A HOSPITAL-BASED STUDY ON ASSOCIATION OF BMI AND DIETARY HABITS IN INDIVIDUALS WITH STROKE AND WITHOUT STROKE IN THE AGE GROUP OF 60-75YEARS

Azka Tauqeer[1], Maryam Zahid[1], Idrees Khan[2], Shafiq Ali Shah[3], Tassawer-e-meran[3], Muhammad Usama[2,] Laila Sumreen[4], Tahira Shamim*[4]

1. *Rashid Latif Medical College*
2. *Department of Eastern Medicine, Superior University Lahore*
3. *Department of Pharmaceutical Sciences, Superior University Lahore*
4. *University College of Conventional Medicine, Faculty of Medicine and Allied Health Sciences, The Islamia University of Bahawalpur, Bahawalpur, Pakistan.*

Corresponding author
Tahira Shamim, University College of Conventional Medicine, Faculty of Medicine & Allied Health Sciences, The Islamia University of Bahawalpur, Bahawalpur, 63100, Pakistan.

Abstract

The effect of diet on the development of stroke has recently achieved much interest by various research groups, but with inconclusive results. The aim of the present study was to evaluate the relationship between adherence to dietary patterns and stroke. The dietary habits that protect against stroke was reduced sodium intake and increased consumption of fruits and vegetables, the consumption of whole grains and products (Barley, bran, oats, wheat etc.), fatty fish, legumes, nuts, skim milk and products, unsaturated fat (canola, olive oil etc.), non-starchy vegetables (spinach, turnips, sprouts etc.), moderate consumption of caffeinated beverages was significantly higher in patients with without stroke (controls) as compared to patients with stroke (cases). A prudent or a traditional Mediterranean dietary pattern may also prevent stroke. The current research demonstrated that dietary habits had a significant impact on stroke, and it came to the stroke is significantly influenced by patient's dietary practices.

Key words: BMI, Dietary habits, Stroke, Fruits, Vegetables

1. Introduction

Stroke is a sudden injury to brain tissue resulting from impaired blood flow through an artery that supplies blood to the brain also called a cerebrovascular accident [1]. Stroke is the third leading cause of death in the United States after heart disease and cancer [2]. It is the most common cause of significant disability in adults [3]. There are many risk factors that predispose people to stroke, some of which are modifiable [4]. Lacks of exercise, poor diet, smoking and excessive alcohol intake are common risk factors of stroke [5]. The risk factors of stroke include hypertension which is the most important risk factor of stroke [6]. Cigarette smoking increases the risk of cardiovascular disease, especially in people who started young and heavy smokers or passive smoking is also a factor of stroke [7]. While the incidence of stroke is declining in many developed countries, it is likely that, with a globally aging population, the absolute number of stroke will increase worldwide [8]. Stroke affects 15 million people worldwide every year, it is estimated that 5 million of these will die and a further five million will be left with a permanent disability [9]. This makes stroke the second leading cause of death worldwide [10]. Stroke is the third leading cause of death in the United States, and incidence is higher in women than men [11]. Several foods and nutrients have been linked to stroke risk, therefore dietary modification may be an important way to reduce risk of stroke [12]. These include an inverse relationship between fish, fruits vegetables and whole grains intake and stroke risk [13]. Because nutrients and food are consumed in combination, their cumulative effects on disease risk are best investigated by considering the entire eating pattern [14].

Many foods have been suggested to influence the risk of stroke [15]. Studies suggest that a dietary pattern which contains higher intakes of red and processes meats, refined grains, and sweets a may increase stroke risk, whereas a diet higher in fruits and vegetables, fish, a whole grains may protect against stroke [16]. Dietary patterns have been widely used to identify typical combinations of foods [17]. High intakes of refined carbohydrates and sodium may be related to stroke [18]. The cereal foods mainly refined carbohydrates with high glycemic load and less fiber are associated with higher risk of stroke [19]. The refined cereals pattern is associated with high plasma homocysteine concentration, a cardiovascular disease risk factor [19]. High sodium consumption may also increase stroke risk [20]. Increased consumption of red meats, eggs and oils and a decrease in fruits and vegetables intake are also associated with stroke risk [21]. White rice-based food and tea consumption associated with

increased risk of ischemic stroke, whereas a fruit-rich diet associated with a reduced risk of stroke death [22]. Epidemiological studies have extensively focused on dietary habits and their impact on risk for stroke [23]. Moreover, the American Heart Stroke Association strongly promotes a healthy way of living, including consuming healthy dietary patterns and exercising on a regular basis, achieving ideal body weight and abstinence from smoking prevent from stroke [24]. Thus, a healthy dietary pattern exerts a beneficial effect on stroke incidence and mortality, adding a new direction towards stroke prevention on population level [25].

The focus of nutrition care is to help patients maintain nutrition status and overall health despite the disability caused by stroke [26]. Patients may need to learn about dietary treatment that improves blood lipid level and blood pressure [26]. Diet influence stroke risk via several mechanisms. A diet low in sodium and high in potassium lowers blood pressure which will likely reduce stroke risk [27]. Consumption of fruits and vegetables, whole grains, fatty fish are each likely to reduce stroke risk [13]. A prudent or traditional Mediterranean dietary pattern, which incorporates these individual dietary components as well as intake of legumes and olive oil may also prevent stroke [28]. Stroke remains one of the most devastating of all neurological conditions [29]. Worldwide stroke accounts for approximately 5.5million deaths annually [30]. Therefore, a study was designed to compare dietary habits of individuals with stroke and without stroke and also to determine the association of BMI and stroke in the study population [31].

2. Methodology

It was a case control study. The convenient sampling technique was used in this study. The sample size of 112 study patient was included in the study divided into two groups: (56) stroke and (56) without stroke by using 95% confidence level, ± 5% margin of error and by taking expected proportion 50% respectively.

$$n = \frac{NZ^2P(1-P)}{d^2(N-1)+Z^2P(1-P)}$$

(n= Population size=112 (35), z= Statistics for level of confidence=1.96(Cl 95%), P= Expected proportion=50%, d= Margin of error±5%)

Patients of age 60-75 years (older adults) were included in this study. Patients < 60 years, >75 years and those unwilling to participate were excluded from this study. Study population was taken from Lahore General Hospital, Central Park Teaching Hospital Lahore and Sheikh Zayed hospital Lahore. The time scale of this study was 3 months. Data was collected by using a questionnaire (Annexure I) to assess basic data (age & gender), anthropometric measurements (weight, height and body mass index) and dietary history of participants.

