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Research Article

Dietary factors affecting control of hypertension in Minia Cardiothoracic University Hospital

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Abstract

Background: Uncontrolled hypertension is a major risk factor for global cardiovascular morbidity and mortality, causing an estimated half of the cardiovascular events. The relationship between blood pressure and obesity, excessive or deficient intake of certain nutrients is a subject of great importance. Aim of the study: Assessment of the nutritional status of hypertensive patients and its effect on the control of their hypertension. **Methods:** This study was a hospital based cross-sectional study among adult hypertensive patients (older than 18 years old) who attended the outpatient clinic in Minia Cardiothoracic University Hospital, in the period from May 2023 until October 2023. Patients were interviewed and the data was collected through a designed well-structured questionnaire including socio-demographic data and dietary assessment of each patient. **Results:** Total number of patients included in the study was 322 patients. The mean age was 56.9 ± 12.62 years, with (34.2%) males and (65.8%) females. The percentage of uncontrolled hypertension was 34%. There was a significant effect of consuming grains (P=0.001), proteins (P=0.001), sweets (P=0.004), different types of fats (P=0.038), and amount of salt (P=0.001) on the control of hypertension. **Conclusion:** Dietary factors decreasing the control of hypertension include consumption of grains, proteins, sweets, ghee, hydrogenated oils, and salt. These factors should be restricted in the diet of hypertensive patients to achieve the best possible control.

Key words: Hypertension, control, diet, nutrition

Introduction

Nutritional status and nutrient consumption influence hypertension occurrence and severity. One of the main reasons why people get hypertension is when they consume too much calories and are overweight. An increase in renin-angiotensin-aldosterone activity (and maybe other mineralocorticoid activities), insulin resistance, salt-sensitive hypertension, and decreased kidney function are all linked to obesity.

Factors related to nutrition that might impact blood pressure include being overweight, consuming a lot of calories, fat, salt, potassium, magnesium, dietary fibre, interactions between nutrients and genes, and interactions between nutrients and medications [1].

While both potassium and sodium are essential for proper nutrition, eating too much sodium and not enough potassium raises the risk of hypertension [2]. It is crucial for cardiovascular health to maintain a balanced intake of potassium and salt in the diet. According to the World Health Organization, one should not consume more than 85 millimoles of sodium per day and 90 millimoles of potassium per day [3].

Many studies have shown that the amount of salt consumed via food has a direct

correlation with blood pressure (BP) [4]. People of African origin, the elderly, and those with diabetes, metabolic syndrome, or chronic renal disease are more likely to experience the antihypertensive effects of sodium restriction than young Caucasians in generally good health [5]. Furthermore, salt is frequently disguised in processed meals, so cutting down may not be simple all the time. Lastly, the link between a substantial decrease in the risk of cardiovascular disease and long-term dietary salt restriction is not so clear [6].

It seems that hypertension in hypertensive individuals may be induced by a high caloric intake even in the absence of fat. In this respect, the CALERIE study was a significant one (Comprehensive Assessment of Long-term Effects of Reducing Intake of Energy). This research aimed to examine the effects of a calorie restriction of 10–30% on lipid profile and body composition parameters at 6 and 12 months in a group of middle-aged, non-obese individuals. The ratio of total cholesterol to high-density lipoprotein cholesterol (HDL-c), systolic blood pressure (SBP), and diastolic blood pressure (DBP), as well as other cardio-metabolic risk variables, reduced after two years of dietary therapy [7].

It is debatable whether or not magnesium supplements have an antihypertensive impact on people with hypertension. Contrary to popular belief, magnesium does not lower blood pressure in all trials [8].

There is a negative correlation between protein consumption and blood pressure, according to epidemiological research [9]. Soybean protein supplements may reduce SBP or DBP, according to a modest number of clinical investigations [10]. Many hypotheses have been advanced to account for the possible BP-lowering effects of soybean protein. The amino acid arginine is present in high concentrations in soybean protein and may be transformed into the powerful vasodilator nitric oxide. Injecting arginine intravenously lowers blood pressure and peripheral vascular resistance in humans [10].

