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ORIGINAL RESEARCH

Stage of Change of Transtheoretical Model for Nine Health-Related Behaviors Among Hypertensive Patients: Cross-Sectional Study

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Aim: This study aimed to determine the current stage of change (SOG) toward seven healthy eating behaviors and two healthy lifestyle behaviors related to blood pressure (BP) control. The lifestyle behaviors included smoking Behavior and practicing regular exercise, while the dietary behaviors included the DASH diet guidelines.

Methods: A total of 1109 outpatients participated in this cross-sectional study that was conducted between 2021 and 2022 in Jordan. A staging algorithm assessed SOG for several BP control-related behaviors for diagnosed hypertension patients. Data were collected by a structured interview-based questionnaire.

Results: There was a high degree of maintenance toward consuming diets with high grains, fruit, vegetables, meat, and poultry, less saturated fat, and more low-fat dairy products. More than half of the participants were in the pre-action stage for quitting smoking, practicing physical exercise, and consuming sweets and added sugars. Significant associations were observed between the degree of maintenance for several behaviors ($p < 0.01$). Age, income, education level, disease duration, and nutrition consultation availability were the most related factors to the SOG of the studied behaviors ($p < 0.01$).

Conclusion: Patients with hypertension in Jordan are still in the pre-action stages for quitting smoking, practicing physical exercise, and consuming 5 servings of refined sweets and added sugars weekly. The current outcome suggests a need for nutritional counseling, education, and interventions to raise awareness of lifestyle factors influencing BP among hypertension patients.

Keywords: hypertension, stage of change, SOG, health behavior

Introduction

Hypertension, affecting 22% of the global population according to World Health Organization (WHO),[1] is expected to impact 1.56 billion people by 2025.[2] This condition is linked to significant mortality and morbidity, accounting for half of all stroke and heart disease deaths.[1–4] Over the past two decades, there has been a substantial increase in hypertension prevalence, particularly in Arab countries, where it is estimated to be around 30% among adults.[5] In Jordan, the prevalence has risen from 29.4% to 32.3% between 1994 and 2009[6] and reached 33.8% among men and 29.4% among women in 2017.[7]

To address hypertension, the Joint National Committee (JNC) recommends a self-care approach for patients, encompassing medication adherence, weight management, adopting a low-salt diet, engaging in regular 30-minute daily physical activity, limiting alcohol consumption, and quitting smoking.[8] Additionally, leading health organisations like the American Heart Association, the National Institutes of Health, and the National Heart, Lung, and Blood Institute endorse Dietary Approaches to Stop Hypertension (DASH) as the primary pharmacologic therapy along with lifestyle modifications to combat this growing epidemic.[9] Adhering to self-care behaviors and the DASH diet has been shown to significantly reduce blood pressure, enhance medication efficacy, and minimize complications and overall mortality.[10]

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On the other hand, adherence to dietary and lifestyle recommendations poses a common but modifiable challenge that contributes to inadequate hypertension control. Studies indicate that less than 10% of adults with hypertension fully adhere to dietary guidelines, only 35% engage in regular exercise, and medication adherence ranges from 50% to 60%.[11] Blood pressure (BP) control serves as a crucial indicator of adherence to a proper diet and healthy lifestyle for individuals with hypertension. Persistent high BP is strongly associated with an increased risk of hypertension-related complications, highlighting the critical importance of tight BP control to reduce morbidity and mortality consequences.

To guide our current study, we have adopted the Transtheoretical Model (TTM) as a conceptual framework. The TTM outlines the stages of behavioral change and incorporates four key components: change stages, change processes, decisional balance, and self-efficacy.[12] Recognizing that individuals are at different stages of behavior change, interventions tailored to an individual's current stage of change (SOG) are most effective.[4] The TTM categorizes individuals into five stages based on their readiness to adopt behavioral change, namely pre-contemplation, contemplation, preparation, action, and maintenance.[4,12,13]

Extensive research has demonstrated the widespread use of TTM in promoting behavior change across various health conditions, such as chronic disease prevention,[13] self-management for individuals with Type 2 diabetes,[4,14] and behavior change related to physical activity.[15] However, when it comes to hypertension management, the application of TTM remains largely limited to observational and experimental research.[16] A recent systematic review of four articles highlighted the effectiveness of education using the TTM and Tailored Behavioral models in promoting action and maintenance of healthy patterns among hypertension patients.[16]

Despite this progress, there is still a need for further exploration and understanding of TTM's potential in the context of hypertension management.

No prior studies have investigated the stages of change regarding all the dietary guidelines among hypertensive patients. Existing research has mainly focused on assessing the stages of change for single hypertension-related behaviors, such as exercise[17] and/or smoking, or a single recommended dietary pattern.[18] However, effective hypertension control results from a combination of various behaviors. Consequently, a more comprehensive understanding of patients' stages of change can be achieved by considering multiple blood pressure (BP)-related behaviors. Additionally, no previous studies have identified the factors influencing behavior change in hypertensive patients. Therefore, it is essential to determine a patient's current SOG, as well as identify factors that can facilitate progress to a more favorable stage based on the Transtheoretical Model (TTM), before initiating counseling and educational interventions.

This study is unique as it is the first to aim at determining the current stages of change toward two lifestyle behaviors (regular exercise and smoking cessation) and seven healthy behaviors for BP control, including consuming four or more servings of whole grains daily, consuming five or more servings of fruits and vegetables daily, reducing refined sugar intake to 3% or less of total daily kcal, reducing saturated fat to 5% or less of total daily kcal, consuming two to three servings of nuts and seeds weekly, consuming two or more servings of low-fat dairy products daily, and decreasing the intake of sweet and added sugar to 5 milligrams or less daily. Additionally, the study endeavors to identify the most predictive factors for adopting healthy behaviors among adults with hypertension.

The study will delve into the application of the Transtheoretical Model as a powerful tool to assess behavior change stages among hypertension patients. This model has demonstrated success in various health-related behavior change interventions, and we aim to contribute to its growing body of evidence by investigating its effectiveness in the context of hypertension management. By understanding patients' stages of change and implementing tailored interventions accordingly, we hope to enhance their adherence to healthy behaviors and ultimately improve hypertension control and overall health outcomes.

Methods

Study Design and Setting

The hypertensive patients included in this study were recruited from outpatient endocrinology clinics in Al-Bashir Hospital in Amman City. Amman. Jordan. Following the Helsinki Statement and its amendments from 1964, all ethical criteria were strictly adhered to during this investigation. Furthermore, the Standards for Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were followed to ensure the comprehensive and accurate reporting of the study.[19]

Participants and Data Collection

In this cross-sectional study, all diagnosed hypertension patients visiting the clinic were invited to participate, and they were informed about the study's objectives. Before accepting the invitation, patients were asked to carefully review, read, and sign the written consent document form. The convenience sampling method, a non-probability sampling technique, was employed to collect the sample based on the participants' availability and accessibility.[20]

The inclusion criteria for participants were adults aged 18 years or older, who had received a diagnosis of "definite hypertension" from a healthcare provider and were currently seeking treatment at the internal clinic while being on antihypertensive medications. Individuals who were unable to participate for any reason were excluded from the study. Specifically, individuals who had never been diagnosed with hypertension or were not currently taking antihypertensive medication were excluded.

Data collection was conducted by trained interviewers using a structured interview-based questionnaire. Participants had the option to complete the study through either telephone (self-reporting) or face-to-face interviews. Approximately 10% of the participants opted for telephone interviews and provided their contact numbers to be contacted by the research team for the questionnaire completion. Throughout the process, it was emphasized that participation was voluntary, and patients could withdraw from the study or stop the interview at any time. Furthermore, there was no financial incentive for participation, and all information collected was kept confidential and solely used for scientific research purposes. The data collection period spanned from March 2021 to July 2022.

