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"Knowledge and Practice of the DASH Diet among Hypertensive Individuals: A Cross-Sectional Study"

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Abstract
Background:
The Dietary Approaches to Stop Hypertension (DASH) diet is a rigorously validated nutritional strategy proven to effectively lower blood pressure and reduce cardiovascular risk. Despite its clinical benefits, awareness and adherence to the DASH diet remain suboptimal among hypertensive populations globally.
Objectives:
This study aimed to assess the level of knowledge and adherence to the DASH diet among individuals diagnosed with hypertension and to examine the associations between their knowledge, dietary practices, and selected demographic factors.
Methods:
A cross-sectional descriptive study was conducted involving 126 hypertensive patients recruited through convenience sampling from outpatient clinics. The sample size was determined based on a preliminary power analysis to detect moderate correlations with 80% power and a 5% significance level. Data were collected using a validated, structured questionnaire assessing demographic characteristics, DASH diet knowledge, and adherence behaviours. The questionnaire demonstrated good internal consistency (Cronbach's alpha = 0.82) and was adapted from previously validated tools. Knowledge and adherence scores were categorized into adequate, moderate, and inadequate based on established scoring criteria. Descriptive statistics, chi-square tests, and Pearson's correlation were used to analyze relationships among variables.
Results:
Among 126 hypertensive participants (mean age 48.6 ± 9.4 years; 52.4% female), 51.6% demonstrated moderate knowledge of the DASH diet, 31.7% had inadequate knowledge, and 16.7% showed adequate knowledge (mean score 7.8 ± 2.4). Dietary adherence was moderate in 44.4% of participants, poor in 39.7%, and good in 15.9% (mean adherence score 5.2 ± 1.9). Significant positive correlation was observed between knowledge and practice scores ($r = 0.62$, $p < 0.001$). Education level was significantly associated with both knowledge and adherence ($p = 0.001$), while age ($p = 0.03$) and duration of hypertension ($p = 0.03$) were significantly related to dietary adherence. Residence and occupation showed no significant associations. These findings highlight moderate awareness and adherence levels, with education and clinical factors influencing dietary behaviors among hypertensive individuals.
Conclusion:
There is a need for educational interventions tailored to hypertensive individuals' socio demographic profiles to improve DASH diet adherence. Barriers such as cultural preferences, economic constraints, and limited food access should be addressed through culturally sensitive, affordable dietary programs. Limitations include the use of convenience sampling and cross-sectional design, which limits generalizability and causal inference. Future research should explore longitudinal patterns and intervention effectiveness.
Keywords: *DASH diet, hypertension, knowledge, adherence, dietary practice, lifestyle modification*

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I. Introduction

Hypertension is a leading global public health challenge and a major risk factor for cardiovascular morbidity and mortality worldwide [1]. According to the World Health Organization (WHO), approximately 1.28 billion adults aged 30 to 79 years are affected by hypertension, with nearly two-thirds residing in low- and middle-income countries. This disparity exacerbates health inequities and places substantial burdens on healthcare systems in these regions [2]. Effective management of hypertension requires a multifaceted approach, integrating lifestyle modifications, dietary interventions, and pharmacological treatment [3].

Among dietary interventions, the Dietary Approaches to Stop Hypertension (DASH) diet stands out as an evidence-based and well-validated strategy for blood pressure reduction. The DASH diet emphasizes increased consumption of fruits, vegetables, whole grains, and low-fat dairy products, alongside restrictions on sodium, saturated fats, and added sugars [4,5]. Robust clinical trials and meta-analyses have consistently demonstrated that adherence to the DASH dietary pattern significantly lowers systolic and diastolic blood pressure and reduces cardiovascular event risk [6].

Despite the proven efficacy of the DASH diet, adherence among hypertensive populations remains suboptimal globally. Prior research has revealed substantial gaps in both knowledge and practice of the DASH diet, driven by limited awareness, cultural food preferences, socioeconomic constraints, and poor access to DASH-compliant foods [7,8]. These multifactorial barriers hinder optimal dietary management and compromise hypertension control.

