ID Design Press, Skopje, Republic of Macedonia
Open Access Macedonian Journal of Medical Sciences. 2019 Mar 15; 7(5):831-837.
https://doi.org/10.3889/oamjms.2019.046
eISSN: 1857-9655
Public Health

Prevalence of Risk Factors for Diabetes Mellitus and Hypertension Among Adult in Tabuk - Kingdom of Saudi Arabia

Nagwa A. Mohamed[1,2*]

[1]Nursing Department, Umuljj University College, University of Tabuk, Tabuk, Kingdom of Saudi Arabia; [2]Faculty of Nursing, Assiut University, Assiut, Egypt

Citation: Mohamed NA. Prevalence of Risk Factors for Diabetes Mellitus and Hypertension Among Adult in Tabuk - Kingdom of Saudi Arabia. Open Access Maced J Med Sci. 2019 Mar 15; 7(5):831-837. https://doi.org/10.3889/oamjms.2019.046

Keywords: Cardiovascular Risk Factors; Hypertension; Diabetes Mellitus; Saudi Arabia

***Correspondence:** Nagwa A. Mohamed. Nursing Department, Umuljj University College, University of Tabuk, Tabuk, Kingdom of Saudi Arabia; Faculty of Nursing, Assiut University, Assiut, Egypt. E-mail: n-mohamed@ut.edu.sa

Received: 30-Oct-2018; **Revised:** 08-Jan-2019; **Accepted:** 09-Jan-2019; **Online first:** 14-Mar-2019

Funding: This research was financially supported by the Deanship of Scientific Research (DSR), University of Tabuk, Tabuk, Saudi Arabia, under grant no. S-1439-0028

Competing Interests: The authors have declared that no competing interests exist

Abstract

BACKGROUND: Cardiovascular disease (CVD) is a common but chronic condition that can cause death, and is seen as a substantial source of disability and health costs. A balance between prevention and intervention, as is the case with other infectious diseases, is the best way to stem the increasing burden of CVD.

AIM: This study assesses the prevalence of diabetes mellitus, hypertension, in a sample from the University of Tabuk.

METHODS: A cross-sectional study was done in 2018, with 120 employees and students at the University of Tabuk (in Tabuk City, Saudi Arabia), for those over age 20 (60 males and 60 females) from different faculties and departments at the university.

RESULTS: Assessment was done with 120 participants to assess the prevalence of hypertension and diabetes mellitus, at the University of Tabuk, in which the prevalence is actually higher than in most cities of Saudi Arabia. Ten percent of participants are hyperglycemic and 10% are developing problems in that area, with no significant difference between males and females.

CONCLUSION: This study shows that cardiovascular risk factors will influence those with major health disorders in the future. Consequently, a nationwide campaign encouraging wholesome eating, better lifestyles, as well as physical activity, is a healthcare priority.

Introduction

Cardiovascular diseases (CVD) are one of the most common chronic diseases that cause death and are a substantial source of chronic disability and health costs [1]. The major identified risk factors for CVD include high blood pressure, high blood glucose, serum lipid abnormalities, smoking, obesity, low fruit/vegetable intake, and physical inactivity. Studies have indicated that these risk factors are widespread globally.

Most developing countries in the Middle East countries are in a stage of epidemiologic transition, which is the transition from infectious to chronic diseases [2]. These countries are also experiencing a major transition in the lifestyle patterns regarding the nutritional habits, physical activity and certain habits (such as smoking). In Saudi Arabia, there is little information about the influence of changes in lifestyle such as the reduction of physical activity and dietary habits on the prevalence of diabetes mellitus, hypertension and hypercholesterolemia. Consequently, these changes are occurring rapidly in Saudi Arabia.

CVD can be prevented if the community acquires appropriate information, education and communication on possible risk factors. Most of the risks are attributable to lifestyle and behavioral patterns and can be changed [3]. Therefore, determining the burden of risk factors for CVD in the population helps to design and implement promotional

and preventive measures. In the developing world, a wide gap exists between the reality of the chronic disease burden and response to it. If the emergence and prevention of risk factors are left undirected, the growth of the problem will continue accelerating [4], [5].

A systematic Literature review carried out by Colosia, et al., (2013) [6] the link between Diabetes Mellitus and Hypertension is discussed. It was found that the patients of diabetes mellitus are very much likely to have hypertension as well. It was identified that diabetes and hypertension are correlated with each other in a sense that their root cause is obesity. Through literature search of different databases the correlation of hypertension and obesity with type II diabetes has been investigated.

