

# Assessment of Adherence to Lifestyle Modification among Hypertensive Patients in Saudi Arabia

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## Abstract

This study assess how well hypertensive patients adhered to lifestyle modifications and it identifies the barriers to compliance with lifestyle modifications. It employed an online-based cross-sectional study among hypertensive patients in the east, west, middle, north, and south regions of Saudi Arabia. The study included 1135 participants, 55.8% of them were females and 44.2% of them were males. 25.2% of participants aged between 41- 50 years old. 33.4% of participants had hypertension for less than one year, 28.2% for 1- 5 years and 23.8% for more than 10 years. 56.5% of participants take anti-hypertensive medications. 32.6% have 3 meals per day 27% have less than three meals and 21.9% have 4 meals per day. 41.1% of the participants exercise. 15.1% of the participants were smokers. Medication adherence was significantly associated with age, BMI, marital status, educational level, occupation, and hypertension ( $P < 0.05$ ). Exercise adherence was significantly associated with age, BMI, marital status, gender, educational level, and job but not with duration of hypertension. Diet adherence was significantly associated with age, BMI, marital status, educational level, and duration of hypertension ( $P < 0.05$ ). Smoking was significantly associated with participants' gender, age, educational level, job, and duration of diabetes ( $P < 0.05$ ). In conclusion, few hypertensive patients practice healthy lifestyles. Age, level of education, occupation, length of illness, and marital status of respondents were found to be important predictors of effective lifestyle modification strategies.

**Keywords:** Lifestyle modification, Hypertensive patients, Healthy lifestyles, Saudi Arabia

## INTRODUCTION

Hypertension, also known as high blood pressure, is a common chronic condition in which the long-term force of the blood against the arterial walls is sufficient to trigger health problems. Blood pressure is determined by both the volume of blood pumped by the heart and the amount of resistance to blood flow in the arteries. The blood pressure is considered normal if it is below 120/80 mmHg. The more blood that the heart pumps and the narrower the arteries, the higher the blood pressure [1]. In terms of diagnosis, hypertension is diagnosed when the systolic blood pressure is greater than or equal to 140 mmHg and/or the diastolic blood pressure is greater than or equal to 90 mmHg on two different days [2].

From an epidemiological view of disease prevalence, worldwide, hypertension affects approximately 1.39 billion of the adult population [2]. While in Saudi Arabia, the prevalence is increasing dramatically affecting more than 15 percent of the adult Saudi population who are 15 years old and above. This large number is attributed to a variety of factors, including a shift in the Saudi Arabian lifestyle toward urbanization, unhealthy dietary habits, and obesity [3].

Hypertension is a serious and silent condition because although symptoms might not appear, it predisposes patients to life-threatening complications such as stroke, myocardial infarction, and acute aortic syndromes. Therefore, early detection of hypertension and adherence to the treatment can reduce the incidence of complications [4].

Hypertension therapy aims to maintain blood pressure at or below 140/90mmHg to avoid mortality and sequelae [5]. The treatment of hypertension is classified into two main parts,

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pharmacological therapy, and non-pharmacological therapy such as the use of prescribed medications and lifestyle modifications, respectively. Even though most people commit to therapeutic drugs, adherence to non-pharmacological treatment should be considered equally because it lowers blood pressure, improves drug potency, and may even reduce or eliminate the need for antihypertensive drugs [6].

There are three major concepts involved in lifestyle changes. First, overweight, or obese people can lose weight by following the Dietary Approaches to Stop Hypertension (DASH) guidelines, which emphasize fruits and vegetables, high-fiber foods, and low-fat dairy products since obesity increases the risk of hypertension 5-fold. Secondly, increased physical activity triggers autonomic and hemodynamic changes in the cardiovascular system, resulting in a reduction in peripheral resistance to blood flow and, ultimately, a drop in blood pressure [7]. Finally, quitting smoking since the nicotine may raise blood pressure and heart rate because it narrows the arteries and hardens their walls [8]. Thus, adherence to lifestyle modifications can facilitate drug dropout and drug retreat in people who achieve and maintain improvements in lifestyle [9].

From the available literature reviews about adherence to lifestyle changes, there was significant variation across countries; for instance, a study conducted in Ghana showed that out of 300 participants, 216 (72.0%) were adherent to lifestyle modifications [10] while research in Northeast Ethiopia reported the overall adherence (included diet, exercise, smoking, and moderation of alcohol consumption) was 23.6% [6].

Locally, a study in Taif, Saudi Arabia measured the level of adherence to lifestyle changes in two hospitals which was 20.1% adherence to exercise, 11.8% to a healthy diet, and 34.7% to medications [11]. In addition, the physician must be educated about HTN management guidelines since there is a local study in the southwest of Saudi Arabia that shows a lack of knowledge about specific hypertension management guidelines and inadequately reported practices detected among primary health care physicians in the Jazan region [12]. Moreover, the majority of studies of hypertension management commitment focus on adherence to pharmacological treatment but neglect compliance with other recommendations, such as lifestyle changes. Therefore, the goal of this study is to assess how well hypertensive patients adhered to lifestyle modifications. Furthermore, it aims to identify the barriers to compliance with lifestyle modifications and to determine the elements that encourage hypertensive patients to adhere to lifestyle changes.

## MATERIALS AND METHODS

### Study Design

Online-based cross-sectional study that is designed to assess the adherence to lifestyle modifications among hypertensive patients in the east, west, middle, north, and south regions of Saudi Arabia.

### Study Area/Setting

This study was conducted in the west, east, north, south, and middle regions of Saudi Arabia.

### Study Subjects

All hypertensive patients (aged 18 years and above) who live in Saudi Arabia.

### Inclusion Criteria

This study included all male and female, Saudi and non-Saudi patients who are 18 years old and above who agreed to participate in our research. Individuals with hypertension for any period .

Exclusion criteria: participants aged less than 18 and those who are not willing to participate.

### Sample Size

The Raosoft sample size calculator was used. The estimated sample size was equal to 384 with a confidence level of 95% and a 5% margin of error. However, as we are targeting hypertensive patients from all regions in Saudi Arabia, we distributed this survey to 2000 patients to target a minimum of 50% response rate reaching a sample size of 1000 patients.

### Sampling Technique

Random sampling technique via social media.