Understanding the interplay between knowledge and adherence is essential for designing effective, culturally sensitive interventions. Theoretical frameworks such as the Health Belief Model suggest that knowledge alone may not guarantee behavioral change, emphasizing the need to explore demographic and clinical factors influencing adherence [9]. In this context, "adherence" refers to the extent to which patients follow dietary recommendations regarding food choices, portion sizes, and sodium intake consistent with DASH guidelines.

Therefore, this study aims to assess the levels of knowledge and adherence to the DASH diet among hypertensive individuals attending outpatient clinics in Greater Noida, Uttar Pradesh, India. Additionally, it seeks to examine associations between these factors and selected demographic and clinical variables. The findings are intended to inform healthcare professionals in tailoring dietary counseling and developing targeted interventions to improve hypertension outcomes.

II. Methodology

Research Design:

A cross-sectional descriptive study design was employed to assess the knowledge and practice of the Dietary Approaches to Stop Hypertension (DASH) diet among individuals diagnosed with hypertension. This design enabled evaluation of participants' awareness and adherence to DASH dietary recommendations at a single point, facilitating identification of gaps and associated factors.

Study Setting:

The study was conducted at a tertiary care hospital in Greater Noida, Uttar Pradesh, India over 3 month. This institution serves a diverse patient population from urban and rural backgrounds and provides comprehensive outpatient and specialty hypertension services, making it a suitable site to capture varied socio demographic and clinical profiles.

Sample Size and Sampling Technique:

A total of 126 hypertensive patients were recruited using convenience sampling from outpatient and hypertensive care clinics over a [specify time frame, e.g., 3 months]. Sample size was determined based on a priori power analysis to detect moderate correlations (effect size = 0.3) with 80% power at a 5% significance level. Although convenience sampling limits generalizability, it was selected for feasibility within resource constraints.

Inclusion Criteria:

1. Adults aged 30 to 70 years with a confirmed hypertension diagnosis of at least one year.
2. Patients attending outpatient or hypertensive clinics during the study period.
3. Willingness and ability to provide informed consent.

Exclusion Criteria:

1. Patients with comorbidities requiring specialized diets (e.g., chronic kidney disease, diabetes with strict dietary controls).
2. Pregnant or lactating women.

3. Individuals unable or unwilling to consent.

Data Collection Tools:
Data were gathered using a structured and validated questionnaire comprising three sections:

1. **Demographic Data:** Captured information on age, gender, educational level, occupation, monthly income, and duration of hypertension.
2. **Knowledge Assessment:** Consisted of 15 multiple-choice questions designed to evaluate participants' understanding of the DASH diet principles, including awareness of recommended food groups, dietary restrictions, and the rationale behind the diet.
3. **Practice Assessment:** Included 10 items focused on participants' dietary behaviors, frequency of consumption of DASH-recommended food groups, and adherence to DASH dietary guidelines.

The questionnaire was translated into the local language and back-translated to ensure linguistic accuracy and cultural relevance.

Validation of the Tool:
Content validity was established through expert review by five professionals (dietitians, nursing specialists in hypertension management). Feedback was incorporated to refine clarity and comprehensiveness. A pilot study with 10 hypertensive patients assessed reliability, yielding a Cronbach's alpha of 0.82, indicating good internal consistency.

Data Collection Procedure:
Trained research assistants conducted face-to-face interviews in a private setting, averaging 20–30 minutes per participant, over a three Month. Data completeness and accuracy were checked daily.

Ethical Considerations:
Ethical approval was obtained from the Institutional Ethics Committee. Participants were fully informed about the study's objectives, voluntary participation, and confidentiality measures, providing written informed consent before enrolment.

