Effects of nutrition intervention on management of hypertensive patients attending tertiary hospitals in Imo State

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Abstract

Hypertension can silently inflict damage on an individual's body for extended periods before symptoms manifest. It poses a risk factor for arterial damage and constriction. If left unmanaged, it may lead to disability, compromised quality of life, or fatal heart attacks. Eating behaviours stand out as an essential risk factor in the epidemiological study of hypertension. Therefore, this study was undertaken to improve the eating behaviour of hypertensive patients by introducing a nutrition intervention strategy which comprised of the use of modified diet (DASH). In a cross-sectional study, using multi-stage sampling techniques, 400 hypertensive adults were selected. Validated questionnaires were administered to elicit information on socio-demographic, food frequency, lifestyle and nutrition knowledge by the respondents. The 400 participants were split into two groups being, 200 in experimental group and 200 in control group. Experimental group was counselled on use of (DASH) diet while control group was not counselled on use of the diet. Blood pressure, blood sugar, dietary diversity score and nutrition knowledge were assessed at baseline and end line study. The respondents were followed up for two months to ascertain effectiveness of counselling given to experimental group. (Data were analysed using descriptive statistics, student T-test and ANOVA at $p<0.05$). Results indicated that mean systolic blood pressure for the experimental and control groups were 132.4400±6.21577 and 130.1300±8.11557, while the corresponding diastolic blood pressure were 95.3600±65.06920 and 83.5850±0.20753, respectively at baseline. Mean weight and height in experimental group were 70.335±11.64 and 1.558±70.862, respectively. In control group, these figures were 79.7451±6.7 and 1.596±0.1025. Both groups had mean BMIs of 29.5±6.04 and 31.95±6.7 at baseline. Mean blood glucose levels

were 126.2400±24.80259 and 91.0350±11.00679 for the experimental and control groups, respectively, at baseline. By the end line, mean systolic blood pressure for the experimental and control groups were 129.24±9.60 and 130.665±5.90994, and the corresponding diastolic blood pressure were 86.3000±7.45034 and 84.2850±8.07402. Mean blood glucose levels were 100.03502±0.67173 and 90.8650±7.65505, respectively. Mean weight and height for the experimental group were 63.27±9.0218 and 1.55870.862. Mean BMIs were 26.7±4.8 and 31.3±5.7, respectively at end line. (The study showed that nutrition intervention was effective in the control of high blood pressure, BMI and blood sugar. This research could be beneficial in future as it could reduce other cardiovascular diseases. (Based on the above, it is recommended among others that a greater emphasis on the implementation of the program that encourages counselling should be made. This will go a long way to ensure an effective uptake of health and nutrition, improved dietary and food consumption practices as well as dietary diversification.)

Key words: Nutritional Intervention, (DASH) diet, High blood pressure and dietary diversity score.

Effets de l'intervention nutritionnelle sur la gestion des patients hypertendus fréquentant des hôpitaux tertiaires dans l'État de l'Imo

Résumé

L'hypertension peut silencieusement infliger des dommages au corps d'un individu pendant de longues périodes avant que les symptômes ne se manifestent. Il pose un facteur de risque de dommages artériels et de constriction. S'il n'est pas géré, cela peut entraîner un handicap, une qualité de vie compromise ou des crises cardiaques mortelles. Les comportements alimentaires se distinguent comme un facteur de risque essentiel dans l'étude épidémiologique de l'hypertension. Par conséquent, cette étude a été entreprise pour améliorer le comportement alimentaire des patients hypertendus en introduisant une stratégie d'intervention nutritionnelle qui comprenait l'utilisation de l'alimentation modifiée (DASH). Dans une étude transversale, en utilisant des techniques d'échantillonnage en plusieurs étapes, 400 adultes hypertendus ont été sélectionnés. Des questionnaires validés ont été administrés pour obtenir des informations sur les répondants sociodémographiques, de fréquence alimentaire, de style de vie et de nutrition par les répondants.