Glutamic acid, found in abundance in plant-based proteins, may possess unique properties that reduce blood pressure [11]. Bioactive peptides that inhibit angiotensin-converting enzyme and likely have additional antihypertensive effects may be released during digestion of food-derived proteins. It is quite probable that these peptides will be produced by milk-derived proteins. This might be one reason why the DASH (dietary approaches to stop hypertension) diet helps lower blood pressure [12].

The excretion of salt, water, and free dopamine in the urine may be enhanced by protein as well. Blood pressure may be reduced by a dopamine-mediated natriuresis caused by consumed protein [13]. Insulin sensitivity and glucose tolerance may both be enhanced by soybean protein [14].

Healthy diets include dietary fibre, which may have beneficial benefits on the heart and intestines. In a meta-analysis, ***Streppel et al., (2005)*** suggested that preventing hypertension in Western populations—where the typical fibre consumption is much lower than recommended levels—may be as simple as increasing dietary fibre intake [15].

A further meta-analysis by ***Whelton et al., (2005)*** found that hypertension patients may have a drop in blood pressure with an increase in dietary fibre consumption; however, in normotensive people, the drop was lower and less definitive [16][

Aim of the study:

1. To determine the effect of certain nutritional factors on control of hypertension.
2. To determine the relation between socio-demographic characteristics and control of hypertension.

Subjects and methods:

This cross-sectional study was conducted among hypertensive patients attending Minia Cardiothoracic University Hospital, Minia, Egypt, during the period from May to October 2023, and included all patients older than 18 years who were on antihypertensive medication and attended Minia Cardiothoracic University Hospital outpatient clinic during the study period.

The sample size was calculated using this single population proportion formula; $n=Z^2*P*(1-P)/W^2$ [17]

Where n is the required sample size for the population, Z is the standard normal distribution set as 1.96, P is prevalence of hypertension estimated to determine sample size which is 30% in Egypt [18], and W is the degree of accuracy which is 0.05.

The required sample size has been estimated to be 322 patients.

Data collection

All patients were interviewed and a designed well-structured questionnaire was completed. The aim of the study was explained, verbal consents from the patients were obtained and the questions were filled in by the researcher. The questionnaire included: socio-demographic data as age, sex, occupation, education, marital status and residence, Dietary lifestyle including consumption of fruits, vegetables, grains, proteins, legumes, sweets, dairy products, salt, fat, number of meals per day and timing of last meal before bedtime.

Two BP readings were taken at each visit by two different nurses, with the patient rested in a relaxed sitting position using a manual sphygmomanometer. An individual's BP constantly varies, thus two measurements were taken to give a more accurate reflection of the patient's usual BP. The two BP measurements were separated by a resting interval of 5 to 15 minutes. The average of the two BP readings was recorded to be used for analysis.

Blood pressure was considered controlled when the systolic BP was below 140 and diastolic BP below 90 [19]

Ethical consideration

The Ethical Committee of the faculty of medicine and the Minia University Hospital administration both gave their assent. Additionally, after describing the data's nature, purpose, and use to each participant, verbal agreement was obtained. We took into account the need to protect the privacy of everyone who took part in the survey.

Statistical analysis

A version of SPSS, 25 was used for all analyses. The initial step was to clean the data in order to find any missing or incorrect variables. The frequency distribution was used to display qualitative data, whilst the mean and standard deviation were used to display quantitative data. The proportions were compared using a chi-square test. Two means were compared using a student t-test. In order to determine the overall impact of each independent variable on the dependent variable, multiple regression analysis was used (dependent variable). All statistically significant tests were considered to have a probability lower than 0.05.

Results

The total number of patients included in the study was 322 patients; 66% have controlled hypertension and 34% have uncontrolled hypertension.

