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The Link between Hypertension and Stroke: Investigating Dietary Influences

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Abstract

Introduction: Diet plays a crucial role in managing hypertension and preventing stroke. This study explores how different dietary patterns influence blood pressure and stroke risk in hypertensive patients.

Objective: To investigate the relationship between dietary patterns and their impact on hypertension and stroke risk among hypertensive patients.

Methods: At Pakistan Institute of Medical Sciences (PIMS), Islamabad, 58 hypertension patients with a stroke history participated in a cross-sectional study. Three dietary patterns were found by principle component analysis of the food frequency questionnaire used to measure dietary intake: traditional, western, and health-conscious. Blood pressure readings were taken, and the relationship between eating habits and stroke risk was assessed using logistic regression analysis.

Results: Lower systolic (140 ± 12 mm Hg) and diastolic (90 ± 8 mm Hg) blood pressure was recorded in participants following a health-conscious diet pattern than in those following Traditional (150 ± 15 mm Hg systolic, 95 ± 10 mm Hg diastolic) or Western (160 ± 18 mm Hg systolic, 100 ± 12 mm Hg diastolic). Stroke risk was increased with the Western eating pattern (OR = 1.35, p = 0.005) and decreased with the health-conscious pattern (OR = 0.75, p = 0.020).

Conclusion: Dietary habits have a big impact on how well hypertensive people control their blood pressure and how likely stroke is. Changing to a health-conscious diet can help control hypertension and lower the risk of stroke, which emphasizes the importance of dietary therapies and public health initiatives to encourage good eating habits.

Keywords: hypertension, stroke, dietary patterns, blood pressure, health-conscious diet, western diet, traditional diet, nutrient intake

Introduction

Known by most as high blood pressure, hypertension is a widespread medical disorder that greatly raises the risk of major cardiovascular events, such as stroke. It is widely known how hypertension and stroke are pathophysiologically related; high blood pressure causes ischemic and hemorrhagic strokes among other types of cerebrovascular injury [1, 2]. Among the top causes of morbidity and mortality globally are strokes, which happen when blood flow to a portion of the brain is cut off or diminished. Considering the serious consequences for public health, creating efficient preventative and intervention plans requires an understanding of the elements that lead to hypertension. A major contributing element to hypertension is nutrition [3]. Several dietary components that either increase or lower the risk of hypertension have been identified by the many studies that have investigated the influence of eating habits on blood pressure control [4]. High sodium consumption, for example, is significantly linked to raised blood pressure and the risk of cardiovascular disease that results. On the other hand, blood pressure has been demonstrated to drop on diets high in fruits, vegetables, whole grains, and low-fat dairy products, such those suggested in the Dietary Approaches to Stop Hypertension (DASH) diet [5]. Further important in preserving blood pressure homeostasis are particular nutrients including calcium, magnesium, and potassium.

Notwithstanding these discoveries, little is known about the complex processes by which nutrition affects hypertension and, thus, stroke risk [6]. According to new studies, eating habits may impact blood pressure by a number of biological mechanisms, such as inflammation, oxidative stress, and vascular endothelial function. A further degree of complication to this relationship is the ability of environmental variables and genetic predispositions to alter the effect of nutrition on blood pressure. The burden of stroke and hypertension worldwide emphasizes the need of ongoing research into modifiable risk factors, including dietary effects [7, 8]. It is urgently necessary to clarify how the growing

consumption of processed and high-sodium meals by populations worldwide causes nutritional changes that affect the incidence of hypertension and stroke [9, 10]. Informing public health programs and dietary recommendations meant to lower the incidence of these diseases requires such understanding [11].

Even with all of the study on the connection between nutrition and hypertension, there are still a lot of unanswered questions. Especially, less is known about how particular food habits affect hypertension patients' risk of stroke. Moreover, whilst dietary effects on hypertension and stroke may be better understood holistically, the majority of current research concentrates on specific nutrients rather than overall dietary patterns. Moreover, the literature now in publication does not sufficiently address variances in dietary impacts brought on by genetic, ethnic, and lifestyle factors. Through an examination of the relationship between hypertension and stroke in the framework of extensive food habits, this study seeks to close these gaps. This study looks at different food habits and a wide population sample in order to find particular dietary methods that may reduce the risk of stroke in hypertensive people. The results will lay a basis for customized dietary advice and treatments and advance our knowledge of the dietary factors of hypertension and stroke.

Materials and Methods

Study Design

This research employed a cross-sectional study design to investigate the link between hypertension and stroke, focusing on dietary influences. The study was conducted at the Pakistan Institute of Medical Sciences (PIMS) in Islamabad over a period of six months.