Les 400 participants ont été divisés en deux groupes étant, 200 en groupe expérimental et 200 en groupe témoin. Le groupe expérimental a été conseillé sur l'utilisation du régime (DASH) tandis que le groupe témoin n'a pas été conseillé à l'utilisation du régime alimentaire. La pression artérielle, la glycémie, le score de diversité alimentaire et les connaissances en nutrition ont été évalués à l'étude de base et de ligne finale. Les répondants ont été suivis pendant deux mois pour déterminer l'efficacité des conseils donnés au groupe expérimental. (Les données ont été analysées en utilisant des statistiques descriptives, un test t des étudiants et une ANOVA à p <0,05). Les résultats ont indiqué que la pression artérielle systolique moyenne pour les groupes expérimentaux et témoins était de 132.4400±6.21577 et 130.1300±8.11557, tandis que la pression artérielle diastolique correspondante était respectivement de 95,3600±65.06920 et 83.5850±0.20753, au départ. Le poids et la hauteur moyens dans le groupe expérimental étaient respectivement de 70,335±11,64 et 1,558±70,862. Dans le groupe témoin, ces chiffres étaient de 79,7451±6.7 et 1,596±0.1025. Les deux groupes avaient des IMM moyens de 29,5±6,04 et 31,95±6.7 au départ. La glycémie moyenne était de 126.2400±24.80259 et 91.0350±11.00679 pour les groupes expérimentaux et témoins, respectivement, au départ. À la ligne finale, la pression artérielle systolique moyenne pour les groupes expérimentaux et témoins était de 129.24±9.60 et 130.665±5.90994, et la pression artérielle diastolique correspondante était de 86.3000±7.45034 et 84.2850±8.07402. La glycémie moyenne était de 100,03502±0.67173 et 90.8650±7.65505, respectivement. Le poids et la hauteur moyens du groupe expérimental étaient de 63,27±9.0218 et 1,55870.862. Les IMC moyens étaient respectivement de 26,7±4,8 et 31,3±5.7, respectivement à la ligne finale. (L'étude a montré que l'intervention nutritionnelle était efficace dans le contrôle de l'hypertension artérielle, de l'IMC et de la glycémie. Cette recherche pourrait être bénéfique à l'avenir car elle pourrait réduire d'autres maladies cardiovasculaires. (Sur la base de ce qui précède, il est recommandé parmi les autres qu'un Un accent plus important sur la mise en œuvre du programme qui encourage les conseils devrait être fait.

Mots-clés: Intervention nutritionnelle, (Dash) Régime, score élevé de l'hypertension et de la diversité alimentaire.

يمكن أن يؤدي ارتفاع ضغط الدم بصمت إلى إلحاق الضرر بجسم الفرد لفترات طويلة قبل ظهور الأعراض يشكل عامل خطر لتلف الشرايين وانقباضها إذا تُركت بدون إدارة، فقد تؤدي إلى إعاقة، وضعف نوعية الحياة، أو النوبات القلبية القاتلة. سلوكيات الأكل هي عامل خطر في الدراسة الوبائية لارتفاع ضغط الدم لذلك، تم إجراء هذه الدراسة لتحسين سلوك الأكل مرضى ارتفاع ضغط الدم عن طريق وضع استراتيجية للتدخل في مجال التغذيةالتي تتألف من استخدام نظام غذائي معدل في دراسة مقطعية، باستخدام تقنيات أخذ العينات متعددة المراحل، تم اختيار 400 بالغ من ارتفاع ضغط الدم أجريت استبيانات موثقة للحصول على معلومات عن الحالة الاجتماعية – الديمغرافية وتواتر الغذاء ونمط الحياة والمعرفة التغذوية من جانب المجيبين. تم تقسيم المشاركين البالغ عددهم 400 إلى مجموعتين 200 في المجموعة التجريبية و 200 في المجموعة الضابطة تم تقديم المشورة للمجموعة التجريبية بشأن استخدام النظام الغذائي (DASH) بينما لم يتم تقديم المشورة لمجموعة التحكم بشأن استخدام النظام الغذائي تم تقييم ضغط الدم وسكر الدم ودرجة التنوع الغذائي ومعرفة التغذية في دراسة خط الأساس وخط النهاية تمت متابعة المستجيبين لمدة شهرين للتأكد من فعالية المشورة المقدمة للمجموعة التجريبية تم تحليل البيانات باستخدام أشارت النتائج إلى أن هذا يعني ضغط الدم الانقباضي للتجربة والمجموعات ($p < 0.05$ على ANOVA و T الإحصاءات الوصفية، واختبار الطالب و 65.06920±بينما كان ضغط الدم الانبساطي المقابل 95.3600 8.11557±130.1300 و 6.21577±الرقابية 132.4400 في المجموعة الضابطة، كانت هذه 70.862±1.558 و 11.64±كان متوسط الوزن والطول في المجموعة التجريبية 70.335 0.2075±83.5850 في بداية الدراسة 6.7 31.95 و 6.04 كانت كلتا المجموعتين تعني مؤشرات كتلة الجسم 29.5 0.1025±1.596 و 6.7±الأرقام 79.7451 للمجموعتين التجريبية والسيطرة، على التوالي، 11.00679±91.0350 و 24.80259±متوسط مستويات الجلوكوز في الدم كانت 126.2400 و 9.60±عند خط الأساس بحلول الخط النهائي، كان متوسط ضغط الدم الانقباضي للمجموعات التجريبية والسيطرة 129.24 متوسط مستويات الجلوكوز في 8.07402±84.2850 و 7.45034±وكان ضغط الدم الانبساطي المقابل 86.3000 5.90994±130.665 و 9.0218±كان متوسط الوزن والطول للمجموعة التجريبية 63.27 7.65505±90.8650 و 0.67173±الدم كانت 100.03502 أظهرت الدراسة أن التدخل الغذائي كان فعالاً في السيطرة على ارتفاع ضغط الدم 5.7±31.3 و 4.8±مؤشر كتلة الجسم 26.7 .1.55870.862 ومؤشر كتلة الجسم والسكر في الدم. يمكن أن يكون هذا البحث مفيدًا في المستقبل لأنه يمكن أن يقلل من أمراض القلب والأوعية الدموية الأخرى واستنادا إلى ما تقدم، يوصى، في جملة أمور، بما يلي: زيادة التركيز على تنفيذ البرنامج التي تشجع على تقديم المشورة. سيقطع هذا شوطًا طويلاً لضمان استيعاب فعال للصحة والتغذية وتحسين ممارسات الاستهلاك الغذائي والغذائي فضلا عن تنويع النظم الغذائية

