DOI: 10.7860/JCDR/2023/64472.18721

Original Article

Physiology Section

Gender-wise Distribution of Cardiovascular Risk and its Correlation with Dietary Intake, Physical Activity, and Perceived Stress: A Cross-sectional Study

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ABSTRACT

Introduction: Cardiovascular Diseases (CVDs) are a group of disorders affecting the heart and blood vessels, including Coronary Heart Disease (CHD), cerebrovascular disease, rheumatic heart disease, peripheral artery disease, congenital heart disease, and pulmonary embolism. CVDs contribute to approximately 17.9 million deaths worldwide each year. Risk factors for CVDs can be classified as non modifiable (such as age, gender, ethnicity, and family history) and modifiable (such as obesity, dyslipidaemia, diabetes, hypertension, stress, poor diet, and physical inactivity). Men are more susceptible to CVDs than women. The QRISK3 risk score is an algorithm used to predict an individual's 10 year risk of developing CVDs.

Aim: To assess the distribution of CVD risk among men and women aged 30-70 years using the QRISK3 risk score and its correlation with dietary intake, physical activity, and perceived stress.

Materials and Methods: A cross-sectional study was conducted at the Department of Physiology at RUHS-CMS and Associated Hospitals in Jaipur, Rajasthan, India. The study duration was six months, from July 2022 to December 2022. A total of 220 subjects, aged 30-70 years, of both sexes were recruited from the Outpatient Department (OPD) of Medicine, based on inclusion and exclusion criteria. The QRISK3 web calculator was used to calculate the CVD risk, which was then correlated with the Food Frequency Questionnaire (FFQ), Perceived Stress Scale (PSS), and Global Physical Activity Questionnaire (GPAQ). Statistical analysis was performed using the Chi-square test for qualitative analysis, and Pearson's correlation analysis was used to assess correlations.

Results: The mean age of the study participants (males) was 42.75±10.86 years and (females) was 42.82±10.85 years. A total of 220 participants (123 males and 97 females) aged between 30-70 years were included in the study. Among the males, 90 (73.17%) had low CVD risk, 15 (12.19%) had moderate risk, and 18 (14.63%) had high risk. Among the females, 83 (85.57%) had low risk, 9 (9.28%) had moderate risk, and 5 (5.15%) had high risk. There was a significant association between the QRISK3 risk score and gender (χ^2=6.14, df=218, p=0.04). Males showed a stronger association with the QRISK3 risk score compared to females within different age groups. Significant positive correlations were observed between the QRISK3 score and FFQ (r=0.28) and PSS (0.42). Additionally, a significant negative correlation was found between the QRISK3 score and GPAQ (-0.24).

Conclusion: The QRISK3 score calculator was found to be useful in assessing the 10-year risk of developing CVDs in males and females across different age groups. The association between CVD risk and various scores suggests that perceived stress is strongly correlated with CVD risk.

Keywords: Cardiovascular disease, Food frequency questionnaire, Risk factors, Rheumatic heart disease

INTRODUCTION

Non Communicable Diseases (NCDs) are a broad category of chronic illnesses that cannot be spread. They are defined as diseases of long duration, generally slow progression, and are the major cause of adult mortality and morbidity worldwide [1]. Approximately 41 million people die each year from NCDs worldwide, accounting for around 71% of all fatalities [2]. NCDs also account for 48% of the healthy life years lost, known as Disability Adjusted Life Years (DALYs), worldwide [3]. The major four NCDs are CVD, Chronic Respiratory Conditions (CRC), malignancies, and diabetes. Each year, approximately 17.9 million people die worldwide due to CVDs, followed by cancers (9.3 million) WHO, 2021 [4]. The total number of CVD cases nearly doubled from 271 million in 1990 to 523 million in 2019, and CVD-related fatalities rose sharply from 12.1 million in 1990 to 18.6 million in 2019 [5].

The CVD risk factors are classified into two broad categories. non modifiable risk factors include age, gender, ethnicity, and family history of CVD. Modifiable risk factors include smoking, dyslipidaemia, diabetes, hypertension, abdominal obesity, lack of daily consumption of fruits and vegetables, lack of physical activity, regular alcohol consumption, and psychosocial factors (e.g., depression, perceived stress, and life events). The identification of modifiable risk factors suggests that aggressive risk factor adjustment in individuals at risk of acquiring the disease can prevent a significant number of CVD cases. Therefore, research has focused on identifying those at the highest risk of developing CVD for over 40 years, allowing effective prevention and treatment methods to be directed towards them [6].

