

## Are Symptoms of Anxiety, Depression and Stress Risk Factors for Hypertension?

<sup>1</sup>Abdulbari Bener, <sup>2</sup>Abdulaziz Kamal, <sup>3</sup>Mohammed Al-Banna,

<sup>4</sup>Ahmed A. K. Al-Mulla and <sup>5</sup>Isam-Eldin A. Elbagi

<sup>1</sup>Department of Medical Statistics and Epidemiology, Hamad General Hospital and Hamad Medical Corporation and University of Qatar, Doha, Qatar

<sup>2</sup>Department of Psychology, Faculty of Education, University of Qatar

<sup>3</sup>Department of Psychiatry, Hamad Medical Corporation, Doha, Qatar

<sup>4</sup>Director Smoking Clinic, Hamad Medical Corporation, Hamad General Hospital

<sup>5</sup>Consultant, Family and Community Medicine, West Bay Primary Health Center

**Abstract:** Lay people often mention anxiety, depression and sometimes stress as the most important risk factors for hypertension. Previous studies have supported contradictory either positive or negative to the association between hypertension and stress and anxiety. The aim of the present study was to examine the role of anxiety, depression and stress symptomatology in the subsequent development of hypertension in newly developed oil-rich Qatari population. Cohort as matched case - control study with prospective outcomes. The survey was carried out in urban and semi-urban Primary Health Care Centers (PHCs). The survey was conducted from January to July 2003 among Qatari nationals, age of 25 to 65 years. During the study period, (400 cases and 400 controls) and total 800 subjects were approached, of whom 318 cases and 318 controls were selected for the study, the response rate was 79.5%. Face-to-face interviews were based on a questionnaire that included variables on age, sex, socioeconomic status (SES), parity, income level, cigarette smoking, physical activity, lifestyle, Body Mass Index (BMI) and blood pressure. This study includes a self-report questionnaire based on face-to-face interview on anxiety, depression and stress symptoms. Of the total number of patients surveyed, 46.7% were males and 53.3% females. The mean age (in years) for males versus females was (45.7 years and 41.3 years, respectively ( $p < 0.001$ )). Overweight and obesity was considerably higher among hypertensive subjects ( $p < 0.001$ ). Diabetes mellitus was significantly more common among hypertensive subjects ( $p < 0.001$ ). Most of the hypertensive subjects had the family history of hypertension 37.6%, followed by diabetes mellitus 33.5%. The mean and median scores are significantly higher among hypertensive compared to controls with the respect of anxiety, depression and stress. Furthermore the study suggests there is a positive correlation between hypertension and psychiatric disorders anxiety, depression and stress. The present study revealed that the anxiety, depression and stress are predictive risk factors for the development of hypertension. The characterization of these factors will contribute to defining more effective and specific strategies to screen for and control hypertension and Cardiovascular Disease (CVD).

**Key words:** Epidemiology, hypertension, anxiety, depression, stress, lifestyle, risk factors, state of Qatar

### INTRODUCTION

Depression and anxiety in young adults are some of the factors identified by researchers as increasing long-term risk of high blood pressure. Hypertension has long been established as a strong independent and significant risk factor for cardiovascular disease<sup>[1]</sup>. Although the role of depression in the onset of cardiovascular disease is widely studied continuously<sup>[2-4]</sup>

only few studies have studied the role of anxiety and stress on hypertension and cardiovascular disease. Recently reported an insignificant increased risk of hypertension among depressive patients after 10 years of follow up. However on the other hand has reported an increased relative risk of hypertension associated with depressive symptoms. Another study was conducted on the data obtained from NHANES of 14,000 Americans<sup>[5]</sup> who have been followed since 1975 and it reported that

**Correspondence Author:** Abdulbari Bener, Advisor to WHO Consultant and Head of Dept. of Medical Statistics and Epidemiology Hamad General Hospital and Hamad Medical Corporation PO Box 3050, Doha

the participants answered a questionnaire which evaluated symptoms of depression and anxiety and they had their blood pressure measured ten years later. At the beginning of the study, none of them was considered to be hypertensive whereas after 10 years, the results showed that both anxiety and depression increased the risk of developing hypertension. This study provides some of the strongest evidence to date that stress, anxiety and depression may be risk factors for developing hypertension.

Qatar, like many other developing countries, has witnessed fast change in many aspects of life during the last two decades. The discovery of oil has contributed to significant social change and modernization and Qatar has experienced a rapid transition in its socioeconomic status<sup>[6]</sup>. People in Qatar now enjoy a high standard of living; a substantial improvement over what had prevailed earlier<sup>[6]</sup>. Data available from several eastern Mediterranean countries<sup>[7]</sup> indicate that hypertension is emerging as an important cause of morbidity and mortality.