2.1: Anthropometric measurements

Height was measured using measuring tape. Weight was measured using a weighing scale. The readings were taken nearest to ½ inches or 0.2 kg. Body mass index calculated by dividing the weight of person in kilograms by height in meter square as shown in table 1.

$$\text{BMI} = \frac{weight\ in\ kg}{height\ in\ m^2}$$

Nutritional Status	Body Mass Index
Underweight	<18.5 kg/m²
Normal	18.5-24.9 kg/m²
Overweight	25-29.9 kg/m²

Obese	30 kg/m² or above

Table 1: nutritional status and body mass index

2.2: Dietary history

Dietary history was obtained by a Food Frequency Chart. Assessment questions included weekly intake (with options of never, 1-2 days/week, 2-4 days/week, 4- 6 days/week and daily) for whole grains and products, refined grains and products, fruits, starchy vegetables, non-starchy vegetables, lean meat, red meat, eggs, legumes, whole milk and products, skim milk and products, saturated fat, unsaturated fat, caffeinated beverages and nuts was obtained.

2.3: Biochemical Values:

The biochemical values used to determine the risk of stroke in hospitalized patients are shown in table 2.

Parameter	Desirable values	Borderline values	Undesirable values
Blood pressure	<120/<80mmHg	120-139/80-89mmHg	≥140/90mmHg
Blood sugar level	70-99mg/dl	100-125mg/dl	≥126mg/dl
Cholesterol	<200mg/dl	200-240mg/dl	>240mg/dl
Triglycerides level	<150mg/dl	150-199 mg/dl	>200-499mg/dl
LDL	130mg/dl	130-159mg/dl	>160mg/dl
HDL	>60mg/dl	40-59mg/dl	<40mg/dl

Table 2: Biochemical values used to determine the risk of stroke

2.4: Data analysis

Data was analyzed by using SPSS software version 25. For interpretation of data Chi square at a statistical level of <0.05 was applied.

3: Results

3.1: Distribution of gender in study population

Percentage distribution of gender in study population showed that out of total 112 individuals was taken, from which 30 (26.8%) males had stroke, 23 (20.5%) had no stroke while 26 (23.2%) females had stroke and 33 (29.5%) had no stroke (Figure 1).

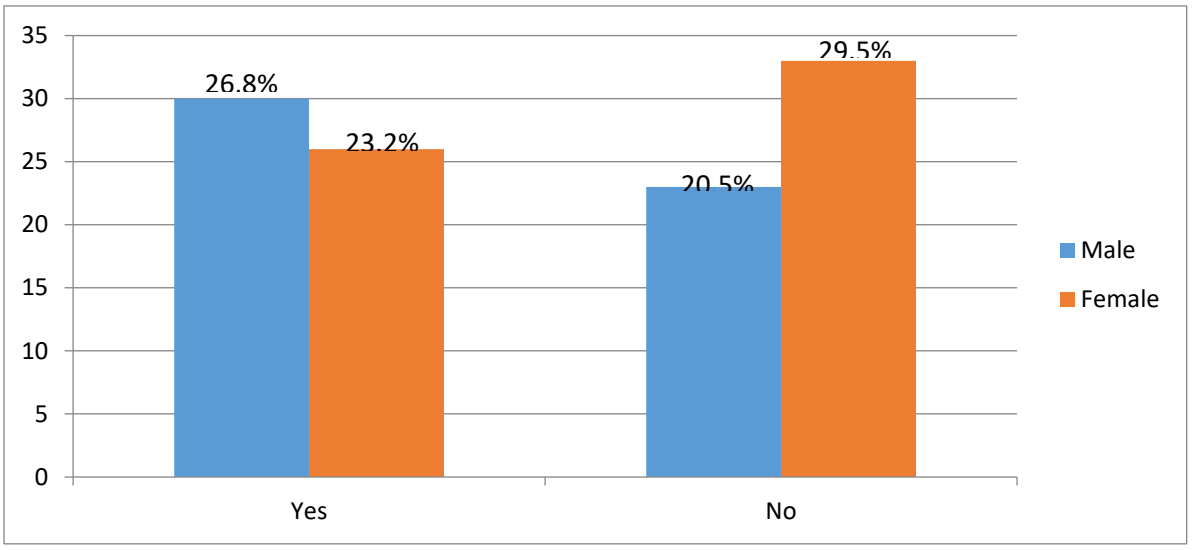

Figure 1: Percentage distribution of gender in study population.

3.2: Distribution of stroke among study population

Percentage distribution of stroke among study population showed that out of total 112 individuals, 56 (50.0%) were diagnosed with stroke and 56 (50.0%) had no stroke (Figure 2).

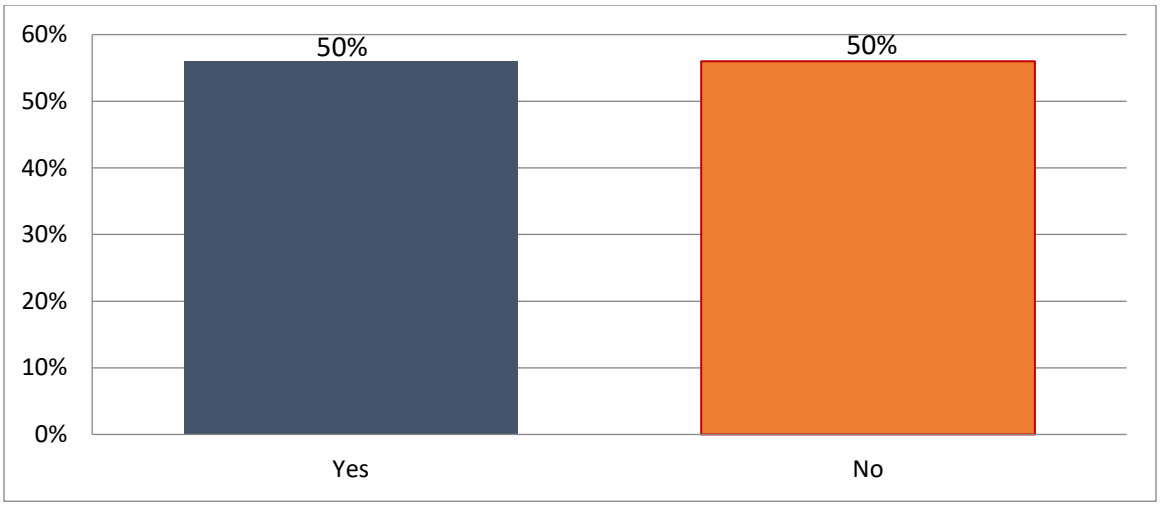

Figure 2: Percentage distribution of stroke among study population

3.3: Percentage distribution of type of stroke in study population

Percentage distribution of type of stroke in study population showed that out of total 112 individuals, 34 (30.4%) had Ischemic stroke, 22 (19.6%) had Hemorrhagic stroke and 56 (50.0%) had no stroke.