Introduction

Nutrition interventions concentrate on altering dietary habits through the integration of nutrition education (Deforche et al., 2017). The primary objective lies in fostering behavioural changes, with nutrition education serving as a facilitator towards this aim (Erickson et al., 2019). The essence of nutritional intervention aims to resolve or

ameliorate diagnosed nutritional issues by offering guidance, education, or tailored meal plans aligning with the patient/client's requirements (Flegal et al., 2018). Strategies for nutrition intervention are chosen to alter dietary intake, enhance nutritional knowledge or behaviors, modify environmental conditions, or ensure access to supportive care and services (Franz et al., 2019). Diet stands out as a crucial and modifiable determinant of human health (Anderson et al., 2012). Nutritional interventions play a pivotal role in reducing hypertension and other cardiovascular diseases. Lifestyle changes, including moderate physical activity, maintaining healthy body weight, limiting alcohol consumption, reducing sodium intake, ensuring adequate potassium intake, and consuming diets rich in fruits, vegetables, and low-fat dairy products, constitute integral components (Baranowski et al., 2016). Research indicates that a high fruit diet notably enhances systolic blood pressure and diet quality in individuals with elevated blood pressure (Franz et al., 2019). These findings find support in various lifestyle interventions, including the Dietary Approaches to Stop Hypertension (DASH) diet, aiming to bolster cardiovascular health.

Lifestyle adjustments, with diet being a fundamental component, hold equal significance to medications in hypertension management (Deforche et al., 2017). (The promotion of the Dietary Approaches to Stop Hypertension (DASH) diet) stands as one of the most recognized dietary strategies for reducing blood pressure (Weber et al., 2017), having demonstrated significant reductions among hypertensive individuals (Duya et al., 2016). The DASH diet advocates for increased consumption of fruits, vegetables, and low-fat dairy products, while aiming to decrease red meat, sweets, sugar-laden beverages, total fats, saturated fats, and cholesterol intake (Bazzano et al., 2019). This dietary pattern emphasizes higher intake of protective nutrients like potassium, calcium, magnesium, fiber, and vegetable proteins while advocating reduced consumption of refined carbohydrates and saturated fats (Chobanian et al., 2019).