In table (1), there is no significant difference in the age and sex for the controlled and uncontrolled groups, however there is statistically significant difference between the two groups regarding their occupation (*P*=0.005), manual workers representing 22.6% of the controlled group, and only 7.3% of the uncontrolled group. There are no significant differences regarding education, marital status, or residence between the controlled and uncontrolled groups.

In table (2), the uncontrolled group sometimes added salt to food before eating or in preparing food (32.7% for each) much more than the controlled group (18.4 and 20.8% respectively). The amount of salt consumed was much more in the uncontrolled group than the controlled group and this is statistically significant (*P*=0.001).

Table (3) shows there are significant differences between the controlled and the uncontrolled groups regarding the dietary consumption of grains, lean proteins, and sweets. The controlled group consumed less daily grains than the uncontrolled group, with mean number of servings of 9.7 for the controlled compared to 11.9 for the uncontrolled group (*P*=0.001). The controlled group also consumed less weekly servings of lean proteins, with mean number 3.4 compared to 4.1 weekly servings in the uncontrolled group (*P*=0.001). Weekly consumed servings of sweets were significantly lower for the controlled group, with a mean of 3.2 compared to 4.2 servings for the uncontrolled group.

Figure (1, 2) show statistically significant differences between the two groups regarding consumption of different types of fats and the timing of the last meal before bedtime (P=0.038 and P=0.021) respectively.

Table (4) shows controlled hypertensive patients have lower odds (95% CI) of consuming more servings of lean protein 0.464 (0.29 – 0.74), sweets 0.589 (0.36 – 0.94), ghee 0.437 (0.239 – 0.79), and hydrogenated oil 0.431 (0.198 – 0.93) in the crude model. In the adjusted model, the association remains significant for servings of lean protein, ghee and hydrogenated oil, while for servings of sweets it loses its significance.

On the other hand, in the unadjusted model controlled hypertensive patients have higher odds of consuming more servings of fruits and vegetables (1.39 and 1.4 respectively), and this association didn't reach a level of significance, while in the adjusted model, this association became significant (P=0.015 and 0.031 respectively). Controlled hypertensive patients who consumed too little and far too little amount of salt have much higher odds ratio compared to those who consumed far too much amount in both adjusted and unadjusted models. This inflated odds ratio reflects the small number of patients who consumed far too much salt in the controlled group (n=8).

Table (1): Demographic characteristics in relation to control of hypertension in studied patients, Minia cardiothoracic University Hospital, 2023

Variable	All patients (n=322)	Controlled hypertension (n=212)	Uncontrolled hypertension (n=110)	Sig.#
Age (years)				t (df) = 0.159 (320) *P*= 0.873
Range	23 - 90	23 - 90	30 - 85	
Mean ± SD	56.9 ± 12.62	57± 12.6	56.8 ± 12.7	
Sex				X^2 (df) = 0.408 (1) *P* =0.523
Male	110 (34.2%)	075 (35.4%)	35 (31.8%)	
Female	212 (65.8%)	137 (64.6%)	75 (68.2%)	
Occupation				X^2 (df) = 12.9 (3) *P* =0.005*
Unemployed/ Housewife	174 (54%)	111 (52.4%)	63 (57.3%)	
Manual worker	056 (17.4%)	48 (22.6%)	08 (7.3%)	
Highly professional	058 (18%)	33 (15.6%)	25 (22.7%)	
Retired	034 (10.6%)	20 (9.4%)	14 (12.7%)	
Education				X^2 (df) = 1.8 (3) *P* =0.612
Illiterate	136 (42.2%)	94 (44.3%)	42 (38.2%)	
Primary	034 (10.6%)	20 (9.4%)	14 (12.7%)	
Secondary	072 (22.4%)	48 (22.6%)	24 (21.8%)	
University or above	080 (24.8%)	50 (23.6%)	30 (27.3%)	
Marital status				X^2 (df) = 4.3 (2) *P* =0.113
Single	003 (0.90%)	003 (1.4%)	00 (0%)	
Married	270 (83.9%)	182 (85.8%)	88 (80%)	
Widower/Divorced	049 (15.2%)	027 (12.7%)	22 (20%)	
Residence				X^2 (df) = 0.010 (1) *P* =0.922
Urban	114 (35.4%)	074 (34.9%)	39 (35.5%)	
Rural	208 (64.6%)	138 (65.1%)	71 (64.5%)	

