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## RESEARCH ARTICLE

### Public's Knowledge of Hypertension and its Associated Factors: A Cross-Sectional Study

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#### Abstract:

##### Background:

Hypertension is a significant challenge for healthcare systems globally. It is estimated to cause 7.5 million deaths worldwide annually. Knowledge of hypertension plays a crucial role in behavioral changes required to prevent and manage the condition. This study aimed to assess the public's knowledge of hypertension's risk factors, symptoms, complications, and treatment.

##### Methods:

This cross-sectional, descriptive, and exploratory study included a convenience sample of 723 Jordanian adults. The Hypertension Knowledge Test was used to measure the participants' knowledge of hypertension's risk factors, symptoms, complications, and treatment.

##### Results:

The participants' mean score of total hypertension knowledge was  $11.5 \pm 3.82$  (52.2%), with 85.9% (n=621) having inadequate knowledge. Their mean scores for hypertension's risk factors, symptoms, complications, and treatment were  $7.45 \pm 2.35$  (62.1%),  $2.29 \pm 1.21$  (45.8%),  $1.38 \pm 0.943$  (46%), and  $0.391 \pm 0.603$  (19.6%), respectively. Four factors were found to be significant predictors of participants' knowledge, such as age ( $p=0.002$ ), education level ( $p<0.001$ ), family history ( $p<0.001$ ), and receiving hypertension-related information ( $p<0.001$ ).

##### Conclusion:

The participants had inadequate knowledge regarding hypertension's complications, risk factors, symptoms, and treatment. Public health education programs that focus on hypertension knowledge are required. Nurses and other healthcare providers should take the initiative in hypertension education. Strategic planning and designing of hypertension programs are required to fit the needs of the Jordanian public to enhance their knowledge of hypertension and related preventive and control measures.

**Keywords:** Complications, Hypertension, Knowledge, Public, Risk factors, Symptoms.

#### Article History

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## 1. INTRODUCTION

Hypertension (HTN) is a major global health problem because of its high prevalence and resulting morbidity, premature mortality, and healthcare expenditure [1, 2]. Hypertension is defined as a systolic blood pressure  $\geq 140$  mmHg and/or a diastolic blood pressure  $\geq 90$  mmHg following repeated measurement on 2-3 different clinic visits [3]. It is a significant risk factor for cardiovascular and kidney diseases and accounts for 51% of stroke mortality and 45% of heart disease mortality worldwide [4].

Each year, HTN causes 9.4 million deaths worldwide [2], nearly one-third of preventable, premature deaths [5]. About 1.13 billion people worldwide have HTN, with two-thirds of the cases reported in low and middle-income countries (LMIC). This number is expected to increase to 1.56 billion (29.2%) by 2025 [6]. In Jordan, around one-third of Jordanian adults have HTN (33.8% of men and 29.4% of women) [7]. In Ghawr Al-Mazraa village in the Jordan Valley, 44.3% of the residents have HTN [8]. Unfortunately, about 23.6% and 31% of all cardiovascular diseases (CVDs) deaths in Jordan, among males and females (respectively), are caused by HTN [9]. Without efficient action, the growing burden of HTN will escalate, particularly in LMIC [10].

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The increasing and large disparities in the regional and global burden of HTN are associated with substantial disparities in HTN awareness, control, and treatment [10]. Therefore, it is necessary to assess HTN knowledge among people from various cultures and regions to plan effective strategies to reduce the burden of HTN. Hypertension is linked to several modifiable risky lifestyle behaviors, such as excessive consumption of fatty diets and dietary salts, physical inactivity, smoking, and alcohol consumption [11]. To modify their lifestyle behaviors, people must know about HTN, especially about risk factors [12].

Knowledge of HTN is a crucial factor that can enhance healthy lifestyle modifications and modify a person's perception of their risk, which are significant in controlling HTN and preventing its related complications. The higher level of knowledge possessed by an individual depicts the more positive behavior towards the health-related issues [11, 13, 14]. Assessing public knowledge is vital since knowledge is not only necessary for patients with HTN but for the general population as well, who might be involved in their care.

In Jordan, most studies were conducted among patients with HTN [13, 15]. However, there is scarce data about HTN's knowledge among the general population [16, 17]. The available study revealed good overall knowledge about HTN among Jordanian adults except for knowledge about the diet and definition of HTN. Adults without HTN had lower knowledge than those with HTN, particularly regarding diet [16].