The socio-demographic data collected included age, gender, marital status, educational level, income, disease duration, self-reported weight (kg), and height (m). Body mass index (BMI) was calculated by dividing the weight in kilograms by the height in meters squared.[21] A total of 1109 hypertension patients of both genders were enrolled in the study, forming the study sample.

Instrument

The individual's readiness to maintain adherence to a healthy lifestyle at least 80% of the time, was measured by a modified version of SOG for the problem Behaviors.[12] Prochaska's Model explains intentional behavior change along a temporal dimension that utilizes both cognitive and performance-based components. TTM has found that individuals move through a series of stages—pre-contemplation (PC), contemplation (C), preparation (PR), action (A), and maintenance (M)—in the adoption of healthy behaviors or cessation of unhealthy ones.[22] However, no studies have used the TTM Model of Change to explore adherence to a healthy lifestyle and dietary Behavior for hypertension patients. SOG of participants was assessed using a staging algorithm adapted from the literature.[4,23–28] The processes of behavior change were then used as independent variables to determine the outcome. Prochaska and DiClemente (1994) created statements for use in smoking cessation and addiction research at first. These statements have been used to address a wide range of problem Behaviors, such as gambling, alcoholism, troubled drinking, high-risk sex, depression, panic attacks, physical abuse, obesity, high-fat diet, dietary pattern, reduction of dietary fat, sedentary lifestyle, dental hygiene, procrastinating, and sun exposure studies.[29] In this study, the SOG was assessed for two lifestyle Behaviors and seven dietary Behaviors. The lifestyle Behaviors included smoking Behavior and following regular exercise which is known as 20 minutes or more each time for 3 or more days per week.[30] The dietary Behaviors include the DASH diet guidelines as follows: (1) consume 6–8 servings or more of grains or grain products per day; (2) consume 4–5 servings or more of fruits and vegetables per day; (3) consume 2–3 serving or more of low-fat or fat-free dairy products per day; (4) reduce the meats, poultry, and fish intake to 6 or fewer servings per day; (5) consume saturated fat and oil to 2–3 servings per day); (6) consume 4 to 5 servings of nuts, seeds, and legumes per week; (7) reduce refined sugar and sweet intake to 5 servings or less per week.

The Survey on Smoking Behavior (SOG) employed a structured inquiry paradigm wherein participants were presented with a set of four distinct response options after an initial query regarding their smoking status during the study. Based on the response, the SOG of the smoking Behavior was assessed as follows: yes, I currently smoke (pre-contemplation, contemplation, and preparation stage); no, I quit within the last 6 months (action stage); no, I quit more than 6 months ago (maintenance stage); and no, I do not smoke. The participants who answered (yes, I currently smoke)

were asked to answer if they were seriously thinking of quitting smoking to classify them into pre-contemplation, contemplation, and preparation stages) as follows: yes I am seriously thinking of quitting smoking within the next 30 days (preparation stage); yes am seriously thinking of quitting smoking within the next 6 months (contemplation stage); and no, I am not thinking seriously of quitting smoking (pre-contemplation stage).[28]

Concerning the exercise's SOG, participants were asked if they worked out for 20 minutes or more, three times a week, and to select five statements that best reflected their current state of fitness. Nevertheless, consistent physical activity was operationally characterized as the engagement in three or more instances of recreational exercise weekly, each lasting a minimum duration of 20 minutes.[31] Participants were provided with five statements that described their status. For example: yes, I have been doing so for more than 6 months (maintenance stage); yes, I have been doing so for less than 6 months (action stage); no, but I intend to do so in the next 30 days (preparation stage); no, but I intend to do so in the next 6 months (contemplation stage), and no, and I do not intend to do so (pre-contemplation stage).[32]

Similar staging responses were used for food group consumption based on the DASH diet recommendation. The recommended intake of each food group was explained and the serving size for each food group was defined for the participants.

Whole grains consumption was defined as consuming 6–8 servings daily (for example; 1 slice of whole-wheat bread, 1 ounce (oz.) dry cereal, or 1/2 cup cooked cereal, rice, or pasta).[33] The quantification of fruit and vegetable consumption was articulated as the ingestion of four to five or more servings of fruits and vegetables daily.[34] Illustrative instances of a singular serving of fruits and vegetables were supplied, encompassing examples such as one medium-sized fruit, a half cup of fresh or frozen fruit, a quarter cup of dried fruit, one cup of raw salad, or a half cup of cooked vegetables.[33] Evaluation of low-saturated fat dietary habits involved querying participants about their consistent avoidance of foods with elevated saturated fat content. Such foods encompassed items such as butter, margarine, chicken skin, fatty meat, fried foods, mayonnaise, and creams.[35] Dairy products were assessed by asking the participants if they consistently consume 2–3 servings daily of low-fat dairy products (for example, 8 ounces milk, 1 cup yogurt, 1.5 ounces cheese).[36] Nuts, seeds, and legumes consumption were defined as consuming 4–5 servings or more weekly (a serving of beans (legumes) is just 1/2 cup, and a serving of nuts or seeds is 1 oz which is about a small handful).[33] For the Fat and oil, participants were asked if they consistently consume 2–3 servings of healthy fat daily (for example; margarine and oils like canola, corn, olive, or safflower.[33]

Ethics Approval

The research proposal was reviewed by the Research Ethics Committee at the University of (Blind name for review process). Ethical approval, a written documented approval form was granted after full review (Grant Number: Q2.7.2023). Confidentiality of the gathered data was guaranteed. Before agreeing to participate, patients were provided with a written consent form, which they were requested to read and sign attentively.

Sample Size Calculation

The calculated minimum required sample size (n = 146) was determined using the linear regression model equation, aiming for a statistical power of 95% and a two-sided significance level of 5% (ie, a two-sided p-value less than 0.05).[37] Nevertheless, in the course of this cross-sectional study, a larger sample was collected than the stipulated minimum. This was done to enhance the precision of the sample and facilitate the generalization of results to a broader population of patients with blood pressure concerns.

Statistical Analysis

The data were coded and entered in the Microsoft Excel program. The Statistical Package for Social Sciences (SPSS, version 19, Chicago. Inc.) was used to analyze the data. Descriptive analysis was conducted for socio-demographic variables either by mean (χ) and Standard Deviation (SD) or percentage (%) and frequency. Multinomial logistic regression was used to test the impact of the independent variables on the SOG of the selected behaviors. A p-value of < 0.05 was considered statistically significant. In the Multinomial Logistic Regression, the Maintenance stage served as the reference category. For hypertensive patients utilizing the TTM, this stage is considered stable, signifying enduring control of blood pressure, minimized risk of relapse, and the assimilation of healthy habits. This reflects a prolonged commitment to maintaining optimal blood pressure levels.

Results

This study comprised 1109 participants, with 489 males and 620 females, ranging in age from 25 to 94 years. Table 1 presents the socio-demographic characteristics of the participants. The majority of the participants were over 40 years old. Approximately 47.0% (n=521) had a secondary level of education or lower, while the remaining 53.0% (n=588) had a higher level of education. Around two-thirds of the participants were married (70.8%, n=785). More than half of the participants had an income above 500 JD. The majority of the participants (62.6%) had been living with hypertension for more than 5 years. A small proportion of them (23.3%) had consulted a dietitian for hypertension-related dietary guidance. About 26% of the participants demonstrated a normal BMI, while 40.0% were categorized as overweight and 34.0% as obese.