Hypertension, or high blood pressure, denotes a chronic medical condition where the pressure within arteries remains persistently elevated (Chobanian et al., 2019). Long-term elevation of blood pressure significantly heightens the risk for coronary artery disease, stroke, heart failure, peripheral vascular disease, vision impairment, and chronic kidney disease (Chobanian et al., 2019). Blood pressure is characterized by two measurements: systolic and diastolic

pressures, representing the maximum and minimum pressures, respectively. Typically, normal resting blood pressure falls within the range of 100-149mmHg systolic and 60-90mmHg diastolic (Chomtho et al., 2018). High blood pressure is diagnosed when resting blood pressure consistently measures at or above 140/90mmHg for most adults (Chomtho et al., 2018).

Materials and method

The study took place in Imo State, situated in the southeastern region of Nigeria, comprising three senatorial zones: Owerri, Orlu, and Okigwe. The study was focused on two hospitals, purposively chosen from Orlu and Owerri zones, specifically Orlu Teaching Hospital and the Federal Medical Centre (FMC), Owerri.

Study Design

The study design used was a cross sectional study design. Dietary management of hypertension was assessed by randomly assigning groups of hypertensive patients and determining the effects of dietary modification on hypertensive patients. This study involved two groups which were experimental and control groups. The respondents in experimental group were managed with DASH diet and anti-hypertensive drugs. They were counselled on dietary choices that conform to DASH diet that would help to manage their disease condition. Respondents in control group were not managed with DASH diet rather, they were advised to continue with their normal diet and drugs.

Population of the Study

The study included individuals aged 20 to 80 years diagnosed with high blood pressure, actively seeking treatment at the chosen hospitals in Imo State.

Sample Selection

The study utilized a multi-stage random sampling approach. Initially, two senatorial zones in Imo State were selected through balloting. Then, one government tertiary hospital was purposefully chosen from each selected senatorial zone. Finally, hypertensive patients attending these hospitals were randomly selected for the study, totalling 200 participants split between the control and experimental groups. Selection was based on eligibility criteria, with half of the eligible participants recruited each day over eight weeks (two months). Participants were asked to randomly select folded papers marked with 'yes' or 'no', with 'yes' assigning them to the experimental group and 'no' to the control group.

Sample size

A total of 400 participants were used for the study of which 200 respondents were

randomly assigned for each group. Respondents in experimental group who were diagnosed of hypertension were managed with DASH diet. They were given counselling on diet modification to meet DASH guidelines while the other 200 respondents with hypertension served as control group. They were not given diet counseling.

Schematics for sample selection

A total of 200 respondents in experimental group were recruited for the study from which only 180 participants were present during the first counselling session while 150 were present during the second counselling session. Calls were made to 20 participants to reschedule an appointment with them of which they complied while the rest were visited. The nutritional intervention counselling given to the participants focused on implementing the Dietary Approaches to Stop Hypertension (DASH) diet to manage hypertension. Counselling sessions were conducted for the experimental group, detailing the essence and components of the DASH diet.

During the first visit, participants were educated on food choices conducive to managing their condition and were advised to avoid processed foods, saturated fats, high-starch content items, fried foods, and excessive salt. They received pamphlets outlining the DASH diet and were encouraged to monitor the progress in their blood pressure Improvement.

On the subsequent visit, instructions were provided on how to prepare meals using available ingredients in alignment with the DASH diet. Examples of DASH-compliant meals for breakfast, lunch, and dinner were given, emphasizing whole grains, lean meats, low-fat dairy, vegetables, and fruits. Participants were guided to limit sodium intake and were advised on low-sodium alternatives for common food items. They were supported through regular calls, weekly visits, and self-monitoring over two months. Dietary recalls and food frequency questionnaires were administered twice to assess changes in their dietary patterns. Weight monitoring was part of the sessions to evaluate the diet's impact on weight.

The control group, not following the DASH diet, continued their regular medication and lifestyle. Their blood pressure was measured twice, and dietary patterns were assessed through 24-hour dietary recalls.

The nutritional intervention's effectiveness was evaluated using anthropometric measurements and dietary assessments to gauge the impact of the counselling provided to the experimental group.

Dietary counsel

Respondents were counseled on the importance of DASH diet in the management of hypertension. They were counselled on the use of DASH diet, its components and recipes. The counselling was done with a food guide pyramid which contained the quantities of food to be consumed. A pamphlet which contained all the necessary information about the DASH diet was also given to the respondents.