Therefore, exploring the level of HTN knowledge among public adults is required for the future development of appropriate educational and self-management programs to prevent and control HTN. The purpose of this study was to assess the public's knowledge of HTN's complications, risk factors, symptoms, and treatment in Jordan.

## 2. MATERIALS AND METHODS

### 2.1. Study Design

A descriptive, exploratory, and cross-sectional designs were used to investigate knowledge of HTN's complications, risk factors, and symptoms among Jordanians.

### 2.2. Sample

A convenience sample of Jordanian adults from the largest four governorates (Amman, Al-Zarqa, Irbid, Al-Mafraq) in the north and middle of Jordan was included in this study. The sample size was calculated by utilizing Slovin's formula based on medium effect size, power of 0.80, and level of significant 0.05. The required sample size was anticipated to be at least 384 participants. However, oversampling was intended to overcome any attrition during the data collection process and to assure the representation of the population [18].

The inclusion criteria were as follows: Jordanian, 18 years and above, able to read and write Arabic, and willing to participate. The sample included individuals without a diagnosis of HTN based on their health records. Individuals whose professional work or study was in the medical field were

excluded because their participation could affect the accuracy of the public's knowledge. People were approached, and those who were willing to participate and met the inclusion criteria were given a questionnaire to complete.

### 2.3. Instrument

The study utilized a self-reported survey composed of two major sections. The first section included demographic data (age, education, gender, governorate, marital status, occupation, and residence) and clinical data (smoking, a family history of HTN, insurance, type of insurances, obtained HTN-related information, and its resources).

The second section was composed of the Hypertension Knowledge Test (HKT). Permission to use the HKT after translation and modification was obtained from Han *et al.*, the developers of this instrument. The original HKT measures the knowledge of HTN complications, risk factors, symptoms, and treatment. It consists of 21 items, of which 12 items have True, False, or I Don't Know format, and nine items were based on a multiple-choice format [19]. The researchers modified some questions to accommodate the Jordanian culture and to be suitable for the public who are not hypertensive. For example, the question: "Do Koreans consume more salt than necessary?" was modified to "overconsumption of salt causes HTN." In addition, the question, "overconsumption of fatty food causes HTN" was added because dyslipidemia is widely prevalent among Jordanian adults [20]. Therefore, the final questionnaire was composed of 22 items to assess the Jordanian's knowledge of HTN.

Knowledge of HTN's risk factors was measured by 12 items: knowledge of HTN symptoms was measured by five items, knowledge of HTN complications was measured by 3 items, and knowledge of HTN medical treatment was measured by two items. A score of one was given to each correct response and zero to incorrect and I Don't Know responses, resulting in a total knowledge score range of 0-22. Based on the instrument's instructions, a total knowledge percentage score of  $\geq 70\%$  (score  $\geq 15.4$  out of 22) indicates adequate knowledge, while  $<70\%$  (score  $<15.4$  out of 22) indicates inadequate knowledge. The internal consistency of the original questionnaire is 0.70 [19].

The HKT tool was originally developed in English, translated to Arabic, and back-translated to English to ensure the quality of the questionnaire's content and meaning. The translation was conducted by bilingual experts (English and Arabic); one expert translated the English version into Arabic, and another expert did the back-translation. Then, a selected panel of four experts in cardiovascular diseases reviewed the questionnaire's content to ensure its validity in measuring knowledge of HTN's complications, risk factors, symptoms, and treatment and to evaluate the clarity and cultural sensitivity of the items. The content validity index was 0.94.

A pilot study was conducted among 15 participants (excluded from study analysis) to assess the questionnaire's clarity and reliability and the time required to complete it. The time required to fill in the questionnaire was 20 minutes. Participants reported that the questionnaire was simple and easy to understand. The internal consistency was 0.72.

#### 2.4. Ethical Considerations

The Institutional Review Board approved this study at a large public university in Jordan (IRB# 19/93/2016). The consent form was obtained from each participant after explaining the nature and the purpose of the study. Participants were assured that their participation was entirely voluntary. They have the right to withdraw from the study or refuse to provide information at any time during the study without penalty. Participants were also assured that their responses would be confidential.

