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Assessment of Cardiovascular Risk Factors Among Sunni Muslims of Delhi, India

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ABSTRACT
Cardiovascular diseases (CVD) are a prominent cause of mortality and morbidity in India. Environment and culture play a significant role in development of CVD in an individual. Since population base data on CVD risk factor is scarce, Sunni Muslims Mendelian population of Delhi was studied for identifying CVD risk factors using principal component analysis. The study includes 17 inter-correlated CVD risk variables i.e. anthropometric, physiological, and biochemical markers. A cross-sectional study was undertaken in urban Delhi, through conducting household survey. A total of 406 Sunni Muslims (125 males and 281 females) between 35-65 years of age were included in the study. The data was analysed using principal component factor analysis (PCFA). The PCFA extracted seven factors which explained nearly 81.17% and 80.06% of total variance of 17 quantitative traits among females and male, respectively. A cumulative risk scale was developed from the factor scores. Waist-height ratio (WHtR) showed strongest correlation for high cumulative risk (OR = 3.402; CI 95% = 1.693-6.834) among females, while among males, Waist-hip ratio (OR = 3.039; CI 95% = 1.029-8.974) showed strongest correlation for high cumulative risk. The findings of the present study add depth to the limited amount of literature on PCFA of cardiovascular risk in Indian ethnic population.
Keywords: cardiovascular disease, Sunni Muslims, principal component factor analysis (PCFA)

INTRODUCTION

The prevalence of cardiovascular disease (CVD) in India has increased many-fold in the past two decades (Badaruddoza et al., 2011; Kaur, 2012) due to lifestyle changes linked with urbanization nutritional transition, and the increasing mean age of the populations (Enas et al., 1992). Several studies have reported different cardiovascular risk factors and it is difficult to trace better predictor for CVD. According to some studies, obesity and central obesity parameters like body mass index, waist circumference, waist-height ratio and waist-hip ratio are significantly associated with CVD (Huxley et al., 2010; Lee et al., 2008; Janssen et al., 2004). Dyslipidaemia has further been linked to the pathophysiology of CVD as modifiable risk factor

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for CVD. Hypertension is also considered a major contributor to CVD worldwide (Kearney et al., 2005). Additionally, studies link central obesity with hyperinsulinemia, insulin resistance, hypertension which can further increase the risk for CVD (Grundy et al., 2005). Vitamin B12 or folate deficiency is associated with increase concentration of hyperhomocysteinemia and is also a potential risk for CVD among Indian (Yagnik et al., 2006). However, these parameters are inter-correlated and equally responsible for CVD. Since CVD does not manifest until adulthood, epidemiological evidence suggests (Chen et al., 2000) that the atherosclerotic process starts earlier, long before the clinical disease. Furthermore, it is essential to find the factors which accounts maximum variance and triggers so that early detection of these factors can prevent the risk of developing CVD in later life.

Therefore, in the present study, seventeen cardiovascular risk factors are considered to identify the independent factors from large amount of inter-correlated factors using principal component factor analysis (PCFA). Considering the above, this study was conducted among Sunni Muslims of Delhi. Delhi was chosen as a study area because it is very populated state of India. It also has high level of urbanization, 97.5% (Kumar, 2016). The prevalence rate of cardiovascular disease in India was found to be higher in urban areas as compared to rural areas (Gupta, 2004*a*,*b*). Urban areas have number of issues like sedentary lifestyle, unhygienic diet, overpopulation and overcrowded areas, stress, pollution and higher fat consumption. These factors increase the risk for cardiovascular disease (Datta, 2006; Ramchandran et al., 2008). The study population is living under similar conditions, highly urbanized and overcrowded area; consumption of a diet extremely rich in saturated fatty acids. The diet of Sunni Muslims includes high amount of red meat, fish, and chicken which is cooked in large quantity of fat, clarified butter (ghee) and spices. Such a diet followed by sedentary lifestyle exposes them to high risk of cardiovascular disease. Understanding the CVD associated risk factors in such population group may be useful in increasing our understanding of this disease.