Measurement of dietary pattern

Food frequency questionnaires, following the method described by Ronit-Herzog et al. (2015), were used to assess participants' diets. These questionnaires, comprising ten food items across various food groups, were administered in-person to gauge the frequency of intake. Participants provided information on their consumption patterns regarding whole cereals, low-fat dairy, fruits, vegetables, meat, poultry, and fish. Their responses were recorded before and after the study to track any changes.

Additionally, a 24-hour dietary recall was conducted. Participants were prompted to recall all food and beverages consumed within the preceding 24 hours, including snacks and drinks.

Measurement of Dietary Diversity

Dietary diversity, as per the method outlined by Moursi et al. (2016), was assessed by tallying the variety of foods or food groups consumed within a specified timeframe. This involved counting the number of distinct foods or food groups. Ten specific food groups were considered in computing the dietary diversity score, including cereals, root and tubers, vegetables, fruits, meat, eggs, fish/seafoods, legumes/nuts and seeds, milk and milk products, as well as oils and fats. The resulting Dietary Diversity Score categorized participants into low (0-3), medium (4-5), or high (>5) dietary diversity groups, determined by the number of food groups included in their diet during the study period. Caregivers assisted those who faced difficulty in recalling their dietary intake.

Anthropometric Measurement

Weight Measurement

The methodology for measuring body weight was adopted from the approach detailed by Farrington et al., (2013). A digital bathroom weighing scale (Kinlee scale, model DT05) was utilized. Subjects were instructed to remove shoes and heavy clothing, including items like keys, phones, and wallets from their pockets. The scale was calibrated to zero, and subjects were directed to stand at the center of the scale, maintaining a straight posture and keeping hands hanging freely by

their sides. Body weight measurements were recorded to the nearest 0.1 kilogram (Kg).

Height Measurement

The process followed for height measurements aligned with the method outlined by (Farrington et al., (2013). Participants were instructed to remove shoes, heavy outerwear, and hair ornaments. They were positioned with their back against the height rule, ensuring contact of the back of the head, back, buttocks, calves, and heels against the upright surface while keeping the feet together. The external auditory meatus (ear canal) was aligned with the cheekbone level, and participants were asked to maintain a straight gaze. The headpiece of the stadiometer was then lowered to flatten the hair, and height measurements were recorded to the nearest millimeter.

Body Mass Index

The calculation involved using the formula weight in kilograms divided by height in meters squared (WHO, 2003). Participants falling below a BMI of 18.49 kg/m² were categorized as underweight, those within 18.5-24.9 kg/m² were considered normal, individuals with a BMI between 25-29.9 kg/m² were classified as overweight, and those exceeding 30 kg/m² were identified as obese according to the WHO guidelines from 2003.

Blood Pressure Measurement

This process aligned with the methodology outlined by (Dianne and Sue, (2013). Blood pressure was measured using a digital sphygmomanometer with an appropriately sized cuff. The cuff was placed around the upper arm, positioned one inch above the ante-cubital fossa. The stethoscope's bell was lightly pressed over the brachial artery just below the cuff's edge. The cuff was then rapidly inflated to 180mmHg, and the systolic and diastolic pressure readings were recorded. This process was repeated twice, and the average of the readings was calculated. Measurements were taken while subjects were seated after a 5-minute rest period. Blood pressure readings were also assessed before and after the study.

Blood Glucose Measurement

The blood glucose readings followed the procedure outlined (Muntner et al., 2019). A glucometer was used to measure blood glucose levels. Subjects were instructed to clean their hands, after which the tip of their thumbs was sterilized with a spirit-soaked cotton wool. The glucometer's test strip was inserted, and a lancing device was used to obtain a drop of blood from the fingertip. The subject then placed the blood sample on the test strip, and the blood glucose result was recorded.

Data analyses

Dietary diversity score (DDS) was analysed using method as outlined by Moursi, (2016) under the following categories: Low DDS (0-3), Medium DDS (4-5) and high (>5).

BMI was analysed using WHO (2003) standard. Independent student T-test was used to determine their differences in mean between both groups.

Independent student T-test was also used to determine the differences in the mean scores of blood pressure and blood glucose of the respondents in both groups.