t test (df) for continuous data which represented by mean ± SD, while X^2 (df) for categorical data represented by number and (%).

* *P* value is significant ≤ 0.05.

Table (2): Dietary salt intake of the studied patients, Minia cardiothoracic University Hospital, 2023

Variable	All patients	Controlled hypertension n=212	Uncontrolled hypertension n=110	Sig.#
Adding salt to food right before eating				X^2 (df) = 17.24 (4) *P* =0.002*
Always	79 (24.5%)	46 (21.7%)	33 (30.0%)	
Often	64 (19.9%)	45 (21.2%)	19 (17.3%)	
Sometimes	75 (23.3%)	39 (18.4%)	36 (32.7%)	
Rarely	54 (16.8%)	41 (19.3%)	13 (11.8%)	
Never	50 (15.5%)	41 (19.3%)	09 (8.2%)	

Adding salt in cooking or preparing foods				
Always	134 (41.6%)	88 (41.5%)	46 (41.8%)	X^2 (df) =
Often	081 (25.2%)	57 (26.9%)	24 (21.8%)	12.25 (5)
Sometimes	080 (24.8%)	44 (20.8%)	36 (32.7%)	*P* =0.032*
Rarely	013 (04.0%)	09 (04.2%)	04 (03.6%)	
Never	006 (01.9%)	06 (02.8%)	00 (00.0%)	
Don't know	008 (02.5%)	08 (03.8%)	00 (00.0%)	
Eating processed food high in salt				
Always	24 (07.5%)	10 (04.7%)	14 (12.7%)	X^2 (df) =
Often	69 (21.4%)	40 (18.9%)	29 (26.4%)	10.79 (5)
Sometimes	77 (23.9%)	54 (25.5%)	23 (20.9%)	*P* =0.056
Rarely	93 (28.9%)	66 (31.1%)	27 (24.5%)	
Never	54 (16.8%)	38 (17.9%)	16 (14.5%)	
Don't know	05 (01.6%)	04 (01.9%)	01 (00.9%)	
Important to lower salt in diet				
Very Important	105 (32.6%)	77 (36.3%)	28 (25.5%)	X^2 (df) = 4.3
Not important	145 (45.0%)	92 (43.4%)	53 (48.2%)	(3)
Somewhat important	024 (07.5%)	15 (07.1%)	09 (08.2%)	*P* =0.230
Don't know	048 (14.9%)	28 (13.2%)	20 (18.2%)	
Too much salt could cause health problems				
Yes	275 (85.4%)	184 (86.8%)	91 (82.7%)	X^2 (df) = 2.8
No	015 (04.7%)	011 (05.2%)	04 (03.6%)	(2)
Don't know	032 (09.9%)	017 (08.0%)	15 (13.6%)	*P* =0.245
Amount of salt consumed				
Far too much	027 (08.4%)	008 (03.8%)	19 (17.3%)	
Too much	059 (18.3%	035 (16.5%)	24 (21.8%)	X^2 (df) = 26.5
Just right amount	181 (56.2%)	126 (59.4%)	55 (50.0%)	(5)
Too little	030 (09.3%)	023 (10.8%)	07 (06.4%)	*P* =0.001*
Far too little	017 (05.3%)	016 (07.5%)	01 (00.9%)	
Don't know	008 (02.5%)	004 (01.9%)	04 (03.6%)	

t test (df) for continuous data which represented by mean ± SD, while X^2 (df) for categorical data represented by number and (%).
* *P* value is significant ≤ 0.05.