The article titled carried out by Saeed, *et al*., (2011) [7] encompasses the different variables related to prevalence, control, awareness and treatment of hypertension. During the study with sample population, the predictors identified are gender, environmental setup, social environment, physical activity and obesity. Though the prevalence of hypertension is found to be high in sample population but awareness and control practices are minimal which needs the introduction of a proficient awareness program to control the prevalence in Saudi Arab population.

Another significant study titled *Prehypertension among young adult females in Dammam* carried out by Koura et al., in 2012 [8]. This study investigates the prevalence of hypertension in young females through studying the sample population from four universities in Dammam. By conducting questionnaire 13.5% females, have the condition of prehypertension and they were unaware of it. The sources of this prevalence are physical inactivity, obesity, and unhealthy lifestyle.

A study *Diabetes Mellitus in Saudi Arabia* carried out by Al-Nozha, *et al.,* in (2004) [9] identified prevalence of the Diabetes Mellitus in the Saudi people among both genders as well as rural and urban communities. It covers the environmental and physiological causes and factors which resulted in the occurrence of disease. Furthermore, study also identifies different health risk associated with diabetes majorly Coronary Artery Disease (CAD)

Another study *Prevalence of diabetes mellitus in rural Saudi Arabia* carried out by Fatani, Mira & El-Zubier in 1987 [10] focuses on the occurrence of the Diabetes Mellitus in the rural areas of the Saudi Arabia. This study deals with the different prevalence and underlying reasons of diabetes in a different environmental setup like rural and urban areas. Through statistical analysis of BMI and blood glucose level in relation to the economic and social condition of the different sample population, the effect of environmental factors have been studied.

In the study *Therapeutic Management of Hypertension and Hyperlipidemia in Type-2 Diabetes Mellitus Patients in Southwestern Region of Saudi Arabia: A Pharmacist Perspective* carried out by Khan, Venkatachalam, Alakhali, Alavudeen, Ck & Ansari in 2014 [11] encompasses the hyperlipidemia in the patients of diabetes mellitus, and provides the identifications of the ways to manage the occurrence and the treatment of hyperlipidemia. Through different therapeutic treatments, systolic HTN can be controlled better in comparison to diastolic.

The article *Prevalence of Obesity and Some Related Attributes among Umm Al-Qura University Female Students in Makkah, Saudi Arabia* (2013) by Abdelhafiz, et al., [12] is about the occurrence of the disease in the female university going healthy females of the society. In the year of 2009-10, 224 students were selected from Umm Al-Qura University, and values of weight, glucose level, BMI, waist-hip ratio were collected. Statistical analysis showed that prevalence of obesity is observed to be 25% due to different social, physical and psychological factors.

Methods

A cross-sectional study was conducted with 120 employees and students at the University of Tabuk, Umluj City kingdom of Saudi Arabia during 2018. Subjects were aged 20 or more years (60 males and 60 females) from different faculties of the University.

The cross-sectional design facilitates observations of some subset of the population at the same time with respect to the independent variables (Polit and Beck, 2004) [13]. A correlation study is an efficient and effective design for collecting large amounts of data regarding certain phenomena (Polit and Beck, 2012) [14].

The sample size was subjected to a power analysis using a power estimation of 0.80 and a medium effect size for a two-tailed test with alpha = 0.05 as the minimum. The adequate sampling size for the study was 120 respondents.

Accordingly, a random sample consisting of employees working in both the male and female campuses were recruited for personal interviews using a questionnaire, clinical examination and body/laboratory measurements. The largest division was by gender. These groups were sub-categorized into four age groups. There were equal numbers in the gender categories, but males and females are not equally numerous in the overall population; their comparative proportions vary with age.

We developed a structured self-administered questionnaire with 25 questions and employing a 4-

point Likert scale to evaluate participants age, sex, level of education, socioeconomic status, presence of risk factors for cardiovascular diseases (family history and pre-existing medical conditions like diabetes mellitus, hypertension and hyperlipidemia). The Cronbach's alpha score was 0.825.