#### 2.5. Data Collection

The researchers and trained research assistants approached the public in 12 primary healthcare centers (3 in each governorate). The data were collected in private rooms in the centers to ensure privacy. The researcher's assistants were trained regarding the study's purpose, inclusion and exclusion criteria, and the meaning of questions and their responses to maintain consistency in data collection and minimize bias and error. To ensure eligibility for participation in the study, participants were asked about their age, occupation, and their ability to read and write. The surveys were distributed after obtaining verbal permission from the directors of healthcare centers. Completed questionnaires were kept in a locked cabinet in the principal investigator's locked office.

#### 2.6. Data Analysis

Data were analyzed using Statistical Package for the Social

Sciences (SPSS) for Windows version 21. Data were tested for normality prior to analysis. Descriptive statistics (frequency, mean, and standard deviation) were used to describe the participants' characteristics. An independent *t*-test and One-way ANOVA tests were used to assess the bivariate association between participants' demographic characteristics and overall knowledge scores. Furthermore, the multivariate linear regression analysis was used to assess factors that would predict HTN knowledge. The level of significance was defined at a *p*-value <0.05.

### 3. RESULTS

A total of 860 questionnaires were distributed; however, 775 completed questionnaires were returned, with a response rate of 90.1%. Of the 775 questionnaires, 52 were excluded, since those participants worked in health care. The final sample size was 723. The participants' mean age was 32.75±11.5 years (Rang 18-69); about half of the participants (52.3%; n=378) were female, and 36.4% (n=263) had secondary education or less.

More than half of the participants, *i.e.*, 53.4% (n=386), had a positive family history of HTN. Only 36.4% (n=263) of the participants had obtained HTN-related information, primarily from the Internet (45.6%; n=120). About two-thirds (69%, n=499) of the participants were smokers. Table 1 shows the participants' socio-demographic and clinical-related characteristics.

**Table 1. Participants' socio-demographic and clinical-related characteristics (n = 723).**

Characteristics	N	%
<b>Age (M, SD) <sup>a</sup></b>	32.75	11.5
<b>Gender</b>	-	-
Male	345	47.7
Female	378	52.3
<b>Maritals status</b>	-	-
Single	322	44.5
Married	381	52.7
Widowed	12	1.7
Divorced	8	1.1
<b>Educational Level</b>	-	-
Graduate study (Master or PhD)	43	5.9
Bachelor	291	40.2
Diploma	126	17.4
Secondary	226	31.3
Primary	31	4.3
Illiterate	6	0.8
<b>Employment</b>	-	-
Employed	421	58.2
Not Employed	269	37.2
Retired	33	4.6
<b>Income (M, SD) <sup>a</sup></b>	311.9	290.63
≤ 350	416	57.5
>350	307	42.5
<b>Smoking</b>	-	-
Yes	499	69.0
No	224	31.0

(Table 1) contd....

<b>Insurance</b>	-	-
Yes	523	72.3
No	200	27.7
<b>Insurance type*</b>	-	-
Governmental	315	60.2
Private	57	10.9
Other	151	28.9
<b>Obtained HTN<sup>b</sup> -related information</b>	-	-
Yes	263	36.4
No	460	63.6
<b>Sources of information**</b>	-	-
Health care provider	87	33.1
Internet	120	45.6
Family and friend	34	12.9
TV	22	8.37
Newspaper	0	0
<b>Family history of HTN</b>	-	-
Yes	385	53.3
No	338	46.7
<b>Governorate</b>	-	-
Amman	179	24.8
Al Zarqa	169	23.4
Irbid	184	24.4
Al Mafraq	191	26.4

<sup>a</sup> Age and income data presented as: M= mean; SD= standard deviation

<sup>b</sup> Hypertension

\*Mutually exclusive to the participant with insurance

\*\*Mutually exclusive to patients obtain information.

### 3.1. Participants' Overall Knowledge of Hypertension

According to the instrument instructions, a total HTN knowledge percentage score of <70% (<15.4 out of 22) was considered inadequate. As shown in Table 2, the participants' mean score of total HTN knowledge was 11.5 ± 3.82 (52.2%), indicating an inadequate level. Overall, 85.9% (n=621) of participants had inadequate knowledge. Their mean scores for HTN's risk factors, symptoms, complications, and treatment were 7.45 ± 2.35 (62.1%), 2.29 ± 1.21 (45.8%), 1.38 ± 0.943 (46%), and 0.391 ± 0.603 (19.6%), respectively.