3.4: Percentage distribution of smoking in study population

Percentage distribution of smoking in study population showed that percentage of smoking was higher in stroke patients than without stroke patients. Out of total 112 individuals, from which 63 (56.3%) were smoking and 49 (43.8%) were not smoking.

3.5: Comparison of BMI of individuals with Stroke and without Stroke

Study was conducted on 112 hospitalized patients divided into two groups 56 with stroke and 56 without stroke and the results showed that out of total 4 (3.6%) were underweight patients all are with stroke. Total 52 (46.4%) were with normal BMI and 8 (7.1%) had stroke and 44 (39.3%) were without stroke. 38 (33.9%) were overweight and the patients with stroke have 31 (27.7%) had high percentage then without stroke 7 (6.3%).Total 18 (16.1%) were obese from which 13 (11.6 %) had stroke and 5 (4.5%) were without stroke. p-value is 0.000 which means that results are statistically significant (Table 3).

BMI	Stroke			p-value
	Yes	No	Total	
Underweight	4 (3.6%)	0 (0.0%)	4 (3.6%)	0.000
Normal	8 (7.1%)	44 (39.3%)	52 (46.4%)	
Overweight	31 (27.7%)	7 (6.3%)	38 (33.9%)	
Obese	13 (11.6%)	5 (4.5%)	18 (16.1%)	
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 3: Comparison of BMI of individuals with Stroke and without Stroke

3.6: Comparison of Triglycerides (TAG) of individuals with Stroke and without Stroke

The results showed The results showed that total 36 (32.1%) patients have desirable TAG levels and 11 (9.8%) were patients with stroke and 25 (22.3%) patients without stroke. 13 (11.6%) patients with stroke were at borderline as compared to 17 (15.2%) patients without stroke of total 30 (26.8%). Undesirable value of TAG was high in stroke patients 32 (28.6%) and 14 (12.5%) without stroke and total patients were 46 (41.1%) and the p-value is 0.001 shows that significant result (Table 4).

TAG	Stroke			p-value
	Yes	No	Total	
Desirable	11 (9.8%)	25 (22.3%)	36 (32.1%)	0.001
Borderline	13 (11.6%)	17 (15.2%)	30 (26.8%)	
Undesirable	32 (28.6%)	14 (12.5%)	46 (41.1%)	
Total	56 (50.0%)	50 (50.0%)	112 (100.0%)	

Table 4: Comparison of (TAG) of individuals with stroke and without stroke.

3.7: Comparison of Low Density Lipoprotein (LDL) of Individuals with Stroke and without Stroke

The results showed that total 50 (44.6%) patients have desirable LDL levels and 10 (8.9%) were patients with stroke and 40 (35.7%) patients without stroke. 20 (17.9%) patients with stroke were at borderline as compared to 11 (9.8%) patients without stroke of total 31 (27.7%). Undesirable value of LDL was high in stroke patients 26 (23.2%) and 5 (4.5%) without stroke and total patients were 31 (27.7%) and the p-value is 0.000 shows that significant result (Table 5).

LDL	Stroke			p-value
	Yes	No	Total	
Desirable	10 (8.9%)	40 (35.7%)	50 (44.6%)	
Borderline	20 (17.9%)	11 (9.8%)	31 (27.7%)	
Undesirable	26 (23.2%)	5 (4.5%)	31 (27.7%)	0.000
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 5: Comparison of (LDL) of individuals with stroke and without stroke

3.8: Comparison of High Density Lipoprotein (HDL) of individuals with Stroke and without stroke

The results showed total 50 (44.6%) patients have desirable HDL levels out of which 10 (8.9%) have stroke and 40 (35.7%) without stroke. And out of 25 (22.3%) patients have borderline values and included 15 (13.4%) patients with stroke and 10 (8.9%) without stroke and total 37 (33.0%) patients have undesirable HDL levels 31 (27.7%) with stroke and 6 (5.4%) without stroke and p-value is 0.001 that shows significant result (Table 6).

HDL	Stroke			p-value
	Yes	No	Total	
Desirable	10 (8.9%)	40 (35.7%)	50 (44.6%)	
Borderline	15 (13.4%)	10 (8.9%)	25 (22.3%)	
Undesirable	31 (27.7%)	6 (5.4%)	37 (33.0%)	0.001
Total	56 (50%)	56 (50%)	112 (100%)	

Table 6: Comparison of (HDL) of individuals with stroke and without stroke

3.9: Comparison of Cholesterol of individuals with Stroke and without Stroke

The results showed total 54 (48.2%) patients have desirable cholesterol levels out of which 15 (13.4%) have stroke and 39 (34.8%) without stroke. And out of 27 (24.1%) patients have borderline values and included 15 (13.4%) patients with stroke and 12 (10.7%) without stroke and total 31 (27.7%) patients have undesirable cholesterol levels 26 (23.2%) with stroke and 5 (4.5%) without stroke and p-value is 0.000 that shows significant result (Table 7).

Cholesterol	**Stroke**			**p-value**
	Yes	**No**	**Total**	
Desirable	15 (13.4%)	39 (34.8%)	54 (48.2%)	
Borderline	15 (13.4%)	12 (10.7%)	27 (24.1%)	
Undesirable	26 (23.2%)	5 (4.5%)	31 (27.7%)	0.000
Total	56 (50%)	56 (50%)	112 (100%)	

Table 7: Comparison of cholesterol of individuals with stroke and without stroke.

3.10: Comparison of Blood Pressure (B.P) of individuals with Stroke and without Stroke

The results showed total 33 (29.5%) patients have desirable B.P levels out of which 8 (7.1%) have stroke and 25 (22.3%) without stroke. And out of 33 (29.5%) patients have borderline values and included 14 (12.5%) patients with stroke and 19 (17.0%) without stroke and total 46 (41.1%) patients have undesirable B.P levels 34 (30.4%) with stroke and 12 (10.7%) without stroke and p-value is 0.000 that shows significant result (Table 8).