Blood pressure measurements were conducted in the morning upon participant's arrival at the study sites. Participants were advised not to eat or drink anything before measurements, and we ensured that the participants had not consumed coffee or smoked before coming to the study because this may affect blood pressure measurements. Blood pressure was measured using a mercury sphygmomanometer (KBM, sm-500, Japan). Two blood pressure readings were taken on the upper left arm with the participant in a seated position after at least 5 to 10 minutes of rest. The average of the two readings was used in this analysis. Hypertension is defined as ≥ 140/90 mmHg in accordance with the WHO Classification of Hypertension (NIH, 2008) [15].

A blood sample was collected by a qualified phlebotomist. Blood samples were separated within 6 to 8 hours of specimen collection and stored at (2-8°C). These were batch tested by a senior technician. The instruments were calibrated daily based on standardized procedures. Fasting blood glucose, total cholesterol, triglycerides, HDL-cholesterol, and LDL-cholesterol levels were measured using spectrophotometer (Optima, sp-300, Japan). Participants were diagnosed with diabetes mellitus if they had fasting blood glucose level of ≥ 126 mg/dl while fasting blood glucose between > 100 and < 125 was considered impaired fasting blood glucose level (CDC, 2011). High cholesterol was defined as ≥ 240 mg/dl. High triglyceride levels were defined as ≥ 200 mg/dl. Low HDL-cholesterol was defined as < 35 mg/Dl for men and < 40 mg/dl for women. The LDL-cholesterol was estimated using the Friedewald formula [i.e., LDL = total cholesterol-HDL-(TG/5)] [16], [17], [18]. High LDL-cholesterol was defined as ≥ 160 mg/dl.

Different methods of data analysis were performed including descriptive analysis and inferential statistical analysis. Descriptive statistics for the demographic data and other questionnaire items were presented using means, standard deviations and P-values. A variety of statistical tests were used to identify the differences between groups such as the independent sample t-test and analysis of one-way variance (ANOVA ≤ 0.05). The sample size was calculated to identify the main outcome variables being measured as well as the instrument used to measure those variables and the anticipated differences between groups (Gerrish and Lacey, 2010) [19].

A medium effect size was expected because this is a very common practice in the field of study [20]. It has been argued that obtaining more responses from the survey site increases its statistical power [21].

Ethical approval for the study was obtained from the research ethical committee of the University of Tabuk on Sep. 20, 2018, Number: S-1439- 0028. Each participant was provided with an information sheet that clarified the aim of the study, the rights of the participants, the assessment process, the process for completing the survey and the use of the collected data. The information sheet also stated that all information provided by the participants would remain anonymous and that privacy would be guaranteed. The information sheet also provided contact details for any queries. The participants were advised about the voluntary nature of participation in the study and informed that they had the option to refuse without penalty or loss of benefit(s). Also, it was made that the study findings would be presented in a format that makes it impossible to identify the participants.

Results

The first group was 20–35 years and contained 20.8% of the subjects. The second group was 36-45 years and contained 21.7% of the subjects. Most participants were in the third group (46-55 years) and fourth age group (> 55 years) with 33.3% and 24.2%, respectively. Moreover, 62.5% of the participants were Saudis and 37.2% were non-Saudis.

Table 1: Participants' distribution regarding to demographic characteristics of the risk factors associated with development of diabetes and hypertension

Demographics	Frequency	Percent
Gender		
Male	60	50%
Female	60	50%
Age		
(20-35)	25	20.8%
(36-45)	26	21.7%
(46-55)	40	33.3%
above 55	29	24.2%
Level of education		
School	24	20%
Diploma	22	18.3%
Undergraduate	13	10.8%
Graduate	61	50.8%
Job Position		
Employees	58	48.3%
Students	62	52.7%
Nationality		
Saudi	75	62.5%
Non Saudi	45	37.5%
Marital Status		
Single	28	23.3%
Married	80	66.7%
Divorce	7	5.8%%
Widowed	5	4.2%

General blood pressure mean for systolic and diastolic was 126.6/85.2 ± 13.9/11.2 mmHg; there were steady additions with both ages. Triglycerides and total cholesterol levels were measured on all subjects. The overall percentage of abnormal cholesterol level was 17.5%. Mean total cholesterol level for female participants was significantly higher than for males (160.1 vs. 157.3, p < 0.047). The mean

values of total cholesterol found here are mostly higher than those levels stated earlier from the general Saudi population [22] and some other studies on Americans and Europeans [23] but comparable to some other studies done somewhere else [24].