METHODS

The present study is a cross-sectional study conducted among Sunni Muslims in Delhi, India. A total of 406 individuals (125 males, 281 females) in the age group of 35-65 years participated in the study. The households in the study of the individuals were identified in the selected areas and random sampling method has been used. All the information such as socio-demographic, medical history, date of birth is collected through pretested interview schedule. Anthropometric measurements such as weight (kg), height (cm), waist circumference (WC, cm), and hip circumference (HC, cm) were taken on each subject using standard procedure (Lohman et al., 1988). The body mass index (BMI) was taken as weight/height^2 (kg/m^2), waist to hip ratio (WHR) was taken as waist circumference divided by hip circumference and waist to height ratio (WHtR) was calculated as waist circumference divided by the individual height. The physiological measurements include systolic blood pressure (SBP, mm Hg) and diastolic blood pressure (DBP, mm Hg). Two consecutive reading were taken as recommended by the American Heart Association (AHA, 1981).

For the biochemical parameters, 5mL of intravenous blood sample after 12 hours of fasting was drawn after obtaining written informed consent from all the participants by trained personnel. Fasting blood samples were drawn to analyse the levels of total cholesterol (TC) (mg/dl), high density lipoprotein (HDL, mg/dl), triglycerides (TG, mg/dl), low density lipoprotein (LDL, mg/dl), very low density lipoprotein (VLDL, mg/dl), vitamin-B12 (Vit-B12, pg/mL), folate (Fol, ng/mL) and homocysteine (HCY, µmol/L). Lipid parameters were estimated using spectrophotometry technique while homocysteine, folate, vitamin B-12 levels were estimated through Immulite 100 using Chemiluminescences technique.

The study was approved by the Ethical Committee, Department of Anthropology, University of Delhi, India.

Statistical Analysis

Estimates are expressed as mean ± standard deviation and median (due to skewness of the data). To compare the mean values of the variables, the test of significance (*t*-test) was used and otherwise Mann-Whitney was performed. Principal component factor analysis (PCFA), a multivariate technique was used to extract orthogonal factors from cardiovascular and obesity related measurements. In the present study, obesity related phenotypes included BMI, WC, HC, WHR, WHtR and cardiovascular related trait included SBP, DBP, TC, TG, HDL, LDL, VLDL, Fol, Vit-B12, and HCY. Kaiser–Meyer–Olkin (KMO, Kaiser, 1974) and Bartlett's test of sphericity produce the measure of sampling adequacy and Bartlett's test of sphericity were used to assess the suitability of the data for PCFA. Kaiser recommended a bare minimum of 0.5 and value between 0.5 and 0.9. For the present data, the KMO value is 0.5 for both males and females, so the sample size is adequate for the factor analysis and Bartlett's test is highly significant ($P<0.001$), and therefore factor analysis is appropriate. The principal component 1 explained the maximum variance and subsequent factors explained progressively smaller portions of the total variance. Factor was simplified by orthogonal (varimax) which minimized the number of variables with high loading on each factor. The correlations between the factors were explained by factor loadings, values greater than or equal to 0.4 were used to indicate significant correlations between the component and the variables. The component with eigen values (sum of the squared factor loading) greater than or equal to 1 was retained for analysis.

In the analysis for PCFA, factor scores are generated for each individual. As standardized variables were used in the analysis, a score >2.0, signifying a value >2 standard deviations for an individual factor was defined as a "high risk score." A cumulative risk score is formed by adding all the scores together for each individual. High cumulative score is defined as a score >95th percentile (>4.43 for women; >5.03 for men). In the present study, logistic regression (odd ratio, OR and confidence interval) adjusted for ages were performed to assess the independent correlates of high cumulative risk in males and females.

Table 1. Baseline character of the cardiovascular variables among Sunni Muslims of Delhi

Variables	Overall (N=406)	Male (N=125)	Female (N=281)	P value
Age (years)	47.54±9.24	50.50±9.46	46.23±8.84	**0.0001*** **
Weight (kg)	70.37±12.87	75.36±12.51	68.14±12.41	**0.0001*** **
BMI (kg/m2)	28.39±5.14	27.79±5.51	29.88±4.95	**0.0002*** **
WC (cm)	98.86±10.68	101.744±11.59	97.57±10.01	**0.0003*** **
HC(cm)	107.82±10.92	107.10±11.97	108.14±10.43	0.376
WHR	0.918±0.062	0.951±0.059	0.903±0.057	**0.0001*** **
WHtR	0.629±0.076	0.618±0.088	0.633±0.07	0.0671
SBP (mm Hg)	135.408±16.68	137.54±16.44	134.32±16.49	0.0698
DBP (mm Hg)	85.066±9.92	86.12±11.18	84.50±9.26	0.128
TC (mg/dl)	208.703±42.42	212.32±43.24	207.10±42.02	0.252
TG (mg/dl)	175.41±75.26	189.20±91.27	169.34±66.14	**0.0139** **
HDL (mg/dl)	46.68±15.60	47.99±15.52	46.10±15.63	0.2619
LDL (mg/dl)	125.75±33.44	124.96±34.62	126.21±32.83	0.727
VLDL (mg/dl)	34.76±13.38	36.45±13.86	34.02±13.11	0.095
Fol (ng/mL)	16.48*	15.94*	16.59*	0.763
Vit-B12 (pg/mL)	326*	325*	326*	0.235
HCY (µmol/L)	18.83±10.55	22.16±12.60	17.35±9.148	**.000*** **