### 3.2. Participants' Knowledge of Hypertension-Related Risk Factors

Participants' knowledge of HTN-related risk factors is

shown in Table 3. Only 32% (n=232) of the participants knew alcohol drinking as an HTN risk factor, and 33.7% (n= 244) knew that cold weather is not a risk factor. Nearly half of participants knew that HTN is an inherited disease (50.8%, n=367) and that pregnancy could contribute to HTN and require a follow-up (55.7%, n=528).

A higher percentage of participants knew excessive intake of salt (86.9%, n=628) and fatty foods (74.0%, n=535), lack of exercise (83.1%, n=601), and overweight (73.0%, n=528) could cause HTN. Nonetheless, only 35.8% (n=259) identified the required changes in their lifestyle to reduce their risk for HTN, including regular exercising for 30 minutes/time for three days/week, and smoking cessation. Besides, 59.1% (n=561) knew that reducing fast/fried foods and salt intake are required dietary lifestyle changes to prevent and control HTN.

**Table 2. Participants' knowledge scores of hypertension (n=723).**

HTN <sup>a</sup> Knowledge Scale/Subscales	Knowledge Scores M±SD	Knowledge Percentage Score	Inadequate Knowledge Level <sup>b</sup>		Adequate Knowledge Level <sup>c</sup>	
			N	%	N	%
Total knowledge	11.5± 3.82	52.2%	621	85.9	102	14.1
Risk factors	7.45 ± 2.35	62.1%				
Symptoms	2.29 ± 1.21	45.8%				
Complications	1.38 ± 0.943	46%				
Medical treatment	0.391± 0.603	19.6%				

<sup>a</sup>Hypertension

<sup>b</sup>A total HTN knowledge score < 70% (a score <15.4 out of 22)

<sup>c</sup>A total HTN knowledge score ≥ 70% (score ≥15.4 out of 22).

### 3.3. Participants' Knowledge of Hypertension-Related Symptoms

Participants' knowledge regarding HTN-related symptoms is shown in Table 4. Among the study's participants, only 10.1% (n=73) knew that HTN does not always have symptoms,

and 35.5% (n=257) recognized that HTN could be diagnosed when an individual had over three elevated measured blood pressure readings at three different times. Also, about half knew that HTN could be life-threatening because it might have no symptoms (53.9%, n=390), and that blood pressure at 140/90 mmHg or over is considered high (56.7%, n=410).

**Table 3. Knowledge of hypertension-related risk factors (n=723).**

Questions	Responses	
	N	%
<b>1. The chance of getting HTN<sup>a</sup> increased, if your mother or father has HTN.</b>	-	-
No	209	28.9
Yes <sup>@</sup>	367	50.8
I don't know	147	20.3
<b>2. Young adults don't get HTN.</b>	-	-
No <sup>@</sup>	502	69.4
Yes	104	14.4
I don't know	117	16.2
<b>3. If you are overweight, you are more likely to develop HTN.</b>	-	-
No	54	7.5
Yes <sup>@</sup>	528	73.0
I don't know	141	19.5
<b>4. Regular exercise can help reducing HTN risk.</b>	-	-
No	55	7.6
Yes <sup>@</sup>	601	83.1
I don't know	67	9.3
<b>5. HTN affects men only.</b>	-	-
No <sup>@</sup>	667	92.3
Yes	20	2.8
I don't know	36	5.0
<b>6. Pregnancy related HTN is a situational problem that does not require follow-up after delivery.</b>	-	-
No <sup>@</sup>	392	54.2
Yes	127	17.6
I don't know	204	28.2
<b>7. Overconsumption of salt causes HTN.</b>	-	-
No	37	5.1
Yes <sup>@</sup>	628	86.9
I don't know	204	8.0
<b>8. Overconsumption of fatty food causes HTN</b>	-	-
No	37	5.1
Yes <sup>@</sup>	535	74.0
I don't know	151	20.9
<b>9. Drinking alcohol lowers the risk for HTN.</b>	-	-
No <sup>@</sup>	232	32.1
Yes	58	8.0
I don't know	433	59.9
<b>10. All of the following are changes that you can make in your diet to reduce risk for HTN, EXCEPT</b>	-	-
Eat fast food or fried food <sup>@</sup>	428	59.2
Eat baked chicken instead of fried	41	5.7
Stop eating potato chips	31	4.3
Avoid adding table salt to food	59	8.2
I don't know	164	22.7
<b>11. Cold weather increase the risk for HTN</b>	-	-
No <sup>@</sup>	244	33.7

(Table 3) contd....