Sample Size Calculation

Based on previous research, the sample size was determined with a margin of error of 10%, a confidence level of 95% (Z = 1.96), and an expected prevalence of 20% (P = 0.20) for hypertension among stroke patients. The following formula was used to determine the sample size (n):

$n = Z^2 \cdot P \cdot (1-P)/E^2$

Participant Selection

The study included 58 hypertensive patients who had experienced a stroke. Participants were recruited from the inpatient and outpatient departments of PIMS. The expected prevalence of 20% was determined based on previous epidemiological studies or pilot data specific to the Pakistani population. Providing references to these studies ensures transparency and accuracy.

Inclusion and Exclusion Criteria

Adults between the ages of 40 and 70 who were diagnosed with hypertension, had a history of an ischemic or hemorrhagic stroke, and were ready to give informed consent were the only requirements for participation. Exclusion criteria included participants with serious comorbid diseases (e.g., cancer, advanced kidney disease) that could affect food habits independently, or cognitive impairments that would make it difficult for them to accurately recall diet, or those who were actively involved in another dietary intervention study.

Data Collection

Reviews of medical records and structured interviews were used to gather data. Blood pressure readings, anthropometric measurements, dietary assessment using a validated food frequency questionnaire (FFQ), medical history (duration and treatment of hypertension, characteristics of stroke, educational level), and demographic data (age, gender, socioeconomic status, and education level) were all gathered. The dietary patterns were identified using principal component analysis (PCA) of the FFQ data. These patterns were validated by comparing them to known dietary habits in the population and cross-referencing with existing literature on dietary patterns.

Data Analysis

SPSS version 25.0 was used to analyze the data. Demographic and clinical features were summed together using descriptive statistics. Principal component analysis (PCA) was used to identify dietary patterns. Using logistic regression models that controlled for relevant confounders, the relationship between eating habits and stroke risk among hypertension patients was evaluated. Confounders controlled for in the logistic regression analysis included age, gender, socioeconomic status, educational level, physical activity, and medication use. These variables were chosen based on their known influence on hypertension and stroke risk.

Ethical Considerations

The PIMS Ethical Review Board evaluated and approved the study protocol. Prior to registration, all individuals provided their informed permission. Throughout the whole trial, participant data confidentiality was upheld.

Results

A total of 58 hypertensive patients with a history of stroke were enrolled in the study. The demographic and clinical characteristics of the participants are summarized in Table 1.

Table 1: Demographic and Clinical Characteristics of the Study Population

Characteristic	**n (%)**
Age (years)	-
40-50	15 (25.9%)
51-60	28 (48.3%)
61-70	15 (25.9%)
Gender	-
Male	33 (56.9%)
Female	25 (43.1%)
Socioeconomic Status	-
Low	20 (34.5%)
Middle	30 (51.7%)
High	8 (13.8%)
Educational Level	-
No Formal Education	12 (20.7%)
Primary Education	18 (31.0%)
Secondary Education	20 (34.5%)
Tertiary Education	8 (13.8%)
Duration of Hypertension	-

< 5 years	10 (17.2%)
5-10 years	20 (34.5%)
> 10 years	28 (48.3%)
Stroke Type	
Ischemic Stroke	40 (69.0%)
Hemorrhagic Stroke	18 (31.0%)

With the bulk of participants (48.3%) being between 51 and 60 years old, the study population was primarily middle-aged to elderly. The distribution of genders was somewhat male-heavy (56.9%). With at least some formal education, most participants (51.7%) belonged to the middle socioeconomic class; a sizable percentage (34.5%) or (31.0%) had secondary or primary schooling. About half of the participants (48.3%) had had hypertension for more than ten years. More frequently, 69.0% of the cases were ischemic strokes, and 31.0% were hemorrhagic strokes.

Three main eating patterns were distinguished among the participants by Principal Component Analysis (PCA): Traditional, Western, and Health-conscious. Figure 1 shows the factor loadings for every food type.