Males are more likely than females to develop CHD and often experience CVD at a younger age. In contrast, women have a higher risk of developing a stroke, which often occurs as they age [7,8]. Women are comparatively protected against CVD before menopause [9]. Premenopausal women have an overall reduced risk of CVD, which is typically attributed to the cardioprotective effects of oestrogen [9-11]. As oestrogen levels gradually decrease after puberty, men are likely to experience heart disease 10 to 15 years earlier than women [12].

In contrast, males over 70 years have a decreased total CV risk compared to women aged 50 years, which is the usual age of menopause in women [13]. The present finding strongly implies that the reduction of oestrogen affects CVD risks more in women than

in men, with upto 2-4 times higher risk at the onset of menopause [14]. Consequently, middle-aged men often have higher rates of stroke and CHD mortality than middle-aged women [15,16].

Several CV risk scoring systems are currently available for different population groups, such as the Framingham Risk Score (RiskFRS) [17,18], Prospective Cardiovascular Munster Score (PROCAM) [19], Systemic Coronary Risk Evaluation (SCORE) [20], World Health Organisation/International Society of Hypertension (WHO/ISH) risk prediction charts (RiskWHO) [21], the American College of Cardiology/American Heart Association (ACC/AHA) pooled cohort equations (RiskACC/AHA) [22], and the 3rd iteration of Joint British Societies' risk calculator (RiskJBS) [23]. These risk algorithms are based on epidemiological data and are applicable only to the populations from which the data was derived. Unfortunately, none of the currently available risk prediction models are based on Indian data, despite the inclusion of Indian ethnicity as a risk factor in the QRISK3 risk score.

In the present study, CV risk was assessed using the QRISK3 risk score, which takes into account the presence and severity of various major CVD risk factors. The QRISK3 prediction algorithm is used to estimate the 10-year risk of CVD in women and men [24]. A 10 year risk of less than 10% is generally considered low risk, 10%-19% indicates intermediate risk, and 20% or higher indicates high risk.

The explosive increase in the prevalence of CVD is due to the adoption of unhealthy lifestyle practices by individuals who are at risk of developing the disease. Lack of physical activity, psychosocial factors (e.g., depression, perceived stress, and life events), and unhealthy diets have emerged as important modifiable risk factors not only for CVD but also for other chronic non communicable diseases like diabetes.

There are very few studies in India, that have reported the distribution of CVD risk in men and women and their correlation with dietary intake, perceived stress, and physical activity is lacking [25,26]. The rationale of the present study was to help identify CV risk and provide a strategy for physicians to intervene and treat high-risk individuals properly. The present study also raised the awareness among people about their CV risk score and CVD risk factors. Therefore, the present study was undertaken with the aim of analysing the gender-wise distribution of CVD risk among the 30-70 years age group population and its correlation with dietary intake, perceived stress, and physical activity. The objectives of the study were to determine the gender-wise distribution of CV risk factors among study participants, assess the correlation of QRISK3 risk score with GPAQ, PSS, and FFQ scores in male and female participants, and assess the correlation of QRISK3 risk score with GPAQ, PSS, and FFQ scores in the total study participants.

MATERIALS AND METHODS

A cross-sectional study was carried out in the Department of Physiology at RUHS-CMS and Associated Hospitals, Jaipur, Rajasthan, India. The study duration was six months, from July 2022 to December 2022. The study was done, after obtaining approval from the Institutional Ethics Committee (IEC/P-17/2022).

Inclusion criteria: Individuals between the ages of 30-70 years, of either sex, who provided written informed consent, and were attending the medicine OPD at RUHS-CMS and associated hospitals, Jaipur, were included in the study.

Exclusion criteria: Individuals with any previously diagnosed coronary artery disease, pregnant or nursing mothers, and individuals with mental illnesses (such as schizophrenia or bipolar disorder) were excluded from the study.

Sample size calculation: The sample size of 220 was calculated using the formula $n=\frac{z^2\times p\times q}{e^2}$, with a confidence interval of 95%, a margin of error of 5%, and a non response rate of 10%, based on the prevalence of 14.1% of CVD [27].