Yes	166	23.0
I do not know	313	43.3
<b>12. All of these lifestyle changes might reduce the risk for HTN, EXCEPT</b>	-	-
Lifting weights frequently <sup>®</sup>	259	35.8
Walking briskly for 30 minutes, three times a week	163	22.5
Quitting cigarette smoking	91	12.6
I do not know	210	29.0

<sup>a</sup>Hypertension<sup>®</sup> Correct response.

Table 4. Knowledge of hypertension-related symptoms, complications, and medical treatment (n=723).

Questions	Responses	
	N	%
<b>Symptoms</b>	-	-
<b>1. HTN<sup>a</sup> has symptoms always.</b>	-	-
Yes	536	77.9
No <sup>®</sup>	73	10.1
I don't know	87	12.0
<b>2. Blood pressure is high when it's at or over 140/90 mmHg.</b>	-	-
Yes <sup>®</sup>	410	56.7
No	103	14.2
I don't know	210	29.0
<b>3. A good blood pressure is</b>	-	-
120/80 <sup>®</sup>	525	72.6
145/110	15	2.1
140/90	45	6.2
180/100	8	1.1
I don't know	130	18.0
<b>4. A person is diagnosed with HTN if he/she has:</b>	-	-
Elevated blood pressure at three different times <sup>®</sup>	257	35.5
A lot of headaches	259	35.8
Family member(s) with high blood pressure	24	3.3
A lot of stress and tension	32	4.4
I don't know	151	20.9
<b>5. Why is HTN called a "silent killer"</b>	-	-
HTN may have no symptoms, and it can be life threatening <sup>®</sup>	390	53.9
The risk of dying from HTN is low	53	7.3
When person does not have pain or feel ill, he/she is okay	115	15.9
I don't know	165	22.8
<b>Complications</b>	-	-
<b>1. All of the following health problems can result from high blood pressure, EXCEPT</b>	-	-
Arthritis <sup>®</sup>	271	37.5
Heart attack	43	5.9
Stroke	58	8.0
Kidney failure	82	11.3
I don't know	269	37.2
<b>2. High blood pressure harms your body over time by:</b>	-	-
Damaging your blood vessels <sup>®</sup>	209	28.9
Causing you to have diabetes	149	20.6
Causing you to gain weight	37	5.1
Making you nervous	147	20.3
I don't know	181	25.1
<b>3. HTN is not life-threatening condition</b>	-	-
Yes	125	17.3

(Table 4) contd.....

No <sup>@</sup>	517	71.5
I don't know	81	11.2
<b>Medical Treatment</b>	-	-
<b>1. There are various types of medications to treat high blood pressure</b>	-	-
Yes <sup>@</sup>	184	25.4
NO	133	18.4
I do not know	406	56.2
<b>2. Taking blood pressure medications for long time can harm the body:</b>	-	-
Yes <sup>@</sup>	99	13.7
NO	205	28.4
I don't know	419	58.0

<sup>a</sup> Hypertension<sup>@</sup>

### 3.4. Participants' Knowledge of Hypertension-Related Complications

Details of participants' knowledge about HTN-related complications are given in Table 4. Although 71.5% (n=517) of the participants considered HTN a life-threatening condition, only 28.9% (n=209) knew that HTN harms the body by damaging the blood vessels, and 37.5% (n=271) recognized HTN related complications.

### 3.5. Participants' Knowledge of Hypertension-Related Medical Treatment

Participants' knowledge regarding HTN medical treatment is also given in Table 4. Among participants, only 25.4% (n=184) knew that there are varied types of antihypertensive medications, and 13.7% (n=99) knew that the treatment with antihypertensive medications for a long time does not harm the body.

