, more research is required (Gorst et al., 2019).

Arabzadeh et al. studied the effects on post-stroke hemiplegic patients of a task-oriented exercise program in 2018. This was a randomized clinical trial that was conducted from October 2015 to January 2016. For this investigation, the Berg Balance Scale was employed. Ten members of the experimental group and ten members of the control group were randomly assigned to each of the twenty Iranian patients who had experienced a stroke and were left hemiplegic. A 4-week task-oriented exercise program served as the intervention for subjects in the experimental group whereas traditional physiotherapy therapy was given to participants in the control group during the 4-week period. The researchers evaluated participants before starting exercises and directly following them. The Berg Balance Scale (BBS) was one of the clinical evaluations. After the intervention, the BBS, center of pressure area, and center of pressure path length of the experimental group all significantly improved in comparison to the control group (Arabzadeh et al., 2018).

Xu et al. carried out a study in 2018 on the risk factors for falls in stroke victims. Before the review started, a protocol for a systematic review was created. They came to the conclusion that stroke survivors were more likely to fall if they had balance and mobility issues, require assistance with self-care, take sedative or psychotropic drugs, have cognitive impairment, are depressed or have a history of falling. All of the task oriented risk factors aside from a history of falls could be addressed with treatments. Future studies on fall prevention strategies for community stroke survivors should take these modifiable risk variables into account, as per our recommendation because post-stroke patients were affected by community fall risk factors (Xu et al., 2018).

Middleton et al. conducted a longitudinal study in 2017 on how people with chronic strokes' capacity to walk faster is limited by balance impairment. The Berg Balance Scale (BBS), a practical and trustworthy instrument for assessing balance in stroke survivors, was employed in this investigation.

The study includes patients who had chronic strokes. They concluded that balance appears to play a major role in the inability of those with chronic strokes to raise walking speed on demand. People who had a Berg balance Score of 47 points may benefit from balance therapies to enhance their capacity to boost their walking speed (Middleton et al., 2017).

To the best of our knowledge, a significant body of research has been done on the

prevalence of balance impairment among stroke survivors. However, there may still be literature gaps that need to be filled. The potential literature gap is lack of studies that specifically focus on the prevalence of balance impairment among post-stroke patients in certain regions or countries.

For example, the majority of research on balance impairment performed in Nigeria creates an inconsistent picture when analyzing prevalence across different global regions. The primary goal of this investigation was to determine the level of balance disturbance among stroke-outpatients throughout Lahore. This study provides awareness to improve balance impairment and other risk factors among post-stroke patients. It also helps to enhance the patient's quality of life and to decrease the impact of psychological issue related diseases on the person personality and work related tasks.

CHAPTER 3

MATERIALS & METHODS

3.1 Study Design:

A cross-sectional observational study was used.

3.2 Duration of Study:

This study was completed within six months after approval of synopsis.

3.3 Study Settings:

The study was conducted on stroke survivors admitted in different Government and Private hospitals of Lahore i.e. Mayo hospital Lahore, General hospital, Shalimar hospital, Services hospital Lahore, Jinnah hospital, Ghurki hospital, Sheikh Zaid Hospital, Nawaz Sharif Hospital, Sehat medical complex, Pakistan Society for the Rehabilitation of the Disabled (PSRD) and Mukhtaran Rafique Hospital.

3.4 Sample Size:

The sample size was calculated by using the following formula through WHO online calculator.

$$n = \frac{z^2_{1-\alpha/2} P(1-P)}{d^2}$$

Where,

Z = Standard normal distribution level corresponding to desired Confidence Level (Z=1.96 for 95% CL)

P is anticipated population proportion = 0.61

d is absolute precision = 0.05

Confidence Interval (CI) = 5%

By putting these values, the sample size =365

3.5 Sampling technique:

The sampling technique was Non- Probability Convenience sampling.

3.6 Data Collection Tool:

The Berg Balance Scale (BBS) was used and has 14 questions. Each question has 0-4 scoring. The score was calculated as the sum of the numbers that correspond to the severity levels identified in each category.

0-20	Balance impairment
21-40	Acceptable Balance
41-56	Good Balance

3.7 Sample Selection:

3.7.1 Inclusion criteria:

- Age range 29-89 years (Smit et al., 2023).
- Hemiparetic patients diagnosed by CT scan or MRI (included both ischemic and hemorrhagic type, with either side involved).
- Male and female.
- Patient who can follow simple movement instructions contained in BBS and sign consent form (Khan and Chevidikunnan., 2021).

3.7.2 Exclusion criteria:

- Patient with different orthopedic conditions (e.g. knee surgery, amputation etc) that impair balance.
- Patient with bilateral stroke.
- Patient with neurological problem (etc., Parkinson's disease, multiple sclerosis) other than stroke that impair balance.

3.8 Data Collection Procedure:

Data was collected by using Berg Balance Scale (BBS) from different Government and Private hospitals of Lahore i.e. Mayo hospital Lahore, General hospital, Shalimar hospital, Services hospital Lahore, Jinnah hospital, Ghurki hospital, Sheikh Zaid Hospital, Nawaz Sharif Hospital, Sehat medical complex, Pakistan Society for the Rehabilitation of the Disabled (PSRD) and Mukhtaran Rafique Hospital to determine the balance impairment among post-stroke patients.

3.9 Data Analysis:

To analyze data SPSS-24 was used.

CHAPTER 4

RESULTS

Descriptive statistics

Table 1.0: Statistics of age

N	365
Minimum	32.00
Maximum	84.00
Mean	56.4740
Standard deviation	12.688

Table 1.1: Frequency of age

	Frequency	Percent	Valid Percent	Cumulative Percent
32.00	15	4.1	4.1	4.1
34.00	2	.5	.5	5.8
35.00	5	1.4	1.4	7.1
36.00	4	1.1	1.1	8.2
37.00	8	2.2	2.2	10.4
38.00	6	1.6	1.6	12.1
39.00	4	1.1	1.1	13.2
40.00	6	1.6	1.6	14.8
41.00	1	.3	.3	15.1
42.00	12	3.3	3.3	18.4
43.00	2	.5	.5	18.9
44.00	2	.5	.5	19.5
45.00	12	3.3	3.3	22.7
46.00	5	1.4	1.4	24.1
47.00	1	.3	.3	24.4
48.00	4	1.1	1.1	25.5
49.00	3	.8	.8	26.3
50.00	21	5.8	5.8	32.1
51.00	1	.3	.3	32.3
52.00	13	3.6	3.6	35.9
53.00	6	1.6	1.6	37.5
54.00	5	1.4	1.4	38.9
55.00	24	6.6	6.6	45.5
56.00	8	2.2	2.2	47.7
57.00	3	.8	.8	48.5
58.00	16	4.4	4.4	52.9
59.00	6	1.6	1.6	54.5
60.00	28	7.7	7.7	62.2
61.00	3	.8	.8	63.0
62.00	7	1.9	1.9	64.9
63.00	7	1.9	1.9	66.8
64.00	6	1.6	1.6	68.5
65.00	30	8.2	8.2	76.7
66.00	9	2.5	2.5	79.2
67.00	2	.5	.5	79.7
68.00	8	2.2	2.2	81.9
70.00	21	5.8	5.8	87.7
71.00	1	.3	.3	87.9
72.00	7	1.9	1.9	89.9

73.00	4	1.1	1.1	91.0
74.00	3	.8	.8	91.8
75.00	8	2.2	2.2	94.0
76.00	6	1.6	1.6	95.6
77.00	4	1.1	1.1	96.7
78.00	2	.5	.5	97.3
80.00	6	1.6	1.6	98.9
81.00	1	.3	.3	99.2
82.00	1	.3	.3	99.5
83.00	1	.3	.3	99.7
84.00	1	.3	.3	100.0
Total	365	100.0	100.0	

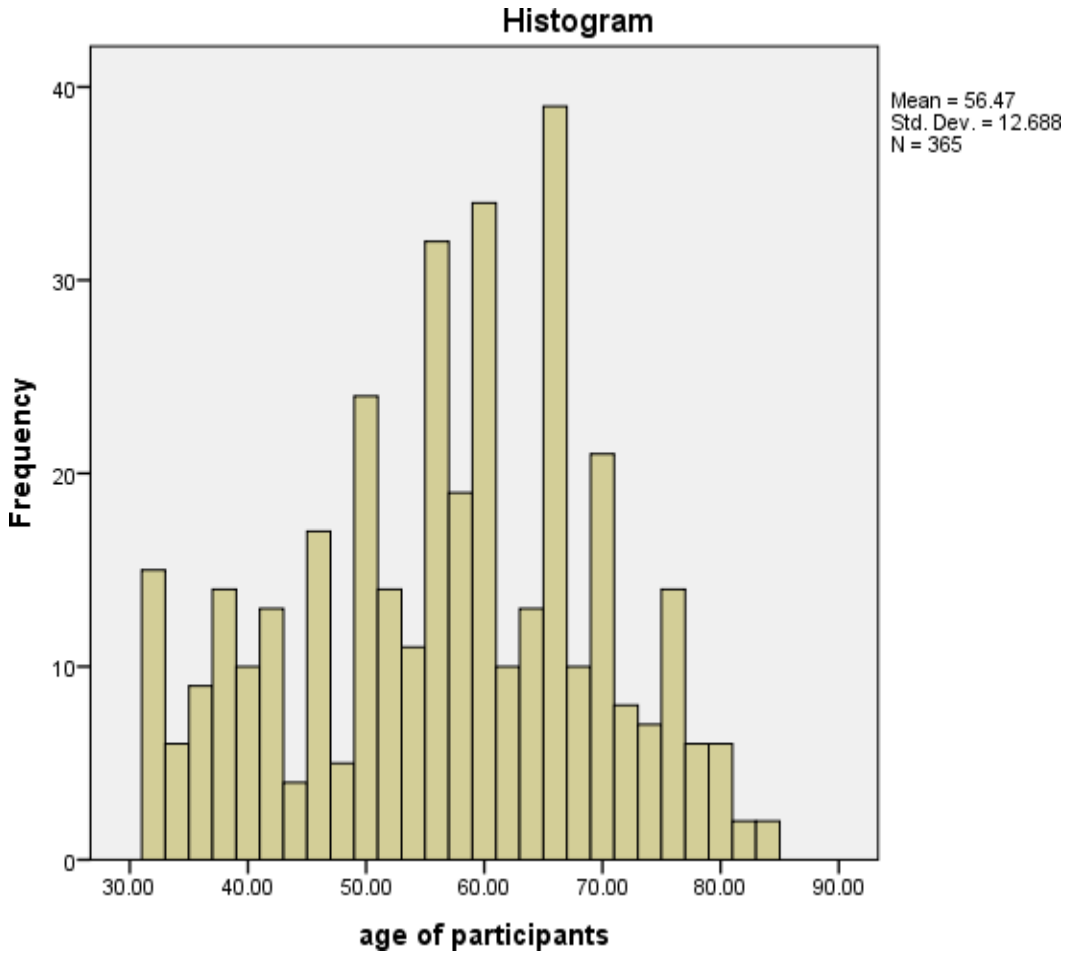

Figure 1.1 Shows that there were 365 participants in my study. Their mean age was 56.47 and the standard deviation was 12.688. The participants minimum age was 32 and maximum age was 84.