### Data Collection Methods, Instruments Used, and Measurements

The data was collected through an online-based, multiple-choice, self-administered questionnaire by medical students.

The app Google form was used to generate the survey form and the link was sent randomly via WhatsApp and other social media platforms to hypertensive patients in Saudi Arabia.

This tool was developed after consulting relevant studies since there were no available standard questionnaires to assess total adherence to lifestyle modifications.

The questionnaire was prepared in English and translated into the Arabic language. The Arabic was distributed to the patients. The Arabic version was retranslated back to English to ensure its consistency by bilingual experts .

It was composed of 4 main sections:

1. The first section focused on the participants' demographic data, including age, nationality, gender, marital status, education level, employment status, household income,

region of residence, weight, and length to calculate the BMI, the time of diagnosis hypertension, usage of antihypertensive medications, and the others diseases .

- The second section was designed to assess the adherence to a healthy diet, exercise, and smoking status .
- The third section included the barriers that interfere with patients' adherence to lifestyle modifications using structured and open-ended questions .
- The fourth section included the factors that promote compliance with lifestyle modifications using structured and open-ended questions .

### Data Management and Analysis Plan

Data was entered on the computer using the “Microsoft Office Excel Software” program (2016) for Windows. After that, the data was transferred to the Statistical Package of Social Science Software (SPSS) program, version 20 (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.) to be statistically analyzed.

## RESULTS AND DISCUSSION

The study included 1135 participants, 55.8% of them were females and 44.2% of them were males. 25.2% of participants were aged between 41- 50 years old, 22.8% were 51- 60 years old and 17.8% were 20- 30 years old. A quarter of participants were overweight, 7.7% obese and 14.4% were underweight. 67.7% of participants were married and 21% were single. 94.6% of participants were Saudi. Almost two-thirds had a bachelor's degree while 21.7% had a secondary school education. 41.8% were employees and 18.8% were retired (Table 1).

**Table 1.** Sociodemographic characteristics of participants (n=1135)

| Parameter      | No.               | %   |      |
|----------------|-------------------|-----|------|
| Age            | less than 20      | 60  | 5.3  |
|                | 20 - 30           | 202 | 17.8 |
|                | 31 - 40           | 201 | 17.7 |
|                | 41 - 50           | 286 | 25.2 |
|                | 51 - 60           | 259 | 22.8 |
| Gender         | more than 60      | 127 | 11.2 |
|                | male              | 502 | 44.2 |
| BMI            | female            | 633 | 55.8 |
|                | underweight       | 163 | 14.4 |
|                | normal weight     | 562 | 49.5 |
| Marital status | overweight        | 284 | 25.0 |
|                | obesity           | 87  | 7.7  |
|                | extremely obesity | 39  | 3.4  |
|                | Single            | 238 | 21.0 |
| Marital status | Married           | 768 | 67.7 |
|                | Divorced          | 67  | 5.9  |
|                | widow             | 57  | 5.0  |

|                 |                 |      |      |
|-----------------|-----------------|------|------|
| Nationality     | other           | 5    | .4   |
|                 | Saudi           | 1074 | 94.6 |
|                 | Non -Saudi      | 61   | 5.4  |
| Region          | the South       | 270  | 23.8 |
|                 | Eastern         | 232  | 20.4 |
|                 | North           | 220  | 19.4 |
|                 | Western         | 226  | 19.9 |
| Education level | Central         | 187  | 16.5 |
|                 | primary         | 59   | 5.2  |
|                 | middle          | 62   | 5.5  |
|                 | secondary       | 246  | 21.7 |
|                 | Bachelor's      | 679  | 59.8 |
| Job             | other           | 89   | 7.8  |
|                 | employee        | 474  | 41.8 |
|                 | Not an employee | 224  | 19.7 |
|                 | Student         | 166  | 14.6 |
|                 | Retired         | 213  | 18.8 |
|                 | other           | 58   | 5.1  |

As illustrated in Table 2, 33.4% of participants had hypertension for less than one year, 28.2% for 1- 5 years, and 23.8% for more than 10 years. 56.5% of participants take anti-hypertensive medications. 32.6% have 3 meals per day 27% have less than three meals and 21.9% have 4 meals per day. 41.1% of the participants exercise, about 35.9% of the participants exercise walking, 28.1% exercise for 30 min to more than 40 min, and 21.2% exercised daily or 5-6 times a week. 15.1% of the participants were smokers, and more than half of those smokers tried to stop smoking after they were diagnosed with high blood pressure.

**Table 2.** Duration of hypertension and lifestyle adherence among participants (n=1135).

| Parameter                   | No.                | %   |      |
|-----------------------------|--------------------|-----|------|
| Duration of hypertension    | less than one year | 379 | 33.4 |
|                             | 1 - 5 years        | 320 | 28.2 |
|                             | 5-10 years         | 166 | 14.6 |
|                             | More than 10 years | 270 | 23.8 |
| Take antihypertensive drugs | Yes                | 641 | 56.5 |
|                             | no                 | 494 | 43.5 |
| Number of meals per day     | less than 3        | 307 | 27.0 |
|                             | 3 times            | 370 | 32.6 |
|                             | 4 times            | 248 | 21.9 |
|                             | 5 times            | 117 | 10.3 |
|                             | 6 times            | 55  | 4.8  |
|                             | more than 6        | 38  | 3.3  |
| Exercising                  | Yes                | 467 | 41.1 |
|                             | no                 | 668 | 58.9 |

|                                       |                                      |     |      |  |     |     |      |
|---------------------------------------|--------------------------------------|-----|------|--|-----|-----|------|
| If yes, type of exercise              | Walking                              | 408 | 35.9 | Smoking  | Yes | 171 | 15.1 |
|                                       | resistance (such as lifting weights) | 75  | 6.6  |  | no  | 964 | 84.9 |
|                                       | running                              | 113 | 10.0 | Previous trials of smoking cessation after being diagnosed with hypertension | Yes | 89  | 7.8  |
|                                       | Bike riding                          | 40  | 3.5  |  | no  | 82  | 7.2  |
|                                       | swimming                             | 47  | 4.1  |  |     |     |      |
| Frequency of exercise during the week | other                                | 73  | 6.4  |  |     |     |      |
|                                       | every day                            | 137 | 12.1 |  |     |     |      |
|                                       | From 1 to 2 times during the week    | 78  | 6.9  |  |     |     |      |
|                                       | 3 to 4 times during the week         | 149 | 13.1 |  |     |     |      |
| Duration of exercise session          | 5 to 6 days during the week          | 103 | 9.1  |  |     |     |      |
|                                       | Less than 10 minutes                 | 15  | 1.3  |  |     |     |      |
|                                       | From 10 to 20 minutes                | 35  | 3.1  |  |     |     |      |
|                                       | 20 to 30 minutes                     | 98  | 8.6  |  |     |     |      |
|                                       | 30 to 40 minutes                     | 134 | 11.8 |  |     |     |      |
|                                       | more than 40 minutes                 | 185 | 16.3 |  |     |     |      |