Study Procedure

After screening 1400 patients, a total of 220 individuals of both genders, aged 30-70 years, attending the medicine OPD, were recruited after providing prior information via the Patient Information Sheet (PIS) and obtaining written informed consent from them. Anthropometric data, including age, gender, height, weight, and waist/hip ratio, were recorded, and the Body Mass Index (BMI) was calculated. Each subject's BMI was calculated as weight in kg divided by height in square meters [28]. Sociodemographic variables such as geographic area, marital status, educational status, and socioeconomic status were also recorded [29]. CVD family history and detailed medical history were collected. Dietary intake was assessed using the FFQ [30]. The nutrient value of each food item was calculated using a scoring key [30]. Perceived stress was assessed using the PSS [31]. Individual scores on the PSS can range from 0 to 40, with higher scores indicating higher perceived stress. Scores ranging from 0-13 were considered as low stress, 14-26 as moderate stress, and 27-40 as high perceived stress [31]. Physical activity was assessed using the GPAQ [32]. According to WHO guidelines, physical activity was calculated in terms of a person's overall energy expenditure {Metabolic Equivalent of Task (MET) minutes per week) using GPAQ data. The following MET values were used: <600 MET minutes/week - physically inactive, 600-1200 MET minutes/week - active, and >1200 MET minutes/week - highly active [32,33]. Blood pressure was recorded for all subjects in a sitting position on the right arm using a standard mercury sphygmomanometer. The mean and Standard Deviation (SD) of systolic blood pressure readings were taken into consideration. After an overnight fasting of 8-10 hours, venous blood samples (5 mL) were collected using aseptic technique and subjected to various routine laboratory investigations, such as total cholesterol, High-density Lipoprotein Cholesterol (HDLC), fasting blood glucose, and Glycated Haemoglobin (HbA1c).

The CVD risk was calculated for each subject using the QRISK3 web calculator, and subjects were categorised as low risk (<10%), moderate risk (10-20%), and high risk (>20%) individuals, according to their QRISK3 risk score [34].

STATISTICAL ANALYSIS

Statistical analysis was performed using International Business Machines (IBM) Statistical Package for Social Sciences (SPSS) version 21.0 software. The Kolmogorov-Smirnov test was conducted to test the normality of the variables. Mean and SD were calculated for individual quantitative parameters. Continuous variables were compared using Student's t-test, while categorical variables were compared using the Chi-square test. A p-value <0.05 was considered statistically significant. Associations were assessed using Chi-square tests of association, and a p-value <0.05 was considered significant. Pearson's correlation analysis was conducted to assess correlations.

RESULTS

The study was conducted on 220 participants, of which 123 were males and 97 were females. [Table/Fig-1] shows that the mean age of males was 42.75±10.86 years and females was 42.82±10.85 years (p=0.96). The mean Body Mass Index (BMI) of males was

S. No.	Anthropometric parameters (mean±SD)	Male	Female	t-value	p-value
1.	Age (in years)	42.75±10.86	42.82±10.85	0.047	0.96
2.	Height (cm)	168.17±8.21	165.01±8.19	-2.838	0.005**
3.	Weight (kg)	67.62±11.23	63.68±11.21	-2.586	0.01*
4.	BMI (kg/m^2)	23.89±3.97	22.69±3.96	-2.228	0.02*
5.	W/H ratio	0.95±0.11	0.93±0.10	-1.393	0.16

[Table/Fig-1]: Distribution of anthropometric parameters in male and female participants.
W/H: Waist-to-hip; Unpaired t-test, p-value <0.05 significant*; <0.001 highly significant**

23.89±3.97 Kg/m^2 and females was 22.69±3.96 Kg/m^2, which is significantly higher in males than in females (p=0.02).

[Table/Fig-2] shows the distribution of study participants according to their sociodemographic variables. According to the geographic area, 68.6% of the people are from urban areas. A total of 77.3% of the study participants are married. According to educational status, 25.9% of the study participants have a middle school certificate. According to socioeconomic status, 41.4% of the participants are from the upper lower class. [Table/Fig-3] shows the distribution of CVD risk factors between males and females. The mean blood pressure was significantly higher in females (p=0.02). The mean Fasting Plasma Glucose (FPG) level of males was significantly higher (p=0.03) than in females. Significantly higher values of total cholesterol (p=0.03) and HDLC (p=0.008) were observed in females.