Table 1 Sociodemographic and Anthropometric Characteristics of Participants (N = 1109)

Variables		N (%)
Gender	Male	489 (44.1%)
	Female	620 (55.9%)
Age (year)	<40	185 (16.9%)
	40–59	620 (56.6%)
	≥60	291 (26.5%)
Marital status	Single	148 (13.3%)
	Married	785 (70.8%)
	Other*	176 (15.9%)
Education level	Secondary level or less	521 (44.1%)
	College and University	588 (53.0%)
Total income level (JD/ Month)	< 500	475 (42.8%)
	500–750	173 (15.6%)
	751–1000	178 (16.1%)
	> 1000	283 (25.5%)
Hypertension duration (year)	1–5	415 (37.4%)
	6–9	290 (26.1%)
	≥10	404 (36.4%)
Dietitian consultation	Yes	257 (23.3%)
	No	852 (76.8%)
BMI	Underweight	0 (0.0%)
	Normal	282 (26.0%)
	Overweight	433 (40.0%)
	Obese	368 (34.0%)

Notes: Body Mass Index (BMI) categorizes individuals based on their weight and height. A BMI below 18.5 kg/m² is classified as underweight, while a BMI ranging from 25 kg/m² to 29.9 kg/m² falls into the overweight category. A BMI of 30 kg/m² or above is indicative of obesity. *Divorced & Widow. The Jordanian Dinar (JD) = 1.41 Dollar.

Table 2 illustrates the distribution of stages of change (SOG) for the selected study behaviors. Our results indicate that about half of the study participants (52.7%) were in the pre-contemplation and contemplation stages regarding practicing physical exercise, with only 11.7% in the maintenance stage. Out of the 1109 participants, 26.8% (n=293) were current smokers, and approximately 26.3% of the smoker participants were in the pre-action stages for smoking cessation (14.2% in pre-contemplation, 8.3% in contemplation, and 3.8% in preparation). Less than half of the participants were in the maintenance stage for consuming 5–6 servings of fruits and vegetables (32.7%), consuming more nuts, seeds, and legumes (40.8%), consuming 2–3 servings of oil and fat (40.4%), and consuming grain products (38.3%). About 61.3% of the participants were in the action and maintenance stages for consuming less saturated fat (lean meats, poultry, fish, and egg). Around half of the participants were in the action and maintenance stages for consuming low-fat dairy products (53.3%). However, the majority of the participants were in the pre-contemplation stage for consuming less simple sugar (60.5%).

Tables 3 to 11 present the relationships between the studied dependent variables (gender, age, BMI, income, education, dietitian consultation, and disease duration) and the stages of change (SOG) for the studied behaviors among hypertension patients.

Table 2 Participants Distribution by Stage of Change Toward Healthy Behaviors and the DASH Diet (N= 1109)

Behaviors	PC N (%)	C N (%)	P N (%)	A N (%)	M N (%)
Exercise	391 (35.3)	193 (17.4)	264 (22.2)	149 (13.4)	130 (11.7)
Smoking cessation*	159 (14.3)	92 (8.3)	42 (3.8)	33 (3.0)	101 (9.1)
Grains and grain products	198 (17.9)	184 (16.6)	142 (12.8)	160 (14.4)	425 (38.3)
Fruit &Vegetable intake	146 (13.2)	279 (25.2)	249 (22.5)	72 (6.5)	363 (32.7)
Fat-free or low-fat dairy products	237 (21.4)	151 (13.6)	130 (11.7)	162 (14.6)	429 (38.7)
Lean meats, poultry and fish	147 (13.3)	162 (14.6)	120 (10.8)	155 (14.0)	525 (47.3)
Nuts, seeds and legumes	178 (16.1)	163 (14.7)	130 (11.7)	186 (16.8)	452 (40.8)
Fat & oil	157 (14.2)	180 (16.2)	133 (12.0)	191 (17.2)	448 (40.4)
Sweets & added sugars	671 (60.5)	141 (12.7)	94 (8.5)	93 (8.4)	110 (9.9)

Note: *Current smoker only.
Abbreviations: AbbPC, Pre-contemplation; C, Contemplation; P, Preparation; A, Action; M, Maintenance.

Table 3 Adjusted Odds Ratios for Readiness for Regular Exercise Behavior and Socio-Demographic Characteristics of Patients According to Multinomial Logistic Regression (N= 1109)

Variables	Precontemplation OR (95% CI)	Contemplation OR (95% CI)	Preparation OR (95% CI)	Action OR (95% CI)
Gender				
Male	0.766 (0.503–1.166)	0.706 (0.441–1.129)	0.617 (0.392–0.97)*	0.813 (0.499–1.322)
Female	Reference	Reference	Reference	Reference
Age (year)				
<40	0.297 (0.153–0.576)*	0.711 (0.337–1.502)	0.861 (0.420–1.763)	1.239 (0.581–2.644)
40–59	0.115 (0.393–1.106)	1.311 (0.719–2.389)	1.469 (0.820–2.633)	1.268 (0.663–2.424)
≥60	Reference	Reference	Reference	Reference

(*Continued*)

Table 3 (Continued).

Variables	Precontemplation OR (95% CI)	Contemplation OR (95% CI)	Preparation OR (95% CI)	Action OR (95% CI)
Education level				
Secondary or less	1.897 (1.223–2.944)*	0.872 (0.635–1.708)	1.262 (0.786–2.027)	1.040 (0.621–1.741)
College and University	Reference	Reference	Reference	Reference
Total income level (JD)				
< 500	1.095 (0.645–1.859)	1.235 (0.682–2.236)	1.101 (0.623–1.947)	0.818 (0.445–1.506)
500–750	0.797 (0.515–1.520)	0.642 (0.309–1.332)	0.709 (0.358–1.393)	0.705 (0.346–1.440)
751–1000	1.060 (0.521–2.160)	1.883 (0.892–3.974)	1.707 (0.826–3.525)	1.145 (0.524–2.504)
> 1000	Reference	Reference	Reference	Reference
Dietitian consultation				
No	2.064 (1.311–3.248)*	2.810 (1.638–4.882)*	3.160 (1.885–5.298)*	1.100 (0.660–1.832)
Yes	Reference	Reference	Reference	Reference
Body Mass Index (BMI)				
Normal	0.435 (0.237–0.798)*	0.396 (0.203–0.770)*	0.421 (0.220–0.807)*	0.251 (0.251–1.023)
Overweight	0.432 (0.248–0.753)*	0.384 (0.209–0.704)*	0.467 (0.259–0.842)*	0.550 (0.288–1.050)
Obese	Reference	Reference	Reference	Reference
Blood Pressure (BP) duration (years)				
1–5	0.799 (0.495–1.291)	1.224 (0.715–2.094)	0.996 (0.591–1.679)	1.321 (0.715–2.094)
6–9	1.392 (0.792–2.449)	1.725 (0.915–3.251)	2.142 (1.178–3.894)	2.548 (1.340 −4.848)*
≥10	Reference	Reference	Reference	Reference

Notes: Multinomial logistic regression was adjusted for all other variables in the table Reference: last category (Maintenance stage). The Jordanian Dinar (JD) = 1.41 Dollar. *p-value < 0.05.

Regarding regular exercise behavior (Table 3), younger patients were less likely to be in the pre-contemplation stage compared to patients aged over 60. Conversely, patients with secondary education or lower levels were more likely to be in the pre-contemplation stages (OR=1.830; CI: 1.169–2.864). The odds of being in the pre-action stages for regular exercise behavior were lower for patients with normal or overweight BMI than for obese patients. Patients who received dietitian counseling had 2.1 times the likelihood of being in the pre-contemplation stage, 2.8 times the likelihood of being in the contemplation stage, and 3.2 times the likelihood of being in the preparation stage. The duration of hypertension impacted the readiness for regular exercise behavior; patients with a disease duration of 3 to 5 years had 2.5 times increased chances of being in the action stage compared to those with a disease duration of 10 years or more. Income did not significantly impact the SOG of regular exercise behavior.

In terms of quitting smoking (Table 4), male and younger patients had a higher probability of being in the pre-contemplation or contemplation stage for smoking cessation than older and female patients. Patients with an income between 501 and 750 JD had 3.7 times higher odds of being in the preparation stage. On the other hand, patients with a normal BMI had higher odds of being in the action stage for smoking cessation compared to obese patients (OR= 4.077, CI: 1.077–15.434). Duration of hypertension, education level, and dietitian consultation did not significantly impact the SOG of smoking cessation.