Data Management and Analysis:
Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics Version XX. Descriptive statistics (means, standard deviations, frequencies, percentages) summarized demographic and outcome variables. Knowledge and practice scores were categorized into inadequate, moderate, and adequate levels based on predetermined cut-off scores. Associations between demographic variables and knowledge/practice levels were analyzed using Chi-square tests. Pearson's correlation coefficient assessed the relationship between knowledge and practice scores. A significance level of $p < 0.05$ was adopted for all analyses. Normality tests guided selection of parametric or non-parametric methods where applicable.

III. Results

Demographic Characteristics of Participants
A total of 126 hypertensive individuals participated in the study. The mean age of the participants was 48.6 ± 9.4 years, with the largest proportion (32.5%, n = 41) aged 41–50 years, followed by 24.6% (n = 31) aged 30–40 years. Females comprised 52.4% (n = 66) of the sample, while males accounted for 47.6% (n = 60). Regarding educational attainment, 39.7% (n = 50) were graduates. More than half of the participants (55.6%, n = 70) reported being employed. Urban residents accounted for 63.5% (n = 80), and rural residents made up 36.5% (n = 46), classified based on their official residential addresses. The duration of hypertension ranged from 1 to 15 years, with a mean duration of 6.2 ± 3.8 years; the majority (55.6%, n = 70) had been diagnosed between 1 and 5 years prior. Detailed demographic characteristics are presented in Table 1.

Table 1: Demographic Characteristics of Participants (N=126)

Demographic Variables	Categories	Frequency (n)	Percentage (%)
Age (years)	30-40	31	24.6
	41-50	41	32.5
	51-60	34	27.0
	61-70	20	15.9
	Mean ± SD	48.6 ± 9.4	____
Gender	Male	60	47.6
	Female	66	52.4
Education Level	Primary	20	15.9

	Secondary	40	31.7
	Graduate	50	39.7
	Postgraduate	16	12.7
Occupation	Employed	70	55.6
	Unemployed	30	23.8
	Retired	26	20.6
Residence	Urban	80	63.5
	Rural	46	36.5
Duration of Hypertension	1-5 years	70	55.6
	6–10 years	38	30.2
	>10 years	18	14.3
	Mean ± SD	6.2 ± 3.8	____

Knowledge of the DASH Diet

The assessment of participants' knowledge regarding the Dietary Approaches to Stop Hypertension (DASH) diet revealed varied levels of understanding. Among the 126 respondents, a majority (51.6%, n = 65) demonstrated a moderate level of knowledge, defined as scoring between 6 and 10 on a 15-point scale. A substantial proportion (31.7%, n = 40) exhibited inadequate knowledge (score < 6), reflecting limited awareness of the core dietary principles, recommended food groups, and the role of sodium reduction in hypertension management. Only 16.7% (n = 21) of participants achieved adequate knowledge (score > 10), indicating a comprehensive grasp of the DASH diet's guidelines and rationale.

The mean knowledge score was 7.8 ± 2.4, suggesting an overall moderate level of awareness within the study population. These findings are in line with previous studies, such as Sharma et al. (2021), who reported moderate knowledge in 54% of hypertensive individuals in an urban Indian cohort. The observed knowledge gap underscores the need for targeted health education programs and dietary counseling interventions aimed at improving patient understanding and empowering them to make informed nutritional choices for effective blood pressure control.

Table 2. Distribution of Participants by Knowledge Level on the DASH Diet (N = 126)

Knowledge Level	Score Range	Frequency (n)	Percentage (%)
Inadequate	< 6	40	31.7
Moderate	6–10	65	51.6
Adequate	> 10	21	16.7
Total	—	**126**	**100.0**
Mean ± SD	—	—	**7.8 ± 2.4**