* Median levels reported due to skewness of the data.

**Significant level for the *P* values<0.05.

*** Significant level for the *P* values<0.01.

Definitions

Generalized obesity was defined as body mass index (BMI) ≥25 kg/m^2; overweight as BMI 23–25 kg/m^2 whereas abdominal obesity was defined as waist circumference (WC) ≥90 cm among males, ≥80 among females (World Health Organization, 2000). Waist to hip ratio (WHR) ≥0.80 for females and ≥0.90 for males (Willett et al., 1999). Waist to height ratio (WHtR) of more than 0.50 was taken as risk category for both sexes (Ashwell, 2005).

Lipid parameter cut off points (NCEP, 2001); hypercholesterolemia (Serum cholesterol levels) ≥200 mg/dl; hypertriglyceridemia (serum triglyceride levels) ≥150 mg/dl; low HDL cholesterol levels <40 mg/dl for males <50 mg/dl for females high LDL cholesterol levels ≥130 mg/dl and high VLDL >30 mg/dl and blood pressure is defined as systolic pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mm Hg (Chobanian et al., 2003).

RESULTS

Table 1 represents the mean and standard deviation (SD) of the anthropometric, physiological and biochemical variables except for folate and vitamin B12 where a median value was calculated due to skewness. The mean age of males and females were 50.50 years and 46.23 years, respectively. The seven variables such as age, weight, BMI, WC, WHR, TG, and HCY among seventeen phenotypes indicate significant (P<0.05) sex-specific difference in trait variance. However, males were observed to have higher mean value pertaining to age,

Table 2. Correlation matrix (bivariate) for cardiovascular risk factors among Sunni Muslims of Delhi

	BMI	Weight	HC	WC	WHtR	TC	LDL	HDL	TG	VLDL	WHR	SBP	DBP	Fol	Vit-B12	HCY	Age
BMI	.	**.836''**	**.818''**	.686**	**.715''**	.071	.052	.061	-.019	.024	-0.116	.007	.111	.036	.052	-.004	-.145
Weight	**.724****	..	**.837''**	**.688''**	**466''**	.028	.023	044	.002	.034	-.147	-.026	.077	.007	-.044	.017	**-.228''**
HC	**.722****	**.763****	...	**.801''**	**687****	.036	.045	-.029	-.014	.028	-.207''	.028	.116	.070	.018	.023	-.100
WC	**.786****	**.794****	**.865****	....	**.896''**	-.006	.000	-.091	.037	.077	**.416''**	.100	**.170****	**.163****	-.020	062	.026
WHtR	**.896****	**.552****	**.747****	**.896****	....	.029	.021	-.106	.020	.062	**.426****	**.125'**	**.183****	**.173''**	.052	.039	.101
TC	-.040	.090	.031	.010	-.071	..	**.728''**	**.539****	**.248****	**.245****	-.057	.043	.054	.084	-.077	.008	**.165****
LDL	-.028	.003	-.023	-.033	-.046	**.779****	....	**.310****	-.042	-.040	-.068	-.031	.046	.047	-.055	.044	.083
HDL	-.150	-.037	-.087	-.063	-.129	**.466****	**.239****	...	-.039	-.038	-.105	.049	-.085	.118	-.070	-.067	-.061
TG	.061	**.228***	.058	.121	.009	**.293****	.012	**.241****	..	**.935****	.085	**.179****	.105	-.031	-.010	.029	**.205****
VLDL	.017	**.184***	.027	.119	-.002	**.288****	-.004	.152	**.722****	....	.083	**.178****	.090	-.040	-.026	.045	**.177****
WHR	.122	.118	**.247****	**.451****	**.381****	.040	.072	.062	.074	.091	....	**.133***	.103	**.154***	-.062	.071	**.205****
SBP	.046	.069	.153	**.230****	**.176***	-.010	-.047	-.058	.137	.129	**.184***	....	**.621***	**.151***	.023	-.056	**.295****
DBP	.009	.053	.089	**.214***	.148	.074	.028	-.064	.161	.124	**.246****	**.685****	....	.082	079	-.032	**.119***
Fol	.028	.075	.091	.109	.060	.044	-.015	.136	-.062	-.044	.060	.048	.016	....	-.014	**-153***	**.**065
Vit-B12	.167	.153	**.184***	**.243****	**.216***	-.116	-.138	**-.185***	.025	.100	-.015	.133	.095	-.016	....	**-.133***	**.151***
HCY	**-.201***	-.194	-.162	**-.187***	-.173	.111	.015	.128	.125	.008	-.088	-.087	-.047	-.175	**-.206***	....	065
Age	.005	**-.228****	**.189***	**.201***	**.200***	-.029	-.018	-.092	-.148	-.053	**.188***	**.314****	.155	.081	**.282****	-.038	....