As illustrated in **Table 3**, 37% of the participants had snacks 4-6 times daily and 3.3% had more than 6 snacks daily. Drinking sweetened beverages, 19.4% drank daily, and 17.3% had 3-6 times a week, eating sweets, 20.8% ate at least once daily, and 20.4% ate 3-6 times a week, eating high-salt snacks, 16.3% ate at least once daily, 16.4% ate 3-6 times a week, and 25.2% ate 1-2 times a week. Consuming fruits and vegetables, 26.4% consume at least once daily, 24.7% consume 3-6 times a week, eating foods containing saturated fats, 33.4% ate at least once daily, and 26.3% ate 3-6 times a week.

**Table 3.** Dietary habits among participants (n=1135).

| Parameter                                  | At least once daily | 1 to 2 times a week | 3 to 6 times a week | Once a month or less | 2 to 3 times a month |
|--|---------------------|---------------------|---------------------|----------------------|----------------------|
| <b>Drink sweetened beverages</b>           | 220<br>19.4%        | 267<br>23.5%        | 196<br>17.3%        | 266<br>23.4%         | 186<br>16.4%         |
| <b>Eat sweets</b>                          | 236<br>20.8%        | 277<br>24.4%        | 231<br>20.4%        | 210<br>18.5%         | 181<br>15.9%         |
| <b>Eat fried foods</b>                     | 151<br>13.3%        | 319<br>28.1%        | 211<br>18.6%        | 232<br>20.4%         | 222<br>19.6%         |
| <b>Eat high-salt snacks</b>                | 185<br>16.3%        | 286<br>25.2%        | 186<br>16.4%        | 268<br>23.6%         | 210<br>18.5%         |
| <b>Consume sugar and honey</b>             | 456<br>40.2%        | 133<br>11.7%        | 200<br>17.6%        | 248<br>21.9%         | 98<br>8.6%           |
| <b>Eat fruits and vegetables</b>           | 300<br>26.4%        | 211<br>18.6%        | 280<br>24.7%        | 160<br>14.1%         | 184<br>16.2%         |
| <b>Eat foods containing saturated fats</b> | 379<br>33.4%        | 268<br>23.6%        | 299<br>26.3%        | 81<br>7.1%           | 108<br>9.5%          |
| <b>Eat fast food</b>                       | 88<br>7.8%          | 248<br>21.9%        | 134<br>11.8%        | 437<br>38.5%         | 228<br>20.1%         |

In **Table 4**, barriers to adherence were reported, the major reported barriers to adhering to a healthy diet were difficulty adhering to a different diet than the rest of the family and social gatherings, 47.4% and 32.1% respectively. Participants reported some factors that may help them adhere to a healthy diet as providing healthy options in public places (such as restaurants, food carts, supermarkets, etc.), having motivators, such as a supportive family member or friend, and increasing awareness of food products suitable for patients with high blood pressure, such as low-sodium and low-fat

products. Reported barriers that prevent participants from exercising are not having enough time, unsuitable weather, workload, poor self-control towards regular exercise, and lack enough knowledge of the appropriate exercise for hypertensive patients. The main reported factors that may contribute to sticking to a regular exercise schedule were providing gyms with reasonable subscription prices, having motivators like friends and family, having a personal trainer, and the availability of free exercising areas in the community.

**Table 4.** Barriers and factors helping for adherence to lifestyle modifications among participants (n=1135).

|  | Parameter   | No. | %    |
|--|---|-----|------|
| Barriers to adopting a healthy diet and suffering from them            | Social gatherings affect my healthy diet  | 364 | 32.1 |
|  | I find it difficult to adhere to a different diet than the rest of the family   | 538 | 47.4 |
|  | I don't want to stick to a healthy diet   | 220 | 19.4 |
|  | I do not have enough knowledge about the appropriate diet for hypertensive patients   | 191 | 16.8 |
|  | I can't control myself towards unhealthy food   | 271 | 23.9 |
|  | I can't buy healthy products or ready-to-eat healthy meals  | 178 | 15.7 |
|  | I can't buy healthy products or ready-to-eat healthy meals  | 25  | 2.2  |
|  | Workload prevents me from sticking to a healthy diet  | 173 | 15.2 |
|  | I don't have enough time to prepare healthy meals   | 252 | 22.2 |
|  | other reasons   | 118 | 10.4 |
| Barriers for exercising  | I do not have enough knowledge of the appropriate exercises for a hypertensive patient  | 185 | 16.3 |
|  | I can't afford a gym membership or exercise equipment   | 118 | 10.4 |
|  | Poor self-control toward regular exercise   | 201 | 17.7 |
|  | I have another disease that prevents me from playing sports   | 145 | 12.8 |
|  | I don't want to do sports   | 130 | 11.5 |
|  | I don't have enough time to exercise  | 291 | 25.6 |
|  | The weather is not suitable for exercise  | 263 | 23.2 |
|  | I don't have a partner who exercises with me to motivate me   | 154 | 13.6 |
|  | There is no suitable environment for exercise   | 167 | 14.7 |
|  | My workload prevents me from doing sports   | 202 | 17.8 |
| Barriers to stop smoking   | I can't afford a gym membership or exercise equipment   | 17  | 1.5  |
|  | other reasons   | 103 | 9.1  |
|  | I am afraid of the withdrawal symptoms of smoking (such as headache, insomnia, sore throat, nervousness)                        | 80  | 7.0  |
|  | I am addicted to smoking  | 102 | 9.0  |
|  | Smoking triggers around me  | 112 | 9.9  |
|  | Relieves my stress  | 98  | 8.6  |
| Factors that may help to adhere to a healthy diet                      | other reasons   | 181 | 15.9 |
|  | Provide healthy options in public places  | 671 | 59.1 |
|  | Having motivators, such as a supportive family member or friend.  | 537 | 47.3 |
|  | Increasing awareness of food products suitable for patients with high blood pressure, such as low-sodium and low-fat products., | 523 | 46.1 |
|  | Motivational groups of hypertensive patients with similar nutritional needs   | 249 | 21.9 |
|  | Providing companies specialized in preparing healthy meals for patients with high blood pressure at reasonable prices           | 430 | 37.9 |
|  | Motivational groups of hypertensive patients with similar nutritional needs   |     | 32.1 |
|  | Other factors   | 116 | 47.4 |
|  | Having motivators like friends and family who exercise with me regularly.   | 490 | 19.4 |
|  | Having a personal trainer   | 326 | 16.8 |
| Factors that may contribute to sticking to a regular exercise schedule | Provides gyms with reasonable subscription prices   | 571 | 23.9 |
|  | Free exercise areas available to the community  | 584 | 15.7 |
|  | Organizing sports competitions suitable for my health condition with prizes for the winners                                     | 190 | 2.2  |
|  | The presence of applications in smart devices that help you track and evaluate your daily activity                              | 281 | 15.2 |
|  | Other factors   | 132 | 22.2 |
| Factors that may help to quit smoking                                  | Use of nicotine replacement therapies   | 340 | 10.4 |
|  | Avoid smoking triggers  | 457 | 16.3 |
|  | Mobile apps that send motivational messages to quit smoking   | 238 | 10.4 |
|  | Having a supportive environment for smoking cessation, such as family and friends   | 634 | 17.7 |