B.P	Stroke			p-value
	Yes	No	Total	
Desirable	8 (7.1%)	25 (22.3%)	33 (29.5%)	0.000
Borderline	14 12.5%)	19 (17.0%)	33 (29.5%)	
Undesirable	34 (30.4%)	12 (10.7%)	46 (41.1%)	
Total	56 (50%)	56 (50%)	112 (100%)	

Table 8: Comparison of (B.P) of individuals with stroke and without stroke.

3.11: Comparison of Blood Sugar Level (BSL) of individuals with Stroke and without Stroke

Study was conducted on 112 hospitalized patients divided into two groups 56 with stroke and 56 without stroke and the results shows total 37 (33.0%) patients have desirable BSL levels out of which 8 (7.1%) have stroke and 29 (25.9%) without stroke. And out of 24 (21.4%) patients have borderline values and included 9 (8.0%) patients with stroke and 15 (13.4%) without stroke and total 51 (45.5%) patients have undesirable BSL levels 39 (34.85%) with stroke and 12 (10.7%) without stroke and p-value is 0.000 that shows significant result (Table 9).

BSL	Stroke			p-value
	Yes	No	Total	
Desirable	8 (7.1%)	29 (25.9%)	37 (33.0%)	0.000
Borderline	9 (8.0%)	15 (13.4%)	24 (21.4%)	
Undesirable	39 (34.85%)	12 (10.7%)	51 (45.5%)	
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 9: Comparison of (BSL) of individuals with stroke and without stroke.

3.12: Comparison of Whole grain and products consumption between individuals with stroke and without stroke

Whole grain consumption	Stroke		Total	p-value
	Yes	No		
Never	3 (2.7%)	0 (0.0%)	3 (2.7%)	
1-2 days/ week	6 (5.4%)	0 (0.0%)	6 (5.4%)	
2-4 days/week	19 (17.0%)	6 (5.4%)	25 (22.3%)	
4-6 days/week	22 (19.6%)	23 (20.5%)	45 (40.2%)	
Daily	6 (5.4%)	27 (24.1%)	33 (29.5%)	
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	0.000

Study was conducted on 112 hospitalized patients divided into two groups 56 with stroke and 56 without stroke and the results showed that total 3 (2.7%) with stroke were never consumed whole grains. 6 (5.4%) patients with stroke were consumed whole grain in 1-2 days/ week. 19 (17.0%) patients with stroke were consumed whole grain in 2-4 days/week and patients without stroke were less 6 (5.4%) and in contrast in both 4-6 days/week and daily consumption of whole grain of patients with stroke were less 18 (18.4%) and 13 (13.3%) respectively and in contrast patients with stroke have highest consumption of whole grains 21 (21.4%) and 24 (24.5%) respectively and the p-value is 0.002 which is statistically significant.

3.13: Comparison of Refined grain and products Consumption between individuals with Stroke and without Stroke

The results showed that refined grains were never consumed by 2 (1.8%) of patients with stroke and 11 (9.8%) without stroke. The highest number of patients without stroke 18 (16.1%) were consumed refined grains between 1-2 days/week in contrast to with stroke patients 6 (5.4%). And most patients with stroke 10 (8.9%) consumed refined grain

between 4-6 days/week in contrast to patients without stroke 7 (6.3%). And patients with stroke 21 (18.8%) consumed refined grains daily in contrast to without stroke patients 12 (10.7%). The p-value is 0.002 which is statistically significant (Table 10).

Refined grain and products consumption	Stroke		Total	p-value
	Yes	No		
Never	2 (1.8%)	11 (9.8%)	13 (11.6%)	0.001
1-2 days/ week	6 (5.4%)	18 (16.1%)	24 (21.4%)	
2-4 days/week	10 (8.9%)	7 (6.3%)	17 (15.2%)	
4-6 days/week	17 (15.2%)	8 (7.1%)	25 (22.3%)	
Daily	21 (18.8%)	12 (10.7%)	33 (29.5%)	
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 10: Comparison of refined grain and products consumption between individuals with stroke and without stroke.

3.14: Comparison of Eggs Consumption between Individuals with Stroke and without Stroke

The results showed that total 23 (20.5%) never ate eggs 18 (16.1%) had stroke and 5 (4.5%) had no stroke, 34 (30.4%) ate eggs for 1-2 days/week18 (16.1%) had stroke and 16 (14.3%) had no stroke, 28 (25.0%) ate for 2-4 days/week 6 (5.4%) had stroke and 22 (19.6%) had no stroke, 16 (14.3%) ate them for 4-6 days/week 8 (7.1%) had stroke and 16 (14.3%) had no stroke and 11(9.8%) ate them daily 6 (5.4%) had stroke and 11 (9.8%) had no stroke. The p-value is 0.002 which is statistically significant (Table 11).

Eggs consumption	Stroke		Total	p-value
	Yes	No		
Never	18 (16.1%)	5 (4.5%)	23 (20.5%)	0.002
1-2 days/ week	18 (16.1%)	16 (14.3%)	34 (30.4%)	
2-4 days/week	6 (5.4%)	22 (19.6%)	28 (25.0%)	
4-6 days/week	8 (7.1%)	16 (14.3%)	16 (14.3%)	
Daily	6 (5.4%)	11 (9.8%)	11 (9.8%)	
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 11: Comparison of eggs consumption between individuals with stroke and without stroke.

3.15: Comparison of legumes Consumption between individuals with Stroke and without Stroke

The results showed that 7 (6.3%) never ate legumes 2 (1.8%) had stroke and 5 (4.5%) had no stroke, 16 (14.3%) ate legumes for 1-2 days/week 7 (6.3%) had stroke and 9 (8.0%) had no stroke, 41 (36.6%) ate for 2-4 days/week 12 (10.7) had stroke and 29 (15.9%) had no stroke, 25 (22.3%) ate them for 4-6 days/week 17 (15.2%) had stroke and 8 (7.1%) had no stroke and 23 (20.5%) ate them daily 18 (16.1%) had stroke and 5 (4.5%) had no stroke. The p-value is 0.001 which is statistically significant (Table 12).