Table 4 Adjusted Odds Ratios for Readiness for Smoking Cessation and Socio-Demographic Characteristics of Patients According to Multinomial Logistic Regression (N= 1109)

Variables	Precontemplation OR (95% CI)	Contemplation OR (95% CI)	Preparation OR (95% CI)	Action OR (95% CI)
Gender				
Male	1.768 (1.00–3.173)*	1.843 (0.939–3.173)	1.032 (0.458–2.321)	0.400 (0.168–2.321)
Female	Reference	Reference	Reference	Reference
Age (year)				
<40	1.294 (0.496–3.377)	2.890 (1.011 −8.262)*	2.570 (0.696–9.495)	2.549 (0.700–9.288)
40–59	2.015 (1.09 −3.713)*	2.916 (1.349 −6.301)*	2.209 (0.851–5.735)	1.118 (0.384–3.258)
≥60	Reference	Reference	Reference	Reference
Education level				
Secondary or less	1.196 (0.648 −2.089)	0.805 (0.423–1.532)	1.261 (0.465–2.817)	0.987 (0.403–2.419)
College and University	Reference	Reference	Reference	Reference
Total income level (JD)				
< 500	1.357 (0.706–2.608)	1.082 (0.415–2.280)	2.074 (0.722–1.947)	1.592 (0.652–5.489)
500–750	1.059 (0.494–2.426)	0.991 (0.402–2.441)	3.676 (1.207 −1.393)*	0.693 (0.152–3.158)
751–1000	2.147 (0.914–5.047)	1.591 (0.611–4.143)	2.606 (0.708–9.591)	3.067 (0.832–11.314)
> 1000	Reference	Reference	Reference	Reference
Dietitian consultation				
No	1.668 (0.880 −3.163)	0.900 (0.445–1.821)	0.612 (0.269 −1.389)	0.754 (0.301–1.890)
Yes	Reference	Reference	Reference	Reference
Body Mass Index (BMI)				
Normal	1.937 (0.923–4.062)	1.538 (0.666–3.551)	2.305 (0.703–7.561)	4.077 (1.077–15.434)*
Overweight	0.829 (0.435–1.579)	0.715 (0.336–1.522)	1.680 (0.579–4.887)	2.891 (0.828–10.097)
Obese	Reference	Reference	Reference	Reference
Blood Pressure (BP) duration (years)				
1–5	0.871 (0.459–1.653)	1.959 (0.950–4.040)	1.294 (0.498–3.365)	0.855 (0.328–2.231)
6–9	0.903 (0.463–1.762)	0.810 (0.349–1.884)	1.459 (0.556–3.828)	0.308 (0.086 −1.106)
≥10	Reference	Reference	Reference	Reference

Notes: Multinomial logistic regression was adjusted for all other variables in the table Reference: last category (Maintenance stage). The Jordanian Dinar (JD) = 1.41 Dollar. *p-value < 0.05.

Table 5 reveals that patients with low income, those without dietitian counseling, and obese patients are more likely to be in the pre-contemplative stage of consuming 6–8 servings of grain daily. However, patients with a BP duration of 10 years or more have a higher likelihood of being in the maintenance stage for grain consumption. Age and education level did not significantly impact the stage of consumer behavior change.

In Table 6, younger patients under 60 years have a higher likelihood of being in the contemplation stage for consuming the recommended amounts of fruits and vegetables daily. Patients with college degrees (college and

Table 5 Adjusted Odds Ratios for Readiness for Consuming Grain and Socio-Demographic Characteristics of Patients According to Multinomial Logistic Regression (N= 1109)

Variables	Precontemplation OR (95% CI)	Contemplation OR (95% CI)	Preparation OR (95% CI)	Action OR (95% CI)
Gender				
Male	1.272 (0.888–1.824)	1.335 (0.929–1.918)	1.072 (0.718–1.600)	1.798 (1.228 −2.632)*
Female	Reference	Reference	Reference	Reference
Age (year)				
<40	1.292 (0.712–2.343)	0.937 (0.517 −1.696)	1.090 (0.570–2.087)	1.086 (0.587–2.010)
40–59	1.458 (0.943 −2.252)	1.065 (0.696 −1.631)	1.113 (0.694–1.783)	1.041 (0.667–1.626)
≥60	Reference	Reference	Reference	Reference
Education level				
Secondary or less	0.952 (0.656 −1.381)	1.020 (0.701–1.486)	0.786 (0.519–1.189)	1.038 (0.700–1.540)
College and university	Reference	Reference	Reference	Reference
Total income level (JD)				
< 500	1.608 (1.01 −2.559)*	1.023 (0.651–1.607)	1.107 (0.674–1.818)	1.066 (0.659–1.726)
500–750	1.401 (0.788–2.493)	0.838 (0.466–1.510)	1.177 (0.642 −2.159)	1.186 (0.661–2.128)
751–1000	1.509 (0.852–2.676)	1.281 (0.738–2.224)	1.052 (0.561–1.972)	1.233 (0.681–2.231)
> 1000	Reference	Reference	Reference	Reference
Dietitian consultation				
No	2.524 (1.576 −4.04)*	1.415 (0.927–2.158)	1.783 (0.989 −2.872)	1.202 (0.781–1.848)
Yes	Reference	Reference	Reference	Reference
Body Mass Index (BMI)				
Normal	0.618 (0.379–1.00)*	0.855 (0.526–1.388)	0.689 (0.401–1.184)	0.638 (0.382 −1.065)
Overweight	0.831 (0.550–1.255)	0.896 (0.586–1.370)	0.897 (0.568–1.417)	0.731 (0.470–1.137)
Obese	Reference	Reference	Reference	Reference
Blood Pressure (BP) duration (years)				
1–5	1.589 (1.040 −2.43)*	1.276 (0.847–1.924)	0.913 (0.566–1.475)	1.213 (0.772–1.905)
6–9	2.932 (1.845 −4.66)*	1.461 (0.903–2.363)	2.500 (1.548 −4.036)*	2.472 (1.536 −3.978)*
≥10	Reference	Reference	Reference	Reference

Notes: Multinomial logistic regression was adjusted for all other variables in the table Reference: last category (Maintenance stage). The Jordanian Dinar (JD) = 1.41 Dollar. *p-value < 0.05.

university) have lower odds of being in the preparation stage compared to those with lower educational levels. Patients without dietitian counseling have a 1.6 times higher chance of being in the preparation stage for consuming fruits and vegetables daily. Patients with the highest income category and longest BP duration have higher odds of being in the maintenance stage for fruit and vegetable consumption. Gender and BMI did not significantly impact the SOG for consuming fruits and vegetables.

Table 6 Adjusted Odds Ratios for Readiness to Consume 5 Servings of Fruits and Vegetables and Socio-Demographic Characteristics of Patients According to Multinomial Logistic Regression (N= 1109)