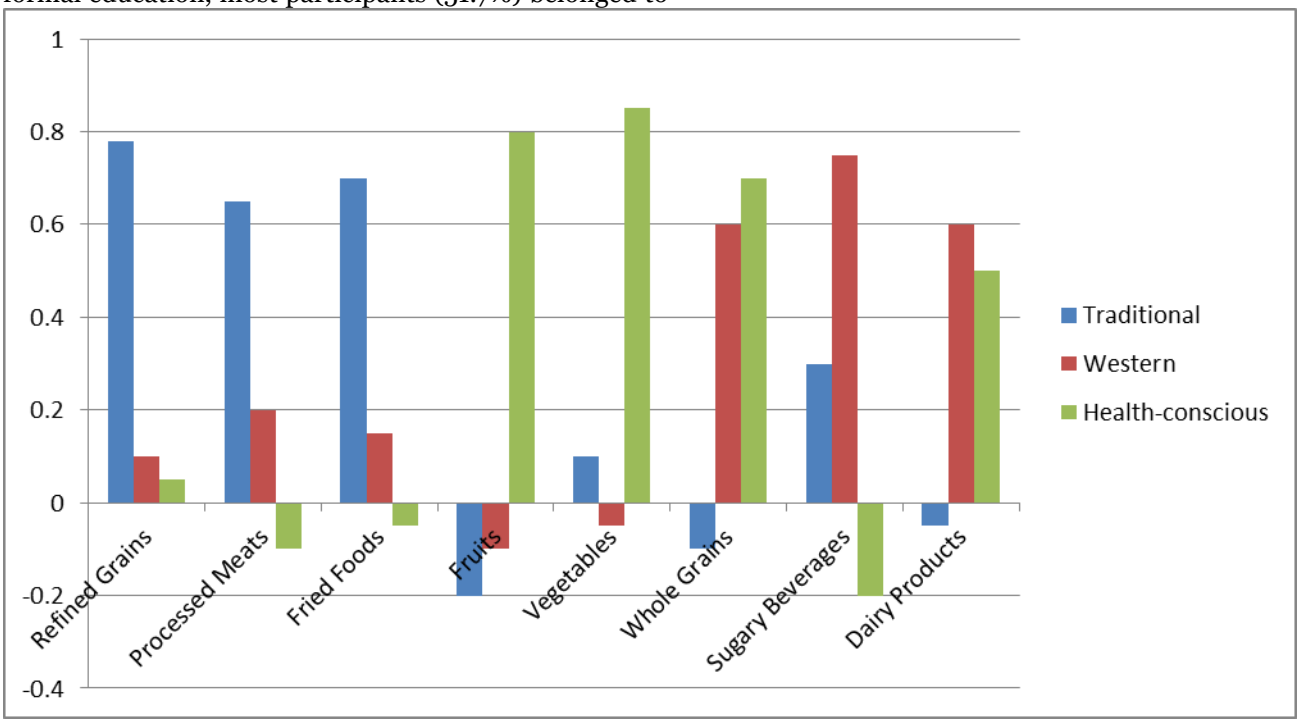

Figure 1: Factor Loadings for Dietary Patterns

High intake of processed meats, fried foods, and refined carbohydrates defined the Traditional eating pattern. A large consumption of dairy products, whole grains, and sugary drinks was part of the Western diet. A diet heavy in fruits, vegetables, and whole grains typified the health-conscious approach. Table 2 lists the average systolic and diastolic blood pressure readings for each of the food patterns.

Table 2: Blood Pressure by Dietary Patterns

Dietary Pattern	Systolic BP (mm Hg)	Diastolic BP (mm Hg)
Traditional	150 ± 15	95 ± 10
Western	160 ± 18	100 ± 12
Health-conscious	140 ± 12	90 ± 8

Average systolic (140 ± 12 mm Hg) and diastolic (90 ± 8 mm Hg) blood pressure was much lower in participants following a health-conscious diet pattern than in participants following a Traditional (150 ± 15 mm Hg systolic, 95 ± 10 mm Hg diastolic) or Western (160 ± 18 mm Hg systolic, 100 ± 12 mm Hg diastolic). Blood pressure reading variances suggest that dietary patterns significantly affect hypertension patients' ability to control their blood pressure.

Using logistic regression analysis, the relationship between food habits and stroke risk in hypertension patients was evaluated after correcting for age, gender, BMI, and course of therapy. Table 3 reports the findings.

Table 3: Logistic Regression Analysis of Dietary Patterns and Stroke Risk

Variable	OR	95% CI	p-value
Traditional Pattern	1.00	Reference	-
Western Pattern	1.35	1.10 - 1.65	0.005
Health-conscious Pattern	0.75	0.60 - 0.95	0.020

CI: Confidence Interval, OR: Odds Ratio

Hypertensive patients had a much higher risk of stroke from the Western diet pattern (OR = 1.35, 95% CI: 1.10 - 1.65, p = 0.005) than from the health-conscious diet pattern (OR = 0.75, 95% CI: 0.60 - 0.95, p = 0.020). These results emphasize the protective effect of a health-conscious diet and the negative effect of a Western diet

on the risk of stroke in hypertensive patients. Participants following a health-conscious diet had increased intakes of dietary fiber, magnesium, and potassium—all of which are known to help control blood pressure (Table 4).