Table 1.2: Gender of participants

	Frequency	Percent	Valid Percent	Cumulative Percent
female	175	47.9	47.9	47.9
male	190	52.1	52.1	100.0
Total	365	100.0	100.0	

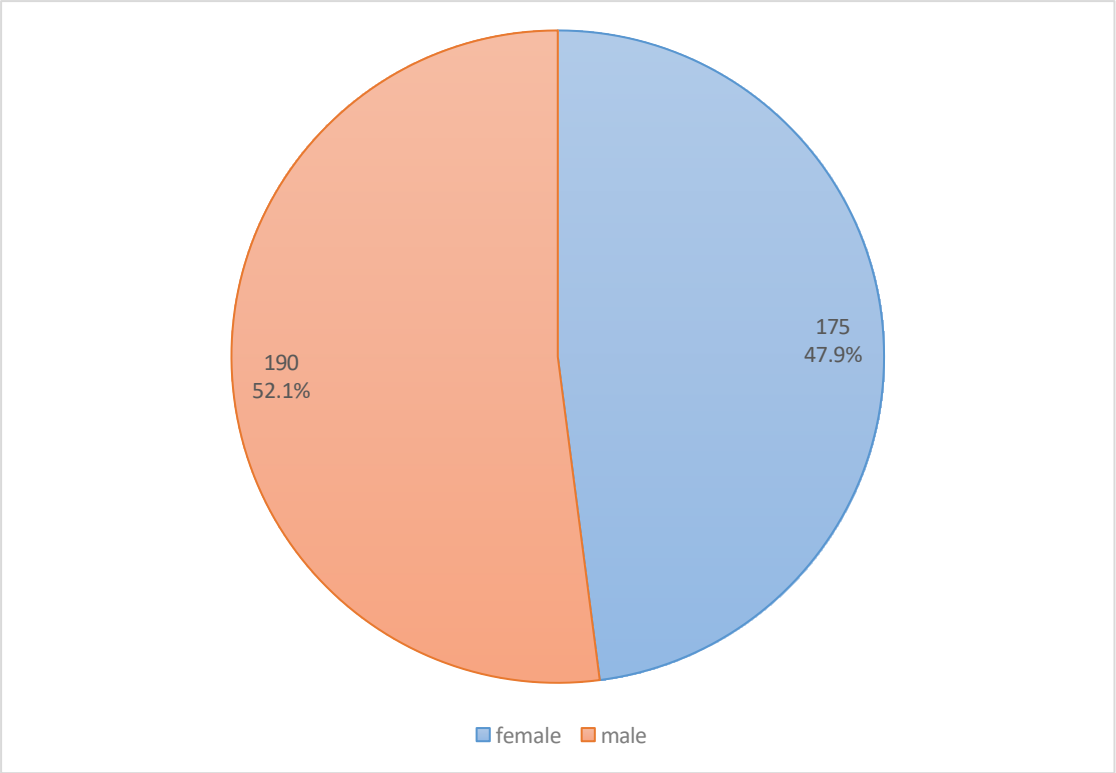

Figure 1.2: Gender of participants

Figure 1.2 Shows that out of 365 participants, there were 190(52.1%) males and 175(47.9%) females.

Table 1.3: Phases of stroke

	Frequency	Percent	Valid Percent	Cumulative Percent
acute	186	51.0	51.0	51.0
chronic	179	49.0	49.0	100.0
Total	365	100.0	100.0	

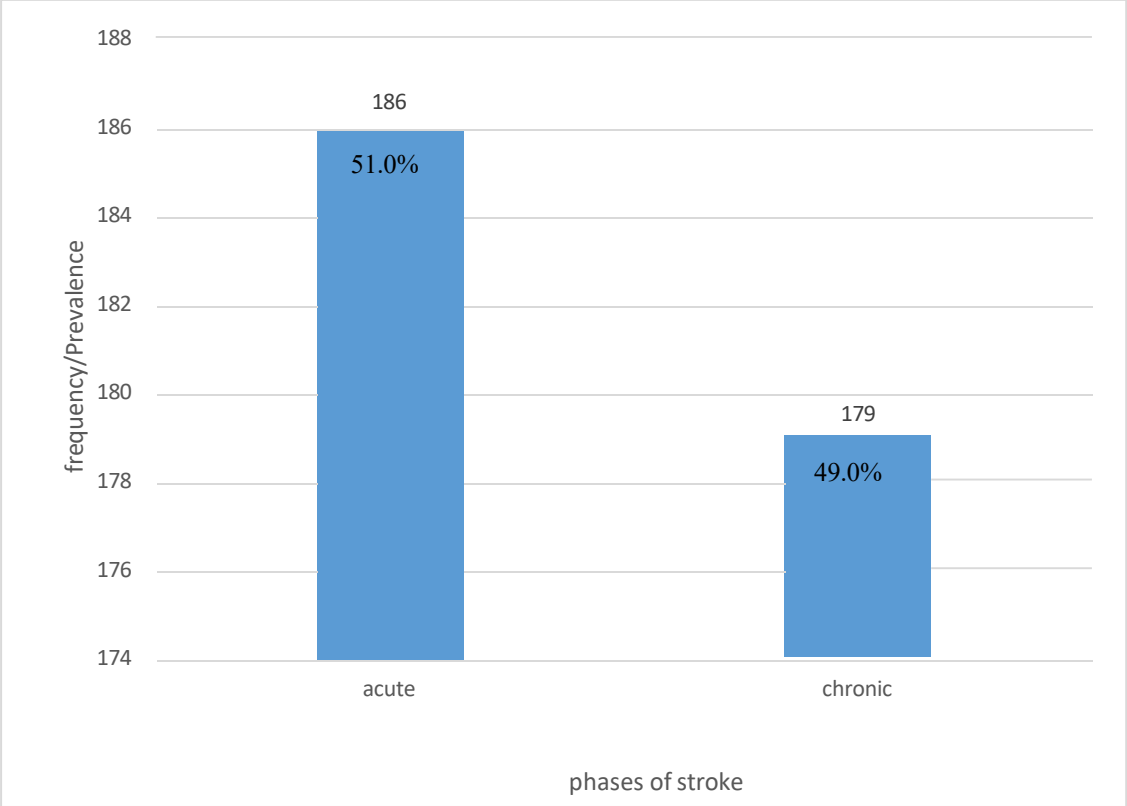

Figure 1.3: Phases of stroke

Figure 1.3 Shows that out of 365 participants, 186(51.0%) participants were in acute phase of stroke and 179(49.0%) participants were in chronic phase of stroke.

Table1.4: Side of Stroke

	Frequency	Percent	Valid Percent	Cumulative Percent
left side	175	47.9	47.9	47.9
right side	190	52.1	52.1	100.0
Total	365	100.0	100.0	

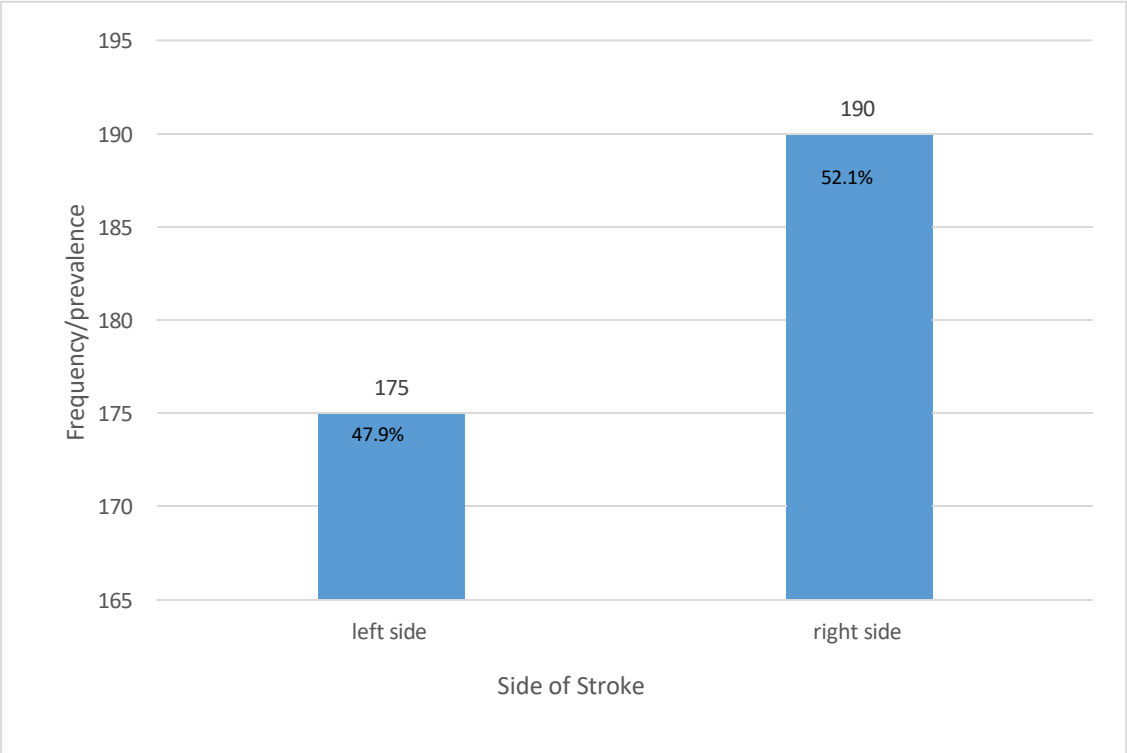

Figure 1.4: Side of stroke

Figure 1.4 Shows that out of 365 participants 175(47.9%) participants had left sided stroke and 190(52.1%) participants had right sided stroke.