Statistical analysis

The gathered questionnaire data underwent coding and analysis utilizing Statistical Package for the Social Sciences (SPSS) version 23.0. Continuous variables such as height, weight, waist circumference, and hip circumference were subjected to mean and standard deviation calculations. Categorical variables, including nutrition knowledge levels, dietary diversity scores, blood pressure, blood glucose records, and body composition, were analysed through frequencies, percentages, means, and standard deviations. To compare mean differences between the experimental and control groups at the baseline and endpoint, T-tests were employed. Association between the treatments received and various variables (anthropometry, body composition, blood glucose, and blood pressure) was determined using ANOVA. A significance level of <0.05 was set for statistical significance. Correlation coefficients were computed to assess the interrelationship between variables in both groups at baseline and the endpoint.

Ethical consideration

Ethical clearance was obtained from the ethical committees in the hospitals before starting the study and informed consent letter was obtained from them.

Results

(Mean) systolic blood pressure for the experimental and control groups were 132.4400±6.21577 and 130.1300±8.11557, while their diastolic blood pressure were 95.3600±65.06920 and 83.5850±0.20753 respectively at baseline. The mean blood glucose levels were 126.2400±24.80259 and 91.0350±11.00679 for the experimental and control groups, respectively, at baseline. The mean weight and height in the experimental group were 70.335±11.64 and 1.558±70.862, respectively. In the control group, these figures were 79.7451±6.7 and 1.596±0.1025. Both groups had mean BMIs of 29.5±6.04 and 31.95±6.7 at baseline.

Mean weight and height for the experimental group were 63.27±9.0218 and 1.55870.862, while for the control group, these figures

were 77.76±3.613 and 1.5587±0.862. Their mean BMIs were 26.7±4.8 and 31.3±5.7, respectively at end line. By the end line, the mean systolic blood pressure for the experimental and control groups were 129.24±9.60 and 130.665±5.90994, and their diastolic blood pressure were 86.3000±7.45034 and 84.2850±8.07402. The mean blood glucose levels were 100.03502±0.67173 and 90.8650±7.65505, respectively

(Table 1): Characteristics of the respondents in experimental and control group at base line

Characteristics	Experimental group Mean (+SD)	Control group Mean (+SD)	F	df	P-value
Weight	70.33±11.64	79.745±16.66	230.31	1	0.00
Height	1.5587±0.08	1.596±0.1	2.0	1	0.15
BMI	29.45±6.04	31.95±6.74	175.7	1	0.00
Systolic blood pressure	131.57±15.68	130.13±8.11	7.28	1	0.07
Diastolic blood pressure	89.74±9.1	83.58±10.2	0.04	1	0.8
Blood Sugar	128.35±25.7	91.03±11.006	935.4	1	0.00
Total	200	200			

Experimental group: respondents managed with DASH diet

Control group: respondents not managed with DASH diet

(Table 1 (CONT'D). Characteristics of the respondents in experimental and control group at end line).

Characteristics	Experimental group Mean (+SD)	Control group Mean (+SD)	F	df	P-value
Weight	63.27±9.02	77.76±13.6	72.6	1	0.00
Height	1.5587±0.08	1.596±0.1	2.0	1	0.15
BMI	26.67±4.85	31.30±5.69	67.9	1	0.00
Systolic blood pressure	129.24±9.60	130.66±5.09	18.5	1	0.00
Diastolic blood pressure	85.74±9.1	88.28±56.8	4.5	1	0.03
Blood Sugar	99.99±20.8	90.86±7.7	913.3	1	0.00
Total	200	200			

Experimental group: respondents managed with DASH diet

Control group: respondents not managed with DASH diet

(Table 2)

(Association between the treatments received the blood pressure and blood sugar of the respondents).

The lifestyle modifications and adherence to the DASH diet notably improved the blood glucose levels ($p<0.05$) and systolic blood pressure of the respondents by the study's end, according to the repeated ANOVA. There was also a significant improvement ($p<0.05$) in the diastolic blood pressure for both the experimental and control groups at the study's conclusion.

(Association between the treatments received, the blood pressure and blood sugar of the respondents).

Blood Pressure (mmHg)	F-Value	P-Value
Systolic blood pressure	18.599	0.00
Diastolic blood pressure	4.54	0.03
Blood Glucose	935.4	0.00

In the analysis, a repeated ANOVA revealed a notable connection between the lifestyle adjustments and adherence to the DASH diet with the respondents' BMI ($P<0.05$). Additionally, the repeated ANOVA indicated a strong relationship between the lifestyle changes and DASH diet modifications with the body composition ($P<0.05$) of the respondents. These interventions notably improved the respondents' body fat ($P<0.05$), muscle content, and bone mass ($P<0.05$) by the study's end. At the end of the study, there was an observable improvement in the daily and weekly consumption of fruits and vegetables among the experimental group. Notably, a reduction in the consumption of oil, fatty foods, and daily milk and milk products was observed. There was a significant increase (40%) in the consumption of fish and seafood daily in the experimental group. Conversely, no notable changes were observed in the daily dietary patterns of the control group by the end of the study.