Fasting sugar testing showed that 10% of the participants were hyperglycemic, and 10% were on the borderline with no significant differences between males and females. Thus, this research shows an increase in the prevalence of diabetes mellitus versus previous Saudi studies.

Triglycerides and total cholesterol levels were measured on all subjects. The overall percentage of abnormal cholesterol level was 17.5%. Mean total cholesterol level for female participants was significantly higher than for males (160.1 vs. 157.3, $p < 0.047$). The mean values of total cholesterol found here are mostly higher than those levels stated earlier from the general Saudi population [22] and some other studies on Americans and Europeans [23] but comparable to some other studies done somewhere else [24].

Table 2: Frequency and Percentage of Laboratory Blood Tests

Laboratory Blood Tests	Frequency	Percent
Blood Pressure		
Less than 140/90	95	79.2%
More than 140/90	25	10.8%
Fasting Blood Sugar		
70-99 mg/dl	96	72.5%
100-126 mg/dl	12	10%
More than 126 mg/dl	12	10%
Cholesterol		
Less than 180 mg/dl	99	82.5%
More than 180 mg/dl	21	17.5%
Triglycerides		
Less than 200 mg/dl	98	81.7%
More than 200 mg/dl	22	18.3%

Table 3 presents the frequency and percentage of the HDL level among male and female participants. According to the Table 3, 16.6% of the participants had HDL level less than 35 mg/dl. The abnormal HDL level among male participants was higher than females (20% vs. 13.3%, respectively). ANOVA analysis between the different age groups with LDL shows that F and P-values were 6.68 and < 0.001 respectively. In addition, analysis amongst different age groups with HDL for women demonstrates that F and P-values were 3.95 and .013 correspondingly. This shows a significant relationship and demonstrates that there is an impact of age on the LDL and HDL for female participants. On the other hand, analysis among different age groups with HDL for men indicates a non-significant relationship with F and P-values of 1.80 and 0.157 respectively (Table 4).

Table 3: HDL Frequency and Percentage Differences between Male and Female

HDL	Male		HDL	Female	
	Freq.	Perc.		Freq.	Perc.
More than 35 mg/dl	42	80%	More than 40	52	86.7%
Less than 35 mg/dl	12	20%	Less than 40	8	13.3%

Table 4 present statistical analysis with ANOVA values for results of the relationship between age with blood pressure, fasting blood sugar, cholesterol and triglycerides. Table 4 shows that blood pressure ANOVA analysis among different age groups had F and P-values of 3.62 and 0.015, respectively. This is a significant relationship and demonstrates that there is an impact of age on blood pressure. Table 4 also showed that ANOVA analysis between different age groups with fasting blood sugar. Here, F and P-values were 2.30 and 0.081 respectively, which demonstrate the non-significant relationship between different age groups and fasting blood sugar. Detailed ANOVA analysis information of the research participants, including the relationship between age with cholesterol and triglycerides, is presented in Table 4.

Table 4: ANOVA Analysis with Age Groups

	F	P-value
Blood Pressure	3.62	0.015
Fasting Blood Sugar	2.30	0.081
Cholesterol	4.62	0.004
Triglycerides	3.99	0.009
LDL	6.68	< 0.001
HDL for male	1.80	0.157
HDL for female	3.95	0.013

Table 5 displays statistical analysis with Independent Sample T-Test values for findings for the relationship between job with blood pressure, fasting blood sugar, cholesterol and triglycerides. The Independent Sample T-Test analysis between students and employee groups for blood pressure had T and P-values of 2.72 and 0.046, respectively (Table 5). This shows a significant relationship and demonstrates the impact of job on blood pressure. Detailed Independent Sample T-Test statistics of the research participants-including the relationship between job and diabetes, cholesterol and triglycerides-are shown in Table 5. Matrix among hypertension and diabetes mellitus with lipid profiles using Pearson's Product-Moment correlation.

Table 5: T-Test of participants regarding their job related to hypertension, diabetes and hyperlipidemia

	T	P-value
Blood Pressure	2.72	0.046
Fasting Blood Sugar	2.93	0.035
Cholesterol	2.76	0.048
Triglycerides	2.6	0.05

It is clear from Table 6 that there was a strong positive correlation between hypertension and triglycerides, cholesterol, HDL for male, HDL for female and LDL ($r = 0.765^{**}$, $r = 0.790^{**}$, $r = 0.896^{**}$, $r = 0.746^{**}$ and 0.845^{**} at P-value < 0.001). In addition, all lipid profiles correlated positively with diabetes mellitus. In fact, the correlation between hypertension and lipid profiles was stronger than the correlation.