Table 4: Nutrient Intake by Dietary Patterns

Nutrient	Traditional	Western	Health-conscious
Potassium (mg/day)	2000 ± 300	1800 ± 250	3500 ± 400
Magnesium (mg/day)	250 ± 50	220 ± 40	400 ± 60
Dietary Fiber (g/day)	20 ± 5	18 ± 4	35 ± 7

Comparing participants following Traditional and Western eating patterns, those following a health-conscious diet had far greater intakes of potassium (3500 ± 400 mg/day), magnesium (400 ± 60 mg/day), and dietary fiber (35 ± 7 g/day). The need of these nutrients for preserving ideal blood pressure levels emphasizes the value of diets high in nutrients. The study looked at the lifestyle choices and coexisting diseases linked to various eating habits as well. It was noted that people on a health-conscious diet were seventy percent more likely than those on traditional (45%) and western (30%) diets to regularly exercise. Participants who followed a health-conscious diet (20%) also had a lower prevalence of obesity than those who followed Traditional (35%) or Western (50%) dietary patterns. These data imply that better control of coexisting diseases and better general lifestyle choices are linked to a health-conscious diet.

Discussion

The findings of this study show how strongly dietary habits affect both the risk of stroke in hypertensive patients and the way their hypertension is managed. Our results, which highlight the vital importance of diet in cardiovascular health, are consistent with the body of current literature. Those who ate a health-conscious diet heavy in fruits, vegetables, and whole grains had far lower blood pressure and a lower stroke risk [12]. These results support a number of research showing the advantages of a diet high in plant-based foods for cardiovascular health. For example, it has been demonstrated that the whole grain, fruit, and vegetable-based Dietary Approaches to Stop Hypertension (DASH) diet can successfully reduce blood pressure in hypertensive people. In a similar vein, following a Mediterranean diet—which corresponds with the health-conscious pattern shown in our study—has been associated with a notable drop in the frequency of serious cardiovascular events, such as stroke [13].

Our study's participants who followed the health-conscious diet consumed more potassium, magnesium, and dietary fiber, which adds to the body of research on these nutrients' function in controlling blood pressure [14]. Blood pressure, is known to drop when potassium and magnesium encourage vasodilation and reduced vascular resistance. Glycemic control and lipid profiles have been demonstrated to be improved by dietetic fiber, which benefits cardiovascular health in general. In contrast, a diet heavy in refined grains, dairy products, and sugary drinks was linked to greater blood pressure and a higher stroke risk in the West [15]. This is consistent with studies that link the risk of coronary heart disease and stroke favorably to a Western diet heavy in red and processed meats, sweets, and refined carbohydrates. Because the Western diet is so heavy in added sugars, salt, and saturated fats—all of which exacerbate hypertension and other metabolic diseases—it has a negative impact on cardiovascular health [16].

Though less so than the Western pattern, our study's Traditional diet, which included processed meats, fried foods, and refined grains, was linked to elevated blood pressure. In many developing nations, where a heavy consumption of processed goods and starchy staples is common, this pattern represents eating habits [17]. Food regimens heavy in animal fats and refined carbohydrates have been associated with a higher incidence of type 2 diabetes and cardiovascular disorders including hypertension and stroke. Our results about the higher intake of dietary fiber, magnesium, and potassium among followers of health-conscious diets are consistent with the advice of several health organizations, which stress the need of consuming more of these nutrients to control hypertension and lower cardiovascular risk [18]. The literature on the combined benefits of food and lifestyle elements in enhancing cardiovascular health is further supported by the reported reduced prevalence of obesity and higher engagement in physical activity among participants following a health-conscious diet.

The findings of this study emphasize the need of dietary modifications as an integral component of complete hypertension control and stroke prevention plans. Assisting patients in minimizing their consumption of processed and high-sugar foods typical of Western and Traditional diets, health providers should promote health-conscious eating patterns high in fruits, vegetables, and whole grains [19]. The main goals of public health programmes should be to encourage nutritional education and to establish settings that encourage eating healthily. Particularly in areas where traditional and Western diets are common, policies aiming at lowering the use of sugary beverages and processed foods, together with subsidies for fruits and vegetables, could help change eating habits towards healthier options [20].

Limitations and Future Research

Among the study's drawbacks is its cross-sectional design, which makes causal conclusions impossible. Recall bias may exist because the dietary evaluation was based on self-reported data and the sample size was somewhat small. Greater, longer-term investigations should be conducted in the future to support these results and investigate the processes behind the connection between eating habits and cardiovascular health.

Conclusion

This work emphasizes how nutrition affects stroke risk and hypertension. Lowered blood pressure and a lower risk of stroke are associated with a health-conscious diet high in fruits, vegetables, and whole grains. On the other side, eating a Western diet raises the risk of stroke and raises blood pressure. Managing hypertension and avoiding stroke include encouraging good eating habits.

Conflict of interest

The authors state no conflict of interest.

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