Many studies have supported a significant correlation between hypertension and depression. Previous studies have addressed the association between stress and changes in blood pressure levels<sup>[6,8,9]</sup>. Depression, anxiety and stress are considered a major risk factor for the development of hypertension<sup>[6,9,10]</sup>, other risk factors-such as nutritional problems, stress, behavioral factors and unhealthy lifestyles-probably also influence the prevalence of hypertension<sup>[6]</sup>. Despite these recent studies the question still remain unanswered as the studies that have tried to measure the relationship of depression and hypertension have known to have limitations<sup>[11]</sup>.

We hypothesize that symptoms of anxiety, depression and stress increases the risk of experiencing hypertension in the Qatari population. The aim of this study was to examine and assess the amount of risk of depression, anxiety and stress has in the subsequent development of hypertension in newly developed Qatari population.

## **MATERIALS AND METHODS**

This is a cohort matched case and control study design performed among adult Qatari population between 25 and 65 years of age between January and March of 2005.

A standard questionnaire was designed for the purpose of this survey including information about socio-demographic characteristics of the subjects, their medical history and psychological disorders. A professional translator translated the questionnaire in Arabic. A

translated Arabic version of the questionnaire was revised by a bilingual consultant in Medicine and then translated back by a bilingual physician who was unfamiliar with the original English version. Both translators made necessary corrections after considering the minor differences that found. The survey instrument was tested on 100 randomly selected subjects with 50 cases and 50 controls who were visiting primary health care centers.

**Psychological measures:** Several self-rating scales have been created to assess symptoms of depression<sup>[12]</sup> and anxiety<sup>[13]</sup> separately. As these conditions often coexist, it has been considered reasonable to use rating instruments that encompass both anxiety and depression simultaneously. Some questionnaires, such as the Hospital Anxiety and Depression Scale (HAD)<sup>[14]</sup> and the Depression Anxiety Stress Scales<sup>[15]</sup>, combine only symptoms of anxiety and depression<sup>[16]</sup>.

**Sample size estimation:** We intended to detect a clinically relevant difference of 5 points on the combined stress, anxiety and depression score with a power of 90%, based on a standard deviation of 20 and a type I error of 5%. The response rate was approximately 70% and based upon that a sample size of 400 cases and 400 controls was required to meet the specific objectives of this study. Of the total of 22 PHC centers available in Qatar, 10 were selected at random. Of these, 8 were located in urban and 2 in semi-urban areas of Qatar. Northern parts of the state of Qatar are fast urbanizing and there are no rural areas in Qatar.

**Selection of hypertensive subjects:** Persons were classified as hypertensive if either of their measured results of systolic blood pressure was  $\leq 140$  mmHg or diastolic blood pressure was  $\leq 90$  mmHg or those who were currently taking antihypertensive medication<sup>[17]</sup>. A total number of 400 hypertensive patients aged 20-65 years were selected by simple random process from PHC Centers and of whom 318 participated and gave a response rate of 79.5%.

**Selection of controls:** Control subjects aged 20-65 years were identified from community as a healthy and if both of their measured of systolic blood pressure  $\leq 140$  mmHg or diastolic blood pressure  $\leq 90$  mmHg or if they were currently not taking antihypertensive medication. This group involved a random sample of 318 healthy subjects who registered with PHC Centers for any reason other than acute or chronic disease.

**Inclusion and exclusion criteria:** The subjects were included in the study if they met the following inclusion criteria. All males and females who were between 20-65 years and who offered consent to participate in the study and who were eligible to participate in the study. The subjects were excluded if any of the exclusion criteria was present. The subject were not in the age group 20-65 years and who refused to give consent and participate in the study. We also excluded pregnant women, subjects with severe medical conditions or psychiatric patients. Also subjects who were currently taking anti-depressive medicines or anti-psychotics were excluded from the study.

Thus the case-control ratio was 1:1 and there were equal number of men and women in the study which is in accordance with their ratio in the whole population. The participants were interviewed by physicians, health educators and nurses concerning their age; gender; nationality; educational level; occupation; place of residence (urban and semi-urban); smoking habits; physical activity; lifestyle; height, weight; eating habits; previous history of hypertension, diabetes and cardiovascular disease; family history of heart attack and stroke; and current use of medications for hypertension and/or diabetes. A current smoker was defined as one who regularly smoked at least one cigarette per day, an ex-smoker was one who had given up smoking for at least 6 months and nonsmoker was a one who had never smoked regularly. Persons who had given up smoking but did not complete six months were considered as current smokers. Patients were classified as physically inactive if they reported not participating in walking, cycling or walking for at least 30 min/day.