Sociodemographic variables		Frequency (n)	Percentage (%)
Geographic area	Rural	69	31.4
	Urban	151	68.6
Marital status	Married	170	77.3
	Unmarried	43	19.5
	Widowed	7	3.2
Education of head of family	Illiterate	14	6.3
	Primary	44	20
	Middle school certificate	52	23.6
	High school certificate	25	11.3
	Intermediate or diploma	17	7.7
	Graduate	39	17.7
	Postgraduate	29	13.1
Socioeconomic status	Upper class	6	2.7
	Upper middle class	36	16.4
	Lower middle class	75	34.1
	Upper lower class	91	41.4
	Lower class	12	5.5

[Table/Fig-2]: Distribution of study participants according to their sociodemographic variables.
Descriptive analysis

S. No.	Cardiovascular (CV) risk factors	Male	Female	t-value	p-value
1.	Pulse (beats/ minute)	82.86±10.57	82.81±10.53	-0.035	0.97
2.	Blood pressure (mmHg)	126.20±13.21	130.54±15.21	2.263	0.02*
3.	Fasting Plasma Glucose (FPG) (mg/dL)	105.84±17.29	100.83±17.25	-2.136	0.03*
4.	HbA1c (%)	5.59±1.04	5.48±0.91	-0.823	0.41
5.	Total cholesterol (mg/dL)	206.62±40.57	218.88±42.49	2.179	0.03*
6.	HDL cholesterol (mg/dL)	49.29±10.44	53.05±10.56	2.639	0.008*
7.	Total/HDL cholesterol	4.19±1.09	4.12±1.08	-0.475	0.63
8.	FFQ score (kcal)	2224.31±785.03	2013.13±770.39	-1.997	0.04*
9.	PSS score	23.24±5.33	25.24±5.34	2.761	0.006*
10.	GPAQ score (MET minute/ week)	1155.51±698.89	1154.82±696.59	-10.56	0.000**

[Table/Fig-3]: Gender-wise distribution of Cardiovascular (CV) risk factors among study participants.
HbA1c: Glycated hemoglobin; HDL: High-density lipoprotein; FFQ: Food frequency questionnaire; PSS: Perceived stress scale; GPAQ: Global physical activity questionnaire; Unpaired t-test, p-value <0.05 significant*; <0.001 highly significant**

Mean FFQ score (p=0.04) and mean GPAQ score were (p<0.001) found to be significantly higher in males, whereas mean PSS score was significantly higher in females (p=0.006). [Table/Fig-4] shows the distribution of CV risk score (QRISK3 score) in males and females. Among the 123 males, 90 (73.17%) had low CVD risk, 15 (12.19%) had moderate risk, and 18 (14.63%) had high CVD risk. On the other hand, among the females, 83 (85.57%) had low, 9 (9.28%) had moderate, and 5 (5.15%) had high CVD risk. QRISK3 risk score is significantly associated with gender (χ^2=6.14 df=218, p=0.04).

Gender	QRISK3 categories			Total	Chi-square (p-value)
	0-10 (Low) n (%)	10-19 (Moderate) n (%)	>20 (High) n (%)		
Male	90 (73.17)	15 (12.19)	18 (14.63)	123	6.14 (0.046)**
Female	83 (85.57)	09 (9.28)	5 (5.15)	97	

[Table/Fig-4]: Distribution of Cardiovascular (CV) risk (QRISK3 risk score) in male and female participants (N=220).
Chi-square test, p-value <0.05; significant

[Table/Fig-5] shows the distribution of CVD risk factors in men and women according to different age groups. Both males and females have a highly significant association with QRISK3 score categories; however, males are more significantly associated than females.

Gender	Age group (in years)	QRISK3 categories			Total n=220	Chi-square (p-value)
		0-10 (Low) n=173	10-19 (Moderate) n=24	>20 (High) n=23		
Male	30-40	77	0	0	77	111.15 (<0.001)
	41-50	12	0	3	15	
	51-60	1	4	6	11	
	61-70	0	11	9	20	
Female	30-40	36	1	1	38	38.15 (<0.001)
	41-50	27	0	0	27	
	51-60	17	3	1	21	
	61-70	3	5	3	11	

[Table/Fig-5]: Distribution of Cardiovascular (CV) risk (QRISK3 risk score) in male and female participants among different age groups.
Chi-square test, p-value <0.05 significant; <0.001 highly significant

[Table/Fig-6] shows the age-wise comparison of CV risk between males and females. In the age group 30-40 years, there is no significant association of QRISK3 score categories between males and females (p=0.127), while in the age groups 41-50 years and 61-70 years, there is a significant association (p<0.05), and in the 51-60 years age group, a highly significant association was found (p<0.001).