Table 1.5: Sitting to standing

	Frequency	Percent	Valid Percent	Cumulative Percent
needs moderate to maximal assist to stand	81	22.2	22.2	22.2
needs minimal assist to stand or to stabilize	64	17.5	17.5	39.7
able to stand using hands after several tries	79	21.6	21.6	61.4
able to stand independently using hands	96	26.3	26.3	87.7
able to stand, no hands and stabilize independently	45	12.3	12.3	100.0
Total	365	100.0	100.0	

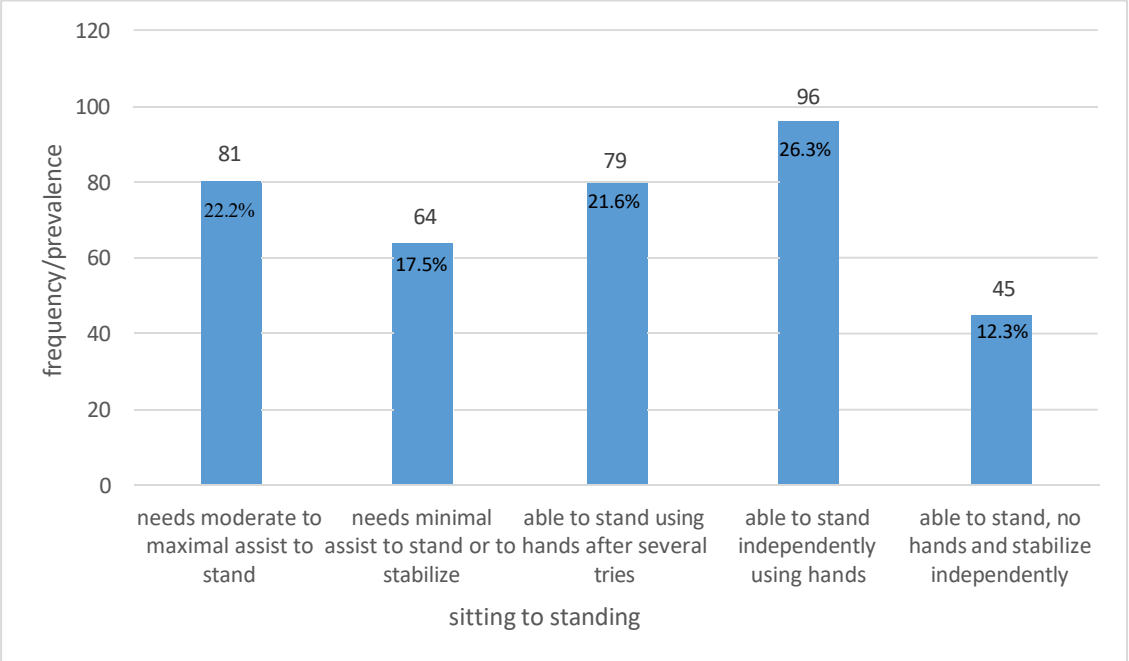

Figure 1.5: Sitting to standing

Figure 1.5 Shows that out of 365 stroke survivors, 81(22.2%) patients needed moderate to maximal assistance, 64 (17.5%) patients needed minimal assistance to stand or stabilize, 79 (21.6%) patients were able to stand using hands after several tries, 96 (26.3%) patients were able to stand independently using hands,45 (12.3%) patients were able to stand with no hands and stabilizes independently.

Table 1.6: Standing unsupported

	Frequency	Percent	Valid Percent	Cumulative Percent
unable to stand 30 seconds unassisted	80	21.9	21.9	21.9
needs several tries to stand 30 seconds unsupported	67	18.4	18.4	40.3
able to stand 30 seconds unsupported	79	21.6	21.6	61.9
able to stand 2 minutes with supervision	92	25.2	25.2	87.1
able to stand safely 2 minutes	47	12.9	12.9	100.0
Total	365	100.0	100.0	

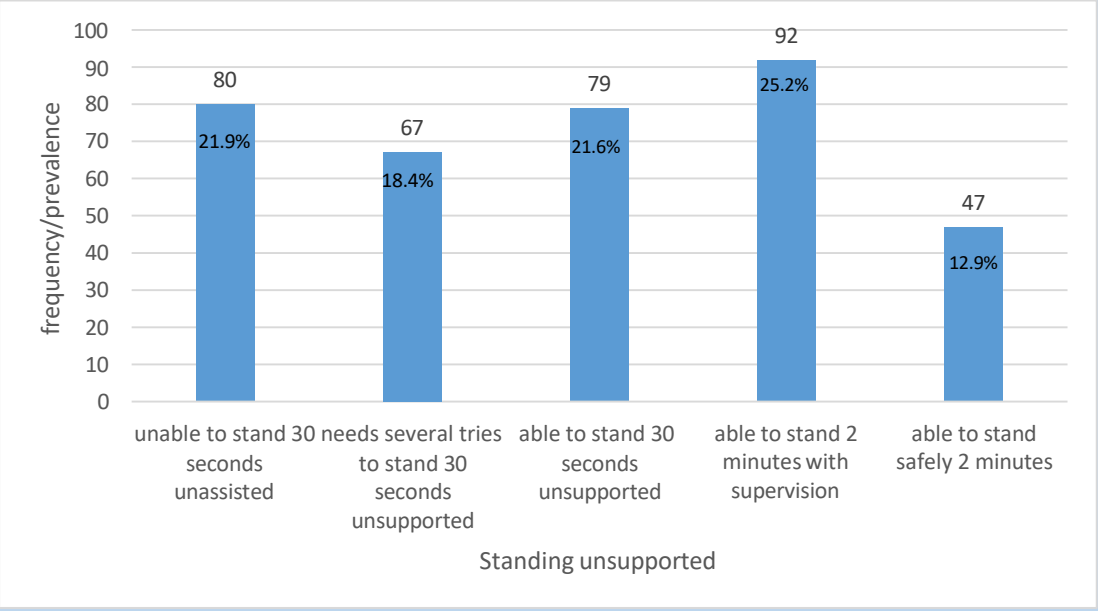

Figure 1.6: Standing unsupported

Figure 1.6 Shows that out of 365 stroke survivors, 80(21.9%) patients were unable to stand 30 seconds unassisted, 67(18.4%) patients needed several tries to stand 30 seconds unsupported, 79(21.6%) patients were able to stand 30 seconds unsupported, 92(25.2%) patients were able to stand 2 minutes under supervision, 47(12.9%) patients were able to stand safely for 2 minutes.

Table 1.7: Sitting unsupported feet on floor

	Frequency	Percent	Valid Percent	Cumulative Percent
unable to sit without support 10 seconds	47	12.9	12.9	12.9
able to sit 10 seconds	66	18.1	18.1	31.0
able to sit 30 seconds	72	19.7	19.7	50.7
able to sit 2 minutes under supervision	85	23.3	23.3	74.0
able to sit safely and securely 2 minutes	95	26.0	26.0	100.0
Total	365	100.0	100.0	

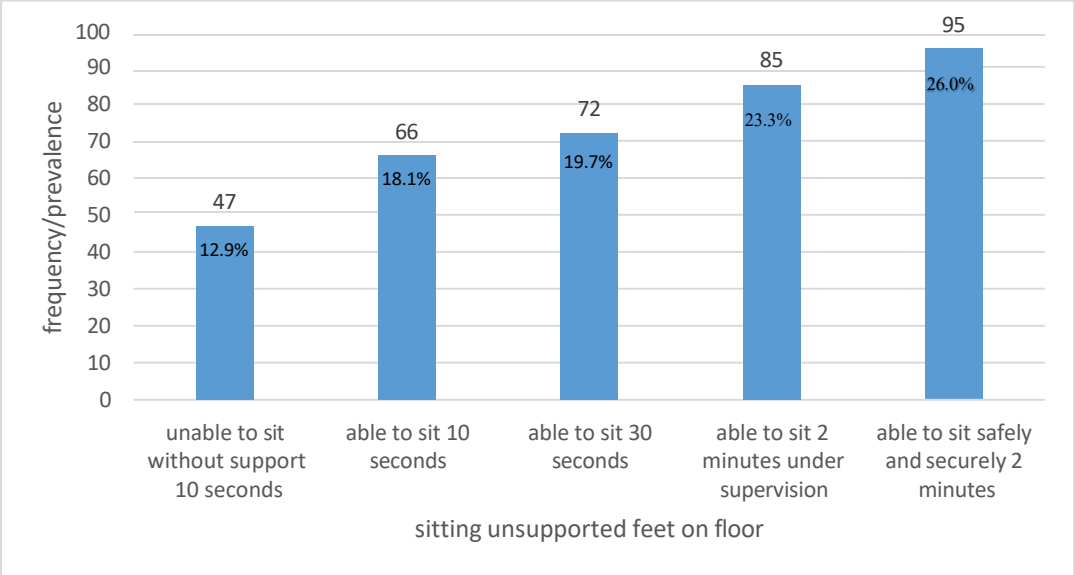

Figure 1.7: Sitting unsupported feet on floor

Figure 1.7 Shows that out of 365 stroke survivors, 47(12.9%) patients were unable to sit without support for 10 seconds. 66(18.1%) patients were able to sit for 10 seconds ,72(19.7%) patients were able to sit for 30 seconds ,85(23.3%) patients were able to sit 2 minutes under supervision ,95(26.0%) patients were able to sit safely and securely for 2 minutes.

Table 1.8: Standing to sitting

	Frequency	Percent	Valid Percent	Cumulative Percent
need assistance to sit	89	24.4	24.4	24.4
sits independently but has uncontrolled descent	64	17.5	17.5	41.9
uses back of legs against chair to control descent	67	18.4	18.4	60.3
controls descent by using hands	79	21.6	21.6	81.9
sits safely with minimal use of hands	66	18.1	18.1	100.0
Total	365	100.0	100.0	

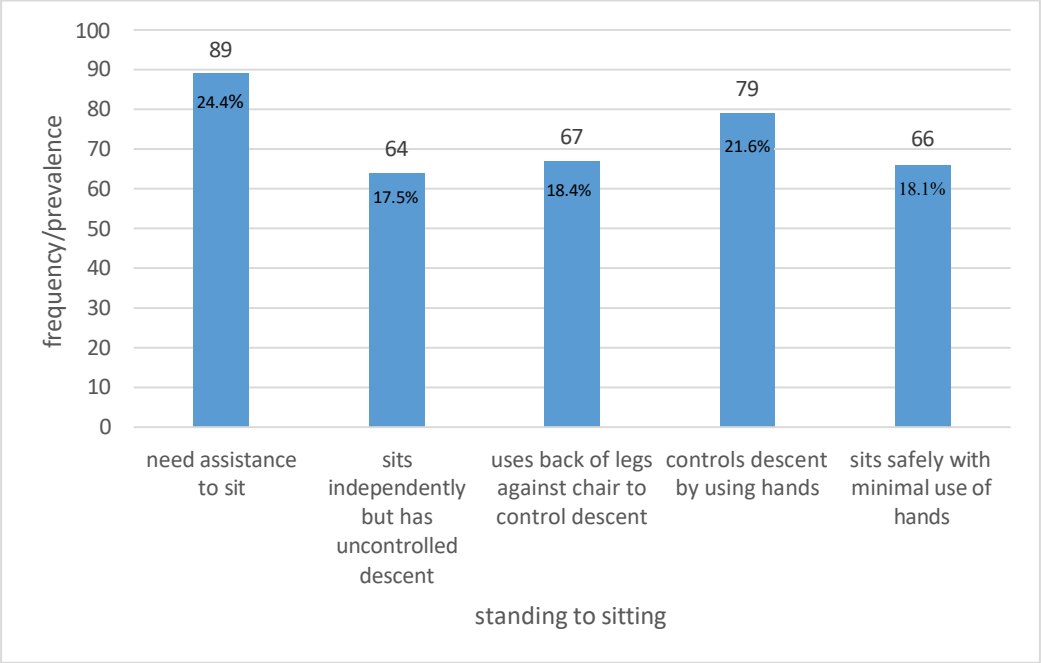

Figure 1.8: Standing to sitting

Figure 1.8 Shows that out of 365 stroke survivors, 89(24.4%) patients needed assistance to sit, 64(17.5%) patients were sit independently but has uncontrolled descent, 67(18.4%) patients used back of legs against chair to control descent, 79(21.6%) patients controlled descent by using hands, 66(18.1%) patients were sits safely with minimal use of hands.