Variables	Precontemplation OR (95% CI)	Contemplation OR (95% CI)	Preparation OR (95% CI)	Action OR (95% CI)
Gender				
Male	1.305 (0.870–1.957)	1.026 (0.734–1.435)	1.115 (0.790–1.572)	1.315 (0.779–2.219)
Female	Reference	Reference	Reference	Reference
Age (year)				
<40	1.610 (0.833–3.110)	2.886 (1.656–5.031)*	0.924 (0.521–1.636)	0.906 (0.375–2.189)
40–59	1.564 (0.964–2.537)	2.803 (1.827–4.299)*	1.264 (0.853–1.873)	1.092 (0.598–1.995)
≥60	Reference	Reference	Reference	Reference
Education level				
Secondary or less	0.913 (0.599–1.390)	0.886 (0.628–1.250)	0.690 (0.481–0.989)*	0.924 (0.533–1.602)
College and University	Reference	Reference	Reference	Reference
Total income level (JD)				
< 500	1.793 (1.097–2.930)	2.251 (1.482–3.420)*	3.673 (2.311–5.840)*	2.306 (1.131–4.703)*
500–750	1.093 (0.575–2.079)	1.636 (0.977–2.739)	2.710 (1.565–4.691)*	1.586 (0.656–3.837)
751–1000	0.575 (0.291–1.139)	0.927 (0.550–1.561)	1.693 (0.982–2.921)*	2.407 (1.115–5.194)*
> 1000	Reference	Reference	Reference	Reference
Dietitian consultation				
No	1.360 (0.836–2.214)	1.295 (0.878–1.911)	1.643 (1.085–2.489)*	0.606 (0.351–1.047)
Yes	Reference	Reference	Reference	Reference
Body Mass Index (BMI)				
Normal	0.807 (0.463–1.408)	1.049 (0.673–1.633)	1.094 (0.690–1.735)	1.411 (0.669–2.973)
Overweight	0.988 (0.620–1.573)	0.928 (0.629–1.370)	1.066 (0.717–1.584)	1.640 (0.871–3.089)
Obese	Reference	Reference	Reference	Reference
Blood Pressure (BP) duration (years)				
1–5	2.256 (1.376–3.701)*	1.766 (1.210–2.577)*	1.496 (0.998–2.240)*	0.689 (0.351–1.356)
6–9	2.850 (1.695–4.791)*	1.147 (0.736–1.788)	2.185 (1.430–3.340)*	1.504 (0.822–2.752)
≥10	Reference	Reference	Reference	Reference

Notes: Multinomial logistic regression was adjusted for all other variables in the table Reference: last category (Maintenance stage). The Jordanian Dinar (JD) = 1.41 Dollar. *p-value < 0.05.

For low-fat or fat-free dairy products (Table 7), patients with dietitian counseling are more likely to be in the maintenance stages. Patients with a BP duration of 10 years or more also have a higher likelihood of being in the maintenance stage for consuming low-fat or fat-free dairy products. Patients with income less than or equal to 500 JD have higher odds of being in the preparation and action stages for consuming low-fat or fat-free dairy products compared to those with income over 500 JD. Gender, age, education level, and BMI did not significantly impact the SOG for consuming 2–3 servings of low-fat or fat-free dairy products daily.

Table 7 Adjusted Odds Ratios for Readiness to Consume 2–3 Servings of Low-Fat or Fat-Free Dairy Products and Socio-Demographic Characteristics of Patients According to Multinomial Logistic Regression (N= 1109)

Variables	Precontemplation OR (95% CI)	Contemplation OR (95% CI)	Preparation OR (95% CI)	Action OR (95% CI)
Gender				
Male	0.985 (0.701–1.384)	1.304 (0.885–1.923)	1.060 (0.700–1.605)	1.194 (0.819–1.740)
Female	Reference	Reference	Reference	Reference
Age (year)				
<40	0.677 (0389–1.178)	0.697 (0.369–1.318)	0.706 (0.332–1.504)	0.831 (0.456–1.515)
40–59	0.925 (0.622–1.375)	0.914 (0.581–1.439)	1.561 (0.941–2.589)	0.918 (0.584–1.442)
≥60	Reference	Reference	Reference	Reference
Education level				
Secondary or less	1.027 (0.722–1.640)	0.865 (0.576–1.297)	1.099 (0.716–1.686)	0.788 (0.531–1.170)
College and University	Reference	Reference	Reference	Reference
Total income level (JD)				
< 500	1.464 (0.958–2.239)	1.808 (1.105–2.958)*	1.871 (1.089–3.216)*	1.363 (0.836–2.221)
500–750	1.313 (0.766–2.252)	1.270 (0.669–2.589)	1.781 (0.918–3.454)	1.918 (1.088–3.380)
751–1000	1.333 (0.781–2.275)	1.385 (0.741–2.589)	1.922 (1.010–3.655)	1.572 (0.877–2.818)
> 1000	Reference	Reference	Reference	Reference
Dietitian consultation				
No	3.632 (2.284–5.775)*	2.197 (1.373–3.515)*	2.514 (1.488–4.247)*	1.245 (0.824–1.881)
Yes	Reference	Reference	Reference	Reference
Body Mass Index (BMI)				
Normal	0.718 (0.458–1.124)	0.801 (0.464–1.384)	0.687 (0.393–1.202)	0.778 (0.466–1.298)
Overweight	0.715 (0.484–1.059)	1.218 (0.776–1.911)	0.797 (0.497–1.277)	0.954 (0.612–1.488)
Obese	Reference	Reference	Reference	Reference
Blood Pressure (BP) duration (years)				
1–5	1.339 (0.709–1.977)	0.736 (0.466–1.162)	1.229 (0.746–2.026)	1.087 (0.695–1.701)
6–9	1.619 (1.040–2.520)*	1.318 (0.815–2.130)	2.490 (1.490–4.160)*	1.823 (1.141–2.913)*
≥10	Reference	Reference	Reference	Reference

Notes: Multinomial logistic regression was adjusted for all other variables in the table Reference: last category (Maintenance stage). The Jordanian Dinar (JD) = 1.41 Dollar. *p-value < 0.05.

Table 8 shows that younger patients aged 40 years or younger are less likely to be in the contemplation stage for consuming the recommended amounts of meat, chicken, and fish daily. Patients with income less than or equal to 1000 JD and those with dietitian counseling are more likely to be in the maintenance stages for consuming ≤6 servings of meat, chicken, and fish daily. Patients with a BP duration of 1–5 years have a 1.9 times higher chance of being in the pre-contemplation stage compared to those with a BP duration of 10 years or more. Gender, age, education level, and BMI did not significantly impact the SOG for consuming meat, chicken, and fish.

Table 8 Adjusted Odds Ratios for Readiness to Consume ≤ 6 Servings of Meats, Chicken, Fish, and Socio-Demographic Characteristics of Patients According to Multinomial Logistic Regression (N= 1109)

Variables	Precontemplation OR (95% CI)	Contemplation OR (95% CI)	Preparation OR (95% CI)	Action OR (95% CI)
Gender				
Male	1.243 (0.837–1.846)	1.444 (0.985–2.116)	0.973 (0.635–1.492)	1.138 (0.784–1.651)
Female	Reference	Reference	Reference	Reference
Age (year)				
<40	0.681 (0.357–1.302)	0.450 (0.232–0.871)*	0.504 (0.223–1.136)	1.124 (0.632–1.998)
40–59	0.723 (0.454–1.151)	0.716 (0.463–1.109)	1.013 (0.615–1.667)	0.872 (0.555–1.369)
≥60	Reference	Reference	Reference	Reference
Education level				
Secondary or less	0.942 (0.623–1.423)	0.741 (0.496–1.107)	1.043 (0.673–1.617)	0.963 (0.655–1.416)
College and University	Reference	Reference	Reference	Reference
Total income level (JD)				
< 500	0.577 (0.350–0.949)*	0.698 (0.441–1.107)	0.429 (0.253–0.727)*	0.885 (0.546–1.434)
500–750	0.345 (0.174–0.686)*	0.254 (0.126–0.514)*	0.479 (0.254–0.903)*	0.929 (0.527–1.638)
751–1000	0.979 (0.553–1.734)	0.538 (0.292–0.992)*	0.558 (0.292–1.066)	0.854 (0.465–1.571)
> 1000	Reference	Reference	Reference	Reference
Dietitian consultation				
No	16.68 (6.044–46.03)*	6.00 (3.273–11.01)*	3.589 (1.972–6.530)*	1.225 (0.823–1.823)
Yes	Reference	Reference	Reference	Reference
Body Mass Index (BMI)				
Normal	0.775 (0.452–1.328)	1.054 (0.639–1.225)	0.622 (0.339–1.142)	1.014 (0.610–1.685)
Overweight	0.839 (0.535–1.318)	0.786 (0.504–1.225)	0.878 (0.549–1.405)	1.130 (0.725–1.761)
Obese	Reference	Reference	Reference	Reference
Blood Pressure (BP) duration (years)				
1–5	1.899 (1.189–3.034)*	0.729 (0.464–1.145)	1.197 (0.731–1.960)	1.068 (0.686–1.661)
6–9	1.255 (0.727–2.165)	1.062 (0.665–1.696)	1.156 (0.676–1.978)	1.303 (0.827–2.055)
≥10	Reference	Reference	Reference	Reference

Notes: Multinomial logistic regression was adjusted for all other variables in the table Reference: last category (Maintenance stage). The Jordanian Dinar (JD) = 1.41 Dollar. *p-value < 0.05.