Table 6 shows the distribution of waist to height ratios over the recommended (> 0.5) level in 16.8% of the Participants, which represents a risk for cardiovascular diseases and diabetes. Also, a positive family history of diabetes, hypertension, or both was found in 26.7% of the participants.

Table 6: Correlation between diabetes mellitus and lipid profiles

		Triglycerides	Cholestero	H.D.L. Male	H.D.L. female	L.D.L.
Hypertension	Pearson Correlation	0.765**	0.790**	0.896**	0.746**	0.845**
	P value	<0.001	<0.001	<0.001	<0.001	<0.001
Diabetes Mellitus	Pearson Correlation	0.560**	0.555**	0.592**	0.478**	0.574**
	P value	<0.001	<0.001	<0.001	<0.001	<0.001

** Correlation is significant at the 0.01 level (2-tailed).

About 43.3% of the participants habitually watched television or played video games for more than 3 hours a day, every day, which is regarded as a risky sedentary habit. Risky dietary habits included the consumption of carbonated drinks or sugary fruit juices daily (36.7%). Also 17% of the Participants admitted to having food outside the home, particularly fast food from branded outlets, on more than 3 days of the week instead of consuming homemade food.

Table 7: Distribution of the risk factors associated with development of diabetes and hypertension among participants

Risk factors	No. participants (n = 120)	%
Waist-to-height ratio (WHR > 0.5)	14	16.8%
Positive family history for diabetes and/or hypertension	32	26.7%
Mostly outside food intake	21	17.5%
Sedentary activities for more than 3 hours per day	52	43.3%
Carbonated drinks/fruit juice	44	36.7%

Discussion

This study measured the prevalence of CVD risk factors. The study was validated with the WHO STEPS rules and testing strategies that included a straightforward and irregular examining method. This study is the first of its kind in the nation to attempt all three segments of WHO STEPS in a group setting. The low response rate might influence the genuine dispersion of the risk factors, and the results should be translated with caution. The prevalence of hyperlipidemia is growing markedly and it is one of the main contributors to the occurrence of several diseases due to its pathophysiological connection to other cardiovascular risk factors such as diabetes mellitus and hypertension [25].

The predominance of hypertension (10.8%) is simlar to that in Butajira, Ethiopia [26] and a meta-analysis (25 studies) from 10 sub-Saharan African nations [27]. Our value is lower than in Addis Ababa, Ethiopia (Tesfaye, 2008) [26] and systematic review of studies in Europe and North America (Wolf-Maier et al., 2003) [28]. The conceivable purposes behind the distinction could be varieties of study populaces in socio-demographic and economic characteristics. The prevalence of hypertension was more than two times higher in urban than rural zones. This is consistent with discoveries in Ethiopia (Tesfaye, 2008) [26] and the systematic review of sub-Saharan studies (Addo *et al.,* 2007) [28]. No significant differences were observed between males and females in terms of hypertension-this contrasts with the Ethiopian study (Tesfaye, 2008) [26] and review of European and North American researches (Wolf-Maier et al., 2003) [28]. However, the results in a review of sub-Saharan Africa did not indicate reliable distinction crosswise over nations (Addo *et al.,* 2007) [26].

This research indicated that hypertension affects less than a quarter of the participants, which agrees with an earlier national study (Al-Nozha *et al.*, 2007) [9]. Of note, our mode age is 10-15 years young than that in corresponding studies in developed nations [29]. This demonstrates the worldwide burden of hypertension is extensive and expanding suggesting the need for urgent intervention. This study demonstrated the significant relationship of hypertension with age in both genders and with national and global studies in many populations the different geographic, social, and financial attributes [30], [31].

Globally, the prevalence of diabetes mellitus will be a rise of 42% from 2003 to 2025. The prevalence in the Gulf area is highest in Bahrain (25.7%) and Oman (16.1%) [32], [33]. This research indicated a further escalation in the prevalence of diabetes mellitus in association with earlier studies carried out in Saudi Arabia. The dramatic rise in the diabetes mellitus prevalence can be clarified by the disorder of advanced years. About 29% of the participants over 55 have diabetes. Studies carried out in Saudi Arabia have diverse age-specific prevalence rates. This study shows an increase in diabetes mellitus prevalence in the elderly. Indeed, this relationship between diabetes and age is consistent with earlier studies [34], [35].