Table 3: Mean dietary diversity score of the respondents

	Experimental Group	Control Group	P-Value
Baseline	4.5±1.78	4.3±1.4	0.330
End line	5.5±1.5	4.9±1.6	0.00

P-Value <0.05

Discussion

Characteristics of the respondents

The higher body mass index (BMI) observed among respondents (31% and 39.5%) in this study could stem from various factors, including eating patterns, physical activity levels, heredity, and certain medications. Chen and Wang (2018) highlighted obesity and overweight as risk factors for high blood pressure, aligning with the significant difference ($p<0.05$) noted between both groups in BMI results at the study's conclusion which could be due to the adherence of the DASH diet counselling. This is in agreement with the study conducted by (Soltani et al., 2023) which reported a substantial improvement with significant difference of ($p<0.05$) in the BMI of the respondents who went on a DASH diet.

The findings of this study demonstrated that within the experimental group, 19% and 8.5% of the respondents exhibited stage 1 and 2 hypertension (SBP), whereas at baseline, 50.5% and 83% of individuals in both the experimental and control groups showed pre-hypertension (SBP). Notably, the presence of stage 1 and 2 hypertension in both groups might be attributed to a lack of understanding regarding the application of the DASH diet, specifically designed to combat hypertension (Kenny et al., 2020). At the conclusion of the study, no respondents in the experimental group had stage 2 hypertension, yet a majority (82% and 90%) in both experimental and control groups, respectively, still exhibited pre-hypertension. This persistence could be linked to the effects of the DASH diet plan provided to the respondents. A significant discrepancy ($p<0.05$) in systolic and diastolic blood pressure between the two groups was observed by the study, aligning with the findings of Appel et al. (2017) regarding the impactful reduction in systolic and diastolic blood pressure through a modified DASH diet (-5.58mmHg-0.94 mmHg, $P<0.05$).

At baseline, normal blood sugar levels were observed among 54% and 85% of hypertensive respondents in both groups, while pre-diabetes and diabetes were present in 26.5% and 19% of hypertensive individuals solely in the experimental group. The presence of pre-diabetes and diabetes might be associated with the co-occurrence of hypertension, considering that diabetes mellitus can predispose an individual to hypertension (John et al., 2023). At end line, there was an improvement (86.5% and 90%) in the blood sugar of the respondents in both groups with a significant difference of ($p<0.05$). This is in line with the study carried out by (Abigail et al., 2018) which reported a total reduction in the blood sugar of the hypertensive adults who went on DASH diet

Dietary Diversity of the Respondents

This study highlighted a low dietary diversity (30.5% and 14%) among respondents in both groups at baseline. However, by the end of the study, an improvement was evident, with 47.5% of the experimental group showing enhanced dietary diversity, while only 17% of the control group lacked good dietary diversity. The low dietary diversity might have contributed to their high blood pressure, as diverse diets provide various nutrients and phytochemicals crucial in preventing nutrient deficiencies and chronic diseases like hypertension (Upadhyay and Palanivel, 2021). Although there was no significant difference ($p>0.05$) between the dietary diversity of both groups at baseline, a significant discrepancy ($p<0.05$) was evident at the study's end. This aligns with Mills et al.'s (2019) study on the link between diet diversity and hypertension, emphasizing that hypertension is linked to an imbalanced diet lacking diverse food groups. Their research emphasized a significant association ($p<0.05$) between a poorly diversified diet and hypertension, highlighting the benefits of a diversified diet for overall health (Upadhyay and Palanivel, 2021).

Conclusion

The study revealed that the nutrition intervention involving dietary modification (DASH) diet is effective in the control of hypertension. This diet consists of fruits and vegetables, whole grains and low fat dairy foods. Intake of DASH diet significantly reduced the weight, blood sugar and high blood pressure of the respondents. It was revealed that the dietary diversity score of the respondents also improved at end line which also contributed to the reduction of high blood pressure of the respondents.

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