Table 1.9: Transfer

	Frequency	Percent	Valid Percent	Cumulative Percent
needs two people to assist or supervise to be safe	50	13.7	13.7	13.7
needs one person to assist	101	27.7	27.7	41.4
able to transfer with verbal cueing or supervision	71	19.5	19.5	60.8
able to transfer safely with definite need of hands	94	25.8	25.8	86.6
able to transfer safely with only minor use of hands	49	13.4	13.4	100.0
Total	365	100.0	100.0	

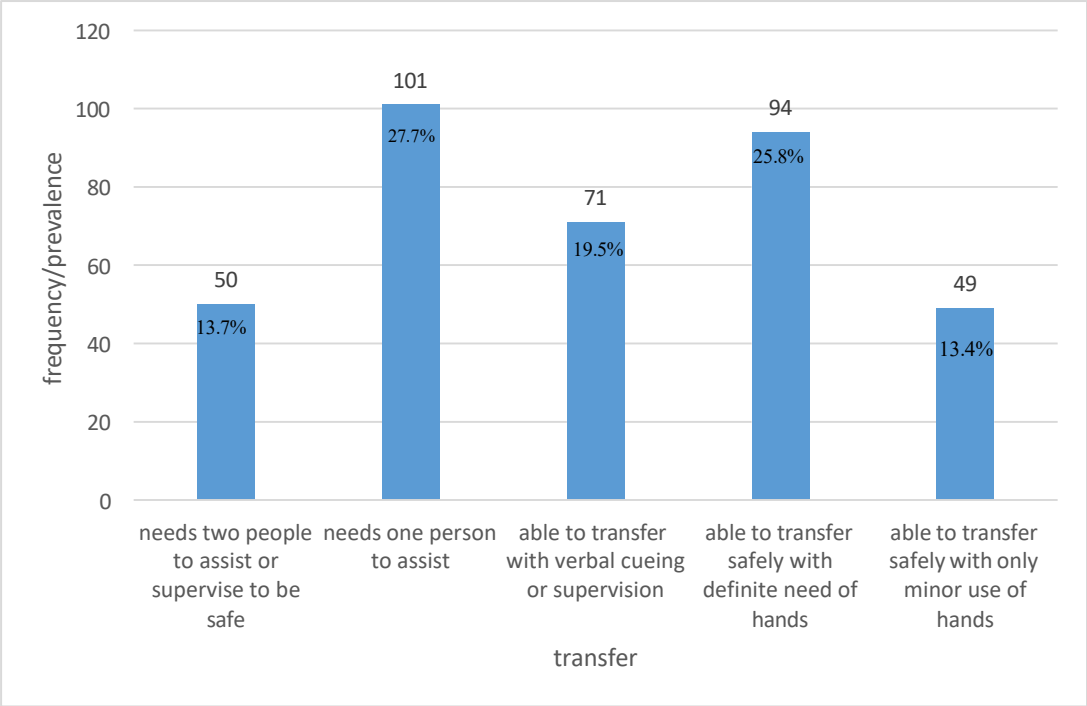

Figure 1.9: Transfer

Figure 1.9 Shows that out of 365 stroke survivors, 50 (13.7%) patients needed two people to assist or supervise to be safe, 101(27.7%) patients needed one person to assist, 71(19.5%) patients were able to transfer with verbal cueing or supervision, 94(25.8%) patients were able to transfer safely with definite need of hands and 49(13.4%) patients were able to transfer safely with only minor use of hands.

Table 1.10: Standing unsupported with eyes closed

	Frequency	Percent	Valid Percent	Cumulative Percent
needs help to keep from falling	97	26.6	26.6	26.6
unable to keep eyes closed 3 seconds but stays steady	65	17.8	17.8	44.4
unable to stand 3 seconds	76	20.8	20.8	65.2
able to stand 10 seconds with supervision	80	21.9	21.9	87.1
able to stand 10 seconds safely	47	12.9	12.9	100.0
Total	365	100.0	100.0	

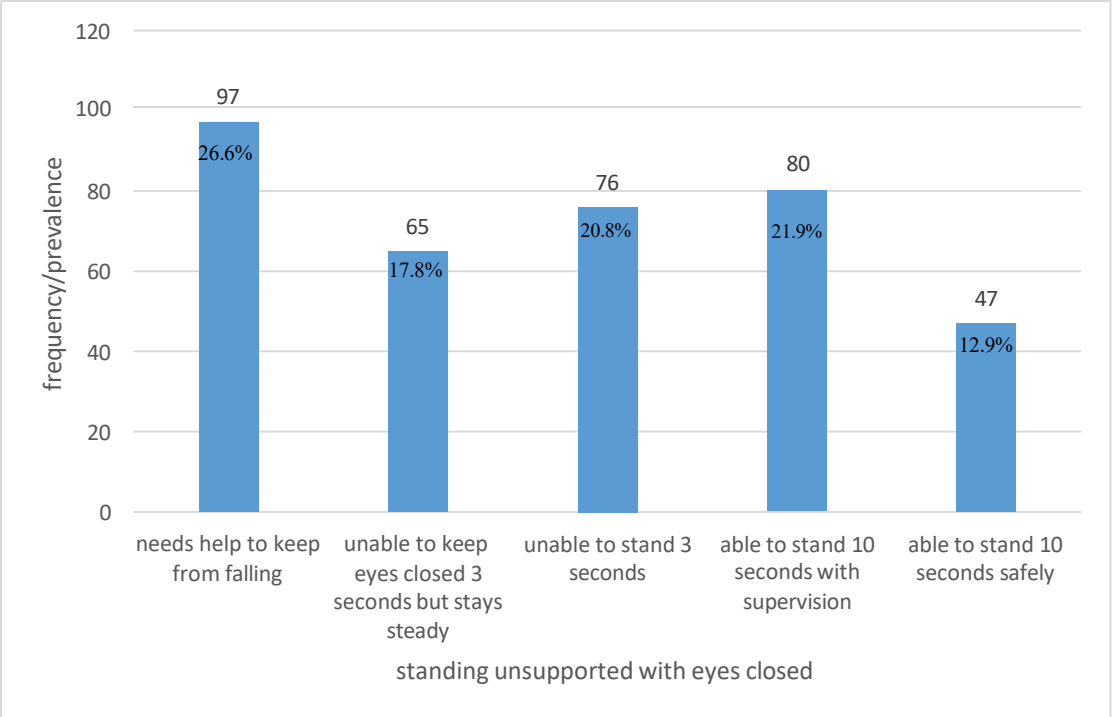

Figure 1.10: Standing unsupported with eyes closed

Figure 1.10 Shows that out of 365 stroke survivors, 97(26.6%) patients needed help to keep from falling, 65(17.8%) patients were unable to keep eyes closed 3 seconds but stayed steady, 76(20.8%) patients were unable to stand 3 seconds, 80(21.9%) patients were able to stand 10 seconds with supervision, 47(12.9%) patients were able to stand 10 seconds safely.

Table 1.11: Standing unsupported with feet together

	Frequency	Percent	Valid Percent	Cumulative Percent
needs help to attain position and unable to hold for 15 seconds	84	23.0	23.0	23.0
needs help to attain position but able to stand 15 seconds feet together	92	25.2	25.2	48.2
able to place feet together independently but unable to hold for 30 seconds	76	20.8	20.8	69.0
able to place feet together independently and stand for 1 minute with supervision	66	18.1	18.1	87.1
able to place feet together independently and stand 1 minute safely	47	12.9	12.9	100.0
Total	365	100.0	100.0	

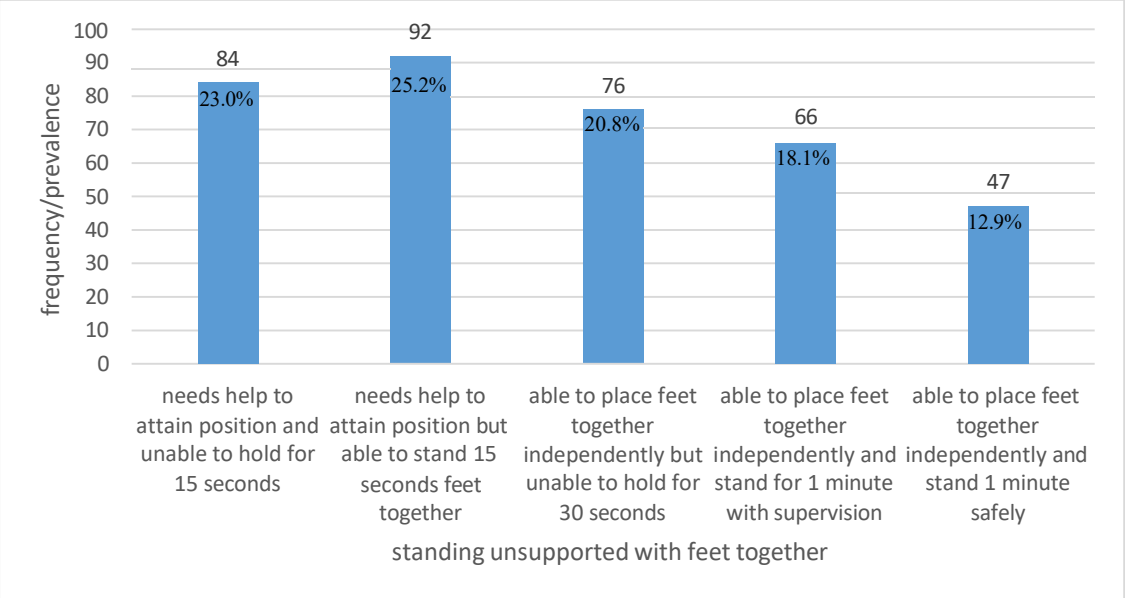

Figure 1.11: Standing unsupported with feet together

Figure 1.11 Shows that out of 365 stroke survivors, 84(23.0%) patients needed help to attain position and unable to hold for 15 seconds, 92(25.2%) patients needed help to attain position but able to stand 15 seconds feet together, 76(20.8%) patients were able to place feet together independently but unable to hold for 30 seconds, 66(18.1%) patients were able to place feet together independently and stand for 1 minute with supervision, 47(12.9%) patients were able to place feet together independently and stand 1 minute safely.