Legumes Consumption	Stroke		Total	p-value
	Yes	No		
Never	2 (1.8%)	5 (4.5%)	7 (6.3%)	0.001
1-2 days/ week	7 (6.3%)	9 (8.0%)	16 (14.3%)	
2-4 days/week	12 (10.7%)	29 (15.9%)	41 (36.6%)	
4-6 days/week	17 (15.2%)	8 (7.1%)	25 (22.3%)	

Daily	18 (16.1%)	5 (4.5%)	23 (20.5%)
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)

Table 12: Comparison of legumes consumption between individuals with stroke and without stroke

3.16: Comparison of lean meat Consumption between individuals with Stroke and without Stroke

The results showed that 27 (24.1%) never ate lean meat 21 (18.8%) had stroke and 6 (5.4%) had no stroke, 41 (36.6%) ate them for 1-2 days/week 15 (13.4%) had stroke and 26 (23.2%) had no stroke, 25 (22.3%) ate for 2-4 days/week 11(9.8%) had stroke and 14 (12.5%) had no stroke, 14 (12.5%) ate them for 4-6 days/week 9 (8.0%) had stroke and 5 (4.5%) had no stroke and 5 (4.5%) ate them daily 5 (4.5%) were without stroke. The p-value is 0.001 which is statistically significant (Table 13).

Lean meat Consumption	**Stroke**		**Total**	**p-value**
	Yes	**No**		
Never	21 (18.8%)	6 (5.4%)	27 (24.1%)	0.001
1-2 days/ week	15 (13.4%)	26 (23.2%)	41 (36.6%)	
2-4 days/week	11 (9.8%)	14 (12.5%)	25 (22.3%)	
4-6 days/week	9 (8.0%)	5 (4.5%)	14 (12.5%)	
Daily	0 (0.0%)	5 (4.5%)	5 (4.5%)	
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 13: Comparison of lean meat consumption between individuals with stroke and without stroke.

3.17: Comparison of red meat Consumption between individuals with Stroke and without Stroke

The results showed that 35 (31.3%) never ate red meat 8 (7.1%) had stroke and 27

(24.1%) had no stroke, 13 (11.6%) ate them for 1-2 days/week 6 (5.4%) had stroke and 7 (6.3%) had no stroke, 16 (14.3%) ate for 2-4 days/week 4 (3.6%) had stroke and 12 (10.7%) had no stroke, 26 (23.3%) ate them for 4-6 days/week 21 (18.8%) had stroke and 5 (4.5%) had no stroke and 22 (19.6%) ate them daily 17 (15.2%) had stroke and 5 (4.5%) had no stroke. The p-value is 0.001 which is statistically significant (Table 14).

Red meat Consumption	**Stroke**		**Total**	**p-value**
	Yes	**No**		
Never	8 (7.1%)	27 (24.1%)	35 (31.3%)	0.000
1-2 days/ week	6 (5.4%)	7 (6.3%)	13 (11.6%)	
2-4 days/week	4 (3.6%)	12 (10.7%)	16 (14.3%)	
4-6 days/week	21 (18.8%)	5 (4.5%)	26 (23.2%)	
Daily	17 (15.2%)	5 (4.5%)	22 (19.6%)	
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 14: Comparison of red meat consumption between individuals with stroke and without stroke.

3.18: Comparison of Starchy vegetables Consumption between individuals with Stroke and without Stroke

The results showed that 18 (16.1%) never ate starchy vegetables 11 (9.8%) had stroke and 7 (6.3%) had no stroke, 25 (22.3%) ate them for 1-2 days/week 5 (4.5%) had stroke and 20 (17.9%) had no stroke, 30 (26.8%) ate for 2-4 days/week 13 (11.6%) had stroke and 17 (15.2%) had no stroke, 18 (16.1%) ate them for 4-6 days/week 13 (11.6%) had stroke and 5 (4.5%) had no stroke and 21 (18.8%) ate them daily 14 (12.5%) had stroke and 7 (6.3%) had no stroke. The p-value is 0.003 which is statistically significant (Table 15).

Starchy vegetable Consumption	Stroke		Total	p-value
	Yes	No		
Never	11 (9.8%)	7 (6.3%)	18 (16.1%)	0.003
1-2 days/ week	5 (4.5%)	20 (17.9%)	25 (22.3%)	
2-4 days/week	13 (11.6%)	17 (15.2%)	30 (26.8%)	
4-6 days/week	13 (11.6%)	5 (4.5%)	18 (16.1%)	
Daily	14 (12.5%)	7(6.3%)	21 (18.8%)	
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 15: Comparison of starchy vegetables consumption between individuals with stroke and without stroke.

3.19: Comparison of Non Starchy vegetables Consumption between individuals with Stroke and without Stroke

The results showed that 7 (6.3%) never ate non starchy vegetables 2 (1.85%) had stroke and 5 (4.5%) had no stroke, 16 (14.3%) ate them for 1-2 days/week 7 (6.3%) had stroke and 9 (8.0%) had no stroke, 41 (36.6) ate for 2-4 days/week 12 (10.7%) had stroke and 29 (25.9%) had no stroke, 25 (22.3%) ate them for 4-6 days/week 17 (15.2%) had stroke and 8 (7.1%) had no stroke and 23 (20.5%) ate them daily 18 (16.1%) had stroke and 5 (4.5%) had no stroke. The p-value was 0.001 which is statistically significant (Table 16).

Non Starchy Vegetables Consumption	Stroke		Total	p-value
	Yes	No		
Never	2 (1.85%)	5 (4.5%)	7 (6.3%)	0.001
1-2 days/ week	7 (6.3%)	9 (8.0%)	16 (14.3%)	
2-4 days/week	12 (10.7%)	29 (25.9%)	41 (36.6%)	
4-6 days/week	17 (15.2%)	8 (7.1%)	25 (22.3%)	
Daily	18 (16.1%)	5 (4.5%)	23 (20.5%)	

Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 16: Comparison of non-starchy vegetables consumption between individuals with stroke and without stroke.

3.20: Comparison of Fruits Consumption between individuals with Stroke and without Stroke

The results showed that 27 (24.1%) never consumed fruits 22 (19.6%) had stroke and 5 (4.5%) had no stroke, 16 (14.3%) ate them for 1-2 days/week 12 (10.7%) had stroke and 4 (3.6%) had no stroke, 22 (19.6%) ate for 2-4 days/week 9 (8.0%) had stroke and 13 (11.6%) had no stroke, 24 (21.4%) ate them for 4-6 days/week 5 (4.5%) had stroke and 19 (17.0%) had no stroke and 23 (20.5%) ate them daily 8 (7.1%) had stroke and 15 (13.4%) had no stroke. The p-value was 0.001 which is statistically significant (Table 17).