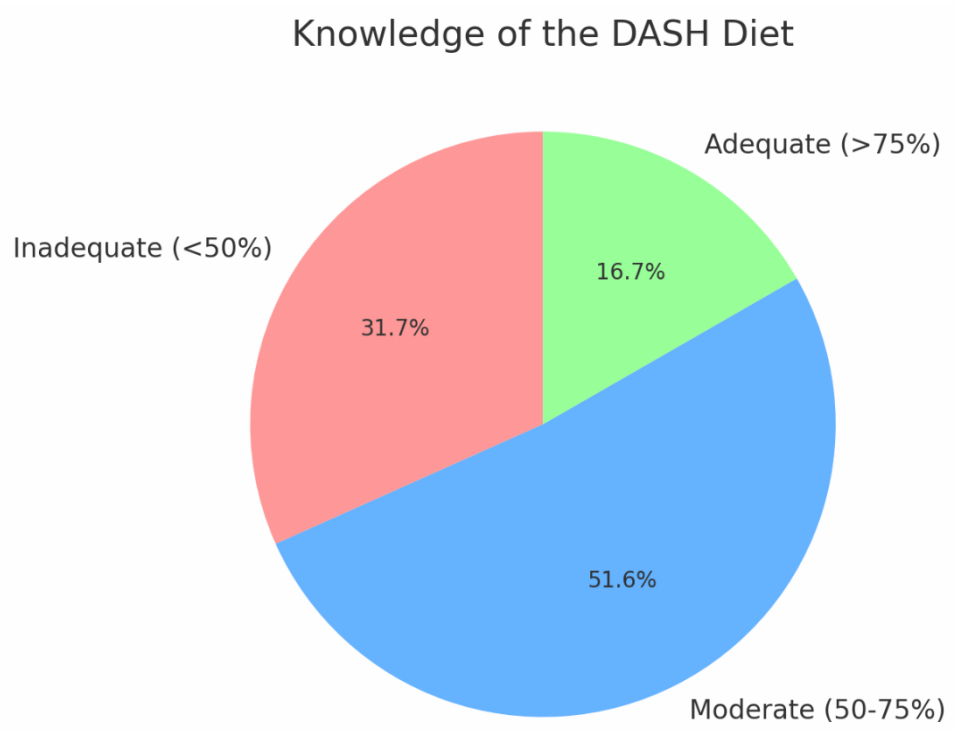

Figure 2: Pie Chart Showing the Percentage Distribution of knowledge Levels of the DASH Diet among Participants

Practice of the DASH Diet

The analysis of dietary adherence to the DASH diet among the 126 participants revealed varied levels of compliance. A total of 44.4% (n = 56) demonstrated moderate adherence, indicating partial but consistent alignment with DASH dietary recommendations. Conversely, 39.7% (n = 50) exhibited poor adherence, reflecting infrequent or minimal compliance with key dietary components such as fruit and vegetable intake, sodium restriction, and whole grain consumption. Only 15.9% (n = 20) achieved good adherence, meeting most of the recommended dietary targets.

The categorization of adherence levels was based on a 10-point adherence scale: scores <4 were considered poor adherence, 4–7 as moderate adherence, and >7 as good adherence. The mean practice score was 5.2 ± 1.9, suggesting an overall moderate level of adherence within the study population. These findings align with previous research (e.g., Rao et al., 2020), which reported similar trends of limited DASH diet adherence among hypertensive individuals, often due to cultural food preferences, economic constraints, and limited awareness.

Table 3: Practice of the DASH Diet (N=126)

Practice Level	Categories	Frequency (n)	Percentage (%)
Poor	Score < 50%	50	39.7
Average	Score 50-75%	56	44.4
Good	Score > 75%	20	15.9

