PREVALENCE AND RISK FACTORS ASSOCIATED WITH HYPERTENSION AMONG COLLEGE STUDENT ASSOCIATED WITH BEHAVIORAL FACTORS A RIYADH, SAUDI ARABIA

Ahmed I. Andijani*, Abdulaziz Mohammad Alaiban, Yazeed Fahad Alghulayqah, Abdullah Naif Albugami, Khuloud Mohammed Balkhsal and Thamer Ahmed Alohali

Saudi Arabia.

*Corresponding Author: Ahmed I. Andijani
Saudi Arabia.
Email id: K.aljasser7@outlook.com

INTRODUCTION
Hypertension is defined as a systolic blood pressure (SBP) 140 mm Hg or more, or a diastolic blood pressure (DBP) 90 mm Hg or more in adults.

Its one of the most common medical problems worldwide and is the leading cause of cardiovascular disease, Its significant public-health and clinical challenges for both economically developed and developing nations.

Afflicts almost 1 billion people worldwide and is a leading cause of morbidity and mortality. More than 20% of Americans are hypertensive, and one-third of these Americans are not even aware they are hypertensive.

The prevalence of hypertension in Saudi Arabia was 26.1%. For males and 28.6% for females one of the primary preventable causes for cardiovascular disease and premature death worldwide is hypertention. Universal mean blood pressure (BP) has remained constant or has decreased slightly over the past four decades, consequential to the wide use of antihypertensive medications.[1]

Hypertension is defined as a systolic blood pressure (SBP) 140 mm Hg or more, or a diastolic blood pressure (DBP) 90 mm Hg or more in adults. Refrenc????

National reports since 2000 have indicated that low- and middle-income countries had an increase in the prevalence of hypertension while it has been invariable or decreasing in high income countries.[2]

Little work has been done in promoting primary prevention for hypertension, however impressive gains have been done in improving detection, treatment and control over last several decades. Several factors can contribute to lowering blood pressure, such as healthy diet and increasing physical activity as supported accumulated evidence.[3]

Some of the regional divergency in the prevalence of hypertension could be explained by the diversity in the levels of risk factors, such as high sodium intake, low potassium intake, obesity, alcohol consumption, physical inactivity and unhealthy diet.[1]

Hypertension is the leading cause of death in Saudi Arabia as estimated by the Global Burden of Disease in 2010. Total number of death due to hypertension from cardiovascular and circulatory diseases accounted for about 24%, while death from urogenital, blood, and endocrine diseases due to hypertension accounted about 1.87%.[4]

The prevalence of hypertension in Saudi Arabia was 26.1%. For males and 28.6% for females (what year? Refrence??)

The aim of this study is to estimate the prevalence of hypertension in the city of Riyadh, Saudi Arabia. As well as identifying the most common associated risk factors such as age, gender, life style, physical activity, healthy food consumption, in hope of of prevention, control and treatment.

METHODOLOGY
To address this issue, we conducted this survey aiming to identify prevalence and risks factors like obesity/overweight that association with hypertension in college students.

Associated with behaviour factors, after identify the most common risk factors that association with hypertension its will be help us to prevent it We expect at least 500 will participate in the survey in Riyadh.

DISCUSSION

Our study showed that the overall prevalence of hypertension was 10%, which is comparable to a few previous studies. The less recent one was done at 2005 which reported a prevalence a of 11.5% between the age groups of 15-64. Moreover, a more recent study which was conducted in 2013 in the kingdom was Saudi Arabia, has reported prevalence of 917,188 (7.1%) out of 12,000 participants.[4]

The result of this study shows that, shows a significate result for the number of women affected by hypertension with a P value of 0.011. which comparable with very few studies in literature but contradicts many previous studies that stated that men are more susceptible to be diagnosed with hypertension.[1,4,5] One recent study done in Alkharj, Saudi Arabia had similar results to our study with the female participant being more affect than males with hypertension.[6]

The results also indicates that the older the individuals are the more they are affected by hypertension, as the major number of participants were young and aged from 20-29 years but had the lowest percentage of 7%, and the fewer number of participant 38 that ager >40 years had the highest percentage 39%. Which is comparable to many previous studies, as age is considered one of the major, non-modifiable risk factors, this indicates that with advancing in age the higher the risk for hypertension.[1,4,5,6]

Participants social statues (married/single/widowed) were affected to some degree, as Divorced/separated/widowed individuals were more affected by hypertension rather than single and married ones. Which is similar to what a recent study indicated about how being single has high risk to be diagnosed with hypertension and pre-hypertension.[6]

Modifiable risk factors such as high BMI, unhealthy diet, smoking, alcohol consumption and regular measuring for blood pressure had a big impact on being diagnosed with hypertension. Furthermore, high BMI being one of the major risk factors with a P value of 0.009. These results are similar to a recent study done in Urban Varanasi in 2017 that stated that overweight and obesity measured by both BMI and waist circumference had a major impact on being affected with hypertension.