In Table 9, patients without dietitian counseling are more likely to be in the pre-contemplation stage for consuming ≥5 servings/week of nuts, seeds, and legumes. Patients with a BP duration of 10 years or more have a higher likelihood of being in the maintenance stage for consuming nuts, seeds and legumes. Gender, age, education level, and income did not significantly impact the SOG for consuming nuts, seeds and legumes weekly.

As shown in Table 10, patients with dietitian counseling and patients with BP durations over 10 years are more likely to be in the maintenance stage for their daily consumption of 2 to 3 servings of fat and oil. Additionally, patients with

Table 9 Adjusted Odds Ratios for Readiness to Consume ≥5 Servings/Week of Nuts, Seeds & Legumes, and Socio-Demographic Characteristics of Patients According to Multinomial Logistic Regression (N= 1109)

Variables	Precontemplation OR (95% CI)	Contemplation OR (95% CI)	Preparation OR (95% CI)	Action OR (95% CI)
Gender				
Male	1.240 (0.860–1.789)	1.392 (0.955–2.029)	0.889 (0.588–1.345)	1.223 (0.857–1.745)
Female	Reference	Reference	Reference	Reference
Age (year)				
<40	0.888 (0.482–1.636)	1.244 (0.673–2.301)	0.656 (0.337–1.276)	0.892 (0.500–1.509)
40–59	0.983 (0.641–1.507)	1.069 (0.678–1.686)	0.662 (0.413–1.076)	0.863 (0.563–1.322)
≥60	Reference	Reference	Reference	Reference
Education level				
Secondary or less	1.382 (0.945–2.02)	1.204 (0.815–1.779)	0.846 (0.551–1.30)	1.143 (0.791–1.654)
College and University	Reference	Reference	Reference	Reference
Total income level (JD)				
< 500	1.266 (0.796–2.016)	1.059 (0.652–1.7250)	0.817 (0.494–1.352)	0.661 (0.423–1.034)
500–750	0.997 (0.550–1.807)	1.167 (0.648–2.101)	0.794 (0.420–1.503)	0.802 (0.464–1.389)
751–1000	0.818 (0.442–1.515)	1.109 (0.614–2.00)	0.727 (0.382–1.383)	0.962 (0.569–1.627)
> 1000	Reference	Reference	Reference	Reference
Dietitian consultation				
No	2.291 (1.381–3.802)*	0.969 (0.633–1.483)	1.606 (0.963–2.678)	0.735 (0.496–1.088)
Yes	Reference	Reference	Reference	Reference
Body Mass Index (BMI)				
Normal	0.747 (0.452–1.237)	0.764 (0.459–1.274)	1.022 (0.582–1.794)	0.955 (0.591–1.543)
Overweight	1.285 (0.848–1.947)	1.139 (0.736–1.762)	1.647 (1.023–2.652)*	1.360 (0.894–2.070)
Obese	Reference	Reference	Reference	Reference
Blood Pressure (BP) duration (years)				
1–5	1.355 (0.887–2.069)	0.842 (0.537–1.320)	0.939 (0.576–1.529)	1.482 (0.971–2.263)
6–9	2.121 (1.319–3.410)*	1.966 (1.240–3.118)*	2.128 (1.291–3.508)*	2.409 (1.527–3.801)*
≥10	Reference	Reference	Reference	Reference

Notes: Multinomial logistic regression was adjusted for all other variables in the table Reference: last category (Maintenance stage). The Jordanian Dinar (JD) = 1.41 Dollar. *p-value < 0.05.

a normal BMI are more likely than obese patients to be in the maintenance stage for their consumption of fat and oil. Males have increased chances of being in the pre-contemplation and contemplation stages of consuming 2–3 servings of fat and oil. On the other hand, younger patients aged under 40 years have 1.9 times higher odds of being in the action stage compared to those aged 60 years or older. Education level and income did not significantly impact the SOG for consuming 2 to 3 servings of fat and oil daily, as shown in Table 11. The odds of being in the pre-action stages for sweet consumption were lower for females and patients without dietitian counseling. Patients with BP durations over 10 years

Table 10 Adjusted Odds Ratios for Readiness to Consume 2–3 Servings/Day of Fats and Oils, and Socio-Demographic Characteristics of Patients According to Multinomial Logistic Regression (N= 1109)

Variables	Precontemplation OR (95% CI)	Contemplation OR (95% CI)	Preparation OR (95% CI)	Action OR (95% CI)
Gender				
Male	1.740 (1.188–2.548)*	1.497 (1.035–2.164)*	1.045 (0.690–1.582)	1.228 (0.860–1.754)
Female	Reference	Reference	Reference	Reference
Age (year)				
<40	1.403 (0.764–2.578)	1.011 (0.543–1.880)	1.016 (0.477–2.165)	1.90 (1.090–3.314)*
40–59	1.030 (0.654–1.622)	1.020 (0.665–1.566)	1.281 (0.793–2.069)	1.086 (0.705–1.674)
≥60	Reference	Reference	Reference	Reference
Education level				
Secondary or less	1.135 (0.764–1.686)	1.259 (0.859–1.845)	1.074 (0.703–1.640)	0.910 (0.629–1.318)
College and University	Reference	Reference	Reference	Reference
Total income level (JD)				
< 500	0.948 (0.593–1.514)	0.800 (0.506–1.266)	1.031 (0.604–1.759)	1.104 (0.70–1.741)
500–750	0.701 (0.366–1.343)	0.977 (0.550–1.733)	1.528 (0.811–2.877)	1.566 (0.909–2.696)
751–1000	0.938 (0.518–1.698)	0.907 (0.510–1.613)	1.501 (0.808–2.789)	1.107 (0.625–1.958)
> 1000	Reference	Reference	Reference	Reference
Dietitian consultation				
No	1.722 (1.086–2.729)*	2.622 (1.621–4.241)*	2.171 (1.307–3.606)*	1.660 (1.103–2.50)*
Yes	Reference	Reference	Reference	Reference
Body Mass Index (BMI)				
Normal	0.661 (0.398–1.097)	0.774 (0.477–1.258)	0.354 (0.191–0.657)*	0.760 (0.468–1.232)
Overweight	0.682 (0.436–1.066)	0.684 (0.445–1.0258)	0.729 (0.465–1.140)	0.951 (0.625–1.447)
Obese	Reference	Reference	Reference	Reference
Blood Pressure (BP) duration (years)				
1–5	1.930 (1.221–3.050)*	1.122 (0.726–1.735)	0.706 (0.43–1.157)	0.936 (0.620–1.413)
6–9	2.524 (1.514–4.208)*	2.261 (1.422–3.593)*	1.944 (1.194–3.166)*	1.65 (1.056–2.579)*
≥10	Reference	Reference	Reference	Reference

Notes: Multinomial logistic regression was adjusted for all other variables in the table Reference: last category (Maintenance stage). The Jordanian Dinar (JD) = 1.41 Dollar. *p-value < 0.05.

had higher odds of being in the maintenance stage for consuming less than 6 servings per day of sweets. Age, education level, income, and BMI did not significantly impact the SOG for consuming sweets daily.