|  |     |      |
|--|-----|------|
| Regular visits to anti-smoking clinics | 378 | 12.8 |
| Other factors                          | 251 | 11.5 |

As shown in **Tables 5-7**, the main barriers to quitting smoking were smoking triggers, smoking addiction, relieving stress, and fear of withdrawal symptoms. Participants reported some factors that may help them quit smoking as having a supportive environment for smoking cessation, such as family and friends, avoiding smoking triggers, and regular visits to anti-smoking clinics. Medication adherence was significantly associated with age, BMI, marital status, educational level, occupation, and hypertension ( $P < 0.05$ ).

Exercise adherence was significantly associated with age, BMI, marital status, gender, educational level, and job but not with duration of hypertension. Diet adherence was significantly associated with age, BMI, marital status, educational level, and duration of hypertension ( $P < 0.05$ ). Smoking was significantly associated with participants' gender, age, educational level, job, and duration of diabetes ( $P < 0.05$ ).

**Table 5.** Association between medication adherence and sociodemographic characters of participants (n=1135).

|                | Medication Adherence |              | Total (N=1135) | P value      |              |
|----------------|----------------------|--------------|----------------|--------------|--------------|
|                | Yes                  | No           |                |              |              |
| Age            | less than 20         | 16<br>1.4%   | 44<br>3.9%     | 60<br>5.3%   | <b>0.001</b> |
|                | 20 - 30              | 62<br>5.5%   | 140<br>12.3%   | 202<br>17.8% |              |
|                | 31 - 40              | 77<br>6.8%   | 124<br>10.9%   | 201<br>17.7% |              |
|                | 41- 50               | 167<br>14.7% | 119<br>10.5%   | 286<br>25.2% |              |
|                | 51 -60               | 201<br>17.7% | 58<br>5.1%     | 259<br>22.8% |              |
|                | more than 60         | 118<br>10.4% | 9<br>0.8%      | 127<br>11.2% |              |
| BMI            | underweight          | 65<br>5.7%   | 98<br>8.6%     | 163<br>14.4% | <b>0.001</b> |
|                | normal weight        | 303<br>26.7% | 259<br>22.8%   | 562<br>49.5% |              |
|                | overweight           | 191<br>16.8% | 93<br>8.2%     | 284<br>25.0% |              |
|                | obesity              | 59<br>5.2%   | 28<br>2.5%     | 87<br>7.7%   |              |
|                | extremely obesity    | 23<br>2.0%   | 16<br>1.4%     | 39<br>3.4%   |              |
| Marital status | Single               | 82<br>7.2%   | 156<br>13.7%   | 238<br>21.0% | <b>0.001</b> |
|                | Married              | 469<br>41.3% | 299<br>26.3%   | 768<br>67.7% |              |
|                | Divorced             | 40<br>3.5%   | 27<br>2.4%     | 67<br>5.9%   |              |
|                | widow                | 48<br>4.2%   | 9<br>0.8%      | 57<br>5.0%   |              |
|                | other                | 2<br>0.2%    | 3<br>0.3%      | 5<br>0.4%    |              |
| Nationality    | Saudi                | 609          | 465            | 1074         | <b>0.515</b> |