One of the most significant non modifiable risk factors for hypertension are having other co-morbidities and family history for hypertension with both having a p value of < 0.001. These results are agreeable with more than one previous study, that co-morbidities as diabetes, high cholesterol level and having renal diseases greatly affect being diagnosed with high blood pressure.[5,7]

One of these studies assessed cardiometabolic risk factors by assessing the serum cholesterol level and HGA1C level in hypertensive and pre-hypertensive individuals. It was found that hypertensive individuals had a high serum cholesterol and low LDH level in comparison to pre-hypertensive individuals, in addition level of HGA1C was high in both hypertensive and pre-hypertensive individuals.[6]

One of the limitations of this study is the small sample size, as well as the data being self-reported and not collected from patient medical record, in addition to some individuals may be undiagnosed in addition some patients could not know the difference between hypertension pre-hypertension.

Further research is needed to establish individuals' awareness, control, level and access to treatment. As well as look for other risk factors as having depression or anxiety. furthermore, is assessing how an intervention with healthy diet, increasing physical activity as well as smoking and alcohol cessations can affected the diagnosis and prognosis of hypertension.

RESULT

Demographic Profile

A total of 414 people took part in this survey. Male participants dominated the study by 63% and majority of the sample were single (70%). There were 78% participants aged 20-29 years, 13% aged 30-39 years, 7% aged 40-49 years, and the remaining 2% aged above 50 years. The vast majority work on the weekend accounting for 85% of the total sample while 15% work more than 3 days. Over half mentioned working 8 hours per day (56%).

Table 1: *The sociodemographic characteristics of the participants.*

Variable	Frequency	Percentage
Gender		
Male	259	63%
Female	155	37%
Age Group		
20-29	324	78%
30-39	52	13%
40-49	28	7%
≥ 50	10	2%
Status		
Single	287	70%
Married	102	25%

Divorced / widowed	23	6%
Ethnicity		
White	209	51%
Asian	143	35%
Hispanic or Latino	27	7%
Black	19	5%
American Indian	11	3%
Total days of work per week		
more than 3 days	63	15%
only weekend	349	85%
Working hours per day		
Less than 8 hours per day	134	32%
8 hours per day	232	56%
12 hours per day	47	11%

Table 2 presents the characteristic of the participants related to their health behaviours and conditions. Over half (56%) were in healthy weight but only 29% of them have healthy diet. Majority (60%) take 3-4 meals per day but only 23% have sufficient vegetable intake and 17% have sufficient fruit consumption. Less than half (46%) have low physical activity, 28% have moderate physical activity and only 8% with high physical activity. The vast majority respondents did not consume alcohol (88%) an did not smoke (69%).

Table 2: *Health behaviours and conditions of the participants.*

Variable	Frequency	Percentage
BMI		
Healthy weight (BMI < 25)	230	56%
Overweight & Obese (BMI >= 25)	183	44%
Diet		
Healthy diet	120	29%
Unhealthy diet	292	71%
Number of meals per day		
Less than 2 Meals	127	31%
3- 4 Meals	249	60%
More than 4 Meals	38	9%
Vegetable intake		
Insufficient	132	32%
Normal	186	45%
Sufficient	93	23%
Fruit consumption		
Insufficient	171	42%
Normal	171	42%
Sufficient	69	17%
Frequency of coffee consumption		
one	192	47%
two	115	28%
three and more	103	25%
Alcohol consumption		
Yes	48	12%
No	365	88%
Smoking		
Current smokers	130	31%
Non-smokers	283	69%
Physical activity		
Low	192	46%
Moderate	157	38%
High	32	8%
Never	32	8%
Family history of hypertension		
Yes	219	53%

No	194	47%
Co-existing disease		
Yes	55	13%
No	356	87%
Measuring blood pressure regularly		
Yes	88	21%
No	323	79%

Prevalence of Hypertension across Demographic Profile

Out of 412 respondents, 42 of them were reported to have hypertension, showing a hypertension prevalence of 10%. The prevalence is 8% among males and 14% among females. Generally, the prevalence of hypertension increases as the age increases. It was 39% among older age group of above 40 years and below 10% among younger age group (20-29 years). Total days of work per week does not show any different in hypertension prevalence. These percentages of hypertension prevalence across demographic variables are summarized in Table 3 and shown in Figure 2.