### 3.6. Association between Participants' Overall Knowledge and their Demographic and Clinical Characteristics

Table 5 shows the differences between participants' characteristics and overall HTN knowledge. The knowledge score was higher among older participants ( $F = 2.89, p < 0.035$ ), with higher educational level ( $F = 15.1, p < 0.001$ ), employed ( $F = 4.70, p = 0.009$ ), higher monthly income ( $t = -3.81, p < 0.001$ ), having insurance ( $t = -4.67, p < 0.001$ ), and with family history of HTN ( $t = -6.32, p < 0.001$ ). Also, participants who had obtained HTN-related information had a higher knowledge score ( $13.1 \pm 3.28$ ), than those who did not ( $10.6 \pm 3.84$ ), ( $t = -9.11, p < 0.001$ ). Furthermore, the knowledge was significantly different between the four governorates ( $F = 4.15, p = 0.006$ ), with the highest knowledge score of participants in the Al-Zarqa and Irbid governorates.

Table 5. Hypertension knowledge by participants characteristics (n = 723).

Characteristics	Total Knowledge Score		Association	
	M	SD	test	P value
<b>Age</b>	-	-	-	-
18-24	11.0	3.66	F = 2.89	.035
25-34	11.5	4.11	-	-
35-44	12.0	3.75	-	-
≥ 45	12.0	3.74	-	-
<b>Gender</b>	-	-	-	-
Male	11.5	4.03	t = .254	.800
Female	11.6	3.65	-	-
<b>Marital status</b>	-	-	-	-
Single	11.3	3.851	F = .817	.485
Married	11.7	3.72	-	-
Widowed	10.7	6.21	-	-
Divorced	12.5	3.82	-	-
<b>Educational level</b>	-	-	-	-
Illiterate	6.00	3.35	F = 15.1	<.001
Primary	8.87	3.33	-	-
Secondary	10.6	3.66	-	-
Diploma	11.4	4.13	-	-
Bachelor	12.3	3.50	-	-
Graduate study Master, PhD)	13.8	3.45	-	-
<b>Employment</b>	-	-	-	-

(Table 5) contd....

not worked	11.0	3.76	F = 4.70	.009
retired	12.4	4.48	-	-
worked	11.8	3.79	-	-
<b>Income (JD<sup>a</sup>)</b>	-	-	-	-
≤ 350	11.1	3.66	t = -3.81	<.001
>350	12.1	3.98	-	-
<b>Smoking</b>	-	-	-	-
Yes	11.4	3.94	t = .447	.655
No	11.6	3.79	-	-
<b>Medical insurance</b>	-	-	-	-
Yes	11.9	3.85	t = -4.67	<.001
No	10.5	3.58	-	-
<b>Obtained HTN<sup>b</sup>-related information</b>	-	-	-	-
Yes	13.1	3.28	t = -9.11	<.001
No	10.6	3.84	-	-
<b>Family history of HTN</b>	-	-	-	-
Yes	12.3	3.46	t = -6.32	<.001
No	10.6	4.01	-	-
<b>Governorate</b>	-	-	-	-
Amman	11.2	3.80	F = 4.15	.006
Al-Zarqa	12.0	3.86	-	-
Irbid	12.0	3.93	-	-
Al-Mafraq	10.9	3.65	-	-

<sup>a</sup> Jordan Dinar, <sup>b</sup> hypertension

**Table 6. Predictors of hypertension knowledge (n = 723).**

Predictors	B	Std. Error	$\beta$	t-value	P value
Constant	3.55	0.91	-	3.92	<.001
Age	0.04	0.01	0.127	3.16	.002
Education years	0.34	0.05	0.248	6.47	<.001
Income	0.00	0.001	0.024	0.55	.583
Not worked vs. worked	0.32	0.33	0.041	0.97	.333
Retired vs. worked	0.16	0.65	0.009	0.25	.804
Medical Insurance	0.48	0.30	0.056	1.58	.114
Obtained HTN <sup>a</sup> information	1.71	0.28	0.215	6.16	<.001
Family history of HTN	1.32	0.26	0.172	5.04	<.001

<sup>a</sup> hypertension

Dependent variable= HTN knowledge score, Multiple R=0.455, R squared = 0.207. Durbin-Watson statistic= 1.72, F (8, 714) = 23.3, p<.001.

Factors that were significantly associated with HTN knowledge score were included in the multiple linear regression model. As shown in Table 6, the model was statistically significant (F (8,714)= 23.3,  $p<0.001$ ,  $R^2= 0.207$ ), accounting for 20.7 of the variances in knowledge level. Four factors were significant predictors of participants' knowledge, including age ( $p=0.002$ ), education ( $p<0.001$ ), family history ( $p<0.001$ ), and receiving HTN-related information ( $p<0.001$ ).