|                                 |                    |       |       |       |              |
|---------------------------------|--------------------|-------|-------|-------|--------------|
|                                 |                    | 53.7% | 41.0% | 94.6% |              |
|                                 | Non -Saudi         | 32    | 29    | 61    |              |
|                                 |                    | 2.8%  | 2.6%  | 5.4%  |              |
| <b>Gender</b>                   | Male               | 287   | 215   | 502   | <b>0.674</b> |
|                                 | Female             | 354   | 279   | 633   |              |
|                                 |                    | 31.2% | 24.6% | 55.8% |              |
| <b>Region</b>                   | the South          | 148   | 122   | 270   |              |
|                                 |                    | 13.0% | 10.7% | 23.8% |              |
|                                 | Eastern            | 137   | 95    | 232   |              |
|                                 |                    | 12.1% | 8.4%  | 20.4% |              |
|                                 | North              | 120   | 100   | 220   | <b>0.524</b> |
|                                 | 10.6%              | 8.8%  | 19.4% |       |              |
|                                 | Western            | 136   | 90    | 226   |              |
|                                 |                    | 12.0% | 7.9%  | 19.9% |              |
|                                 | Central            | 100   | 87    | 187   |              |
|                                 |                    | 8.8%  | 7.7%  | 16.5% |              |
| <b>Education level</b>          | primary            | 50    | 9     | 59    |              |
|                                 |                    | 4.4%  | 0.8%  | 5.2%  |              |
|                                 | middle             | 38    | 24    | 62    |              |
|                                 |                    | 3.3%  | 2.1%  | 5.5%  |              |
|                                 | secondary          | 141   | 105   | 246   | <b>0.001</b> |
|                                 |                    | 12.4% | 9.3%  | 21.7% |              |
|                                 | collegiate         | 343   | 336   | 679   |              |
|                                 |                    | 30.2% | 29.6% | 59.8% |              |
|                                 | other              | 69    | 20    | 89    |              |
|                                 |                    | 6.1%  | 1.8%  | 7.8%  |              |
| <b>Job</b>                      | employee           | 252   | 222   | 474   |              |
|                                 |                    | 22.2% | 19.6% | 41.8% |              |
|                                 | Not an employee    | 133   | 91    | 224   |              |
|                                 |                    | 11.7% | 8.0%  | 19.7% |              |
|                                 | Student            | 53    | 113   | 166   | <b>0.001</b> |
|                                 |                    | 4.7%  | 10.0% | 14.6% |              |
| Retired                         | 166                | 47    | 213   |       |              |
|                                 |                    | 14.6% | 4.1%  | 18.8% |              |
|                                 | other              | 37    | 21    | 58    |              |
|                                 |                    | 3.3%  | 1.9%  | 5.1%  |              |
| <b>Duration of hypertension</b> | less than one year | 116   | 263   | 379   |              |
|                                 |                    | 10.2% | 23.2% | 33.4% |              |
|                                 | 1 - 5 years        | 211   | 109   | 320   |              |
|                                 |                    | 18.6% | 9.6%  | 28.2% | <b>0.001</b> |
|                                 | 5-10 years         | 125   | 41    | 166   |              |
|                                 |                    | 11.0% | 3.6%  | 14.6% |              |
|                                 | More than 10 years | 189   | 81    | 270   |              |
|                                 |                    | 16.7% | 7.1%  | 23.8% |              |

**Table 6.** Association between exercise adherence and sociodemographic characters of participants (n=1135).

|                       |                   | Exercise     |              | Total (N=1135) | P value      |
|-----------------------|-------------------|--------------|--------------|----------------|--------------|
|                       |                   | Yes          | No           |                |              |
| <b>Age</b>            | less than 20      | 38<br>3.3%   | 22<br>1.9%   | 60<br>5.3%     | <b>0.001</b> |
|                       | 20 - 30           | 104<br>9.2%  | 98<br>8.6%   | 202<br>17.8%   |              |
|                       | 31 - 40           | 78<br>6.9%   | 123<br>10.8% | 201<br>17.7%   |              |
|                       | 41- 50            | 99<br>8.7%   | 187<br>16.5% | 286<br>25.2%   |              |
|                       | 51 -60            | 100<br>8.8%  | 159<br>14.0% | 259<br>22.8%   |              |
|                       | more than 60      | 48<br>4.2%   | 79<br>7.0%   | 127<br>11.2%   |              |
| <b>BMI</b>            | underweight       | 78<br>6.9%   | 85<br>7.5%   | 163<br>14.4%   | <b>0.001</b> |
|                       | normal weight     | 253<br>22.3% | 309<br>27.2% | 562<br>49.5%   |              |
|                       | overweight        | 103<br>9.1%  | 181<br>15.9% | 284<br>25.0%   |              |
|                       | obesity           | 25<br>2.2%   | 62<br>5.5%   | 87<br>7.7%     |              |
|                       | extremely obesity | 8<br>0.7%    | 31<br>2.7%   | 39<br>3.4%     |              |
|                       | Single            | 131<br>11.5% | 107<br>9.4%  | 238<br>21.0%   |              |
| <b>marital status</b> | Married           | 288<br>25.4% | 480<br>42.3% | 768<br>67.7%   | <b>0.001</b> |
|                       | Divorced          | 30<br>2.6%   | 37<br>3.3%   | 67<br>5.9%     |              |
|                       | widow             | 16<br>1.4%   | 41<br>3.6%   | 57<br>5.0%     |              |
|                       | other             | 2<br>0.2%    | 3<br>0.3%    | 5<br>0.4%      |              |
|                       | Saudi             | 450<br>39.6% | 624<br>55.0% | 1074<br>94.6%  |              |
| <b>Nationality</b>    | Non -Saudi        | 17<br>1.5%   | 44<br>3.9%   | 61<br>5.4%     | <b>0.030</b> |
|                       | Male              | 231<br>20.4% | 271<br>23.9% | 502<br>44.2%   | <b>0.003</b> |
| <b>Gender</b>         | Female            | 236<br>20.8% | 397<br>35.0% | 633<br>55.8%   |              |
|                       | <b>Region</b>     | the South    | 130<br>11.5% | 140<br>12.3%   | 270<br>23.8% |
| Eastern               |                   | 104<br>9.2%  | 128<br>11.3% | 232<br>20.4%   |              |
| North                 |                   | 69<br>6.1%   | 151<br>13.3% | 220<br>19.4%   |              |
| Western               |                   | 93<br>8.2%   | 133<br>11.7% | 226<br>19.9%   |              |

|                                 |                    |              |              |              |              |
|---------------------------------|--------------------|--------------|--------------|--------------|--------------|
| <b>Education level</b>          | Central            | 71<br>6.3%   | 116<br>10.2% | 187<br>16.5% | <b>0.001</b> |
|                                 | primary            | 16<br>1.4%   | 43<br>3.8%   | 59<br>5.2%   |              |
|                                 | middle             | 20<br>1.8%   | 42<br>3.7%   | 62<br>5.5%   |              |
|                                 | secondary          | 93<br>8.2%   | 153<br>13.5% | 246<br>21.7% |              |
|                                 | collegiate         | 312<br>27.5% | 367<br>32.3% | 679<br>59.8% |              |
|                                 | other              | 26<br>2.3%   | 63<br>5.6%   | 89<br>7.8%   |              |
|                                 | employee           | 193<br>17.0% | 281<br>24.8% | 474<br>41.8% |              |
| <b>Job</b>                      | Not an employee    | 75<br>6.6%   | 149<br>13.1% | 224<br>19.7% | <b>0.001</b> |
|                                 | Student            | 95<br>8.4%   | 71<br>6.3%   | 166<br>14.6% |              |
|                                 | Retired            | 85<br>7.5%   | 128<br>11.3% | 213<br>18.8% |              |
|                                 | other              | 19<br>1.7%   | 39<br>3.4%   | 58<br>5.1%   |              |
|                                 | less than one year | 174<br>15.3% | 205<br>18.1% | 379<br>33.4% |              |
| <b>Duration of hypertension</b> | 1 - 5 years        | 126<br>11.1% | 194<br>17.1% | 320<br>28.2% | <b>0.086</b> |
|                                 | 5-10 years         | 69<br>6.1%   | 97<br>8.5%   | 166<br>14.6% |              |
|                                 | More than 10 years | 98<br>8.6%   | 172<br>15.2% | 270<br>23.8% |              |