Table 1.12: Reaching forward with outstretched arm

	Frequency	Percent	Valid Percent	Cumulative Percent
needs help to keep from falling	61	16.7	16.7	16.7
reaches forward but needs supervision	82	22.5	22.5	39.2
can reach forward >2 inches safely	95	26.0	26.0	65.2
can reach forward >5 inches safely	75	20.5	20.5	85.8
can reach forward confidently >10 inches	52	14.2	14.2	100.0
Total	365	100.0	100.0	

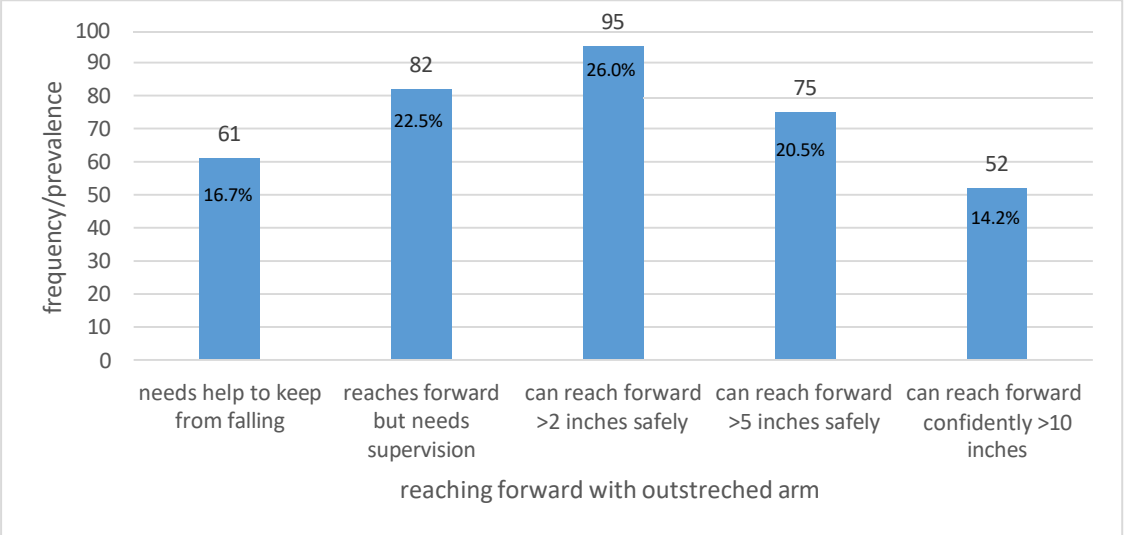

Figure 1.12: Reaching forward with outstretched arm

Figure 1.12 Shows that out of 365 stroke survivors, 61(16.7%) patients needed help to keep from falling, 82(22.5%) patients were reached forward but needed supervision, 95(26.0%) patients can reached forward >2 inches safely, 75(20.5%) patients can reached forward >5 inches safely, 52(14.2%) patients can reached forward confidently >10 inches.

Table 1.13: Pick up object from the floor

	Frequency	Percent	Valid Percent	Cumulative Percent
unable to try/needs assist to keep from falling	79	21.6	21.6	21.6
unable to pick up and needs supervision while trying	96	26.3	26.3	47.9
unable to pick up but reaches 1-2 inches from slipper and keeps balance independently	70	19.2	19.2	67.1
able to pick up slipper but needs supervision	70	19.2	19.2	86.3
able to pick up slipper safely and easily	50	13.7	13.7	100.0
Total	365	100.0	100.0	

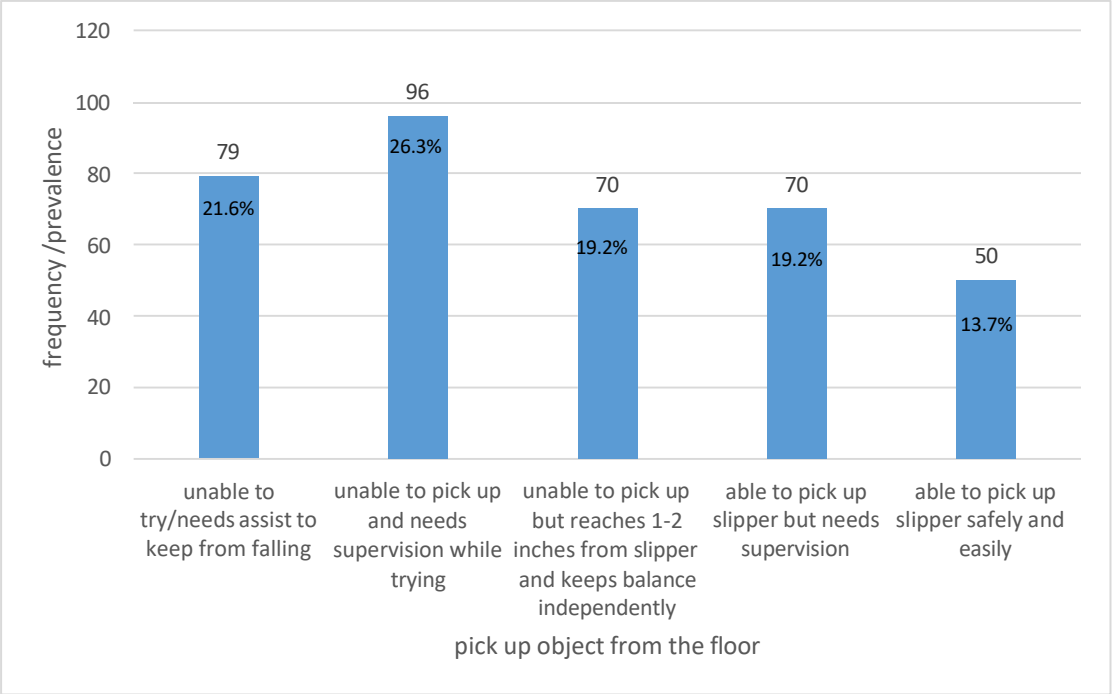

Figure 1.13: Pick up object from the floor

Figure 1.13 Shows that out of 365 stroke survivors, 79(21.6%) patients were unable to try/needed assist to keep from falling, 96(26.3%) were unable to pick up and needed supervision while trying, 70(19.2%) patients were unable to pick up but reached 1-2 inches from slipper and keeps balance independently, 70(19.2%) patients were able to pick up slipper but needed supervision, 50(13.7%) patients were able to pick up slipper safely and easily.

Table 1.14: Turning to look behind/over left and right shoulder

	Frequency	Percent	Valid Percent	Cumulative Percent
needs assist to keep from falling	43	11.8	11.8	11.8
needs supervision when turning	94	25.8	25.8	37.5
turns sideways only but maintains balance	82	22.5	22.5	60.0
looks behind one side only; other side shows less weight shift	79	21.6	21.6	81.6
looks behind from both sides and weight shifts well	67	18.4	18.4	100.0
Total	365	100.0	100.0	

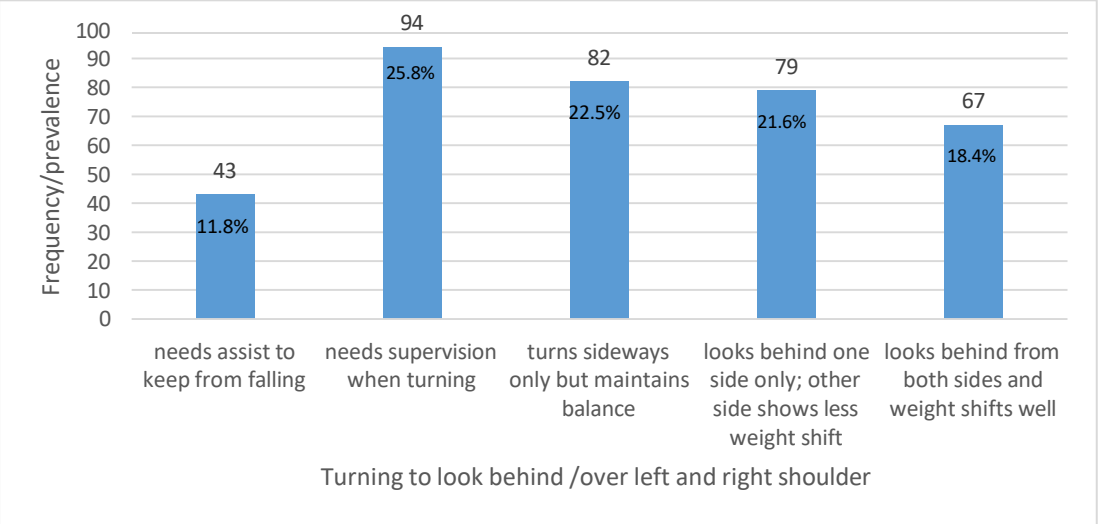

Figure 1.14: Turning to look behind/over left and right shoulder

Figure 1.14 Shows that out of 365 stroke survivors 43(11.8%) patients needed assistance to keep from falling, 94(25.8%) patients needed supervision when turning, 82(22.5%) patients turned sideways only but maintains balance, 79(21.6%) patients were able to look behind one side only; other side shows less weight shift, 67(18.4%) patients were able to look behind from both sides and weight shifts well.