Table (3): Diet life style of the studied patients, Minia cardiothoracic University Hospital, 2023

Variable	**All patients (n=322)**	**Controlled hypertension** n=212	**Uncontrolled hypertension** n=110	**Sig.#**
Serving of fruits (weekly) Mean ± SD	3.15 ± 1.7	3.2 ± 1.7	3 ± 1.6	t (df) = 1.06 (318) *P* =0.287
Serving of vegetables (weekly) Mean ± SD	3.8 ± 1.9	3.9 ± 1.7	3.7 ± 1.7	t (df) = 0.081 (320) *P* =0.417
Serving of Grains (daily) Mean ± SD	10.5 ± 5.4	9.7 ± 5.3	11.9 ± 5.2	t (df) = -3.66 (320) *P* =0.001*
Servings of lean protein(weekly) Mean ± SD	3.6 ± 1.8	3.4 ± 1.5	4.1± 2	t (df) = -3.7 (320)

				P =0.001*
Servings of legumes (weekly) Mean ± SD	3.3 ± 2.3	3.4 ± 2.4	3.1 ± 2.2	t (df) = 1.2 (320) *P* =0.229
Servings of sweets (weekly) Mean ± SD	3.5 ± 2.9	3.2 ± 2.3	4.2 ± 3.7	t (df) = -2.8 (320) *P* =0.004*
Servings of dairy products (weekly) Mean ± SD	3.5 ± 2.4	3.5 ± 2.4	3.4 ± 2.3	t (df) = 0.58 (320) *P* =0.558

t test (df) for continuous data which represented by mean ± SD, while X^2 (df) for categorical data represented by number and (%).
* *P* value is significant ≤ 0.05.

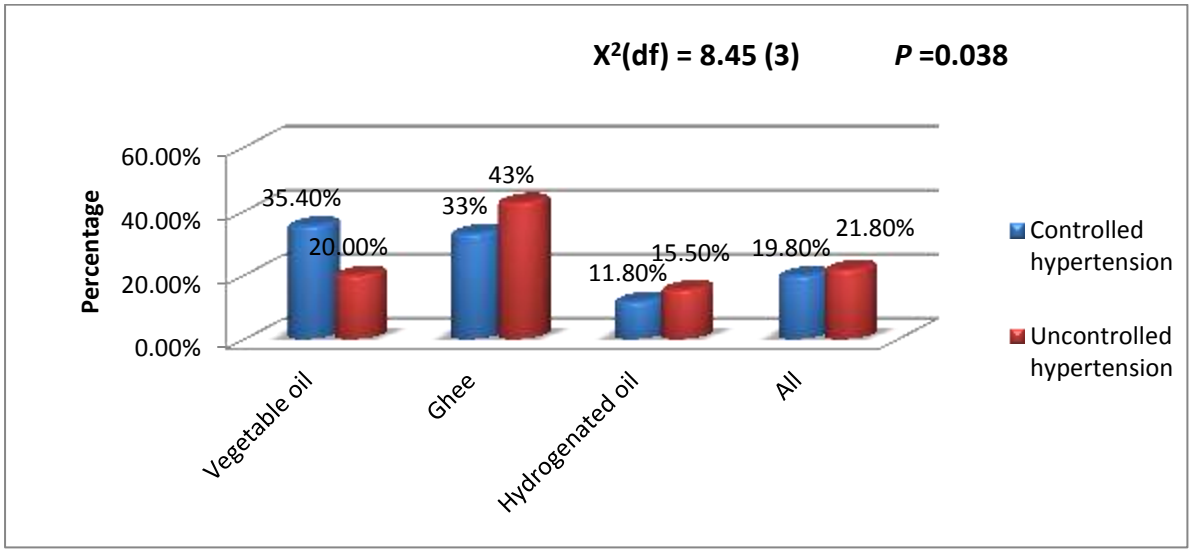

Figure (1) Types of fat consumed by the studied patients, Minia cardiothoracic University Hospital, 2023