The body mass index (BMI) was calculated as the weight in kilograms (with 1 kg subtracted to allow for clothing) divided by height in meters squared. Subjects were classified into three categories: acceptable weight, BMI <25; overweight, BMI 25-29.9 and obese, BMI >30, in accordance with the classification described by Bray<sup>[18]</sup>.

Blood pressure measurement was carried out by trained practical nurses according to the World Health Organization (WHO) standardized criteria<sup>[17]</sup>. WHO, 1999). Blood pressure was measured at home three times, with the patient resting for 10 min after each measurement, from the right upper arm using a random-zero sphygmomanometer with a 14-cm cuff. Blood pressure was recorded to the nearest milliliter of mercury (mmHg). Systolic Blood Pressure (SBP) was recorded at the appearance of the first Korotkoff sound and Diastolic Blood Pressure (DBP) at the disappearance of the fifth Korotkoff sound. The mean value obtained from three readings was used in the analysis. Hypertension was defined according to WHO criteria as SBP > 140 mmHg

and/or DBP > 90 mmHg and/or the use of antihypertensive medication<sup>[19]</sup>.

Student's t-test was used to find the difference between means of two continuous variables and confirmed by a nonparametric Mann-Whitney test. The Fisher exact test (two-tailed) and chi-square test were used to compare frequencies between two or more than two categories. The Spearman rank correlation coefficient was used to evaluate the strength association between two continuous variables. The level  $p < 0.05$  was taken as the cutoff value for significance.

## RESULTS

The total number of patients surveyed, 46.7% were males and 53.3% females. The mean±SD age (in years) for males versus females was (45.7±14.6 and 41.3±13.1). The distribution of selected risk factors among hypertensive and normotensive patients are presented in Table 1. It can be seen that overweight and obesity are considerably higher among hypertensive subjects ( $p < 0.001$ ). Some complications such as diabetes mellitus 22.6%, was statistically significant higher in diabetes mellitus patients only. ( $p < 0.001$ ). On the other hand hormonal disorders 15.7%, Kidney problems 15.7% and heart disease 12.2% did not show any significant difference.

Table 2 shows self reported family history of medical conditions and lifestyle habits of hypertensive patients versus healthy controls. Most of the hypertensive subjects had the family history of hypertension 37.6%, followed by Diabetes Mellitus 33.5%. Also, there was a significant relationship between the hypertensive and normotensive subjects when they had family history of hypertension and diabetes mellitus. 58.6% of the hypertensive subjects were using olive oil and 44.8% of them were having salty food.

Table 3 and 4 present the mean and median score of stress, anxiety and depression among hypertensive and normotensive subjects. The mean scores were significantly higher among hypertensive compared to normotensive subjects.

Furthermore, the correlation matrix suggests very strong relationship between hypertension and socio-demographic factors, anxiety, depression and stress Table 5.

## DISCUSSION

To our knowledge, there are no population-based studies that have examined the effect of anxiety, depression and stress on development of hypertension and its associated risk factors in Arabian Gulf Country. In Qatar, diseases of the circulatory system (ICD 9, 390-459)

Table 1: Demographic information and medical history of hypertensive patients with normotensive patients

		Hypertensive	Normotensive*	p-value
		N=318 n(%)	N=318 n(%)	
Age group	<35	26(8.2)	58(18.2)	<0.001
	35-44	63(19.7)	65(20.4)	
	45-54	88(27.6)	100(31.4)	
	>54	141(44.5)	95(29.9)	
Gender	Male	141(44.2)	156(49.1)	NS
	Female	177(55.8)	162(50.9)	
Marital status	Currently single	72(22.6)	84(26.4)	NS
	Currently married	246(77.4)	234(73.6)	
BMI group (Kg/m <sup>2</sup> )	≤25 (Normal)	20(6.3)	65(20.4)	<0.001
	25-30 (Overweight)	146(45.8)	142(44.7)	
	>30 (Obese)	152(48.0)	111(34.9)	
Education Level	Illiterate	81(25.4)	66(20.8)	NS
	Primary	75(23.5)	69(21.7)	
	Secondary	88(27.6)	96(30.2)	
	University	74(23.5)	87(27.4)	
Smoking status	Smoker	84(26.3)	62(19.5)	0.036
	Ex-smoker	9(2.8)	18(5.7)	
	Non smoker	225(70.8)	238(74.8)	
	Physical inactivity	159(49.8)	172(54.1)	
Medical conditions	Diabetes mellitus	72(22.6)	26(8.2)	<0.001
	Heart disease	39(12.2)	32(10.1)	NS
	Heart attack	17(5.3)	13(4.1)	NS
	Kidney problems	14(4.4)	16(5.0)	NS
	Hormonal disorders	50(15.7)	45(14.2)	NS
Psychological conditions	Anxiety	140(43.9)	86(27.0)	<0.001
	Depression	129(40.4)	72(22.6)	<0.001
	Stress	187(58.9)	152(47.8)	0.005