Age group (in years)	QRISK3 categories	Gender		Total N=220	Chi-square (p-value)
		Males	Females		
30-40	0-10 (Low)	77	36	113	4.12 (0.127)
	10-19 (Moderate)	0	1	1	
	>20 (High)	0	1	1	
41-50	0-10 (Low)	12	27	39	6.41 (0.041)*
	10-19 (Moderate)	0	0	0	
	>20 (High)	3	0	3	
51-60	0-10 (Low)	1	17	18	16.41 (<0.001)**
	10-19 (Moderate)	4	3	7	
	>20 (High)	3	0	3	
61-70	0-10 (Low)	0	3	3	6.15 (0.04)*
	10-19 (Moderate)	11	5	16	
	>20 (High)	9	3	12	

[Table/Fig-6]: Age-wise comparison of Cardiovascular (CV) risk (QRISK3 risk score) between males and females.
Chi-square test, p-value <0.05 significant; <0.001 highly significant

[Table/Fig-7] shows the highly significant negative correlation between QRISK3 risk score and GPAQ score (p<0.001). There was

a highly significant positive correlation observed between QRISK3 and PSS score (p<0.001). There was a weak significant positive correlation found between QRISK3 and FFQ score (p<0.001). PSS score is predominantly associated with increasing CVD risk.

S. No.	Scores	Parameters	QRISK3 score
1.	QRISK3	Pearson's correlation	1
		Sig. (two-tailed)	-
2.	GPAQ	Pearson's correlation	-0.24
		Sig. (two-tailed)	0.001**
3.	PSS	Pearson's correlation	0.42
		Sig. (two-tailed)	0.001**
4.	FFQ score	Pearson's correlation	0.28
		Sig. (two-tailed)	0.001**

[Table/Fig-7]: Correlation of QRISK3 risk score with GPAQ, PSS and FFQ score in total study participants.
Pearson's correlation, p-value <0.05; significant; <0.001 highly significant

[Table/Fig-8] shows the significant negative correlation between QRISK3 score and GPAQ score in both males (p<0.05) and females (p<0.05). A highly significant positive correlation was found between QRISK3 and Perceived Stress Scale (PSS) score in both males (<0.001) and females (<0.001). A highly significant positive correlation was found between QRISK3 and FFQ score in males (<0.001), and there was a weak significant positive correlation found between QRISK3 and FFQ score in females (p<0.05).

S. No.	Scores	Males		Females	
		r-value	p-value	r-value	p-value
1.	QRISK3 and GPAQ	-0.23	0.011*	-0.27	0.008*
2.	QRISK3 and PSS	0.40	<0.0001**	0.45	<0.0001**
3.	QRISK3 and FFQ	0.29	<0.001**	0.26	0.01*

[Table/Fig-8]: Correlation of QRISK3 risk score with GPAQ, PSS and FFQ score in male and female participants.
Pearson's correlation, p-value <0.05; significant, <0.001 highly significant

DISCUSSION

The prevalence of CVD, including atherosclerosis, stroke, and myocardial infarction, has also been demonstrated to rise with aging in both men and women. CVD risks are increased by additional modifiable risk factors, such as obesity, dyslipidaemia, diabetes, hypertension, stress, poor diet, and inactivity. These factors are known to exacerbate and complicate cardiac risk factors linked to the onset of old age. In the present study, authors analysed the CVD risk profile in an outpatient setting in Jaipur, Rajasthan, India. There was no statistically significant difference found in the mean age of males and females in the present study. The mean BMI for males was significantly higher than for females [Table/Fig-1]. These results were similar to a study done by Zhang J et al., which reported that men had a significantly higher mean BMI [34].

In the present study, a higher number of subjects were in the upper lower class [Table/Fig-2]. Another study done by Pangtey R et al., reported that most of the population belongs to the upper-lower class, which is consistent with the results of the present study [35]. The mean blood pressure was significantly higher in females compared to males. Mohanty P et al., also reported that males had a higher prevalence of hypertension up to 50 years, after which females had significantly higher rates, which is consistent with the results of the present study [36].

The mean FPG level was significantly higher in males [Table/Fig-3]. These results were similar to a study conducted by Soeters MR et al., in which plasma glucose levels were significantly lower in women than in men, whereas FFA and lipolysis were significantly higher [37]. In the present study, 12.7% of participants were prediabetic and 9.5% were diabetic, as measured by HbA1c levels according to American with Disabilities Act (ADA) criteria. There was no statistically significant difference in the mean HbA1c levels between males and females [Table/Fig-3], which is contrary to a study conducted by Ma Q et al., where HbA1c levels in the male group were significantly higher than those in the female group [38].