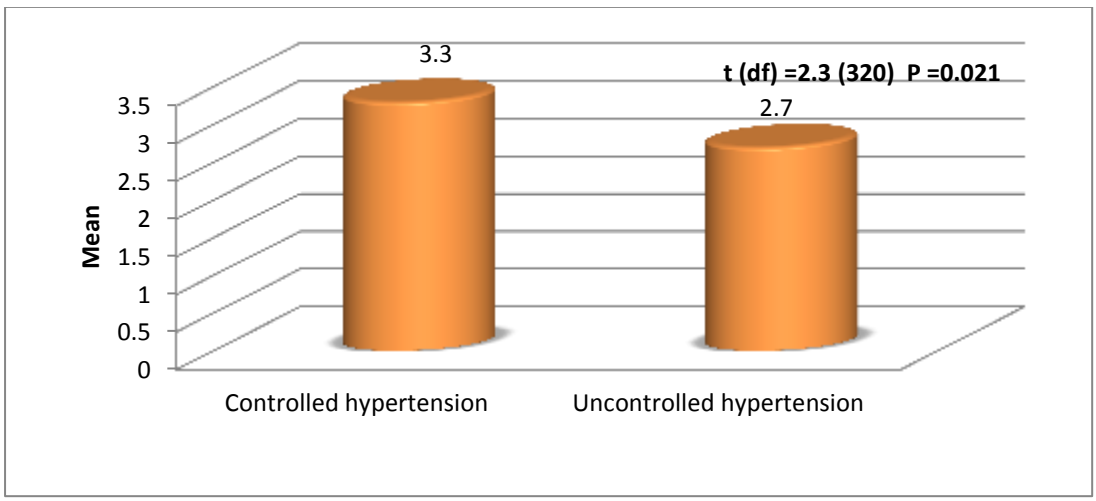

Figure (2) Timing of the last meal before bedtime of the studied patients, Minia cardiothoracic University Hospital, 2023

Table (4): Multiple regression analysis for dietary factors affecting control of hypertension in the studied patients, Minia cardiothoracic University Hospital, 2023

Independent variables	Crude OR (95% CI)	P value	Adjusted OR# (95% CI)	P value
Serving of fruits	1.39 (0.86 – 2.26)	0.175	2.19 (1.09 – 4.4)	0.015*
Serving of vegetables	1.4 (0.89 – 2.2)	0.138	1.9 (0.96 - 3.8)	0.031*
Serving of Grains	0.227 (0.05 - 1)	0.051	0.148 (0.02 – 0.859)	0.110
Servings of lean protein	0.464 (0.29 – 0.74)	0.001*	0.308 (0.144 – 0.66)	0.001*
Servings of legumes	1.4 (0.88 – 2.3)	0.143	1.6 (0.83 – 2.07)	0.155
Servings of sweets	0.589 (0.36 – 0.94)	0.027*	0.754 (0.34 – 1.6)	0.754
Servings of dairy	1.29 (0.90 – 2)	0.285	1.8 (0.91 – 3.8)	0.055
Type of fats				
Vegetable oil	Ref		Ref	
Ghee	0.437 (0.239 – 0.79)	0.007*	0.240 (0.102 – 0.56)	0.005*
Hydrogenated oil	0.431 (0.198 – 0.93)	0.034*	0.211 (0.064 – 0.69)	0.002*
Mixed types	0.513 (0.257 – 1.02)	0.059	0.353 (0.129 – 0.96)	0.001*
Timing of last meal	1.16 (1.02 – 1.32)	0.023	1.14 (0.96 – 1.36)	0.127
Adding salt to food right before eating				
Always	Ref		Ref	
Often	0.69 (0.84 – 3.4)	0.137	0.029 (0.810 – 5.08)	0.131
Sometimes	0.77 (0.41 – 1.46)	0.438	0.439 (0.91 – 1)	0.050*
Rarely	2.2 (1.05– 4.87)	0.037*	0.936 (0.314– 2.7)	0.906
Never	3.26 (1.39 – 7.6)	0.006*	2.6 (0.88 – 7.88)	0.083
Eating processed food high in salt				
Always	Ref		Ref	
Often	1.9 (0.75 – 4.9)	0.171	1.1 (0.35 – 3.6)	0.830
Sometimes	3.28 (1.27 – 8.4)	0.014*	2.04 (0.63 – 6.6)	0.232
Rarely	3.4 (1.35– 8.6)	0.009*	1.59 (0.49– 5.15)	0.434
Never	3.3 (1.22 – 9.03)	0.019*	1.56 (0.44 – 5.5)	0.488
Amount of salt consumed	Ref		Ref	
Far too much	0.45 (1.3 – 4.9)	0.013*	0.75 (1.1 – 4.9)	0.025*
Too much	2.44 (2.2 – 8.4)	0.001*	1.9 (0.55 – 2.6)	0.009*
Just right amount	5.4 (2.39– 13.17)	0.001*	4.3 (1.68– 5.7)	0.007*
Too little	7.8 (2.4 – 25.4)	0.001*	6.5 (1.5 – 25.4)	0.020*
Far too little				