Table 1.15: Turn 360 degree

	Frequency	Percent	Valid Percent	Cumulative Percent
needs assistance while turning	94	25.8	25.8	25.8
needs close supervision or verbal cueing	90	24.7	24.7	50.4
able to turn 360 safely but slowly	87	23.8	23.8	74.2
able to turn 360 safely one side only in < 4 seconds	62	17.0	17.0	91.2
able to turn 360 safely in < 4 seconds each side	32	8.8	8.8	100.0
Total	365	100.0	100.0	

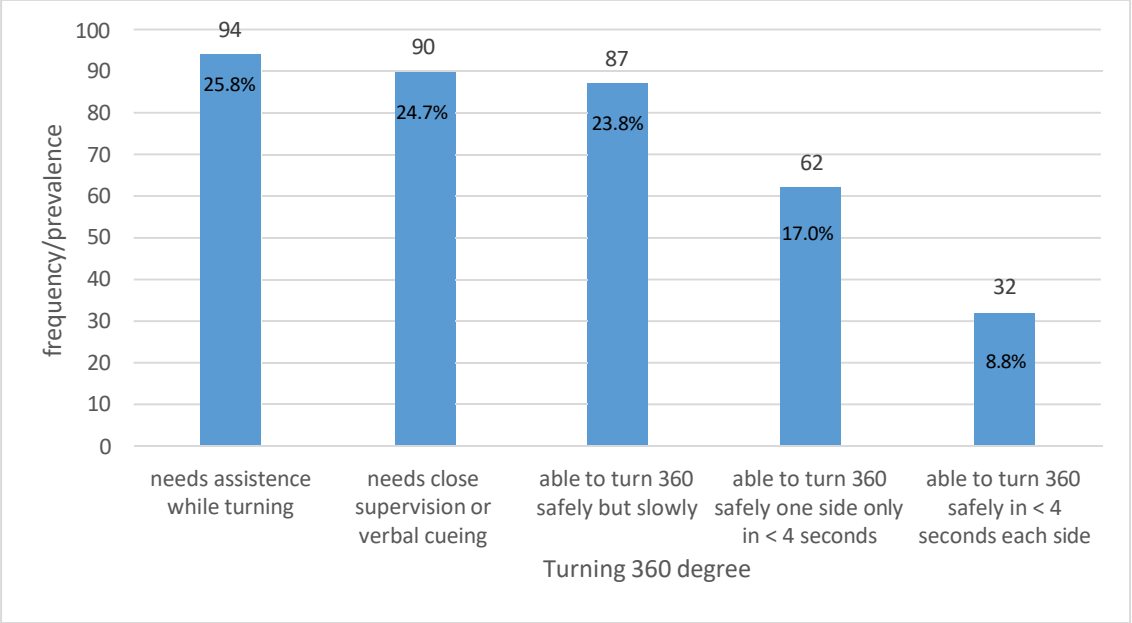

Figure 1.15: Turning 360 degree

Figure 1.15 Shows that out of 365 stroke survivors 94(25.8%) patients needed assistance while turning ,90(24.7%) patients needed close supervision or verbal cueing ,87(23.8%) patients were able to turn 360 degree safely but slowly, 62(17.0%) patients were able to turn 360 degree safely one side only in < 4 seconds, 32(8.8%) patients were able to turn 360 degree safely in < 4 seconds each side.

Table 1.16: Count number of times step touched measured stool

	Frequency	Percent	Valid Percent	Cumulative Percent
needs assistance to keep from falling/unable to try	91	24.9	24.9	24.9
able to complete > 2 steps needs minimal assist	86	23.6	23.6	48.5
able to complete 4 steps without aid with supervision	85	23.3	23.3	71.8
able to stand independently and complete 8 steps in > 20 seconds	71	19.5	19.5	91.2
able to stand independently and safely and complete 8 steps in 20 seconds	32	8.8	8.8	100.0
Total	365	100.0	100.0	

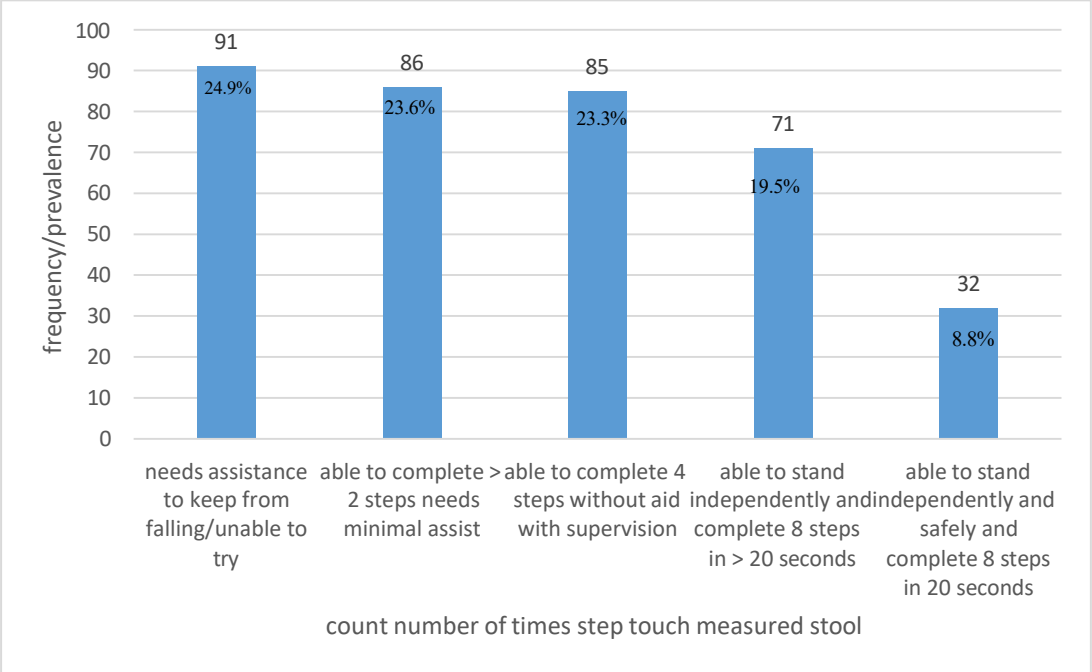

Figure 1.16: Count number of times step touch measured stool

Figure 1.16 Shows that out of 365 stroke survivors 91(24.9%) patients needed assistance to keep from falling/unable to try ,86(23.6%) patients were able to complete > 2 steps and needed minimal assistance ,85(23.3%) patients were able to complete 4 steps without aid with supervision, 71(19.5%) patients were able to stand independently and complete 8 steps in > 20 seconds ,32(8.8%) patients were able to stand independently and safely and complete 8 steps in 20 seconds**.**

Table 1.17: Standing unsupported, one foot in front

	Frequency	Percent	Valid Percent	Cumulative Percent
loses balance while stepping or standing	102	27.9	27.9	27.9
needs help to step but can hold 15 seconds	67	18.4	18.4	46.3
able to take small steps independently and hold 30 seconds	92	25.2	25.2	71.5
able to place foot ahead of other independently and hold 30 seconds	71	19.5	19.5	91.0
able to place foot tandem independently and hold 30 seconds	33	9.0	9.0	100.0
Total	365	100.0	100.0	

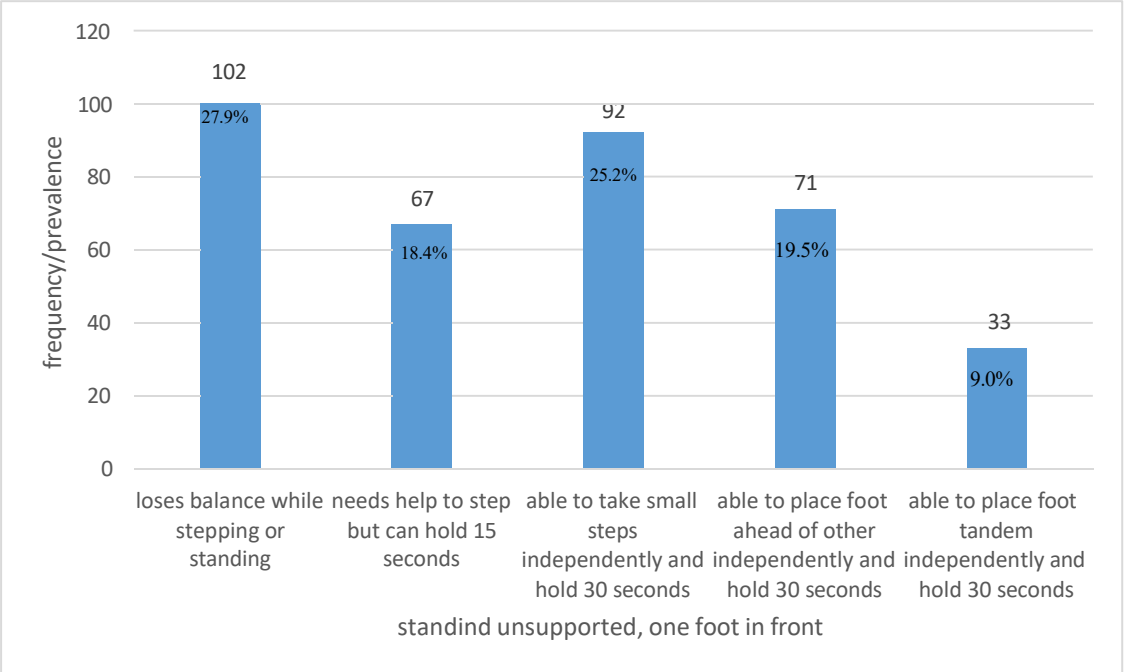

Figure 1.17: Standing unsupported, one foot in front

Figure 1.17 Shows that out of 365 stroke survivors 102(27.9%) patients were lost their balance while stepping or standing, 67(18.4%) patients needed help to step but can hold 15 seconds, 92(25.2%) patients were able take small steps independently and hold 30 seconds, 71(19.5%) patients were able to place foot ahead of other independently and hold 30 seconds, 33(9.0%) patients were able to place tandem independently and hold 30 seconds.