The prevalence of diabetes mellitus (10%) and borderline diabetes (10%) is similar to the results of Al-Nozha, *et al.,* in 2004 [34] that recognized the prevalence of diabetes mellitus in the Saudi population in both males and females. Another study by Fatani, *et al.,* (1987) [10] reported the rate of diabetes mellitus in rural Saudi Arabia-both studies were consistent with this study. Worldwide, the prevalence of diabetes mellitus is similar in males and females, but it is slightly higher in females at < 60 years of age and in males < 60 years old. This was not detected in this research. Hyperlipidemia is reaching advanced prevalence rates in Saudi Arabia. Moreover, these findings show that hypercholesterolemia (HC) (total cholesterol < 180 mg/dl) and hypertriglyceridemia (HT) (total triglycerides < 200 mg/dl) are prevalent health problems that affect around 18% of the Saudi community. This increases the risk for Coronary Artery Disease (CAD) and other disorders related to excess lipids. Clearly, the HC and HT prevalence increase with age. This finding suggests that CAD will soon be the main health problem. Increasing physical activity, a reduction in obesity and implementing healthier nutrition habits should be of considerable

interest to Saudi Arabian citizens.

A cross-sectional national epidemiological study was carried out in Saudi Arabia involving of 4539 Saudi participants over the age of 15 years (Al-Nuaim, *et al.,* 1996) [36]. The prevalence of HC (5.2-6.2 mmol/l) was 9% and 11% for all male and female participants, respectively (P = 0.74). The prevalence of HC (> 6.2 mmol/l) was 7% and 8% for male and female participants, respectively (P = 0.52). However, the HC in our study was 17.5% in both male and female participants. Thus, our study indicated a further increase in the prevalence of HC. Other principal risk factors explored in this study showed that the waist-to-height ratio (WHtR) was more than the recommended limit in 16.8% of the participants. Many studies have supported the use of WHtR inclusively in identifying at risk populations with prevalence ranging from 10-23%.

This study also revealed that 38.9% of the participants had a positive family history for diabetes and hypertension which independently is a strong predictor of its occurrence in later years. This finding is supported by studies that points to an overwhelming genetic predisposition towards this disease and consanguinity as one of the primary reasons for it. In fact, the World Health Organization has declared physical inactivity to be one of the top five risk factors for premature mortality. Dietary choices like preference for food outside the home (fast food, restaurant meals, etc.) was found among 11.5% of the participants, coupled with a higher intake of carbonated drinks or sugary fruit juices (36.4%) signaling a high risk for obesity and overweight among participants, in this study.

In summary, the prevalence of hypertension and diabetes mellitus found in the Umluj City, University of Tabuk, is higher than the prevalence stated in most cities of Saudi Arabia, Attar (2015) [37]. The prevalence of cardiovascular risk factors is higher than in other previous Saudi studies Abdelhafez, (2013) [12]. Despite having a younger population, Tabuk Umluj City had a high prevalence of cardiovascular risk factors. Indeed, even higher than European and North American countries. This implies there will eventually be an increase in the prevalence of hypertension and diabetes a as the population ages unless preventive policies are presented. The data suggest that cardiovascular risk factors influence individuals and will be major health disorders in the future. Consequently, a nationwide campaign encouraging healthy diet and lifestyle should be promoted.

Acknowledgment

The Authors would like to acknowledge financial support for this work, from Deanship of Scientific Research (DSR), University of Tabuk, Tabuk, Saudi Arabia, under grant no. S-1439-0028. Also, we would like to thank the participants of the University of Tabuk in Umluj City, Saudi Arabia, this study would not have been possible without their assistance.

References

1. Strong K, Mathers C, Leeder S, Beaglehole R. Preventing chronic diseases: how many lives can we save? The Lancet. 2005; 366(9496):1578-82. https://doi.org/10.1016/S0140-6736(05)67341-2

2. Santosa A, Wall S, Fottrell E, Högberg U, Byass P. The development and experience of epidemiological transition theory over four decades: a systematic review. Global health action. 2014; 7(1):23574. https://doi.org/10.3402/gha.v7.23574 PMCid:PMC4038769

3. World Health Organization. Preventing chronic diseases: a vital investment. Geneva: WHO, 2012.

4. Jamison DT, Breman JG, Measham AR, Alleyne G, Claeson M, Evans DB, Jha P, Mills A, Musgrove P, editors. Disease control priorities in developing countries. The World Bank, 2006.