In the present study, mean total cholesterol levels and mean HDLC levels in females were significantly higher than in males in the present study [Table/Fig-3]. These results were similar to a study conducted by Gupta R et al., [39]. There was no significant difference found in the mean total cholesterol/HDLC ratio between males and females [Table/Fig-3]. These results are contrary to a study conducted by Gupta R et al., in which there was a significantly higher total/HDLC ratio in males [39].

The observed FFQ score in the present study for males was significantly higher than for females [Table/Fig-3]. Similar results were reported in a study done by Gray P et al., in which males had a significantly higher calorie intake than females [40]. The present study also shows that the mean PSS score is significantly higher in females [Table/Fig-3]. Similarly, Graves BS et al., found significant gender differences in perceived stress levels, with females reporting significantly higher total PSS levels [41]. The GPAQ score was found to be significantly higher in males in the present study [Table/Fig-3], which is consistent with a study done by Carthy M et al., who observed gender differences in physical activity status [42].

The present study concludes that CV risk is significantly associated with gender [Table/Fig-4], and a higher proportion of males were in the high-risk category compared to females [Table/Fig-5]. Similar results were observed in a study done by Mukhopadhay S et al., where high CVD risk was found to be significantly more common in males [43]. Before menopause, women are relatively protected from CVD. Oestrogen plays a cardioprotective role and is directly associated with a lower incidence of CVD in premenopausal women. After menopause, the risk for cardiac disease greatly increases in women [37].

A significant negative correlation was found between the QRISK3 score and the GPAQ score in the present study. A study conducted by Rasiah R et al., showed a statistically significant inverse relationship between physical activity and cumulative CVD risk factors. These findings are consistent with the present study [44]. The correlation of the QRISK3 risk score with the PSS score was significantly positive in the present study. Similarly, Santosa A et al., found a positive correlation between psychological stress and the risk of CVD [45]. The present study also shows a weak positive correlation between the QRISK3 score and the FFQ score, which is supported by another study done by McKeown NM et al., [Table/Fig-7] [46].

Limitation(s)

Data should have been obtained from different centres to obtain more reliable results. Additionally, comparing the data of the QRISK3 score with other validated CV risk scores would provide more convincing results in this regard.

CONCLUSION(S)

The QRISK3 risk score takes into consideration many CVD risk factors, including Indian ethnicity. In addition to the classical CVD risk factors, QRISK3 also includes chronic kidney disease, migraine, the presence of inflammatory diseases such as rheumatoid arthritis and systemic lupus erythematosus, the use of atypical antipsychotics, and erectile dysfunction. Based on the findings of the present study, QRISK3 can be employed as a screening tool to identify individuals at high risk for CVD at early stages. This would allow for better education and the development of appropriate treatment strategies.

Acknowledgement

The authors would like to thank the staff of Department of Physiology and Medicine, RUHS College of Medical Sciences and associated hospitals, Jaipur, Rajasthan, India.