Table 1.18: Standing on one leg

	Frequency	Percent	Valid Percent	Cumulative Percent
unable to try or needs assist to prevent fall	125	34.2	34.2	34.2
tries to lift leg; unable to hold 3 seconds but remains standing independently	88	24.1	24.1	58.4
able to lift leg independently and hold =0r >3 seconds	70	19.2	19.2	77.5
able to lift leg independently and hold 5-10 seconds	60	16.4	16.4	94.0
sable to lift leg independently and hold > 10 seconds	22	6.0	6.0	100.0
Total	365	100.0	100.0	

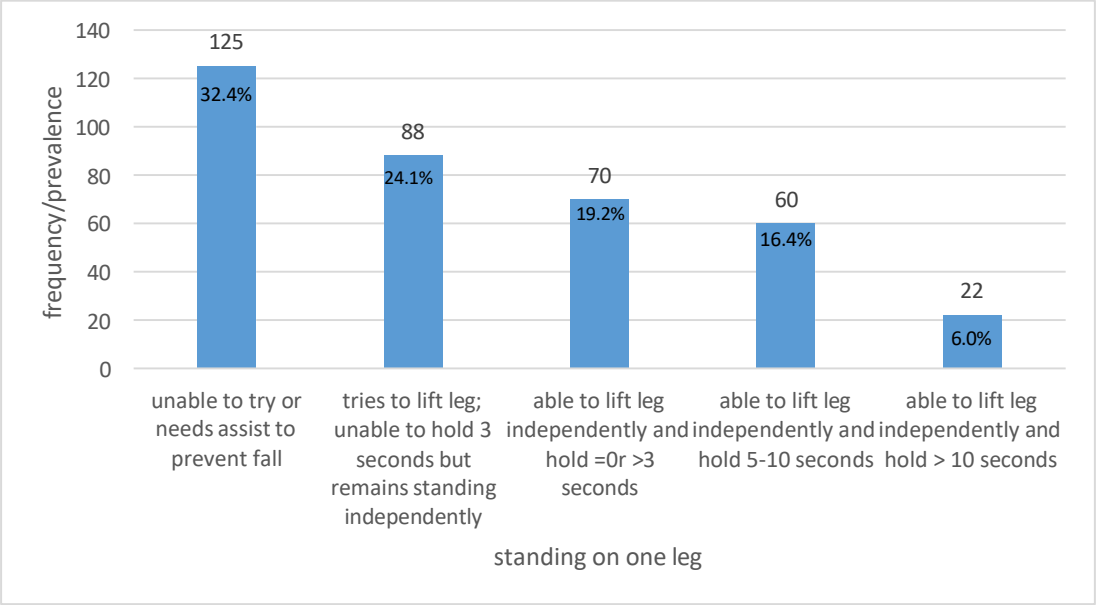

Figure 1.18: Standing on one leg

Figure 1.18 Shows that out of 365 stroke survivors, 125(32.4%) patients were unable to try or needed assist to prevent fall, 88(24.1%) patients tried to lift leg; were unable to hold 3 seconds but remains standing independently, 70(19.2%) patients were able to lift leg independently and hold=0r > 3 seconds, 60(16.4%) patients were able to lift leg independently and hold 5-10 seconds, 22(6.0%) patients were able to lift leg independently and hold > 10 seconds.

Table 1.19: Frequency of Stroke Survivors and BBS score

BBS score	Frequency	Percent	Valid Percent	Cumulative Percent
.00	7	1.9	1.9	1.9
1.00	4	1.1	1.1	3.0
2.00	11	3.0	3.0	6.0
3.00	2	.5	.5	6.6
4.00	8	2.2	2.2	8.8
5.00	10	2.7	2.7	11.5
6.00	5	1.4	1.4	12.9
7.00	1	.3	.3	13.2
8.00	7	1.9	1.9	15.1
9.00	20	5.5	5.5	20.5
10.00	12	3.3	3.3	23.8
11.00	3	.8	.8	24.7
12.00	4	1.1	1.1	25.8
13.00	1	.3	.3	26.0
14.00	2	.5	.5	26.6
15.00	4	1.1	1.1	27.7
16.00	5	1.4	1.4	29.0
17.00	12	3.3	3.3	32.3
18.00	8	2.2	2.2	34.5
19.00	2	.5	.5	35.1
20.00	4	1.1	1.1	36.2
21.00	4	1.1	1.1	37.3
22.00	10	2.7	2.7	40.0
23.00	9	2.5	2.5	42.5
24.00	6	1.6	1.6	44.1
25.00	8	2.2	2.2	46.3
26.00	11	3.0	3.0	49.3
27.00	8	2.2	2.2	51.5
28.00	9	2.5	2.5	54.0
29.00	14	3.8	3.8	57.8
30.00	7	1.9	1.9	59.7
31.00	9	2.5	2.5	62.2
32.00	16	4.4	4.4	66.6
33.00	5	1.4	1.4	67.9
34.00	16	4.4	4.4	72.3
35.00	8	2.2	2.2	74.5
36.00	7	1.9	1.9	76.4
37.00	9	2.5	2.5	78.9

38.00	3	.8	.8	79.7
39.00	6	1.6	1.6	81.4
40.00	10	2.7	2.7	84.1
41.00	6	1.6	1.6	85.8
42.00	6	1.6	1.6	87.4
43.00	5	1.4	1.4	88.8
44.00	3	.8	.8	89.6
45.00	6	1.6	1.6	91.2
46.00	3	.8	.8	92.1
47.00	4	1.1	1.1	93.2
48.00	4	1.1	1.1	94.2
49.00	5	1.4	1.4	95.6
50.00	3	.8	.8	96.4
51.00	3	.8	.8	97.3
52.00	2	.5	.5	97.8
53.00	1	.3	.3	98.1
54.00	1	.3	.3	98.4
55.00	1	.3	.3	98.6
56.00	5	1.4	1.4	100.0
Total	365	100.0	100.0	

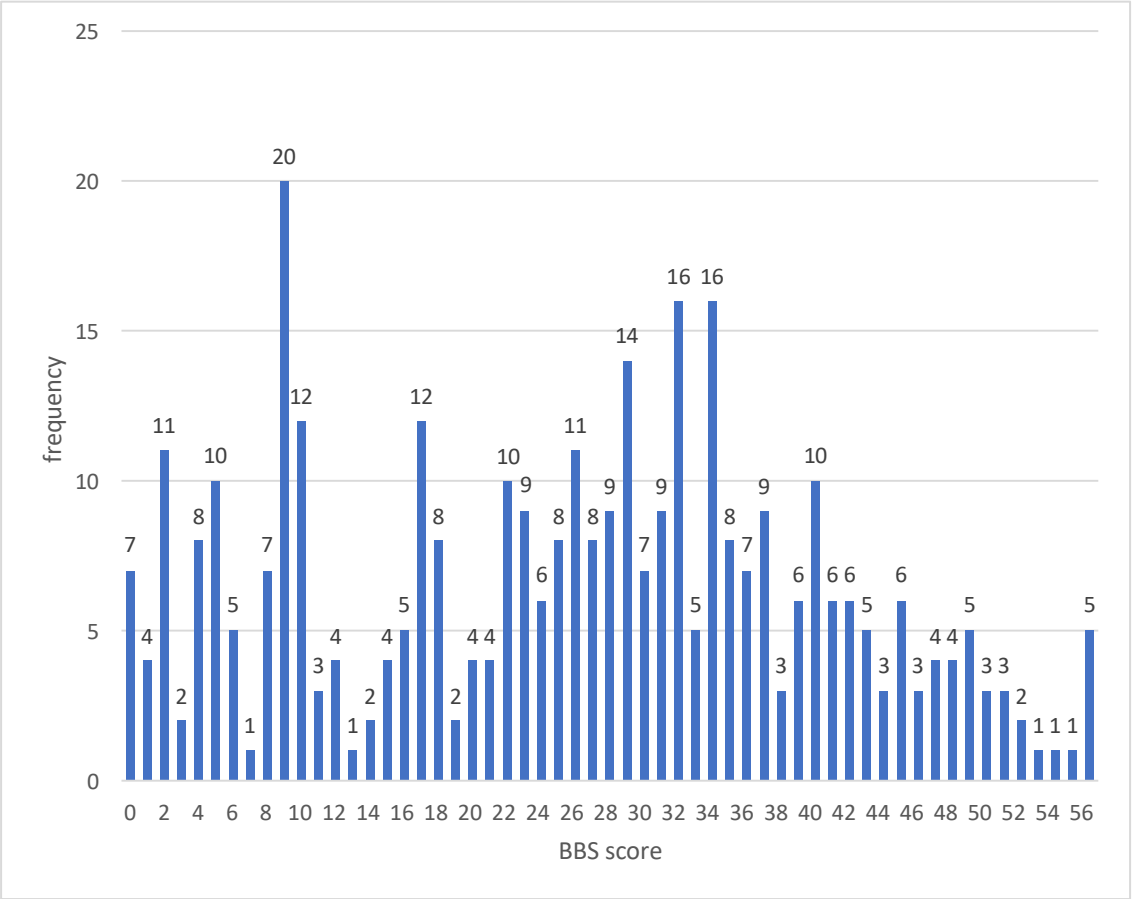

Figure 1.19: Frequency stroke survivors and BBS score

Figure 1.19 Shows that there were 7 stroke survivors patients who scored 0, 4 who scored 1, 11 who scored 2, 2 who scored 3, 8 who scored 4, 10 who scored 5, 5 who scored 6, 1 who scored 7, 7 who scored 8, 20 who scored 9, 12 who scored 10, 3 who scored 11, 4 who scored 12, 1 who scored 13, 2 who scored 14, 4 who scored 15, 5 who scored 16, 12 who scored 17, 8 who scored 18, 2 who scored 19, 4 who scored 20, 4 who scored 21, 10 who scored 22, 9 who scored 23, 6 who scored 24, 8 who scored 25, 11 who scored 26, 8 who scored 27, 9 who scored 28, 14 who scored 29, 7 who scored 30, 9 who scored 31, 16 who scored 32, 5 who scored 33, 16 who scored 34, 8 who scored 35, 7 who scored 36, 9 who scored 37, 3 who scored 38, 6 who scored 39, 10 who scored 40, 6 who scored 41, 6 who scored 42, 5 who scored 43, 3 who scored 44, 6 who scored 45, 3 who scored 46, 4 who scored 47, 4 who scored 48, 5 who scored 49, 3 who scored 50, 3 who scored 51, 2 who scored 52, 1 who scored 53, 1 who scored 54, 1 who scored 55, 5 who scored 56 had balance impairment who filled the Berg Balance Scale(BBS).

Table 1.20: Statistics level of BBS

	Frequency
Valid	365
Mean	25.4795
Minimum	.00
Maximum	56.00

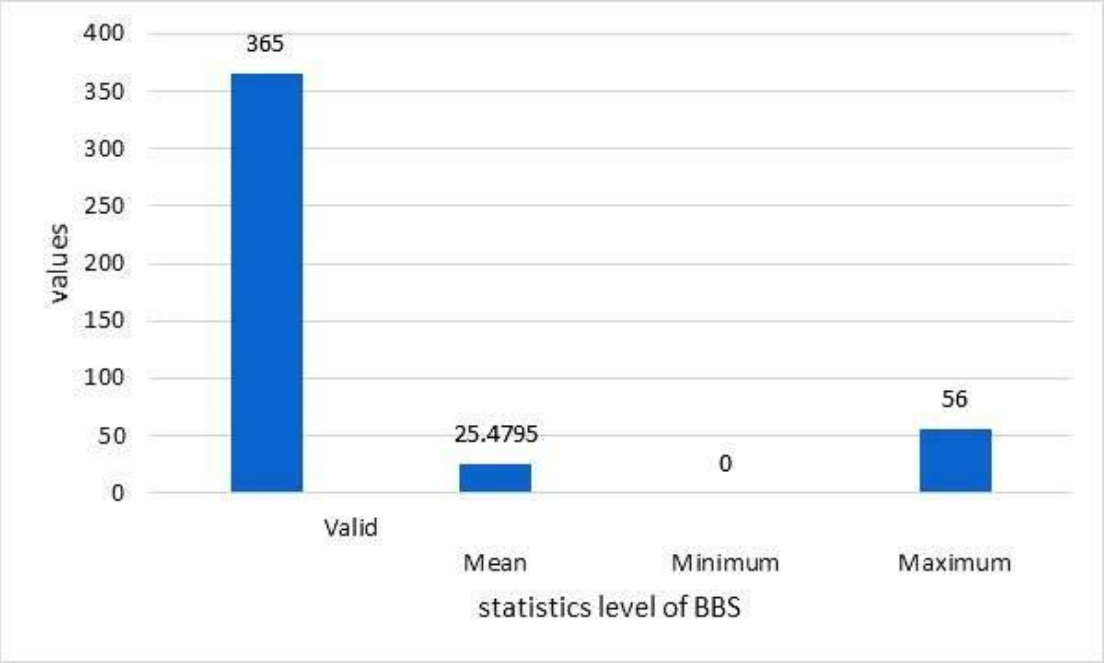

Figure 1.20: Statistics level of BBS

Figure 1.20 Shows that average score of level of BBS was 25.4795 with minimum value of 0 and maximum value of 56.