Fruits Consumption	**Stroke**		**Total**	**p-value**
	Yes	**No**		
Never	22 (19.6%)	5 (4.5%)	27 (24.1%)	0.000
1-2 days/ week	12 (10.7%)	4 (3.6%)	16 (14.3%)	
2-4 days/week	9 (8.0%)	13 (11.6%)	22 (19.6%)	
4-6 days/week	5 (4.5%)	19 (17.0%)	24 (21.4%)	
Daily	8 (7.1%)	15 (13.4%)	23 (20.5%)	
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 17: Comparison of fruits consumption between individuals with stroke and without stroke.

3.21: Comparison of Whole milk Consumption between individuals with Stroke and without Stroke

The results showed that 34 (30.4%) never consumed whole milk 11 (9.8%) had stroke

and 23 (20.5%) had no stroke, 24 (21.4%) consumed them for 1-2 days/week 7 (6.3%) had stroke and 17 (15.2) had no stroke, 13 (11.6%) consumed for 2-4 days/week 7 (6.3%) had stroke and 6 (5.4%) had no stroke, 22 (19.6%) consumed for 4-6 days/week 18 (16.1%) had stroke and 4 (3.6%) had no stroke and 19 (17.0%) consumed daily 13 (11.6%) had stroke and 6 (5.4%) had no stroke. The p-value was 0.001 which is statistically significant (Table 18).

Whole Milk Consumption	Stroke		Total	p-value
	Yes	No		
Never	11 (9.8%)	23 (20.5%)	34 (30.4%)	0.001
1-2 days/ week	7 (6.3%)	17 (15.2%)	24 (21.4%)	
2-4 days/week	7 (6.3%)	6 (5.4%)	13 (11.6%)	
4-6 days/week	18 (16.1%)	4 (3.6%)	22 (19.6%)	
Daily	13 (11.6%)	6 (5.4%)	19 (17.0%)	
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 18: Comparison of whole milk consumption between individuals with stroke and without stroke

3.22: Comparison of Skim milk Consumption between individuals with Stroke and without Stroke

The results showed that 36 (32.1%) never consumed skim milk 13 (11.6%) had stroke and 23 (20.3%) had no stroke, 24 (21.4%) consumed for 1-2 days/week 7 (6.3%) had stroke and 17 (15.2%) had no stroke, 13 (11.6%) consumed for 2-4 days/week 7 (6.3%) had stroke and 6 (5.4%) had no stroke, 22 (19.6%) consumed for 4-6 days/week 18 (16.1%) had stroke and 4 (3.6%) had no stroke and 17 (15.2%) consumed daily 11 (9.8%) had stroke and 6 (5.4%) had no stroke. The p-value was 0.002 which is statistically significant (Table 19).

Skim Milk Consumption	Stroke		Total	p-value
	Yes	No		
Never	13 (11.6%)	23 (20.5%)	36 (32.1%)	0.002
1-2 days/ week	7 (6.3%)	17 (15.2%)	24 (21.4%)	
2-4 days/week	7 (6.3%)	6 (5.4%)	13 (11.6%)	
4-6 days/week	18 (16.1%)	4 (3.6%)	22 (19.6%)	
Daily	11 (9.8%)	6 (5.4%)	17 (15.2%)	
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 19: Comparison of skim milk consumption between individuals with stroke and without stroke

3.23: Comparison of Saturated Fat Consumption of individuals with Stroke and without Stroke

The results showed that 30 (25.8%) never consumed saturated fat 8 (7.1%) had stroke and 22 (19.6%) had no stroke, 21 (18.8%) consumed them for 1-2 days/week 9 (8.0%) had stroke and 12 (10.7%) had no stroke, 7 (6.3%) consumed for 2-4 days/week 7 (6.3%) were without stroke, 31 (27.7%) consumed them for 4-6 days/week 22 (19.6%) had stroke and 9 (8.0%) had no stroke and 23 (20.5%) consumed them daily 17 (15.2%) had stroke and 6 (5.4%) had no stroke. The p-value was 0.002 which is statistically significant (Table 20).

Saturated Fat Consumption	Stroke		Total	p-value
	Yes	No		
Never	8 (7.1%)	22 (19.6%)	30 (25.8%)	0.000
1-2 days/ week	9 (8.0%)	12 (10.7%)	21 (18.8%)	
2-4 days/week	0 (0.0%)	7 (6.3%)	7 (6.3%)	
4-6 days/week	22 (19.6%)	9 (8.0%)	31 (27.7%)	

Daily	17 (15.2%)	6 (5.4%)	23 (20.5%)	
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 20: Comparison of saturated fat consumption between individuals with stroke and without stroke.

3.24: Comparison of Unsaturated Fat Consumption between individuals with Stroke and without Stroke

The results showed that 41 (36.6%) never consumed unsaturated fat 8 (7.1%) had stroke and 33 (29.5%) had no stroke, 39 (24.8%) consumed for 1-2 days/week 16 (14.3%) had stroke and 23 (20.5%) had no stroke, 7 (6.3%) consumed for 2-4 days/week 7 (6.3%) were with stroke, 16 (14.3%) consumed for 4-6 days/week 16 (14.3%) were with stroke and 9 (8.0%) consumed unsaturated fat daily. The p- value was 0.000 which is statistically significant (Table 21).

Unsaturated Fat Consumption	**Stroke**		**Total**	**p-value**
	Yes	**No**		
Never	8 (7.1%)	33 (29.5%)	41 (36.6%)	0.000
1-2 days/ week	16 (14.3%)	23 (20.5%)	39 (24.8%)	
2-4 days/week	7 (6.3%)	0 (0.0%)	7 (6.3%)	
4-6 days/week	16 (14.3%)	0 (0.0%)	16 (14.3%)	
Daily	9 (8.0%)	0 (0.0%)	9 (8.0%)	
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 21: Comparison of unsaturated fat consumption between individuals with stroke and without stroke.

3.25: Comparison of Caffeinated beverages Consumption between individuals with Stroke and without Stroke

The results showed that 22 (19.6%) never consumed caffeinated beverages 5

(4.5%) had stroke and 17 (15.2%) had no stroke, 12 (10.7%) consumed for 1-2 days/week 5 (4.5%) had stroke and 7 (16.3%) had no stroke, 14 (12.5%) consumed for 2-4 days/week 5 (4.5%) had stroke and 9 (8.0%) had no stroke, 35 (31.3%) consumed for 4-6 days/week 27 (24.1%) had stroke and 8 (7.1%) had no stroke and 29 (25.9%) consumed daily 14 (12.5%) had stroke and 15 (13.4%) had no stroke. The p-value was 0.001 which is statistically significant (Table 22).