#The adjustment was made for number of servings of fruits, vegetables, grains, lean protein, legumes, sweets, dairy products type of fats, adding salt to food right before eating, eating processed food high in salt and amount of salt consumed,
**P* value is significant ≤ 0.05.

Discussion

This study found that there was a significant association between occupation and the control of hypertension; 22.6% of controlled patients were manual workers compared to only 7.3% of uncontrolled patients being manual workers. This is similar to the findings of a study in 2019 conducted by ***Jayarajah*** et al. addressed occupational aspects of hypertension and reported that workers with a sedentary lifestyle, high levels of job strain and job demand, have higher systolic blood pressure [20].

Additionally, another study conducted by ***Ribeiro Junior*** in 2020 found that 62% of workers with only one form of physical activity or no physical activity had higher blood pressure levels [21]. Another study conducted in China about the interaction between occupational stress and hypertension found that occupational stress was associated with higher

prevalence of hypertension, supporting the conclusion that the higher the level of stress is, the higher the risk of hypertension becomes [22].

In contrast to these findings, ***Clougherty et al., (2010)*** who studied work and its role in shaping the social gradient in health, reported that manual workers had a low education and low salaries, were more likely exposed to unhealthy life styles and poor living conditions compared to white-collar workers, these conditions may escalate the risk of uncontrolled hypertension [23].

Moreover, the amount of salt consumed by the uncontrolled group was found to be significantly more than the amount consumed by the controlled group. This is similar to a study in New Zealand on low sodium salt substitutes (LSSS) demonstrated a mean reduction in systolic blood pressure of 4.76 mmHg (95% confidence interval (CI) 3.50 - 6.01) and diastolic blood pressure of 2.43 mmHg (95% CI 3.50 - 1.36) with the use of LSSS [24]. Another study done on the Chinese population that stated that salt overconsumption leads to several clinical complications starting from raised blood pressure further worsens hypertension and is independently associated with cardiovascular disease and mortality [25].

The type of fat consumed was found to be significantly different between the two groups, with the controlled group consuming more vegetable oils, and the uncontrolled group consuming more ghee (saturated fat) and hydrogenated oils (trans fat). This is in accordance with a study conducted in USA by ***Wang et al., (2010)*** who studied dietary fatty acids and the risk of hypertension, and concluded that higher intake of saturated fatty acids (SFAs), monounsaturated fatty acids (MUFAs), *trans*-unsaturated fatty acids (*trans* FAs) was each associated with increased risk of hypertension [26].