5. Unwin N, Setel P, Rashid S, Mugusi F, Mbanya JC, Kitange H, Hayes L, Edwards R, Aspray T, Alberti KG. Noncommunicable diseases in sub-Saharan Africa: where do they feature in the health research agenda? Bulletin of the World Health organization. 2001; 79:947-53. PMCid:PMC2566676

6. Colosia AD, Palencia R, Khan S. Prevalence of hypertension and obesity in patients with type 2 diabetes mellitus in observational studies: a systematic literature review. Diabetes, metabolic syndrome and obesity: targets and therapy. 2013; 6:327. https://doi.org/10.2147/DMSO.S51325 PMCid:PMC3785394

7. Saeed AA, Al-Hamdan NA, Bahnassy AA, Abdalla AM, Abbas MA, Abuzaid LZ. Prevalence, awareness, treatment, and control of hypertension among Saudi adult population: a national survey. International journal of hypertension. 2011; 2011.

8. Koura MR, Al Dabal BK, Rasheed PA, Al Sowielem LS, Makki SM. Prehypertension among young adult females in Dammam, Saudi Arabia, 2012.

9. Al-Nozha MM, Abdullah M, Arafah MR, Khalil MZ, Khan NB, Al-Mazrou YY, Al-Maatouq MA, Al-Marzouki K, Al-Khadra A, Nouh MS, Al-Harthi SS. Hypertension in Saudi Arabia. Saudi medical journal. 2007; 28(1):77-84.

10. Fatani HH, Mira SA, El-Zubier AG. Prevalence of diabetes mellitus in rural Saudi Arabia. Diabetes care. 1987; 10(2):180-3. https://doi.org/10.2337/diacare.10.2.180

11. Khan NA, Venkatachalam V, Alakhali KM, Alavudeen SS, Ck D, Ansari SMA. Therapeutic Management of Hypertension And Hyperlipidemia In Type-2 Diabetes Mellitus Patients In Southwestern Region Of Saudi Arabia: A Pharmacist Perspective. Asian Journal of Pharmaceutical and Clinical Research. 2014; 17:3143–3421.

12. Abdelhafez AM, Al-Mashi SM. Prevalence of obesity and some related attributes among umm al-Qura University female students in Makkah, Saudi Arabia. Pak J Nutr. 2013; 12(3):275-84. https://doi.org/10.3923/pjn.2013.275.284

13. Polit DF, Beck CT. Nursing research: Generating and assessing evidence for nursing practice. Lippincott Williams & Wilkins, 2008.

14. Polit DF, Beck CT. Nursing research: Principles and methods. Lippincott Williams & Wilkins, 2004.

15. World Health Organization. The global burden of disease: 2004 update. Geneva: WHO; 2008. The term "burden of disease"

indicates the gap between actual and ideal health status. t is measured in disability adjusted life years (DALY), a combination of years of life lost due to premature mortality and time lived in less than full health, 2012.

16. Expert Panel on Detection E. Executive summary of the third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III). Jama. 2001; 285(19):2486. https://doi.org/10.1001/jama.285.19.2486

17. Shojaei M, Jahromi AS, Ebadat H, Moosavy SH, Seddigh B, Madani A. Anti-β2 glycoprotein-i antibody in acute myocardial infarction. American Journal of Applied Sciences. 2011; 8(8):758-61. https://doi.org/10.3844/ajassp.2011.758.761

18. Johnson R, McNutt P, MacMahon S, Robson R. Use of the Friedewald formula to estimate LDL-cholesterol in patients with chronic renal failure on dialysis. Clinical chemistry. 1997; 43(11):2183-4.

19. Gerrish K, Lacey A. The research process in nursing. John Wiley & Sons, 2010.

20. Watson R, McKenna H, Cowman S, Keady J, editors. Nursing Research: Designs and Methods E-Book. Elsevier Health Sciences, 2008.

21. Kemper EA, Stringfield S, Teddlie C. Mixed methods sampling strategies in social science research. Handbook of mixed methods in social and behavioral research. 2003:273-96.

22. Al-Hazzaa H, Sulaiman AM, Al-Mottairrtk KF, Al-Attas OS. Prevalence of coronary arl'ery disease risk factors in Saudi children, 1993.