Caffeinated Beverages Consumption	Stroke		Total	p-value
	Yes	No		
Never	5 (4.5%)	17 (15.2%)	22 (19.6%)	0.001
1-2 days/ week	5 (4.5%)	7 (6.3%)	12 (10.7%)	
2-4 days/week	5 (4.5%)	9 (8.0%)	14 (12.5%)	
4-6 days/week	27 (24.1%)	8 (7.1%)	35 (31.3%)	
Daily	14 (12.5%)	15 (13.4%)	29 (25.9%)	
Total	56 (50.0%)	56 (50.0%)	112 (100.0%)	

Table 22: Comparison of caffeinated beverages consumption between individuals with stroke and without stroke.

3.26: Comparison of Nuts Consumption with individuals with Stroke and without Stroke

The results showed that 32 (28.6%) never consumed nuts 21 (18.8%) had stroke and 11 (9.8%) had no stroke, 20 (17.9%) consumed for 1-2 days/week 16 (14.3%) had stroke and 4 (3.6%) had no stroke, 25 (22.3%) consumed for 2-4 days/week 10 (8.9%) had stroke and 15 (13.4%) had no stroke, 26 (23.2%) consumed for 4-6 days/week 6 (5.4%) had stroke and 20 (17.9%) had no stroke and 9 (8.0%) consumed daily 3 (2.7%) had stroke and 6 (5.4%) had no stroke. The p-value is 0.001 which is statistically significant (Table 23).

Nuts Consumption	Stroke		Total	p-value
	Yes	No		
Never	21 (18.8%)	11 (9.8%)	32 (28.6%)	0.001
1-2 days/ week	16 (14.3%)	4 (3.6%)	20 (17.9%)	
2-4 days/week	10 (8.9%)	15 (13.4%)	25 (22.3%)	
4-6 days/week	6 (5.4%)	20 (17.9%)	26 (23.2%)	
Daily	3 (2.7%)	6 (5.4%)	9 (8.0%)	
Total	56(50.0%)	56(50%)	112(100%)	

Table 23: Comparison of nuts consumption between individuals with stroke and without stroke

4: Discussion

Worldwide, stroke has become the major cause of mortality and morbidity among the old-age population [32]. Stroke is a disease, in which the major arteries of the brain get blocked, and oxygen supply is depleted, resulting in death or disability [33]. There are mainly two types of strokes [34]. Most common type of stroke is ischemic stroke and other is hemorrhagic stroke [35]. The risk factors of stroke include hypertension, diabetes; cigarette smoking, abnormal blood lipids levels increased the risk of stroke [6].

Body mass index (BMI) is long established term defined as an index of weight-for-height [36]. Increasing BMI was associated with a steady increase in the risk of total ischemic, hemorrhagic stroke [37]. Diet plays a crucial role in the occurrence of stroke [38]. Several foods and nutrients have been linked to stroke risk, therefore dietary modification may be an important way to reduce risk of stroke [12]. A healthy dietary pattern exerts a beneficial effect on stroke incidence and mortality, adding a new direction toward stroke prevention on population level [39].

Result of present study showed that, 34 had ischemic stroke, 22 had hemorrhagic stroke and 56 without stroke. Result of LDL and HDL cholesterol shows that, out of 112 individuals 50 were desirable, 31 borderline and 31 were undesirable. The result of TAG level shows that, out of 112

individuals 36 were desirable, 30 borderline, and 46 were undesirable while cholesterol levels shows that 54 were desirable, 27 borderline, and 31 were undesirable Result showed that the percentage of smoking was 63 higher in stroke patients and 49 without stroke individuals. Levels of Blood pressure and diabetes were higher in stroke patients rather than without stroke individuals.

Present study was conducted on 112 hospitalized patients divided into two groups 56 with stroke and 56 without stroke and the results of present study shows that 49(3.6%) were underweight,52 (46.4%) were normal weight,38 (33.9%) were overweight, and 13(11.6%) were obese. A total of 112 individuals, stroke patient reported a high caloric intake than controls. Current findings suggested that participants who consumed higher amount of refined products, red processed meat, eggs, legumes, saturated and unsaturated fats, caffeinated beverages was associated with an elevated risk of stroke.

While, individuals who have higher intake of whole grains (wheat, barley) fiber (fruits and vegetables), lean meat (fish, poultry), low fat dairy products (skim milk) associated with lower risk of stroke. Thus, the recommended healthy lifestyle and health behaviors improved the nutritional status of individuals and also prevent from stroke.

5: Conclusion

Worldwide, stroke is a significant public health burden. Because of aging, the global stroke burden is increasing dramatically. Lifestyle factors linked to stroke include dietary factors. However, foods and nutrients are consumed in combination and the effect of individuals dietary items on disease risk can vary in relation to overall dietary pattern. Consumption of refined products, red processed meat, and high fat dairy products was significantly higher in stroke as compared to patients with without stroke. High intakes of whole grains, fruits, vegetables; lean meat, low fat dairy products was associated with reduced risk of stroke. A Mediterranean dietary pattern is one of the best dietary patterns for stroke prevention.

Conflicts of interest

There was no conflict of interest among all the authors.

Competing interests

There is no any financial or personal competing interest among authors.