**Table 7.** Association between diet adherence and sociodemographic characters of participants (n=1135).

|            |              | Number of meals per day |             |            |            |            |             | Total (N=1135) | P value      |
|------------|--------------|-------------------------|-------------|------------|------------|------------|-------------|----------------|--------------|
|            |              | Less than 3             | 3 Meals     | 4 Meals    | 5 Meals    | 6 Meals    | More than 6 |                |              |
| <b>Age</b> | less than 20 | 16<br>1.4%              | 14<br>1.2%  | 11<br>1.0% | 6<br>0.5%  | 7<br>0.6%  | 6<br>0.5%   | 60<br>5.3%     | <b>0.012</b> |
|            | 20 - 30      | 63<br>5.6%              | 58<br>5.1%  | 34<br>3.0% | 24<br>2.1% | 11<br>1.0% | 12<br>1.1%  | 202<br>17.8%   |              |
|            | 31 - 40      | 58<br>5.1%              | 61<br>5.4%  | 44<br>3.9% | 24<br>2.1% | 9<br>0.8%  | 5<br>0.4%   | 201<br>17.7%   |              |
|            | 41 - 50      | 77<br>6.8%              | 88<br>7.8%  | 66<br>5.8% | 31<br>2.7% | 16<br>1.4% | 8<br>0.7%   | 286<br>25.2%   |              |
|            | 51 -60       | 65<br>5.7%              | 100<br>8.8% | 64<br>5.6% | 21<br>1.9% | 5<br>0.4%  | 4<br>0.4%   | 259<br>22.8%   |              |
|            | more than 60 | 28<br>2.5%              | 49<br>4.3%  | 29<br>2.6% | 11<br>1.0% | 7<br>0.6%  | 3<br>0.3%   | 127<br>11.2%   |              |
|            | <b>BMI</b>   | underweight             | 49          | 52         | 32         | 13         | 7           | 10             |              |

|  |                   |       |       |       |      |      |      |       |              |
|--|-------------------|-------|-------|-------|------|------|------|-------|--------------|
|  |                   | 4.3%  | 4.6%  | 2.8%  | 1.1% | 0.6% | 0.9% | 14.4% |              |
|  | normal weight     | 150   | 178   | 124   | 66   | 28   | 16   | 562   |              |
|  |                   | 13.2% | 15.7% | 10.9% | 5.8% | 2.5% | 1.4% | 49.5% |              |
|  | overweight        | 61    | 96    | 72    | 30   | 18   | 7    | 284   |              |
|  |                   | 5.4%  | 8.5%  | 6.3%  | 2.6% | 1.6% | 0.6% | 25.0% |              |
|  | obesity           | 35    | 31    | 15    | 2    | 2    | 2    | 87    |              |
|  |                   | 3.1%  | 2.7%  | 1.3%  | 0.2% | 0.2% | 0.2% | 7.7%  |              |
|  | extremely obesity | 12    | 13    | 5     | 6    | 0    | 3    | 39    |              |
|  |                   | 1.1%  | 1.1%  | 0.4%  | 0.5% | 0.0% | 0.3% | 3.4%  |              |
|  | Single            | 71    | 69    | 50    | 23   | 13   | 12   | 238   |              |
|  |                   | 6.3%  | 6.1%  | 4.4%  | 2.0% | 1.1% | 1.1% | 21.0% |              |
|  | Married           | 202   | 266   | 174   | 70   | 36   | 20   | 768   |              |
|  |                   | 17.8% | 23.4% | 15.3% | 6.2% | 3.2% | 1.8% | 67.7% |              |
|  | Divorced          | 21    | 14    | 11    | 17   | 2    | 2    | 67    | <b>0.003</b> |
|  |                   | 1.9%  | 1.2%  | 1.0%  | 1.5% | 0.2% | 0.2% | 5.9%  |              |
|  | widow             | 11    | 21    | 13    | 5    | 4    | 3    | 57    |              |
|  |                   | 1.0%  | 1.9%  | 1.1%  | 0.4% | 0.4% | 0.3% | 5.0%  |              |
|  | other             | 2     | 0     | 0     | 2    | 0    | 1    | 5     |              |
|  |                   | 0.2%  | 0.0%  | 0.0%  | 0.2% | 0.0% | 0.1% | 0.4%  |              |
|  | Saudi             | 287   | 350   | 237   | 111  | 52   | 37   | 1074  |              |
|  |                   | 25.3% | 30.8% | 20.9% | 9.8% | 4.6% | 3.3% | 94.6% | <b>0.877</b> |
|  | Non -Saudi        | 20    | 20    | 11    | 6    | 3    | 1    | 61    |              |
|  |                   | 1.8%  | 1.8%  | 1.0%  | 0.5% | 0.3% | 0.1% | 5.4%  |              |
|  | Male              | 135   | 170   | 104   | 48   | 26   | 19   | 502   |              |
|  |                   | 11.9% | 15.0% | 9.2%  | 4.2% | 2.3% | 1.7% | 44.2% | <b>0.823</b> |
|  | Female            | 172   | 200   | 144   | 69   | 29   | 19   | 633   |              |
|  |                   | 15.2% | 17.6% | 12.7% | 6.1% | 2.6% | 1.7% | 55.8% |              |
|  | the South         | 67    | 105   | 62    | 21   | 10   | 5    | 270   |              |
|  |                   | 5.9%  | 9.3%  | 5.5%  | 1.9% | 0.9% | 0.4% | 23.8% |              |
|  | Eastern           | 57    | 79    | 51    | 29   | 7    | 9    | 232   |              |
|  |                   | 5.0%  | 7.0%  | 4.5%  | 2.6% | 0.6% | 0.8% | 20.4% |              |
|  | North             | 51    | 49    | 57    | 36   | 17   | 10   | 220   | <b>0.001</b> |
|  |                   | 4.5%  | 4.3%  | 5.0%  | 3.2% | 1.5% | 0.9% | 19.4% |              |
|  | Western           | 68    | 86    | 43    | 8    | 11   | 10   | 226   |              |
|  |                   | 6.0%  | 7.6%  | 3.8%  | 0.7% | 1.0% | 0.9% | 19.9% |              |
|  | Central           | 64    | 51    | 35    | 23   | 10   | 4    | 187   |              |
|  |                   | 5.6%  | 4.5%  | 3.1%  | 2.0% | 0.9% | 0.4% | 16.5% |              |
|  |                   | 15    | 17    | 18    | 4    | 2    | 3    | 59    | <b>0.024</b> |