23. Tell GS, Tuomilehto J, Epstein FH, Strasser T. Studies of atherosclerosis determinants and precursors during childhood and adolescence. Bulletin of the World Health Organization. 1986; 64(4):595.

24. Kafatos AG, Panagiotakopoulos G, Bastakis N, Trakas D, Stoikidou M, Pantelakis S. Cardiovascular risk factor status of Greek adolescents in Athens. Preventive medicine. 1981; 10(2):173-86. https://doi.org/10.1016/0091-7435(81)90072-4

25. Sibai AM, Nasreddine L, Mokdad AH, Adra N, Tabet M, Hwalla N. Nutrition transition and cardiovascular disease risk factors in Middle East and North Africa countries: reviewing the evidence. Annals of Nutrition and Metabolism. 2010; 57(3-4):193-203. https://doi.org/10.1159/000321527

26. Tesfaye F. Epidemiology of cardiovascular disease risk factors in Ethiopia: the rural-ruban gradient (Doctoral dissertation, Epidemiologi och folkhälsovetenskap), 2008.

27. Addo J, Smeeth L, Leon DA. Hypertension in sub-saharan Africa: a systematic review. Hypertension. 2007; 50(6):1012-8. https://doi.org/10.1161/HYPERTENSIONAHA.107.093336

28. Wolf-Maier K, Cooper RS, Banegas JR, Giampaoli S, Hense HW, Joffres M, Kastarinen M, Poulter N, Primatesta P, Rodríguez-Artalejo F, Stegmayr B. Hypertension prevalence and blood pressure levels in 6 European countries, Canada, and the United States. Jama. 2003; 289(18):2363-9. https://doi.org/10.1001/jama.289.18.2363

29. Perkovic V, Huxley R, Wu Y, Prabhakaran D, MacMahon S. The burden of blood pressure-related disease: a neglected priority for global health. Hypertension. 2007; 50(6):991-7. https://doi.org/10.1161/HYPERTENSIONAHA.107.095497

30. Erem C, Hacihasanoglu A, Kocak M, Deger O, Topbas M. Prevalence of prehypertension and hypertension and associated risk factors among Turkish adults: Trabzon Hypertension Study. Journal of Public Health. 2008; 31(1):47-58. https://doi.org/10.1093/pubmed/fdn078 PMid:18829520

31. Singh RB, Fedacko J, Pella D, Macejova Z, Ghosh S, De AK, Begom R, Tumbi ZA, Memuna H, Vajpeyee SK, De Meester F. Prevalence and risk factors for prehypertension and hypertension in five Indian cities. Acta cardiologica. 2011; 66(1):29-37. https://doi.org/10.1080/AC.66.1.2064964 PMid:21465750

32. Al-Lawati JA, Al Riyami AM, Mohammed AJ, Jousilahti P. Increasing prevalence of diabetes mellitus in Oman. Diabetic medicine. 2002; 19(11):954-7. https://doi.org/10.1046/j.1464-5491.2002.00818.x PMid:12421434

33. Hamadeh R. Noncommunicable diseases among the Bahraini population: Prevention & Management of DM complications, Guideline for Diabetes Mellitus Management in Family Practice, 2000: 6–24.

34. Al-Nozha MM, Al-Maatouq MA, Al-Mazrou YY, Al-Harthi SS, Arafah MR, Khalil MZ, Khan NB, Al-Khadra A, Al-Marzouki K, Nouh MS, Abdullah M. Diabetes mellitus in Saudi Arabia. Saudi medical journal. 2004; 25(11):1603-10. PMid:15573186

35. Wild SH, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030 response to Rathman and Giani. Diabetes care. 2004; 27(10): 2569-2569. https://doi.org/10.2337/diacare.27.10.2569-a

36. Al-Nuaim AR, Al-Rubeaan K, Al-Mazrou Y, Al-Attas O, Al-Daghari N. Prevalence of hypercholesterolemia in Saudi Arabia, epidemiological study. International journal of cardiology. 1996; 54(1):41-9. https://doi.org/10.1016/0167-5273(96)02555-7

37. Attar SM. Hyperlipidemia in rheumatoid arthritis patients in Saudi Arabia: Correlation with C-reactive protein levels and disease activity. Saudi medical journal. 2015; 36(6):685. https://doi.org/10.15537/smj.2015.6.10557 PMid:25987110