References

1. Andjelkovic, A.V., et al., *Modeling blood–brain barrier pathology in cerebrovascular disease in vitro: current and future paradigms.* Fluids and Barriers of the CNS, 2020. **17**: p. 1-21.
2. Towfighi, A., B. Ovbiagele, and J.L. Saver, *Therapeutic milestone: stroke declines from the second to the third leading organ-and disease-specific cause of death in the United States.* Stroke, 2010. **41**(3): p. 499-503.
3. Askoxylakis, V., et al., *Long-term survival of cancer patients compared to heart failure and stroke: a systematic review.* BMC cancer, 2010. **10**(1): p. 1-8.
4. Owolabi, M.O., et al., *Dominant modifiable risk factors for stroke in Ghana and Nigeria (SIREN): a case-control study.* The Lancet Global Health, 2018. **6**(4): p. e436-e446.
5. Tabish, S., *Lifestyle diseases: consequences, characteristics, causes and control.* J Cardiol Curr Res, 2017. **9**(3): p. 00326.
6. Alloubani, A., A. Saleh, and I. Abdelhafiz, *Hypertension and diabetes mellitus as a predictive risk factors for stroke.* Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 2018. **12**(4): p. 577-584.
7. Kondo, T., et al., *Effects of tobacco smoking on cardiovascular disease.* Circulation Journal, 2019. **83**(10): p. 1980-1985.
8. Katan, M. and A. Luft. *Global burden of stroke*. in *Seminars in neurology*. 2018. Thieme Medical Publishers.
9. Chen, Y., et al., *Mortality and recurrent vascular events after first incident stroke: a 9-year community-based study of 0· 5 million Chinese adults.* The Lancet Global Health, 2020. **8**(4): p. e580-e590.
10. Murphy, S.J. and D.J. Werring, *Stroke: causes and clinical features.* Medicine, 2020. **48**(9): p. 561-566.
11. Koton, S. and K.M. Rexrode, *Trends in stroke incidence in the United States: Will women overtake men?* 2017, AAN Enterprises. p. 982-983.
12. Kahleova, H., S. Levin, and N.D. Barnard, *Vegetarian dietary patterns and cardiovascular disease.* Progress in cardiovascular diseases, 2018. **61**(1): p. 54-61.
13. Bechthold, A., et al., *Food groups and risk of coronary heart disease, stroke and heart failure: a systematic review and dose-response meta-analysis of prospective studies.* Critical reviews in food science and nutrition, 2019. **59**(7): p. 1071-1090.
14. Guasch-Ferré, M. and W. Willett, *The Mediterranean diet and health: A comprehensive overview.* Journal of internal medicine, 2021. **290**(3): p. 549-566.
15. Ayuso, M.I., R. Gonzalo-Gobernado, and J. Montaner, *Neuroprotective diets for stroke.* Neurochemistry International, 2017. **107**: p. 4-10.

16. Medina-Remón, A., et al., *Dietary patterns and the risk of obesity, type 2 diabetes mellitus, cardiovascular diseases, asthma, and neurodegenerative diseases.* Critical reviews in food science and nutrition, 2018. **58**(2): p. 262-296.
17. Zhao, J., et al., *A review of statistical methods for dietary pattern analysis.* Nutrition journal, 2021. **20**(1): p. 1-18.
18. Agarwal, S.K., *Impact of Diet on Cardiovascular Diseases: Hypertension and Stroke.* Asian Journal of Cardiology Research, 2021. **5**(4): p. 1-13.
19. Reynolds, A., et al., *Carbohydrate quality and human health: a series of systematic reviews and meta-analyses.* The Lancet, 2019. **393**(10170): p. 434-445.
20. Li, Y., et al., *Longitudinal change of perceived salt intake and stroke risk in a Chinese population.* Stroke, 2018. **49**(6): p. 1332-1339.
21. Clark, M.A., et al., *Multiple health and environmental impacts of foods.* Proceedings of the National Academy of Sciences, 2019. **116**(46): p. 23357-23362.
22. Li, Y., et al., *Dietary patterns are associated with stroke in Chinese adults.* The Journal of nutrition, 2011. **141**(10): p. 1834-1839.
23. Rosique-Esteban, N., et al., *Dietary magnesium and cardiovascular disease: a review with emphasis in epidemiological studies.* Nutrients, 2018. **10**(2): p. 168.
24. Chiba, R., et al., *Factors influencing quality of life in stroke patients: Focus on eating habits.* Journal of stroke and cerebrovascular diseases, 2019. **28**(6): p. 1623-1628.
25. Hemler, E.C. and F.B. Hu, *Plant-based diets for cardiovascular disease prevention: all plant foods are not created equal.* Current atherosclerosis reports, 2019. **21**: p. 1-8.
26. Miller, E.L., et al., *Comprehensive overview of nursing and interdisciplinary rehabilitation care of the stroke patient: a scientific statement from the American Heart Association.* Stroke, 2010. **41**(10): p. 2402-2448.
27. Rust, P. and C. Ekmekcioglu, *Impact of salt intake on the pathogenesis and treatment of hypertension.* Hypertension: from basic research to clinical practice, 2017: p. 61-84.
28. Chen, X., et al., *Dietary patterns and cognitive health in older adults: findings from the Sydney Memory and Ageing Study.* The journal of nutrition, health & aging, 2021. **25**: p. 255-262.
29. Mukherjee, D. and C.G. Patil, *Epidemiology and the global burden of stroke.* World neurosurgery, 2011. **76**(6): p. S85-S90.
30. Donkor, E.S., *Stroke in the century: a snapshot of the burden, epidemiology, and quality of life.* Stroke research and treatment, 2018. **2018**.
31. Micha, R., et al., *Association between dietary factors and mortality from heart disease, stroke, and type 2 diabetes in the United States.* Jama, 2017. **317**(9): p. 912-924.
32. Rupasinghe, C.D., et al., *Frequency of Stroke and Factors Associated With It Among Old Age Hypertensive Patients in Karachi, Pakistan: A Cross-Sectional Study.* Cureus, 2022. **14**(3).
33. Tuo, Q.z., S.t. Zhang, and P. Lei, *Mechanisms of neuronal cell death in ischemic stroke and their therapeutic implications.* Medicinal Research Reviews, 2022. **42**(1): p. 259-305.
34. Christensen, E.R., S.L. Golden, and S.B. Gesell, *Perceived benefits of peer support groups for stroke survivors and caregivers in rural North Carolina.* North Carolina medical journal, 2019. **80**(3): p. 143.
35. Ojaghihaghighi, S., et al., *Comparison of neurological clinical manifestation in patients with hemorrhagic and ischemic stroke.* World journal of emergency medicine, 2017. **8**(1): p. 34.

36. Nuttall, F.Q., *Body mass index: obesity, BMI, and health: a critical review.* Nutrition today, 2015. **50**(3): p. 117.
37. Shiozawa, M., et al., *Association of body mass index with ischemic and hemorrhagic stroke.* Nutrients, 2021. **13**(7): p. 2343.
38. Huang, A., et al., *Gut microbiome plays a vital role in post-stroke injury repair by mediating neuroinflammation.* International Immunopharmacology, 2023. **118**: p. 110126.
39. Galli, F., et al., *Vitamin E: Emerging aspects and new directions.* Free Radical Biology and Medicine, 2017. **102**: p. 16-36.