REFERENCES

[1] World Health Organization. Preventing chronic diseases: A vital investment: WHO global report 2005. World Health Organization. [Online]. Available from: https://apps.who.int/iris/handle/10665/43314.
[2] World Health Organization. Noncommunicable diseases [Internet]. [cited 2018 June 1].
[3] Bloom DE, Cafiero ET, Jané-Llopis E, Abrahams-Gessel S, Bloom LR, Fathima S, et al. The Global Economic Burden of Noncommunicable Diseases. Geneva: World Economic Forum; 2011.
[4] World Health Organization. Noncommunicable Diseases [Internet]. [cited 2021 Sep 2].
[5] Roth GA, Mensah GA, Johnson CO, Addolorato G, Ammirati E, Baddour LM, et al. Global burden of cardiovascular diseases and risk factors, 1990-2019: Update from the GBD 2019 study. J Am Coll Cardiol. 2020;76(25):2982-3021.
[6] Khot UN, Khot MB, Bajzer CT, Sapp SK, Ohman EM, Brener SJ, et al. Prevalence of conventional risk factors in patients with coronary heart disease. JAMA. 2003;290(7):898-904.
[7] George J, Rapsomaniki E, Pujades-Rodriguez M, Shah AD, Denaxas S, Herrett E, et al. How does cardiovascular disease first present in women and men? Incidence of 12 cardiovascular diseases in a contemporary cohort of 1,937,360 people. Circulation. 2015;132(14):1320-28.
[8] Leening MJG, Ferket BS, Steyerberg EW, Kavousi M, Deckers JW, Nieboer D, et al. Sex differences in lifetime risk and first manifestation of cardiovascular disease: Prospective population based cohort study. BMJ. 2014;349:g5992.
[9] Villa A, Rizzi N, Vegeto E, Ciana P, Maggi A. Estrogen accelerates the resolution of inflammation in macrophagic cells. Sci Rep. 2015;5:15224.
[10] Iorga A, Cunningham CM, Moazeni S, Ruffenach G, Umar S, Eghbali M, et al. The protective role of estrogen and estrogen receptors in cardiovascular disease and the controversial use of estrogen therapy. Biol Sex Differ. 2017;8(1):33.
[11] Xue B, Singh M, Guo F, Hay M, Johnson AK. Protective actions of estrogen on angiotensin II-induced hypertension: Role of central nitric oxide. Am J Physiol Heart Circ Physiol. 2009;297(5):1638-46.
[12] Baker L, Meldrum KK, Wang M, Sankula R, Vanam R, Raiesdana A, et al. The role of estrogen in cardiovascular disease. J Surg Res. 2003;115(2):325-44.
[13] Lloyd-Jones DM, Leip EP, Larson MG, D'Agostino RB, Beiser A, Wilson PW, et al. Prediction of lifetime risk for cardiovascular disease by risk factor burden at 50 years of age. Circulation. 2006;113(6):791-98.
[14] Costello BT, Sprung K, Coulter SA. The rise and fall of estrogen therapy: Is testosterone for "manopause" next? Tex Heart Inst J. 2017;44(5):338-40.
[15] Ali MK, Jaacks LM, Kowalski AJ, Siegel KR, Ezzati M. Non communicable diseases: Three decades of global data show a mixture of increases and decreases in mortality rates. Health Aff. 2015;34(9):1444-55.
[16] Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, et al. Heart disease and stroke statistics-2015 update: A report from the American Heart Association. Circulation. 2015;131(4):e29-322.
[17] Wilson PW, D'Agostino RB, Levy D, Belanger AM, Silbershatz H, Kannel WB. Prediction of coronary heart disease using risk factor categories. Circulation. 1998;97(18):1837-47.
[18] D'Agostino RB Sr, Vasan RS, Pencina MJ, Wolf PA, Cobain M, Massaro JM, et al. General cardiovascular risk profile for use in primary care: The Framingham heart study. Circulation. 2008;117(6):743-53.
[19] Assmann G, Cullen P, Schulte H. Simple scoring scheme for calculating the risk of acute coronary events based on the 10-year follow-up of the prospective cardiovascular Münster (PROCAM) study. Circulation. 2002;105(3):310-15.
[20] Conroy RM, Pyörälä K, Fitzgerald AP, Sans S, Menotti A, De Backer G, et al; SCORE project group. Estimation of ten-year risk of fatal cardiovascular disease in Europe: The SCORE project. Eur Heart J. 2003;24(11):987-1003.
[21] World Health Organization. Prevention of Cardiovascular Disease Guidelines for Assessment and Management of Cardiovascular Risk. Geneva: WHO; 2007.
[22] Goff DC Jr, Lloyd-Jones DM, Bennett G, Coady S, D'Agostino RB, Gibbons R, et al. American College of Cardiology/American Heart Association Task Force on Practice Guidelines. 2013 ACC/AHA guideline on the assessment of cardiovascular risk: A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation. 2014;129(25 Suppl 2):S49-73.
[23] JBS3 Board. Joint British Societies' consensus recommendations for the prevention of cardiovascular disease (JBS3). Heart. 2014;100(Suppl 2):ii1-ii67.
[24] Hippisley-Cox J, Coupland C, Brindle P. Development and validation of QRISK3 risk prediction algorithms to estimate future risk of cardiovascular disease: Prospective cohort study. BMJ. 2017;357:j2099.