Upper triangle corresponds for female and lower triangle corresponds to correlate for male Sunni Muslims of Delhi.

*Correlation is significant at 0.05 (two-tailed).

** Correlation is significant at 0.01 (two-tailed).

weight, WC, WHR, SBP, DBP, TC, TG, HDL, VLDL, and HCY while among female BMI, HC, WHtR, LDL, Vit- B12, and Fol were higher.

Pearson's correlation matrixes of seventeen variables are presented in **Table 2**. The upper triangle represents the correlation among the different variables corresponding to females, while the lower triangle refers to males. Both males and females show a strong correlation among obesity indicators (like BMI, weight, HC, WHtR, WHR). However, overall anthropometric, biochemical and physiological variables show inter-correlation and support the further use of principal component factor analysis.

The characteristic of derived principal component analysis (PCFA) from seventeen parameters are shown above. The PCFA extracted 7 factors which explained nearly 81.17% and 80.06% of total variance of 17 quantitative traits among females and male, respectively. Factor 1 has been loading of traits reflects such as obesity, BMI, weight, WC, HC, WHtR which explained the maximum portion of total variance (24.16% and 26.290%) among females and males, respectively. Factor 1 is the strong indicator for CVD among Sunni Muslim of Delhi and it is identified as obesity. Factor 2 has been loaded with TC, LDL and HDL cholesterol of total variance (14.47% and 14.86%) among female and males, respectively. Factor 2 is identified as lipid parameter for females and males in the present study. Factor 3 is loaded with TG and VLDL among both sexes of total variance (12.11% and 10.94%). Factor 4 identifies WHtR, WHR and WC among females with total variance of 9.48% while SBP and DBP among male with 9.22% variance, therefore central obesity and hypertension are the indictors of CVD. Factor 5

Table 3. Coefficient and variance of factors satisfying the Eigen value >1 criterion for cardiovascular risk factor among female Sunni Muslims of Delhi

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Communalities
BMI	**.928**	.044	-.004	-.099	.029	.010	.023	**.875**
Weight	**.894**	.011	.020	-.200	-.007	.010	-.132	**.858**
HC	**.945**	.022	-.002	-.113	.071	-.014	.013	**.912**
WC	**.862**	-.043	.034	**.448**	.075	.014	-.020	**.953**
WH_tR	**.785**	-.014	.021	**.513**	.089	.012	.102	**.898**
TC	.027	**.912**	.245	.015	.035	.002	.022	**.895**
LDL	.041	**.854**	-.031	.031	-.005	-.104	.074	**.750**
HDL	-.037	**.694**	-.087	-.133	.006	.225	-.172	.589
TG	-.002	.040	**.973**	.040	.087	-.020	.030	**.960**
VLDL	.047	.040	**.973**	.043	.072	-.033	.003	**.959**
WHR	-.022	-.100	.062	**.906**	.018	.036	-.048	**.838**
SBP	.014	.022	.096	.081	**.890**	.095	.011	**.818**
DBP	.148	-.002	.049	-.010	**.863**	.019	.042	**.771**
HCY	.031	.040	-.005	.163	-.036	**-.799**	-.177	**.700**
Fol	.053	.161	-.068	.346	.099	**.625**	-.122	.578
Vit-B12	.034	-.093	-.019	-.111	-.021	.146	**.879**	**.816**
Age	-.177	.154	.145	.401	.297	-.212	**.519**	.639
Eigen value	4.109	2.460	2.059	1.612	1.408	1.083	1.068	
Variance (%)	24.168	14.471	12.113	9.482	8.284	6.369	6.283	
Cumulative (%)	24.168	38.639	50.751	60.234	68.517	74.886	81.170	