On the other hand, ***Mohammadifard et al., (2010)*** studied the effect of hydrogenated, liquid and ghee oils on serum lipids profile In Iran and concluded that consuming ghee reduced triglycerides and increased HDL-C levels, which could potentially lower blood pressure. This difference can be explained that ghee contains high amounts of SFAs (about 59% of its whole fatty acids). SFAs, except for stearic acid, increase serum total cholesterol. Therefore, ghee that is high in cholesterol and SFAs, is considered harmful. On the other hand, ghee is a good source of oleic acid which is capable of protecting LDL-C particles from oxidation and prevents atherosclerosis. So the effect of ghee is different according to its components and the way it's locally produced in different countries [27].

As regard daily consumption of grains and weekly consumption of sweets, it was found that patients consuming more amounts of grains and sweets, their blood pressure were more uncontrolled. This is in line with the findings of ***Byun et al., (2019)*** who studied quantity, quality, and timing of carbohydrate intake and blood pressure in USA, and stated that excessive sugar intake is associated with higher BP levels, with evidence of a dose-response relationship, and that a low carbohydrate diet was associated with lower blood pressure [28].

On contrary, a study conducted in USA by ***Widmer et al., (2015)*** who studied the Mediterranean diet, its components, and cardiovascular disease, and stated that whole grains as a source of carbohydrate provide fiber which reduced lipid profiles, and blood pressure. This difference could be explained that the current study patients were asked about carbohydrate consumption not whole grains only. And most of the carbohydrate consumption in the studied group was from Egyptian bread, a source of whole grains, the amounts consumed were very large and mostly lead to weight gain, which affected the controlling of hypertension [29].

Proteins were found to have a significant effect on the control of blood pressure, with the controlled group consuming less protein than the uncontrolled. This is approximated to the findings of a study in Italy by ***Savica et al., (2010)*** who studied the effect of nutrition on blood pressure and reported an inverse relationship between protein intake and BP [1].

Additionally, a study in USA conducted by ***Richter et al., (2015)*** who studied the effect of different proteins on cardiovascular diseases also mentioned that blood pressure inverse association with plant or animal protein may particularly depend on the type of carbohydrate consumed with it, and the type of animal protein consumed (i.e., red meat or fish) [30]. Moreover, timing of the last meal before bedtime was found to be significantly different between the two groups, with the controlled group having their last meal earlier than the

uncontrolled group. This is supported by a study in USA by ***Alkhulaifi et al., (2022)*** who studied meal timing, meal frequency and metabolic syndrome and concluded that night eating is associated with an increased prevalence of metabolic syndrome [31]. Also ***Paoli et al., (2019)*** who studied the influence of meal frequency and timing on health in Italy stated that early dining had a positive effect on the control of hypertension [32].

In the current study, a multiple regression analysis for dietary factors affecting control of hypertension was made. It showed that in the multivariate model, consuming more servings of fruits and vegetables and less servings of protien significantly affect the control of blood pressure. This was in agreement with a 2022 study where Wang and his colleges studied fruit and vegetable consumption, cardiovascular disease, and all-cause mortality in China and reported that greater fruit and vegetable consumption was significantly associated with a lower risk of cardiovascular diseases (CVD) [33]. Also a 2023 study in China illustrated the effect of dietary fruits and vegetables on cardiovascular diseases in elderly Chinese and found that higher intakes of total fruits and vegetables were associated with lower risk of CVD [34].

Conclusion:

Dietary factors decreasing the control of hypertension include consumption of grains, proteins, sweets, ghee, hydrogenated oils, and salt. These factors should be restricted in the diet of hypertensive patients to achieve the best possible control. Timing of last meal before bedtime also has an inverse association with the control of hypertension.

Recommendation:

1- Dietary health education should be provided to all hypertensive patients including a diet plan and healthy lifestyle advice.

2- Weight management should be used as a method to manage hypertension in overweight and obese patients.

3- Future studies regarding lifestyle with hypertension and hypertension control are required in Egypt.

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