Table 1.21: Total score of BBS

	Frequency	Percent	Valid Percent	Cumulative Percent
Balance impairment "0-20"	119	32.6	32.6	32.6
Acceptable balance "21-40"	186	51.0	51.0	83.6
Good balance "41-56"	60	16.4	16.4	100.0
Total	365	100.0	100.0	

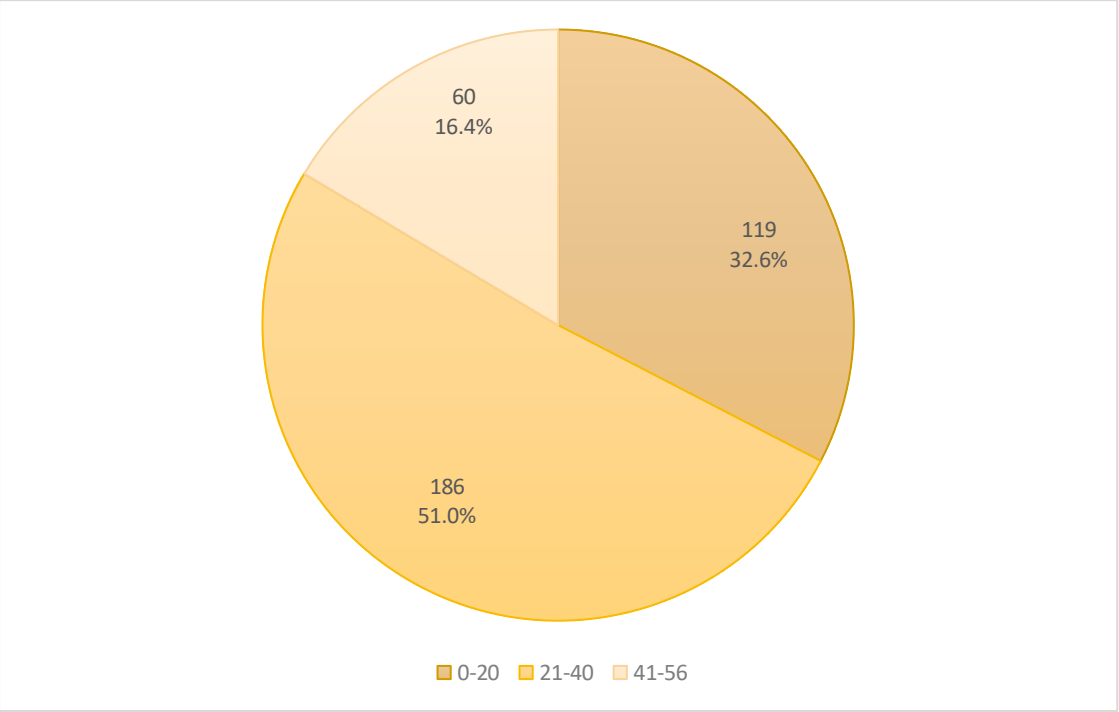

Figure 1.21: Total score of BBS

Figure 1.21 Shows that out of 365 Stroke survivors, 119(32.6%) patients had balance impairment, 186(51.0%) patients had acceptable balance, 60 (16.4%) patients had good balance.

Table 1.22: Relationship between gender of participants and phases of stroke

	phase of stroke		Total
	acute	chronic	
female	89	86	175
male	97	93	190
Total	186	179	365

Table 1.22 shows that, out of 365 patients 89 females and 97 males lie in acute phase of stroke and 86 females and 93 males lie in chronic phase of stroke.

Table 1.23: Relationship between gender of participants and side of stroke

	Side of stroke		Total
	Left side	Right side	
Female	87	88	175
Male	88	102	190
Total	175	190	365

Table 1.23: shows that, out of 365 stroke survivors 87 females and 88 males had suffered from left sided stroke and 88 females and 102 males had suffered from right sided stroke**.**

Table 1.24: Relationship between Total score of BBS and phase of stroke

Total score of BBS	phase of stroke		Total
	acute	chronic	
Balance impairment = 0-20	58	61	119
Acceptable balance = 21-40	103	83	186
Good balance = 41-56	25	35	60
Total	186	179	365

Table 1.24 shows that in acute phase, 58 patients have balance impairment (0-20), 103 patients have acceptable balance (21-40), and 25 patients have good balance (41-56). In chronic phase, 61 patients have balance impairment, 83 patients have acceptable balance, and 35 patients have good balance**.**

CHAPTER 5

DISCUSSION

A cross-sectional study in Ethiopia, concluded that the mean age of stroke survivors in their study was 56.06 ± 20 years, which is very similar to the mean age of 56.47 ± 12 years calculated in my study. However, there is a significant difference in the age range of participants. My study included individuals with a minimum age of 32 and a maximum age of 84, and an age range of 29-89 years, whereas the Ethiopian study covered a much broader age range of 18 to 95 years. This difference in age distribution could influence the generalizability of findings and highlight the importance of considering demographic variations when assessing balance impairments among stroke survivors (Gobezie et al., 2024).

My study, with a sample size of 365 patients, is consistent with Andrea Demeco et al research, which had a sample size of 350 patients. Both studies showed a higher percentage of male stroke patients compared to females. My study had 52.1% males and 47.9% females, while Andrea Demeco et al.'s study had 66.9% males and 32.9% females (Demeco et al., 2023).

A cross-sectional study on prevalence of balance impairment and associated factors conducted by khan and chevidikunnan shows that acute & subacute stroke survivors were 1.5 times more prone to develop balance impairment as compared to chronic stroke survivors. While in contrast to my study out of 365 stroke survivors, 58 acute stroke survivors and 61 chronic stroke patients showed balance impairment. Both studies highlighted the prevalence of balance impairment among stroke survivors in acute and chronic phase (Khan and Chevidikunnan, 2021).

The results of my investigation supported the findings of the study by Shao et al 2024, which demonstrated that balance was a crucial element of post-stroke recovery. My study found that more than one-third (32.6%) of stroke survivors had balance impairment, more than half (51.0%) had satisfactory balance as assessed by the Berg Balance Scale. Shao et al. found that 336 of the 433 patients who were enrolled in the research had a 77% response rate. They came to the conclusion that 18.4% of stroke patients who could walk on their own saw a decline in their everyday activities. According to earlier research, 12–40% of stroke victims see a gradual drop in it.

These results highlight the importance of balance in stroke recovery (Shao et al., 2024).

Schroder et al find out the prevalence of balance impairment and its risk factors in post-stroke patients in South Korea. Researchers had not evaluated balance impairment rates among post-stroke patients in South Korean healthcare institutions. 851 post-stroke patients responded to the Berg Balance Scale. Study showed that 52.0% of the patients had left sided stroke and 47.9% of the patient had right sided stroke. As compared to my study in which 47.9% participants had left sided stroke and 52.1 % had right sided stroke (Schröder et al 2023).

A research conducted by Khan and Chevidikunnan at el revealed that among stroke survivors balance impairment occurred in 48.1% of participants. The patient participants at the study were categorized into groups based on their Berg balance score where those with lower than 45 points received poor balance status and those with scores at 45 or higher had good balance. The assessment of balance impairment in this study yielded comparable outcomes to the current findings showing 32.6% prevalence of balance deficit. They were divided into subjects with good balance 41-56, acceptable balance 21-40, and balance impairment 0-20 (Khan and Chevidikunnan, 2021).

My study results were consistent with the research by Chu et al. (2023), 573 post-stroke patients participated in this cross-sectional study, which mentioned 52.2% of patients were able to maintain their balance during activity performance while the results from my study also showed that 51.0% of patients had acceptable balance and were able to perform activities of daily living (Chu et al., 2023).

Kanzuhiro miyata et al conducted a study on effectiveness of Berg balance scale rating which fulfill the functioning criteria and most reliable scale for the assessment of stroke patients. Similarly, I also used the Berg Balance Scale for the assessment of balance impairment in stroke patients. I used standard version of Berg balance scale in my study as the validity and reliability of berg balance scale is 0.98 (Miyata et al., 2022)

Suruliraj Karthikbabu et al investigated the relationship between core muscle strength, and balance confidence in patients with chronic stroke. This study is consistent with my research, as both researchers address the balance issue among stroke survivors and

emphasize the importance of this problem in stroke survivors.(Karthikbabu and Verheyden, 2021).

5.1 Conclusion:

It is concluded that about one-third stroke survivors exhibited balance impairment and more than half of patients had acceptable balance when assessed with Berg Balance scale (BBS).

5.2 Limitations:

- I did not specify the paraplegic or quadriplegic stroke in my study.
- Other comorbidities that causes neurological deficits were not considered in this research.
- My study was conducted only in specific hospitals of Lahore and did not include stroke survivors in other regions.
- Insufficient time, lack of funding and language barrier were the challenges and limitations in my study.

5.3 Recommendations:

- Stroke survivors need regular balance evaluations because balance remains the most critical element after stroke.
- Future investigations must provide detailed documentation regarding post-stroke rehabilitation interventions that enhance balance recovery.
- Future studies should investigate balance impairment separately by age, gender, and phases of stroke, as my study only find out overall balance impairment in stroke survivors.
- Spasticity was not included due to unavailability of robust measurement tool so future studies should include spasticity as main contributor in loss of balance and function after stroke.
- Identify other risk factors and comorbidities such as neurological diseases and cognitive factors also should be considered that are associated with balance impairment in stroke survivors.
- Further collaborations with welfare and local health centers should be added.

- Patients in rehabilitation centers should be informed and educated properly about balance impairment through seminars and social media.

CHAPTER 6

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