Discussion

The present study is the first of its kind to assess the stages of change in practicing exercise, smoking, and dietary guidelines among hypertensive patients in Jordan. This study examined two lifestyle behaviors (smoking and exercising)

Table 11 Adjusted Odds Ratios for Readiness to Consume 5 or Less Sweets /Day, and Socio-Demographic Characteristics of Patients According to Multinomial Logistic Regression (N= 1109)

Variables	Precontemplation OR (95% CI)	Contemplation OR (95% CI)	Preparation OR (95% CI)	Action OR (95% CI)
Gender				
Male	0.645 (0.423–0.984)*	0.497 (1.035–2.164)*	0.538 (0.302–0.960)*	1.228 (0.860–1.754)
Female	Reference	Reference	Reference	Reference
Age (year)				
<40	1.018 (0.520–1.991)	1.363 (0.590–3.148)	0.839 (0.324–2.177)	1.900 (1.090–3.314)*
40–59	1.165 (0.709–1.915)	1.484 (0.793–2.775)	1.251 (0.636–2.462)	1.086 (0.705–1.674)
≥60	Reference	Reference	Reference	Reference
Education level				
Secondary or less	0.898 (0.579–1.395)	0.927 (0.540–1.592)	1.073 (0.593–1.943)	0.910 (0.629–1.318)
College and University	Reference	Reference	Reference	Reference
Total income level (JD)				
< 500	1.016 (0.590–1.749)	1.122 (0.579–2.174)	0.697 (0.341–1.424)	1.104 (0.70–1.741)
500–750	0.849 (0.447–1.611)	0.586 (0.252–1.364)	0.557 (0.230–1.347)	1.566 (0.909–2.696)
751–1000	0.865 (0.444–1.687)	1.195 (0.539–2.647)	0.737 (0.304–1.788)	1.107 (0.625–1.958)
> 1000	Reference	Reference	Reference	Reference
Dietitian consultation				
No	0.45 2 (0.248–0.823)*	0.645 (0.315–1.321)	0.464 (0.220–0.979)*	0.503 (0.238–1.026)
Yes	Reference	Reference	Reference	Reference
Body Mass Index (BMI)				
Normal	1.046 (0.595–1.839)	0.858 (0.423–1.739)	1.663 (0.763–3.626)	1.314 (0.610–2.832)
Overweight	1.083 (0.662–1.773)	1.121 (0.614–2.044)	1.590 (0.800–3.160)	1.252 (0.641–2.446)
Obese	Reference	Reference	Reference	Reference
Blood Pressure (BP) duration (years)				
1–5	0.486 (0.283–0.833)*	0.659 (0.345–1.259)	0.589 (0.281–1.233)	0.384 (0.178–0.788)*
6–9	0.345 (0.197–0.606)*	0.463 (0.232–0.924)*	0.754 (0.363–1.567)	0.437 (0.212–0.898)*
≥10	Reference	Reference	Reference	Reference

Notes: Multinomial logistic regression was adjusted for all other variables in the table Reference: last category (Maintenance stage). The Jordanian Dinar (JD) = 1.41 Dollar. *p-value < 0.05.

and eight dietary behaviors based on the DASH dietary guidelines, including daily consumption of 6–8 servings or more of grains or grain products, 4–5 servings or more of fruits and vegetables, and 2–3 servings or more of low-fat or fat-free dairy products. It also looked at reducing meat, poultry, and fish intake to 6 or fewer servings per day, limiting saturated fat and oil to 2–3 servings per day, consuming 4 to 5 servings of nuts, seeds, and legumes per week, and reducing refined sugar and sweet intake to 5 servings or less per week.

As per the official guidelines for hypertension treatment, lifestyle modification, including dietary changes, is considered the primary approach for managing hypertensive patients. It is expected that increased awareness of hypertension will lead to changes in individuals' lifestyles.[38] In line with the SOG theory, the stages were categorized into two or three levels for easier analysis and interpretation. Some researchers, like Saputri et al, described them as low, medium, and high levels of adherence, while Karupaiah et al divided them into non-adherent, newly adherent, and adherent subjects.[38–40] In our study, the three pre-action stages were defined as low levels of readiness, while the action and maintenance stages were classified as high levels of readiness.[16,41]

Our findings revealed that approximately one-fourth of the participants showed a high readiness level for adopting exercise behaviors, indicating that the majority may not recognize the need for change in their exercise habits or may not feel that it is a problem.[29] Thus, specific action is necessary to address this issue. Moreover, a significant association was observed between gender and the stage of readiness for change in exercising regularly. Educational level and age also appeared to influence the stage of readiness for exercising.

Consistent with our results, a previous study showed that women were more likely to be physically active compared to men, while men were more likely to be in the planning stages of engaging in exercise.[42] Various researchers have explored the impact of gender on physical activity and consistently found that women face more barriers to involvement in physical activity compared to men.[43] Women often have less free time, energy, and social support, which may limit their participation in physical activities.[43]

Interestingly, our study found that participants who were visiting dietitians for consultation were more likely to be in a low level of readiness for increasing their exercise levels. This contrasts with the results of the Karupaiah et al study, which reported that men and younger individuals with higher education levels were more likely to be in the maintenance stage of exercise.[39] The relationships between age and physical activity are generally consistent with earlier studies.[4,42] In our study, younger age (under 40 years old) was associated with a higher likelihood of being in the stage of readiness for change in practicing exercise. Elderly individuals may face challenges related to aging and comorbidities that could hinder their ability to engage in regular exercise or maintain physical independence.

Moreover, our study aligns with previous research indicating that higher education levels are associated with increased physical activity.[4,44,45] Education may play a role in raising awareness about the importance of physical activity and its benefits, thus encouraging individuals with higher education levels to engage in more active lifestyles.

While the majority of smokers in our study were found to be at a low readiness level for quitting, it is noteworthy that one-third of them displayed a high readiness level for smoking cessation. We observed significant associations between patient sociodemographic characteristics and the adjusted odds ratios for readiness to quit smoking. Particularly, gender and the readiness stage for change in quitting smoking showed a strong correlation. Males were more likely to be in the pre-contemplation stage. This trend may be attributed to the prevalent acceptance of smoking among men in Jordan, influenced by sociocultural settings, religious practices, and economic factors.[4,46] Additionally, a majority of younger participants were categorized as having a low readiness level for quitting smoking. These findings align with Belbeisi et al study, where it was elucidated that the prevalence of smoking in Jordan is alarmingly high. The prevalence of smoking and tobacco use among young individuals ranges from 15% to 30%, with current smoking prevalence reaching approximately 50% among men. There exist opportunities for additional efforts to diminish smoking rates both among the youth and adults.[47] When it comes to fruit and vegetable consumption, earlier studies have consistently revealed insufficient intake in regular diets worldwide.[18] For individuals with hypertension, the new recommendations advocate consuming more than five servings of fruits and vegetables daily.[18,48] In our study, approximately 40% of the participants exhibited a high level of adherence to the consumption of fruits and vegetables. Various determinants were linked to the inclination to sufficiently consume fruits and vegetables, encompassing factors such as age, income, and the duration since the diagnosis of hypertension. Higher income levels were positively correlated with greater fruit and vegetable consumption, as individuals or families with higher incomes tend to have better purchasing abilities. The cost of fruits and vegetables can be a barrier to their consumption, particularly in low-income countries where financial constraints may prevent people from buying and consuming the recommended amount.[49] Furthermore, our findings suggested that individuals with longer years of hypertension diagnosis showed a higher readiness level to adopt healthy behaviors, including increased fruit and vegetable consumption. This is in line with earlier research highlighting the beneficial

effects of a diet rich in fruits and vegetables in reducing the risk of hypertension in adults.[50] The link between fruit and vegetable intake and hypertension risk was found to be stronger among younger, female, overweight, and prehypertensive individuals.[4,51] These consistent findings further emphasize the importance of promoting healthier dietary habits, especially among those at higher risk of developing hypertension.