|                                 |                    |       |       |       |      |      |       |       |              |
|---------------------------------|--------------------|-------|-------|-------|------|------|-------|-------|--------------|
| <b>Education level</b>          | primary            | 1.3%  | 1.5%  | 1.6%  | 0.4% | 0.2% | 0.3%  | 5.2%  |              |
|                                 |                    | 15    | 20    | 11    | 4    | 6    | 6     | 62    |              |
|                                 | middle             | 1.3%  | 1.8%  | 1.0%  | 0.4% | 0.5% | 0.5%  | 5.5%  |              |
|                                 |                    | 74    | 72    | 61    | 21   | 10   | 8     | 246   |              |
|                                 | secondary          | 6.5%  | 6.3%  | 5.4%  | 1.9% | 0.9% | 0.7%  | 21.7% |              |
|                                 |                    | 185   | 220   | 148   | 74   | 33   | 19    | 679   |              |
|                                 | collegiate         | 16.3% | 19.4% | 13.0% | 6.5% | 2.9% | 1.7%  | 59.8% |              |
|                                 | other              | 1.6%  | 3.6%  | 0.9%  | 1.2% | 0.4% | 0.2%  | 7.8%  |              |
| <b>Job</b>                      | employee           | 120   | 151   | 102   | 61   | 25   | 15    | 474   |              |
|                                 |                    | 10.6% | 13.3% | 9.0%  | 5.4% | 2.2% | 1.3%  | 41.8% |              |
|                                 | Not an employee    | 62    | 76    | 55    | 14   | 9    | 8     | 224   |              |
|                                 |                    | 5.5%  | 6.7%  | 4.8%  | 1.2% | 0.8% | 0.7%  | 19.7% |              |
|                                 | Student            | 54    | 44    | 29    | 18   | 12   | 9     | 166   | <b>0.040</b> |
|                                 |                    | 4.8%  | 3.9%  | 2.6%  | 1.6% | 1.1% | 0.8%  | 14.6% |              |
|                                 | Retired            | 54    | 72    | 54    | 21   | 9    | 3     | 213   |              |
|                                 |                    | 4.8%  | 6.3%  | 4.8%  | 1.9% | 0.8% | 0.3%  | 18.8% |              |
| <b>Duration of hypertension</b> | other              | 17    | 27    | 8     | 3    | 0    | 3     | 58    |              |
|                                 |                    | 1.5%  | 2.4%  | 0.7%  | 0.3% | 0.0% | 0.3%  | 5.1%  |              |
|                                 | less than one year | 123   | 119   | 75    | 34   | 11   | 17    | 379   |              |
|                                 |                    | 10.8% | 10.5% | 6.6%  | 3.0% | 1.0% | 1.5%  | 33.4% |              |
|                                 | 1 - 5 years        | 82    | 102   | 82    | 36   | 11   | 7     | 320   |              |
|                                 |                    | 7.2%  | 9.0%  | 7.2%  | 3.2% | 1.0% | 0.6%  | 28.2% | <b>0.022</b> |
|                                 | 5-10 years         | 39    | 55    | 39    | 19   | 11   | 3     | 166   |              |
|                                 |                    | 3.4%  | 4.8%  | 3.4%  | 1.7% | 1.0% | 0.3%  | 14.6% |              |
| More than 10 years              | 63                 | 94    | 52    | 28    | 22   | 11   | 270   |       |              |
|                                 | 5.6%               | 8.3%  | 4.6%  | 2.5%  | 1.9% | 1.0% | 23.8% |       |              |

Worldwide, hypertension is a serious health issue with a high morbidity and mortality rate. Over one billion individuals are affected by the disease globally, and seven million of them pass away every year as a result of serious complications and inadequate control. Saudi Arabia has a high prevalence of hypertension, and the number of people with uncontrolled conditions is considerable. There are a significant number of patients with uncontrolled hypertension in Saudi Arabia, where the frequency of the condition is already high [13, 14]. Controlling hypertension is a difficult task that calls the consideration of both pharmaceutical and non-pharmacological treatments. Insufficient adherence to these measures by hypertension patients was described in the

literature, and the effects were seen. To design and deliver health education, it is crucial to measure the rates of adherence to dietary changes and medication regimens as well as the identification of its factors [11].

To reach the intended therapeutic goal in hypertension patients, adherence to drugs and lifestyle adjustments are crucial. Adoption of Dietary Approach to Stop Hypertension (DASH) eating plans, dietary sodium reduction, weight loss in overweight and obese patients with regular exercise, adequate intake of fruits and vegetables, and a reduction in saturated fat intake are major lifestyle changes that should be

taken into consideration and that help to lower blood pressure [15-18].

In our study 33.4% of the participants were diagnosed with hypertension in less than one year, 28.2% from 1-5 years, and 23.8% for more than 10 years. Moreover, 56.5% of the participants were taking antihypertensive drugs. Our findings were assumed to be better than those of another study held in Taif, Saudi Arabia which illustrates that only 34.7% of the patients were adherent to medications [11]. Another cross-sectional study in Saudi Arabia showed that 42.2% of the participants were adherent to antihypertensive medications [19].