Table 3: *Prevalence of hypertension across demographic variables.*

|	Total Sample	Frequency of Hypertension	% Hypertension
Gender			
Male	258	21	8%
Female	154	21	14%
Age Group			
20-29	322	21	7%
30-39	52	6	12%
40+	38	15	39%
Status			
Single	285	22	8%
Married	102	12	12%
Divorced/separated/widowed	23	8	35%
Working hours per day			
Less than 8 hours per day	134	19	14%
8 hours per day	231	19	8%
12 hours per day	47	4	9%
Total days of work per week			
more than 3 days	63	6	10%
only weekend	348	35	10%
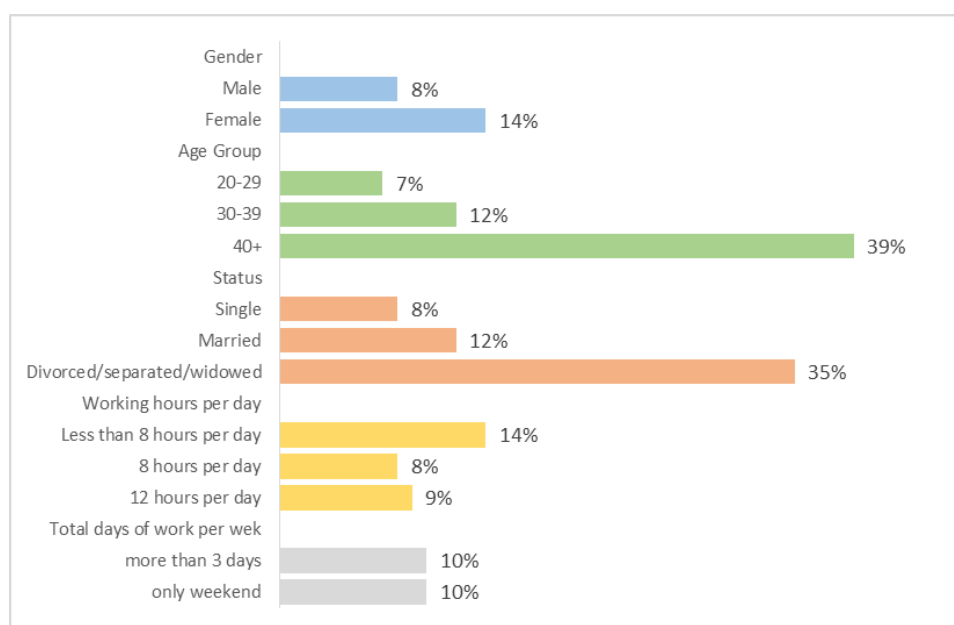
Figure 1: *Prevalence of hypertension across demographic variables.*

Association between Hypertension and Health Behaviours and Conditions

Table 3 summarizes the association between hypertension and health behaviours & conditions. Prevalence of hypertension is higher among those people with overweight & obese, unhealthy diet, smokers, consuming alcohol, co-existing disease, and do regular blood pressure measure. The association between these variables were measured using odds ratio for risk factors consisting of two categories only. Higher odds ratio was found between hypertension and co-existing disease with odds ratio of 57.67, meaning the odds of getting hypertension among people with co-existing disease is about 57 times among people without co-existing disease. The lowest odds ratio was for diet variable, showing that the odds of getting hypertension among those without healthy diet is 34% higher than those with healthy diet.