#### 4. DISCUSSION

The results revealed inadequate overall knowledge of HTN among the participants, which is alarming and sheds light on the need for improving the public's knowledge of HTN, which is congruent with previous studies conducted in Thailand [12], China [14], the United Kingdom [21], and Tibet [22]. The prevalence of HTN is increasing mainly in LMIC countries,

like Jordan because HTN-related risk factors are increasing in those populations [23]. Knowledge about the risk factors of HTN can help in modifying lifestyle behaviors [12]. Some studies conducted in Jordan [16], Saudi Arabia [24], and South Africa [25] found adequate HTN knowledge. The difference between studies could be attributed to the differences in the utilized tools for knowledge assessment and in the sample size and participants' characteristics, such as the educational level, inclusion of hypertensive patients, and exposure to educational programs about HTN [16]. Inadequate public knowledge of HTN is expected because it is more common for individuals to seek health-related information if they, or their family members, are affected with the disease. They would be motivated to learn more about their disease and treatment plan, by having greater control over prevention of the disease's complications [16, 26].

The current study's results revealed a lack of knowledge regarding many risk factors for HTN, particularly alcohol consumption, family history, and pregnancy. Similar results were reported by other studies [11, 12, 22]. A higher percentage of participants recognized a lack of exercise, salt and fatty foods consumption, and obesity as risk factors. Prevention of serious consequences of HTN necessitates knowledge of its risk factors. The public's knowledge of HTN risk factors would have a significant role in changing their lifestyles, such as diet, physical activity, weight, and smoking, which are modifiable risk factors [12, 22]. Unfortunately, a low proportion of the participants identified the necessary lifestyle changes to reduce their risk for HTN, including regular exercising, quitting smoking, and dietary reduction of fast/or fried foods and salt intake. Consistently, a previous Jordanian study reported that the adoption of healthy lifestyles is alarmingly low [27]. A recent study found that most healthy Jordanians were unaware of the negative impact of high sodium consumption on health, and consuming 4.1g/day, which is double the recommended daily allowance [17]. Jordanian adults need educational programs to know all HTN's risk factors and the suitable lifestyle modifications that need to make.

The participants' responses in this study also revealed inadequate knowledge regarding HTN symptoms. HTN rarely has attributable symptoms at early stages, and might not show any symptom until it progresses to an advanced stage [28]. However, most of the study's participants did not recognize this serious information, and only half of them identified this as a life-threatening issue. This finding supports the results of previous studies regarding the misperception of HTN symptoms, such as headaches, palpitations, and dizziness among hypertensive participants [25, 29, 30]. In addition, more than one-third of the study's participants alluded that people could be diagnosed with HTN if they had a lot of headaches. Similarly, in another study [22], participants reported that blood pressure should be checked only if symptoms have appeared. Furthermore, about one-third of the current study participants did not know when blood pressure reading was considered high; this finding was reported by others as well [16, 22]. Being unaware of high blood pressure is alarming. People will misinterpret the disease and will go undiagnosed [28]. This lack of knowledge regarding HTN's symptoms could affect healthcare-seeking behavior [31]. Community awareness campaigns could enhance the public's knowledge of HTN's symptoms and promote the screening and diagnosis of HTN.

Poor knowledge of HTN-related complications was also found among the participants in terms of damaging the blood vessels, stroke, heart attack, and renal failure, which is consistent with previous studies' findings [14, 22]. However, some studies reported high knowledge of HTN-related complications among their participants [16, 24, 32]. This lack of knowledge regarding complications could affect the perception of HTN threat as a silent killer [31] and the adoption of healthy lifestyle modification to prevent the complications [7, 8, 33]. It is worth paying attention to the people with inadequate knowledge since it could be a factor of complications and subsequent disability [16]. In addition, morbidity and mortality associated with HTN (CVD, stroke, *etc.*) were found to have a great impact on the country's healthcare systems as well as the economy [2, 11].

A lack of knowledge about the medical treatment was found among the study's participants. Less than a third recognized the availability of the various types of antihypertensive medications and the harmless effect of lifelong intake, which could be an obstacle in screening and controlling HTN and related complications. This finding indicated lower knowledge regarding medical treatment than that reported by other studies [12, 16, 32].