\* Healthy controls † Not significant

Table 2: Comparison of life style eating and drinking habits among hypertensive patients and normotensive patients

		Hypertensive	Normotensive*	p-value
		N=318 n(%)	N=318 n(%)	Total n(%)
Self-reported family history				
	Hypertension	120(37.6)	59(18.5)	0.001
	Heart attack	43(13.5)	57(17.9)	NS
	Diabetes mellitus	106(33.5)	65(20.4)	0.001
	Stroke	46(14.4)	42(13.2)	NS
Type of oil in food				
	Olive oil	186(58.6)	143(45.0)	0.001
	Vegetable oil	78(24.5)	148(46.5)	<0.001
	Animal fat/butter	55(17.2)	74(23.3)	NS
Type of regular food intake				
	Salty food	143(44.8)	181(56.9)	0.003
	Vegetables	183(57.7)	190(59.7)	NS
	Fruit	172(53.9)	193(60.7)	NS
	Red meat	128(40.1)	162(50.9)	0.007
	Fish/chicken	179(56.1)	211(66.4)	0.009
Hot beverages				
	Arabic coffee	176(55.5)	173(54.4)	NS0
	Turkish coffee	116(36.4)	78(24.5)	0.001
	Tea	147(46.1)	183(57.5)	0.003
	Nescafe	98(30.7)	72(22.6)	0.025

\* Healthy controls † Not significant

Table 3: Stress among hypertensive patients and normotensive patients

	Hypertensive		Normotensive*		p-value
	N=318		N=318		
	Mean±SD	Median	Mean±SD	Median	
Stress (Score 1-5)					
Upset because something happened unexpectedly	2.39±1.34	2.00	2.48±1.31	2.00	NS†
Unable to control important things in life	2.45±1.32	2.00	2.46±1.24	2.00	NS
Felt nervous and stressed	2.55±1.32	3.00	2.59±1.32	3.00	NS
Not feeling confident to handle a personal problems	2.86±1.35	3.00	2.47±1.20	2.00	<0.001
Felt that things are not going your way	3.15±1.28	3.00	2.79±1.19	3.00	<0.001
Felt that you could not cope up with the things you do.	2.52±1.33	2.00	2.45±1.22	2.00	NS
Unable to control irritations in life	3.21±1.26	3.00	2.72±1.18	3.00	<0.001
Did not feel that you were on the top of things	2.89±1.25	3.00	2.64±1.16	3.00	0.008
Angered because things were out of control	2.71±1.20	3.00	2.54±1.29	2.00	NS
Felt that difficulties were piling up so high that could not overcome them	2.71±1.25	2.00	2.56±1.33	2.00	NS

\* Healthy controls † NS= Not significant

Table 4: Anxiety and depression among hypertensive patients and normotensive patients

	Hypertensive		Normotensive*		p-value
	N=318		N=318		
	Mean±SD	Median	Mean±SD	Median	
Anxiety (Score 1-4)					
Feeling tense or wound up	2.38±1.13	2.00	2.26±0.97	2.00	NS†
Frightened feeling as if something awful will happen	2.53±0.90	3.00	2.23±0.96	2.00	<0.001
Worrying thought go through the mind	2.49±0.96	3.00	2.23±1.01	2.00	0.001
Can't sit at ease and relax	2.32±0.85	2.00	2.15±0.91	2.00	0.017
Getting frightened feeling like butterflies in stomach	2.32±0.94	3.00	2.01±0.94	2.00	<0.001
Feeling restless as if to be on a move on	2.30±1.01	2.00	2.24±0.99	2.00	NS
I get sudden feeling of panic	2.53±0.82	3.00	2.13±0.94	2.00	<0.001
Depression (Score 1-4)					
Do not enjoy the things that used to enjoy	2.34±0.82	2.00	2.07±0.89	2.00	<0.001
Unable to laugh and see the funny side of things	2.33±0.92	3.00	2.15±0.90	2.00	0.014
Do not feel cheerful	2.26±0.91	2.00	2.16±0.93	2.00	NS
Feeling as if I am slowed down	2.53±0.93	3.00	2.19±0.97	2.00	<0.001
Lost interest in appearance	2.46±0.92	3.00	2.11±0.97	2.00	<0.001
Unable to look forward with enjoyment of things	2.20±0.89	2.00	1.95±0.88	2.00	<0.001
Cannot enjoy a good book TV or programme	2.05±1.07	2.00	2.09±1.03	2.00	NS