Table 3: *Prevalence of hypertension across demographic variables.*

Variable	n	Frequency of Hypertension	% Hypertension	Odds Ratio (OR)
BMI				
Overweight & Obese (BMI above 25)	183	31	17%	4.04
Healthy weight (BMI below 25)	229	11	5%	
Diet				
Unhealthy diet	292	32	11%	1.34
Healthy diet	119	10	8%	
Smoking				
Current smokers	130	23	18%	3.14
Non-smokers	281	18	6%	
Alcohol Consumption				
Yes	48	20	42%	11.63
No	363	21	6%	
Family history of hypertension				
Yes	219	36	16%	6.13
No	193	6	3%	
Co-existing disease				
Yes	55	33	60%	57.67
No	355	9	3%	
Measuring blood pressure regularly				
Yes	88	29	33%	12.70
No	322	12	4%	
Physical Activity				
Low	191	15	8%	
Moderate	157	12	8%	
High	32	7	22%	
Never	32	8	25%	
Vegetable Intake				
Insufficient	131	13	10%	
Normal	186	12	6%	
Sufficient	93	17	18%	
Fruit Consumption				
Insufficient	170	13	8%	
Normal	171	10	6%	
Sufficient	69	18	26%	
Coffee consumption				
One	192	24	13%	
Two	114	12	11%	
Three and more	103	6	6%	

Multiple Logistic Regression Analysis

A multiple logistic regression analysis is carried out to see determine the risk factors for hypertension. In this case, hypertension variable is considered as the dependent variable in the model while health behaviours and conditions and also sociodemographic variables are treated as predictors in the model. A total of 14 predictors are considered as potential risk factors in the logistic regression model; they are are age group, gender, status, diet status, alcoholic, smoking status, physical activity, BMI, family history of hypertension, vegetable intake, fruit consumption, coffee consumption, co-

existing disease, and regular measure of blood pressure. The parameter estimates from fitting multiple logistic regression model are presented in Table 4. It can be seen that not all predictors have significant effect on hypertension. Thus, unimportant risk factors are eliminated from the model by using stepwise regression model. The reduced model consists of only 7 significant risk factors.

Table 4: *Parameter estimates for multiple logistic regression model.*

	Estimate	Odds Ratio	Std. Error	z value	P-value
(Intercept)	-7.431		1.290	-5.761	<0.001*
Age group *(reference cat: <30 years)*					
Age30+	0.834	2.304	0.814	1.026	0.305
Gender *(reference cat: Male)*					
Female	1.642	5.164	0.642	2.556	0.011*
Status *(reference cat: Single)*					
Divorced/separated/widowed	0.048	1.049	1.178	0.041	0.967
Married	-0.395	0.674	0.865	-0.456	0.648
Diet *(reference cat: Unhealthy diet)*					
Healthy diet	-0.373	0.688	0.689	-0.542	0.588
Alcoholic *(reference cat: No)*					
Yes	0.835	2.304	0.685	1.219	0.223
Smoking Status *(reference cat: Smokers)*					
Current smokers	0.229	1.257	0.605	0.378	0.705
Physical Activity *(reference cat: Low)*					
Never	1.471	4.356	0.758	1.941	0.052
High	-0.025	0.976	0.978	-0.025	0.980
Moderate	-0.780	0.458	0.689	-1.132	0.258
BMI *(reference cat: Healthy weight)*					
Overweight & Obese	1.486	4.419	0.642	2.315	0.021
Family history of hypertension *(reference cat: No)*					
Yes	1.903	6.703	0.667	2.854	0.004*
Vegetable Intake *(reference cat: Insufficient)*					
Normal	0.127	1.135	0.837	0.151	0.880
Sufficient	0.586	1.797	0.785	0.747	0.455
Fruit Consumption *(reference cat: Insufficient)*					
Normal	0.419	1.521	0.813	0.516	0.606
Sufficient	0.154	1.167	0.810	0.190	0.849
Coffee Consumption *(reference cat: 1 or 2)*					
Three or more	-0.957	0.384	0.789	-1.212	0.225
Co-existing Disease *(reference cat: No)*					
Yes	2.948	19.070	0.644	4.575	<0.001*
Regular measure of blood pressure *(reference cat: No)*					
Yes	1.515	4.547	0.593	2.553	0.011*

Significant at 5% level

Table 5 reports the comparison between the full model considering 14 risk factors and the reduced model by retaining only 7 significant risk factors using Chi-square test. The result shows that the reduced model is fitted better than the full model $(\chi^2(8) = 4.754, p = 0.784)$. Thus, we can conclude that the fitted logistic model is improved by eliminating insignificant risk factors from the model.