Factor loading in bold type >0.4; communalities are bold >0.7.

has been loading of trait SBP and DBP among female with 8.28% variance whereas vitamin B12 and age among male with 6.59% variance. Factor 6 has highest loading of folate and homocysteine with variance of 6.36% among females while WHR and age among males with 6.23% variance, since hyperhomocysteinemia is one of the leading factor of CVD. Factor 7 contain the highest loading for vitamin B12 and age among female while folate and homocystein among males with 6.28 and 5.91% variance, respectively.

Communality is the variance in observed variables accounted by common factor. The estimates of communality may be interpreted as the reliability of the indicators. If an indicator scores a low commonality, then the factor model is not working for the indicators and possibly it should be removed from the model. A communality of 0.75 seems high and below 0.5 is to be considered as low communality. Therefore, the greater communality estimated (>0.9) among females on waist circumference, hip circumference, triglyceride and VLDL while among male waist circumference, hip circumference, total cholesterol and waist/hip ratio show high communality. Therefore, these parameters may be considered as good predictors of CVD among Sunni Muslims of Delhi.

Table 4. Coefficient and Variance of factors satisfying the eigen value >1 criterion for cardiovascular risk factor among male Sunni Muslims of Delhi

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Communalities
BMI	**.924**	-.034	-.021	-.040	.052	-.095	.004	**.868**
WC	**.932**	-.007	.077	.132	.087	.229	.075	**.957**
HC	**.894**	-.029	.026	.032	.043	.127	.036	**.821**
WH_tR	**.891**	-.051	-.069	.074	.104	.212	.008	**.862**
Weight	**.851**	.040	.201	.006	-.003	-.153	.097	**.798**
TC	.012	**.920**	.257	.046	-.051	.051	-.007	**.920**
LDL	.010	**.937**	-.101	.071	.011	-.053	-.032	**.897**
HDL	-.130	**.458**	.334	-.243	-.327	.321	.176	.638
VLDL	.034	.071	**.894**	.099	.087	-.012	-.008	**.823**
TG	.077	.082	**.902**	.109	-.064	.011	-.101	**.852**
DBP	.044	.061	.124	**.895**	.034	.066	-.019	**.828**
SBP	.055	.099	.067	**.880**	.017	.167	.025	**.811**
Vit-B12	.139	-.065	.179	-.010	**.876**	.013	.035	**.798**
Age	.008	.024	-.206	.173	**.515**	**.642**	-.016	**.750**
WHR	.282	.019	.065	.220	-.078	**.626**	.082	**.942**
Fol	.015	-.015	-.013	.027	-.125	.255	**.815**	**.747**
HCY	-.189	-.012	.132	-.115	.273	.328	**-.672**	**.701**
Eigen Value	4.469	2.526	1.861	1.568	1.120	1.061	1.006	
Variance (%)	26.290	14.861	10.945	9.224	6.591	6.238	5.916	
Cumulative (%)	26.290	41.151	52.097	61.320	67.971	74.150	80.066	

Factor loading in bold type >0.4; communalities are bold >0.7.

Effect of cardiovascular variable on risk status

In the logistic regression analysis, among females hypercholesterolemia, low HDL cholesterol, high LDL cholesterol, obesity (BMI), abdominal obesity (WC), WHR and low folate were significantly related to high cumulative risk (P<0.05) whereas WHtR (OR = 3.402; CI 95% = 1.693-6.834) show strongest correlation for high cumulative risk. While among males high VLDL, abdominal obesity (WC), WHtR, low Folate and low Vitamin B12 were significantly associated with high cumulative risk (P<0.05) whereas WHR (OR = 3.039; CI 95% = 1.029-8.974) showed strongest correlation for high cumulative risk. Therefore, waist-height ratio showed strongest correlation among the females while waist-hip ratio showed highest correlation among the males.