[25] Unnikrishnan AG, Sahay RK, Phadke U, Sharma SK, Shah P, Shukla R, et al. Cardiovascular risk in newly diagnosed type 2 diabetes patients in India. PLoS ONE. 2022;17(3):e0263619.
[26] Ghosal S, Sinha B, Ved J, Biswas M. Quantitative measure of asymptomatic cardiovascular disease risk in Type 2 diabetes: Evidence from Indian outpatient setting. Indian Heart J. 2020;72(2):119-22.
[27] India State-Level Disease Burden Initiative CVD Collaborators. The changing patterns of cardiovascular diseases and their risk factors in the states of India: The Global Burden of Disease Study 1990-2016. Lancet Glob Health. 2018;6(12):e1339-51.
[28] National Health and Nutrition Examination Survey (NHANES)- Anthropometry Procedure Manual, January 2016. CDC; World Health Organization.
[29] Kuppuswamy B. Manual of socio-economic status scale (urban). Delhi; Manasyan; 1981;66-72.
[30] Telles S, Bhardwaj A, Gupta R, Kumar A, Balkrishna A. Development of a food frequency questionnaire to assess dietary intake for the residents of the northern region of India. Indian Journal to Ancient Medicine and Yoga. 2016;9(4):139-47.
[31] Cohen S, Williamson G. Perceived stress in a probability sample of the United States. The Social Psychology of Health. 1988;31-67.
[32] World Health Organization. Surveillance and Population-Based Prevention, Prevention of Noncommunicable Diseases Department. 20 Avenue Appia, 1211 Geneva 27, Switzerland. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6706262/
[33] Mu X, Wu A, Hu H, Zhou H, Yang M. Assessment of QRISK3 as a predictor of cardiovascular disease events in type 2 diabetes mellitus. Front Endocrinol (Lausanne). 2022;13:1077632.
[34] Zhang J, Xu L, Li J, Sun L, Qin W, Ding G, et al. Gender differences in the association between body mass index and health-related quality of life among adults: A cross-sectional study in Shandong, China. BMC Public Health. 2019;19(1):1021.
[35] Pangtey R, Basu S, Meena GS, Banerjee B. Perceived stress and its epidemiological and behavioral correlates in an urban area of Delhi, India: A community-based cross-sectional study. Indian J Psychol Med. 2020;42(1):80-86.
[36] Mohanty P, Patnaik L, Nayak G, Dutta A. Gender difference in prevalence of hypertension among Indians across various age-groups: A report from multiple nationally representative samples. BMC Public Health. 2022;22(1):1524.
[37] Soeters MR, Sauerwein HP, Groener JE, Aerts JM, Ackermans MT, Glatz JFC, et al. Gender-related differences in the metabolic response to fasting. J Clin Endocrinol Metab. 2007;92(9):3646-52.
[38] Ma Q, Liu H, Xiang G, Shan W, Xing W. Association between glycated hemoglobin A1c levels with age and gender in Chinese adults with no prior diagnosis of diabetes mellitus. Biomed Rep. 2016;4(6):737-40.
[39] Gupta R, Sharma M, Goyal NK, Bansal P, Lodha S, Sharma KK. Gender differences in 7 years trends in cholesterol lipoproteins and lipids in India: Insights from a hospital database. Indian J Endocrinol Metab. 2016;20(2):211-18.
[40] Gray P, Olendzki B, Kane K, Churchill L, Hayes RB, Aguirre A, et al. Comparison of dietary quality assessment using food frequency questionnaire and 24-hour-recalls in older men and women. AIMS Public Health. 2017;4(4):326-46.
[41] Graves BS, Hall ME, Dias-Karch C, Haischer MH, Apter C. Gender differences in perceived stress and coping among college students. PLoS One. 2021;16(8):e0255634.
[42] McCarthy C, Warne JP. Gender differences in physical activity status and knowledge of Irish University staff and students. Sport Sci Health. 2022;18(2):1283-91.
[43] Mukhopadhay S, Mukherjee A, Khanra D, Samanta B, Karak A, Guha S. Cardiovascular risk in newly diagnosed type 2 diabetes patients in India. Egypt Heart J. 2021;73(1):94.
[44] Rasiah R, Thangiah G, Yusoff K, Manikam R, Chandrasekaran SK, Mustafa R, et al. The impact of physical activity on cumulative cardiovascular disease risk factors among Malaysian adults. BMC Public Health. 2015;15:1242.
[45] Santosa A, Rosengren A, Ramasundarahettige C, Rangarajan S, Gulec S, Chifamba J, et al. Psychosocial risk factors and cardiovascular disease and death in a population-based cohort from 21 low-, middle-, and high-income countries. JAMA Netw Open. 2021;4(12):e2138920.
[46] McKeown NM, Meigs JB, Liu S, Rogers G, Yoshida M, Saltzman E, et al. Dietary carbohydrates and cardiovascular disease risk factors in the Framingham offspring cohort. J Am Coll Nutr. 2009;28(2):150-58.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Apr 11, 2023
- Manual Googling: Aug 18, 2023
- iThenticate Software: Sep 16, 2023 (18%)

ETYMOLOGY: Author Origin

EMENDATIONS: 7

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Apr 05, 2023**
Date of Peer Review: **Jul 13, 2023**
Date of Acceptance: **Sep 18, 2023**
Date of Publishing: **Nov 01, 2023**