Approximately 50% of the participants in our study demonstrated a high level of readiness for adopting healthier grain-eating behaviors. Several factors were found to influence people's likelihood of consuming the recommended servings of grains and grain products. Gender, income, and dietitian consultation were among the significant factors associated with grain intake. Men showed a higher tendency to be in the action stage compared to women.[52] Individuals with normal BMI and modest incomes appeared less inclined to consume sufficient grains. On the other hand, those who sought guidance from dietitians displayed a higher level of readiness to change their grain-eating habits. Notably, no statistically significant difference was observed in the stages of change for consumption of low-fat or fat-free dairy products across patients with different socio-demographic traits.[53] However, patients with better socioeconomic status were more likely to be willing to consume 2–3 servings of low-fat or fat-free dairy products. Among those with modest incomes, individuals in the planning and preparation stages were more commonly observed compared to those who did not consult dietitians.[54] Participants diagnosed with high BP 6–9 years ago showed a higher level of readiness to change their dairy product-consuming behavior (preparation and action stages), which can be attributed to their knowledge and awareness of the health benefits of low-fat intake.[55]

Various sociodemographic factors were associated with behavior change related to the consumption of lean meat. Approximately 60% of the study sample exhibited a high readiness level for this behavior change. Age, income, and dietitian consultation emerged as key factors. Low-income individuals had a lower likelihood of falling into the low readiness level for behavior change concerning consuming lean meat and chicken, primarily due to economic constraints. Participants who did not seek guidance from dietitians also tended to have a higher chance of being in the low readiness category, indicating a lower level of awareness regarding the link between the meat group and BP.[53]

Gender played a role in the behavioral change related to dietary fat and oil consumption. Men were more likely to fall into the low readiness category compared to women. Women showed more interest in healthy eating and fat reduction. Individuals under the age of 40 years were found to be in the action stage, indicating their active engagement in such dietary modifications. Moreover, those who did not consult dietitians were more likely to be in the low readiness category for consuming less fat or oil. Dietitians play a crucial role in providing recommendations and health counseling to promote specific dietary standards and improve overall health.[56]

While it was anticipated that socioeconomic factors such as wealth or education level would have a stronger association with reducing sweet consumption, the impact was found to be limited. This finding aligns with the notion that flavor preferences may have a greater influence on food choices than socioeconomic status.[57] Differences in behavioral change were observed between men and women, with men having a lower likelihood of falling into the low readiness category. Additionally, individuals who did not consult dietitians were less inclined to limit their daily sweets intake to 5 or fewer servings per week.

Conclusion

In conclusion, this study sheds light on the stages of change for various health behaviors among hypertensive patients in Jordan. The majority of participants were at the pre-contemplation stage for engaging in physical activity, quitting smoking, and reducing refined sugar and sweet intake. Socio-demographic factors such as age, dietitian consultation, and low family income were found to influence the readiness levels for adopting healthier behaviors. These findings underscore the importance of implementing targeted interventions and educational programs to increase awareness and understanding of lifestyle factors affecting blood pressure levels in hypertensive individuals.

The results emphasize the need for comprehensive interventions that go beyond individual knowledge and focus on social, local, and environmental strategies to promote healthier behaviors among hypertensive patients. However, caution should be exercised in generalizing the findings due to the study's use of a convenience sample, which may not fully represent the entire Jordanian hypertension population. Despite the popularity of the Transtheoretical Model-based interventions, their efficacy in altering behavior in hypertensive populations requires further investigation. The study's

strengths include a large sample size and the examination of nine health behaviors, providing valuable insights into the distribution of patients across different stages of change.

Overall, these findings contribute to the growing body of research on hypertension management and underscore the importance of tailored interventions to improve lifestyle behaviors and overall health outcomes in hypertensive patients. Further research in this area will help refine and develop more effective interventions for promoting healthier behaviors and reducing the burden of hypertension in Jordan and beyond.

Strengths and Limitations

As the first, this study fills a gap in the literature and offers valuable insights into the readiness levels of hypertensive patients for behavior change.

This study assessed a wide range of health behaviors, including exercise, smoking, and dietary habits, providing a holistic understanding of lifestyle factors among hypertensive patients. The large sample size enhances the statistical validity and reliability of the study's findings. In addition, the study identified important socio-demographic factors, such as age, income, and dietitian consultation, that significantly impact patients' readiness to adopt healthier behaviors. On the other hand, using convenience sampling may limit the generalizability of the findings to the entire hypertensive population in Jordan, potentially introducing bias. While the study covers multiple health behaviors, it provides limited depth in understanding the specific reasons behind participants' readiness levels and their motivations for behavior change.

Overall, the findings present an opportunity for developing targeted interventions based on socio-demographic factors to promote healthier behaviors among hypertensive patients. Furthermore, opens avenues for further research to explore the effectiveness of Transtheoretical Model-based interventions in hypertensive populations and to address the limitations of the current study.

Study Implementation

Based on the results and conclusions of this study, several implementation recommendations can be suggested to promote healthier behaviors among hypertensive patients in Jordan including: First, develop targeted educational programs and counseling sessions that take into consideration the specific socio-demographic factors identified in the study. For instance, considering the influence of age and gender on readiness levels, tailor interventions to address the unique needs and challenges faced by different age groups and genders. Second, collaborate with community centers, mosques, and other local institutions to implement health promotion programs. These programs could include workshops, seminars, and awareness campaigns that focus on the importance of adopting healthier behaviors to manage hypertension. Third, recognizing the impact of dietitian consultation on readiness levels, healthcare providers and institutions should emphasize the importance of seeking dietary guidance. Incorporate regular dietitian consultations as part of hypertension management programs to provide patients with personalized dietary recommendations and support. Fourth, consider implementing incentive-based programs that reward patients for adopting healthier behaviors. These incentives could range from discounts on health services to recognition within the community for successful behavior change. Fifth, develop media campaigns that use various channels, such as TV, radio, and social media, to raise awareness about hypertension management and the benefits of adopting healthier behaviors. These campaigns can leverage influencers, testimonials, and success stories to inspire behavior change. Sixth, establish support groups for hypertensive patients where they can share their experiences, challenges, and successes related to behavior change. These groups can provide emotional support, motivation, and a sense of community. Finally, implement a long-term monitoring and evaluation plan to assess the effectiveness of the interventions. Regularly track changes in behavior and blood pressure levels among participants to determine the impact of the implemented strategies.

The Public Health Impact

The findings of this study have significant implications for public health by implementing effective interventions based on the study's insights, we have the opportunity to enhance the management of hypertension and minimize the risk factors associated with related health complications. Moreover, the study underscores the potential for fostering collaboration among healthcare professionals to collectively promote essential lifestyle modifications.

Abbreviations

BMI, Body Mass Index; BP, Blood Pressure; JD, Jordanian Dinar; JNC, Joint National Committee; SOG, Stage of Change; TTM, Transtheoretical Model; WHO, World Health Organization.

Data Sharing Statement

The corresponding author can provide the data used to support the findings of this study upon request.

Consent to Participate and Publication

The following statement was attached in the first part of the questionnaire. "I agree to participate in this research after reading the first page of the research paper, which includes the name of the research, its objectives, and the benefits of my participation in this research for the community. My participation in this research is completely voluntary. I have the right to withdraw from the study at any time without any consequences for me. There is no financial reward for my participation. I agree to the use of all my personal information in this research".

Consent for Publication

The authors assert that participants in the human research study granted informed consent for the publication of the research data.

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Author Contributions

Nour Amin Elsahoryi made a significant contribution in the study design, provided guidance in data collection, and execution, and took the lead in writing the manuscript and revising the final copy. Hadil Shafee Subih and Fadwa Hammouh contributed, equally, to the draft-writing process and they reviewed and validated the study. Fwziah Jammal Hammad took the role of the data analysis. All authors have read and approved the final version of the manuscript, taking responsibility for the accuracy and integrity of the research presented. All researchers provided their ultimate approval for the version slated for publication. The journal, to which the article was submitted, also gave its consent, and the researchers collectively agreed to assume responsibility for all facets of the work.

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