The study results indicated that HTN knowledge was significantly higher among participants from Al-Zarqa and Irbid governorates. The lowest knowledge was reported in Al-Mafraq. This finding accords with a previous Jordanian study that reported good HTN knowledge among the Al-Zarqa population [16]. The four governorates need educational programs but with more focus on Al-Mafraq.

As expected, this study found a significant association between HTN knowledge and the socio-demographic and clinical characteristics, including age, education, employment status, income, insurance, receiving HTN-related information, and family history, which was consistent with previous studies [11, 12, 16, 32, 34]. However, in this study, only the age, education, family history, and receiving HTN information were significant predictors of participants' knowledge.

The study results indicated that being older was a significant predictor of a higher knowledge level. This was inconsistent with the results reported by other studies, which did not find such association [12, 14, 16] or found lower knowledge among older [32, 35]. On the other hand, the findings were congruent with the results of other studies in which knowledge was reported to be higher in older age [34, 36]. This could be a result of the seeking behavior among older adults [36], the prevalence of HTN, and the frequency of visiting healthcare facilities because of other comorbidities, thus having a higher chance of being informed about HTN [7]. In addition, the family history of HTN was a significant predictor of participants' knowledge, which is congruent with previous studies [7, 34, 37]. People with a family history of HTN could learn from their families' experience and are more likely to visit healthcare facilities, thus having a higher chance to receive HTN-related information [7].

As expected, a higher education level was the best predictor for HTN knowledge related to complications, risk factors, symptoms, and treatment, which was congruent with the reported literature [12, 16, 32, 34]. Higher educated people have significantly higher health literacy [38]. Educated people are expected to be more able to find, read, and understand health educational resources [16]. This is also evident in the current study's results, as individuals with higher knowledge were more susceptible to gaining health information. Previous studies also revealed similar results [16, 26, 39, 40]. Moreover, similar to previous studies [14, 16, 40], the most reported information resource in this study was the media (Internet), followed by healthcare providers. However, most of the participants did not obtain HTN-related information. Nurses and other healthcare providers should take the initiative in community-based health education, especially for young age and less-educated adults.

Although HTN is one of the diseases of high prevalence, few campaigns and education are being conducted on the

prevention and control of HTN compared to other diseases. There is a need to establish community-based health education programs regarding the risk factors, symptoms, complications, and management of HTN. Also, the variables that have a significant association with the level of HTN knowledge should be considered when planning and implementing these programs. Improving the public's knowledge of HTN is a key factor to promote the voluntary adoption of healthy lifestyles essential to prevent HTN [7, 8, 33].

Although the study was conducted among the Jordanian public, the findings are consistent with those reported by many studies conducted in several countries and reflective of an important issue worldwide. However, there were a few limitations, such as using a cross-sectional survey and the convenience-sampling technique, narrowing the generalizability. Future research should focus on HTN knowledge to overcome the limitations.

## CONCLUSION

Hypertension is one of the non-communicable chronic diseases associated with long duration and slow progress. Efforts to control HTN necessitate improving public knowledge, thus reducing the cost of medical care and related complications. Results from the present study indicate an inadequate knowledge of HTN's risk factors, symptoms, complications, and medical treatment among Jordanian adults. A lack of HTN knowledge can be an obstacle in the health promotion and control of HTN. These findings have important implications for developing proper and continuous education programs and campaigns for early detection, primary prevention, and control of HTN.

This study provides a population baseline data that can be used as a reference for stakeholders designing healthcare policies and HTN programs to fit Jordanian's needs. Health education and interventions should encompass both clinical and community settings to maintain health and prevent HTN among healthy Jordanian adults to reduce the escalating prevalence of HTN and related complications.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was conducted after obtaining the approval of the Institutional Review Board at the Jordan University of Science and Technology (IRB# 19/93/2016). The consent form was obtained from each participant after explaining the nature and the purpose of the study. Permission to use the Hypertension Knowledge Test after translation and modification was obtained from Han *et al.*, the developers of the instrument.

## HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All human research procedures were followed in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

## CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

## STANDARDS OF REPORTING

STROBE guidelines and methodologies were followed in this study.

## AVAILABILITY OF DATA AND MATERIALS

The data sets used during the current study can be provided from the corresponding author [M.H.A], upon reasonable request.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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