Table 5: *Chi-square test to compare the full and reduced model.*

	Residual df	Residual Deviance	Df	Deviance	p-value
Reduced Model	391	113.05			
Full Model	383	108.3	8	4.754	0.784

Table 6 summarizes the estimated parameters in the reduced model. Co-existing disease was found significant and have the greatest risk factors for hypertension (OR = 22.343, p < 0.001). The odds of getting hypertension for people with co-existing disease is 22.343 times the odds for people without co-existing

disease when other variables are held constant. The second greatest risk factor is family history of hypertension (OR = 5.920, p = 0.004). The odds of hypertension is 5.920 times for those with family history of hypertension than those without history when other variables held constant in the model. Gender is the only sociodemographic variable found significant in the model (OR = 4.012, p = 0.012). The risk of hypertension is higher among female than male. The odds of getting hypertension among female is 4.012 times the odds of hypertension among male when other variables held constant in the model.

Table 6: *Parameter estimates for the reduced multiple logistic regression model.*

	Estimate	**Odds Ratio**	**Std. Error**	**z value**	**P-value**
(Intercept)	-6.939	0.001	0.975	-7.120	<0.001*
Gender *(reference cat: Male)*					
Female	1.389	4.012	0.555	2.502	0.012*
Alcoholic *(reference cat: No)*					
Yes	0.960	2.611	0.623	1.542	0.123
Physical Activity *(reference cat: Never)*					
Never	1.322	3.750	0.708	1.866	0.062
High	-0.016	0.984	0.859	-0.019	0.985
Moderate	-0.891	0.410	0.659	-1.351	0.177
BMI *(reference cat: Healthy weight)*					
Overweight & Obese	1.517	4.557	0.584	2.597	0.009*
Family history of hypertension *(reference cat: No)*					
Yes	1.778	5.920	0.621	2.865	0.004*
Co-existing disease *(reference cat: No)*					
Yes	3.107	22.343	0.586	5.304	<0.001*
Regular measure of blood pressure *(reference cat: No)*					
Yes	1.678	5.356	0.544	3.084	0.002*

*Significant at 5% level

REFERENCES
1. Mills KT, Stefanescu A, He J. The Global Epidemiology of Hypertension [Internet]. Nature News. Nature Publishing Group; 2020 [cited 2021Nov20]. Available from: https://www.nature.com/articles/s41581-019-0244-
2. Mills KT, Katherine T. Mills From Department of Epidemiology, Bundy JD, Joshua D. Bundy From Department of Epidemiology, Kelly TN, Tanika N. Kelly From Department of Epidemiology, et al. Global disparities of hypertension prevalence and control [Internet]. Circulation. 2016 [cited 2021Nov20]. Available from: https://www.ahajournals.org/doi/10.1161/CIRCULA TIONAHA.115.018912?url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org&rfr_dat=c r_pub++0pubmed.
3. Leung AA, Bushnik T, Hennessy D, McAlister FA, Manuel DG. Risk factors for hypertension in Canada. Health reports [Internet]. Statistics Canada. Government of Canada, Statistics Canada; 2019 [cited 2021Nov20]. Available from: https://www150.statcan.gc.ca/n1/pub/82-003-x/2019002/article/00001-eng.htm.
4. El Bcheraoui C, Memish ZA, Tuffaha M, Daoud F, Robinson M, Jaber S, et al. Hypertension and its associated risk factors in the Kingdom of Saudi Arabia, 2013: A national survey [Internet]. International Journal of Hypertension. Hindawi; 2014 [cited 2021Nov20]. Available from: https://www.hindawi.com/journals/ijhy/2014/56467 9/
5. Aldiab A, Shubair MM, Al-Zahrani JM, Aldossari KK, Al-Ghamdi S, Househ M, et al. Prevalence of hypertension and prehypertension and its associated cardioembolic risk factors; a population based cross-sectional study in ALKHARJ, Saudi Arabia [Internet]. BMC public health. BioMed Central; 2018 [cited 2021Nov20]. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC626 7095/
6. Singh S, Shankar R, Singh GP. Prevalence and associated risk factors of hypertension: A cross-sectional study in urban Varanasi [Internet]. International Journal of Hypertension. Hindawi; 2017 [cited 2021Nov20]. Available from: https://www.hindawi.com/journals/ijhy/2017/54918 38/
7. Mills KT, Katherine T. Mills From Department of Epidemiology, Bundy JD, Joshua D. Bundy From Department of Epidemiology, Kelly TN, Tanika N. Kelly From Department of Epidemiology, et al. Global disparities of hypertension prevalence and control [Internet]. Circulation. 2016 [cited 2021Nov20]. Available from: https://www.ahajournals.org/doi/10.1161/CIRCULA TIONAHA.115.018912?url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Acrossref.org&rfr_dat=c r_pub++0pubmed