Almost 36.1% of the participants were overweight, obese, or extremely obese. In the KSA, obesity is still closely linked to diabetes, high cholesterol, and hypertension. The main causes of Saudi Arabia's nutritional issues include dietary changes, illiteracy, and wrong information. Obesity has been linked to uncontrolled blood pressure on its own [20-23]. Similarly, studies in Saudi Arabia reported overweight and obesity to be associated with hypertension [11, 24, 25].

Consistent with a cross-sectional study that was conducted during October-December 2013 at Al-Hada Armed Forces Hospital and Princess Mansour Community Hospital; Taif; Kingdom of Saudi Arabia found that only 11.8% of the participants were adherent to a healthy hypertensive diet [11]. Another study held in Port Said, Egypt found that more than half of the participants were overweight and did not adhere to a healthy diet plan [25]. Inconsistent with studies conducted in Ethiopia, a study held in follow-up units of some public hospitals in Addis Ababa, Ethiopia showed that 69.1% of participants followed diet advice [26]. Another study held in follow-up units of Dessie Referral Hospital, North East Ethiopia, 2020 revealed that 62.5% of the participants adhered to the recommended diet as they incorporated fruits, vegetables, grains, and beans into their diet after being diagnosed with hypertension. Since being diagnosed, over 58%, 81.5%, and 75.4% of all participants have either rarely or never eaten foods high in saturated fat, spicy foods, or salt [6].

Our study showed that 41.1% of the participants practiced sports, about 35.9% of the participants went walking, 28.1% exercised for 30 min to more than 40 min, and 21.2% exercised daily or 5-6 times a week. Those results were consistent with studies in Saudi Arabia, as a study in Taif, Saudi Arabia showed that only 20.1% of the participants were adherent to regular exercise for 30 minutes per day for at least 5 days per week [11]. On the other hand, another study in Ethiopia revealed that 65.1% of respondents said they engaged in physical activity; of these, the majority (90.1%) said they exercised at least three times per week, and a somewhat comparable percentage (90.8%) said they did an activity that lasted at least 30 minutes [26]. Another study held in follow-up units of Dessie Referral Hospital, North

East Ethiopia, 2020 revealed that 51.8% of the hypertensive patients exercised; of them, 87.2% exercised three or more times per week, and 80.8% participated in workouts lasting at least 30 minutes [6]. Another study in Selected Hospitals in the Central Gondar Zone showed that 45% of patients had engaged in the recommended amount of exercise [27]. Another descriptive study in Turkey showed that 41.7% of the participants reported exercising, with 86.9% of them claiming to walk for exercise. However, 58.3% of individuals who identified hurdles to exercise did not engage in any, with around half of them (45%) citing "feelings of fatigue" as a barrier [28].

As for smoking, our results show that 15.1% of the participants were smokers, and more than half of those smokers tried to stop smoking after they were diagnosed with high blood pressure. A study in selected hospitals, in South Ethiopia showed that 91.2% of the participants were non-smokers [29]. On the other hand, a study held in follow-up units of selected public hospitals in Addis Ababa, Ethiopia showed that data revealed that 65.6% of the 404 respondents did not smoke cigarettes. Of those who smoked, 41% continued to do so, while 45.6% did not attempt to stop [26]. Another study held in follow-up units of Dessie Referral Hospital, North East Ethiopia, 2020 revealed that 9.6% of the patients had ever smoked, and 37.9% of them were still doing so. Five of the 11 respondents who continued to smoke cigarettes had tried to give up [6]. Another surprising study in Nigeria showed that 100% of the patients were adherent to non-use of tobacco [30].

Some barriers to adherence were reported in our study, the major reported barriers to adhering to a healthy diet were difficulty adhering to a different diet than the rest of the family and social gatherings, 47.4% and 32.1% respectively. Participants reported some factors that may help them adhere to a healthy diet as providing healthy options in public places (such as restaurants, food carts, supermarkets, etc.), having motivators, such as a supportive family member or friend, and increasing awareness of food products suitable for patients with high blood pressure, such as low-sodium and low-fat products. Similarly, a study in Kuwait showed that 48.6% of the participants were unwilling to adhere to a diet regimen, 30.2% said it is difficult to adhere to a diet regimen different from that of the rest of the family, and 13.7% because of the high frequency of social gatherings [31]. On the other hand a study in Asmara, Eritrea revealed that participants acknowledged that their inability to follow the suggested diet management was hampered by budgetary issues. They complained that the price of fruits was too expensive on the market and that the diet advice did not take their financial situation into account [32].

Reported obstacles that prevent participants from exercising are not having enough time, unsuitable weather, workload, poor self-control towards regular exercise, and lack enough knowledge of the appropriate exercise for hypertensive

patients. The main reported factors that may contribute to sticking to a regular exercise schedule were providing gyms with reasonable subscription prices, having motivators like friends and family, having a personal trainer, and the availability of free exercising areas in the community. Consistent with a study in Kuwait which revealed that 27.8% of the participants said that hot summer weather was from the barriers they faced, 39% said that they are always busy, and 35.6% had coexisting diseases, mainly osteoarthritis, other musculoskeletal diseases, and asthma [31].

In our study, we found that age, BMI, marital status, educational level, occupation, and time when diagnosed with high blood pressure were all significantly associated with adhering to antihypertensive drugs. A nearly similar finding was seen in a study in South Ethiopia which showed that age, and duration of hypertension diagnosis were significantly associated with lifestyle modification practice [29].

## CONCLUSION

In conclusion, few hypertensive patients practice healthy lifestyles. Age, level of education, occupation, length of illness, and marital status of respondents were found to be important predictors of effective lifestyle modification strategies. As revealed in our study there is a lack of adherence to lifestyle modifications and the adherence level for the participants is regarded as low adherence, so to increase the practice of lifestyle adjustment in patients with hypertension, more emphasis should be placed on offering dietary counseling and health promotion. All hypertensive patients who need to control their blood pressure should receive guidance and support to establish and maintain healthy lifestyle habits, regardless of other prescribed therapies.

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Participants were informed that their participation is voluntary and filling the questionnaire indicates their consent to participate.

Written consent was obtained from all individual participants included in the study.

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