DISCUSSION

The data reduction method showed that the obesity parameters are the most important indicator for CVD. In agreement with previous study (Zalesin et al., 2011), Factor 1 was strongly loaded with generalized and central obesity in both males and females in our study. Thus, importance of generalized and central obesity in the pathogenesis and progression of the CVD is clearly established in our study. Factor 2 and 3 for both males and females reflected traits of lipid parameters. Since the dyslipidaemia has been closely associated with the

pathophysiology of CVD, Factor 4 was identified as central obesity among females, while hypertension variables (SBP and DBP) were identified among males. Hence our analysis shows that Factors 1 to 4 identify obesity, dyslipidaemia and hypertension among both males and females to be the main cause of CVD, which support similar finding of previous studies (Kaur et al., 2012; Ghosh, 2005; Shmulewitz et al., 2001). Previous studies have shown that the obesity parameters were the strongest predictor of CVD in white, black and Hispanic Americans (Goodman et al., 2005). Apart from obesity, hypertension and lipid variable, Factors 5, 6, and 7 have been loading of traits like vitamin B12, folate and homocysteine. Since increased homocysteine (HCY) concentration is a risk factor for CVD (McCully, 1969) nutritional deficiencies of folate and vitamin B12 concentrations increase the homocysteine levels. As homocysteine is an unstable amino acid which undergoes auto oxidation and produces free oxygen radical causing oxidative stress, which may contribute to atherosclerosis.

Further analysis on the basis of cumulative risk scale highlighted the point that waist-hip ratio and waist-height ratio rather than BMI better predicts the risk of CVD, as the waist-height ratio among females and waist-hip ratio among males shows strongest correlation for high cumulative risk. Cumulative risk scale showed the agreement with other studies (Wei et al. 1997; Ashwell et al., 2005) which highlighted the point that waist-to-hip ratio or waist to height ratio rather than BMI is the better predictor of CVD. It has been suggested that cardiovascular risk is closely associated with abdominal obesity. Abdominal obesity is higher among Asian Indians as compared to Caucasians and this may be associated with cardiovascular risk factors (Misra and Khurana, 2010).

According to the WHO, obesity is most neglected public health issue affecting both developed and developing countries (WHO, 2000). WHO statistics report (2012) highlighted the point that around 2.8 million people die annually due to obesity. Obesity is associated with cardiovascular disease, dyslipidaemia, and hypertension (Flegal et al., 2013; WHO, 2009). Mungreiphy et al. (2012) conducted a cross-sectional study on three ethnic group from different geographical region of India, Khatri from Delhi and tribal population from Manipur and Ezhava from Kerala and reported the presence of higher obesity among the individuals from Delhi. The study further highlighted that presence of obesity in urban individuals is due to metropolitan city lifestyle, consumption of fast or energy dense food and sedentary lifestyle. Gupta and Kapoor (2010) conducted a study on Aggarwal Baniya of Delhi and reported the prevalence of obesity among males and females. Furthermore, Kapoor et al. (2012) conducted the study on Khatri, Punjabi Arora and Baniya females belonging to different ethnic background but inhabiting Delhi. The study showed presence of obesity and the cultural factors associated with obesity were identified as sedentary lifestyle, increase in energy intake, sweetened beverage intake and changing dietary habits. The Sunni Muslim population of Delhi are living in similar geographical area as other ethnic group inhabiting Delhi with very unique style of cooking food, additionally rich in saturated fat and animal protein, especially red meat.

CONCLUSION

Among the plethora of factors responsible for increase in mortality due to CVD, obesity has been the most neglected public health issue affecting most regions of the globe (Pednekar et al., 2008) and India (Ng et al., 2014) appeared to be the most obese country after China and US. Asian Indians develop CVD at a very early age compared to other populations due to lifestyle linked to urbanization, nutritional transition and economic development (Omran, 1971). Out of the first four factor (Factors 1 to 4) as extracted by PCFA, the top two were obesity and central obesity indicating the public health importance of these two factors in management and control of CVD. The remaining two factors are dyslipidaemia and hypertension. Overall, waist-height ratio was the main predictor for CVD among females while waist-hip ratio was the main predictor for CVD among males. The present study has considered the Sunni Muslim population of Delhi. Further, studies on Mendelian population are required to substantiate these results.

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