\* Healthy controls † NS= Not significant

Table 5: Matrix correlation for hypertensive with socio demographic, medical and psychological factors

Variables	Hypertension	Age	BMI	Smoking habits	Physical inactivity	Diabetes	Family history of hypertension	Stress	Anxiety	Depression
Hypertension	1.00									
Age	0.170**	1.000								
BMI	0.199**	-0.043	1.00							
Smoking habits	0.064	-0.031	-0.055	1.00						
Physical inactivity	-0.042	-0.014	-0.046	0.016	1.00					
Diabetes	0.199**	-0.063	-0.086*	-0.042	-0.034	1.00				
Family history of hypertension	0.125**	-0.036	-0.058	0.016	0.013	0.013	1.00			
Stress	0.143**	0.149**	0.112**	0.036	-0.049	0.550**	0.181**	1.00		
Anxiety	0.198**	0.256**	0.128**	-0.026	0.049	0.490**	0.560**	0.362**	1.00	
Depression	0.182**	-0.009	0.271**	-0.083*	0.005	0.250**	0.270**	0.267**	0.602**	1.00

\* p value<0.05 \*\* p value<0.01

are the first ranked leading causes of death. In the year 2001, 37.8% and in 2003 20.3% of all deaths were related to circulatory system diseases<sup>[20]</sup>.

Stress, anxiety and depression are more prevalent in population of the modern world. Qatar, like many other developing countries, has witnessed a rapid development in many aspects of life during the last two decades. These

dramatic changes have had a great impact on urbanization and life style in the Qatari community. As a result, with the greater availability of housemaids, cars, sophisticated household appliances, the life style of Qataris has become more sedentary. Anxiety is the emotion that is often accompanied by numerous troublesome physical symptoms which include muscle tension, headache, dry

mouth...etc. The present study tested these specific factors in the Qatari population and revealed that there is a positive correlation between hypertension and psychiatric disorders namely anxiety, depression and stress.

Studies on anxiety, depression and stress in hypertensive subjects have led to inconclusive results. While some investigator reported negative association<sup>[9]</sup> between hypertension and psychiatric disorders namely anxiety, depression and stress, other showed positive association<sup>[8,21]</sup>. It is generally accepted that an increased risk of psychiatric morbidity accompanies the presence of hypertension<sup>[19]</sup>. The present study showed an evidence that psychiatric morbidity is significantly higher among hypertensive group than in the control healthy ones.

Despite the importance of the genetic component in the causation of essential hypertension<sup>[6,22]</sup>, increased blood pressure has been associated with chronic environmental stress<sup>[6,7]</sup>, including employment and lifestyle<sup>[6,23]</sup>. There is also evidence that hypertensive patients have socioeconomic and personality problems in relation to anger, anxiety and control of negative emotions<sup>[19,24]</sup>. This is consistent with the present reported study.

Goldberg *et al.*<sup>[25]</sup> did not show an effect of anxiety or depression on hypertension in white women. Although, a study by Makovitz *et al.*<sup>[26]</sup> showed a positive effect of anxiety or depression on hypertension in middle aged white women. Thus, results of studies of the effect in white women are confirmative with the present. Furthermore, several authors<sup>[8,10,20,27,28]</sup> have noted significant and positive effect of anxiety, depression and stress on hypertension.

Recently it has been reported<sup>[29]</sup> that depression causes a number of psychological problems that may be involved in unfavorable evolution of hypertension such as, it affects one's ability to face illness and it increases medical co-morbidity by contributing to a reduction in physical activity and maintenance of addictive habits such as smoking and sedentary life style. In order to implement effective preventive strategies and achieve a considerable reduction in the prevalence of hypertension, a knowledge of the epidemiology of hypertension and the effects of socio-demographic, economic and behavioral factors is essential.

Further more it leads to a new intervention strategies for treating selective hypertensive patients with stress reduction or other appropriate psychological therapies.

### CONCLUSION

The present study revealed that the anxiety, depression and stress are predictive factors of development of hypertension. The study findings

emphasize the importance of effective prevention and health education programs and campaigns for the early recognition and better control of hypertension.

### ACKNOWLEDGEMENT

The project was supported and funded by Hamad Medical Corporation Grant No. 232.

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