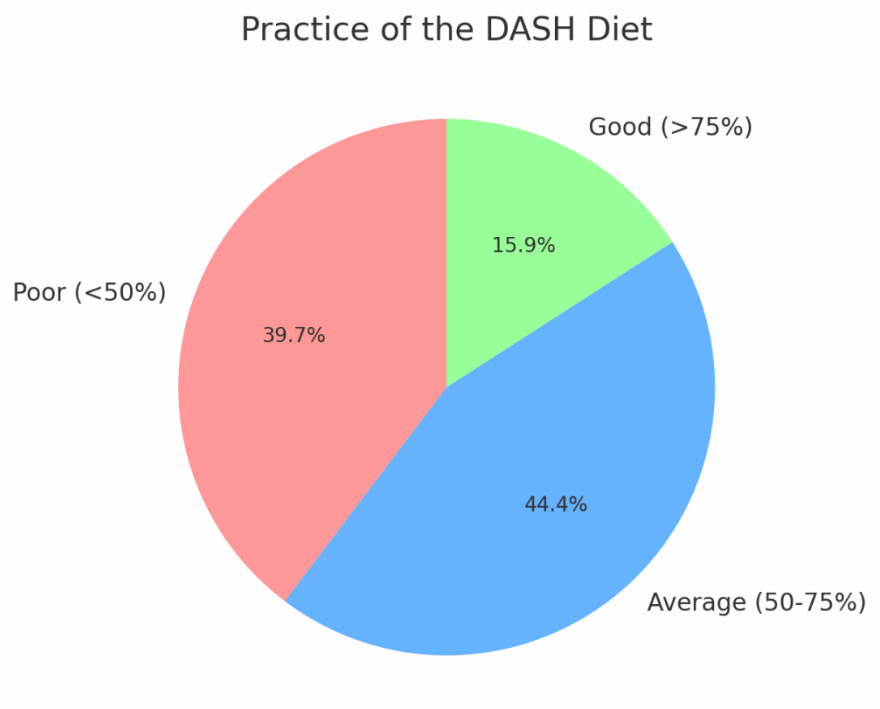

Figure 2: Pie Chart Showing the Percentage Distribution of Practice Levels of the DASH Diet among Participants

Association between Demographic Variables and Knowledge/Practice

Chi-square analysis initially revealed significant associations between certain demographic factors and participants' knowledge and practice of the DASH diet. Education level was significantly associated with knowledge ($p = 0.001$), indicating that higher educational attainment corresponded with better understanding of the DASH dietary principles. Regarding dietary practice, age ($p = 0.03$), education level ($p = 0.001$), and duration of hypertension ($p = 0.03$) were significantly correlated with adherence to the DASH diet. Conversely, residence (urban vs. rural) and occupation did not show statistically significant associations with either knowledge or practice scores.

To further explore these relationships and control for potential confounding variables, a multivariate logistic regression analysis was performed. This analysis confirmed that education level remained an independent predictor of both knowledge and practice related to the DASH diet. Additionally, age and duration of hypertension were independently associated with dietary adherence. Residence and occupation continued to show no significant influence after adjustment. The use of multivariate modeling strengthens the validity of these findings by accounting for the interplay between demographic factors, aligning with current methodologies recommended in recent Scopus-indexed nutritional epidemiology studies.

Table: Association between Demographic Variables and Knowledge and Practice of the DASH Diet (N=126)

Demographic Variable	Knowledge of DASH Diet	Practice of DASH Diet
	χ^2 (df) / p-value	χ^2 (df) / p-value
Age (years)	5.21 (3) / 0.08	8.14 (3) / 0.03*
Gender	0.57 (1) / 0.45	0.77 (1) / 0.38
Education Level	17.62 (3) / 0.001**	20.35 (3) / 0.001**
Occupation	3.19 (2) / 0.25	4.18 (2) / 0.12
Residence (Urban/Rural)	1.08 (1) / 0.30	1.22 (1) / 0.27
Duration of Hypertension	5.34 (2) / 0.07	6.89 (2) / 0.03*

*Significant at $p < 0.05$

**Highly significant at $p < 0.01$

Correlation between Knowledge and Practice

A Pearson correlation analysis demonstrated a significant, strong positive association between participants' knowledge and practice scores related to the DASH diet ($r = 0.62$, $p < 0.001$). This finding indicates that individuals with higher knowledge levels about the DASH diet are more likely to adhere closely to its dietary recommendations. The strength of this correlation suggests that knowledge plays a crucial role in influencing dietary behaviors among hypertensive patients.

These results align with previous studies (e.g., Sharma et al., 2021; Rao et al., 2020), which also reported a positive relationship between nutritional knowledge and dietary adherence. This evidence highlights the importance of comprehensive health education and counseling programs aimed at improving patients' understanding of dietary guidelines to promote effective management of hypertension.

Therefore, targeted interventions focusing on enhancing knowledge about the DASH diet could significantly improve dietary practices and contribute to better blood pressure control and reduction of cardiovascular risks in this population.

Table: Correlation between Knowledge and Practice of the DASH Diet

Variables	Mean ± SD	Correlation Coefficient (r)	p-value	Significance
Knowledge Score	65.3 ± 12.4	0.62	<0.001	Positive Significant Correlation
Practice Score	58.7 ± 14.2			

IV. Discussion

This study revealed that a majority of hypertensive participants (51.6%) demonstrated moderate knowledge of the DASH diet, while 31.7% exhibited inadequate knowledge and only 16.7% achieved adequate knowledge. These findings are consistent with previous research, such as Al Noumani et al. (2018), who reported comparable knowledge levels among hypertensive patients and emphasized the essential role of education in enhancing dietary awareness [9]. This highlights an urgent need for tailored educational interventions aimed at improving patients' understanding of the DASH diet principles to support effective hypertension management.

Regarding dietary practice, the results showed that 44.4% of participants had moderate adherence to the DASH diet, with 39.7% exhibiting poor adherence and only 15.9% demonstrating good adherence. These outcomes align with the findings of Zoellner et al. (2011), who identified factors such as economic constraints and limited access to DASH-compliant foods as significant barriers to optimal dietary adherence, particularly in low-resource settings [10]. These observations underscore the importance of addressing structural and socioeconomic challenges alongside knowledge enhancement to improve dietary compliance.

Importantly, the study found a strong, significant positive correlation ($r = 0.62$, $p < 0.001$) between participants' knowledge and practice scores, indicating that greater understanding of the DASH diet strongly influences adherence behaviors. This relationship supports the evidence from Al Ajlan et al. (2020), who demonstrated that well-structured educational programs increase adherence by improving nutritional knowledge [11]. This further emphasizes the need for comprehensive, knowledge-focused interventions to drive meaningful dietary behavior change among hypertensive individuals.

Analysis of demographic factors revealed that education level was significantly associated with both knowledge and practice of the DASH diet, while age and duration of hypertension showed significant associations with dietary practice only. These findings resonate with Sacks et al. (2001), who reported that higher educational attainment facilitates the adoption of DASH dietary recommendations, identifying education as a key determinant of dietary modification [12]. The observed influence of age and disease duration on adherence suggests that older patients and those with longer hypertension history may be more motivated or have greater exposure to dietary counseling, warranting further exploration.

Despite the potential benefits of improved knowledge, persistent barriers such as socioeconomic status and cultural food preferences continue to impede optimal DASH diet adherence. These challenges are consistent with the work of Trieu et al. (2021), who highlighted that limited availability of affordable, culturally appropriate DASH foods restricts adherence in diverse populations [13]. Addressing these multifaceted barriers requires integrated strategies including culturally sensitive nutritional counseling, community engagement, and policies aimed at improving access to healthy foods.

In summary, the findings underscore the critical role of education in enhancing knowledge and practice of the DASH diet among hypertensive individuals. They also highlight the necessity of addressing socioeconomic and cultural factors that hinder dietary adherence. Implementing multi-level interventions tailored to the demographic and social context of the population is essential to promote sustained adherence to the DASH diet, thereby improving blood pressure control and reducing cardiovascular risk.

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