

High rates of Obesity and Cardiovascular Disease risk factors in lower middle class community in Pakistan: the Metroville Health Study

Barbara Dennis¹, Kalimuddin Aziz², Lilin She¹, Azhar M. A. Faruqui², C.E. Davis¹, Teri A. Manolio³,

Gregory L. Burke⁴, Salim ud din Aziz⁵

Department of Biostatistics, University of North Carolina¹, Chapel Hill, NC, National Institute of Cardiovascular Diseases², Karachi, Division of Epidemiology and Clinical Applications, National Heart, Lung, and Blood Institute³, Bethesda, Maryland, Department of Public Health Science, Wake Forest University School of Medicine⁴, Winston-Salem, NC, PMRC Jinnah Postgraduate Medical Centre⁵ and Chiniot Hospital, Karachi.

Abstract

Objectives: To describe the distribution of over weight and body mass index , waist circumference and waist/hip ratio, correlate obesity measures to coronary heart disease risk factors in comparison to Pakistan National Survey(PNS).

Methods: The Metroville Health Study (MHS) was an urban risk factor reduction intervention study in Metroville Karachi. Base line data was used which was not a random sample. Demographic data including serum cholesterol, glucose, haemoglobin, and blood pressure were collected.

Results: In MHS high cholesterol was 16% and 24% in men and women respectively, and 25% had hypertension. Self-reported diabetes was 8%, over-weight/obesity 34% and 49% for men and women, compared to 16% and 25% for PNS , while high risk waist-hip ratio (WHR) was present in 41% and 72% of men and women respectively. Under-weight in Metroville men was 12% and 9% in women, compared to 26% and 27% in PNS. The anthropometry variables were significantly correlated with each other while weight was significantly correlated with TC and waist circumference (WC).

Conclusion: Obesity was alarmingly prevalent in urban Metroville in comparison to PNS. Cardio Vascular Disease (CVD) risk factors were prevalent in Metroville and TC and WC were significantly correlated with obesity measures. For prevention of increasing CVD in urban communities, targeted programs of intervention are required (JPMA 56:267;2006).

Introduction

Increasing prevalence of urban cardiovascular disease (CVD) risk factors are reported in many countries with emerging economies. These countries are faced with the double burden of infectious diseases, infant mortality, and undernutrition and emerging epidemic of CVD¹, linked in part with obesity. The prevalence of CVD among inhabitants and migrants from the South Asian subcontinent is inordinately high and severe.²⁻⁴ Community prevention focusing on primordial prevention of CVD risk factor such as hypertension, hyperlipidaemia, and obesity is considered the most efficient use of limited resources in these countries.⁵

Prevalence of insulin resistance, low plasma HDL-cholesterol, hypertriglyceridaemia and diabetes has been reported among South Asians and may be more important than conventional risk factors (smoking, high LDL-cholesterol, hypertension) in the etiology of coronary heart disease (CHD) in these populations.³ Obesity, particularly abdominal obesity, has been implicated as a risk factor for CHD in Western populations⁵, and in Asians it has been linked with the major components of the metabolic syndrome.⁶⁻⁸ For unknown reasons, prevalence of complications associated with increased abdominal fat is higher for a given level of obesity in South Asians than in Europeans.⁴ For the population in developed countries the risk of developing CHD increases with increasing BMI so

that in one study the risk increased to more than twice after the BMI of 26, after which it continues to increase with increasing BMI.⁹ A hospital study in Pakistani CVD patients, WHR had odd ratio of 1.06 for developing CVD.¹⁰ A study of 52 countries globally, abdominal obesity had odd ratio of 1.62 for the middle and top for developing acute myocardial infarction.¹¹

Information is scarce on population distributions of anthropometric measures of obesity and fat patterning in Pakistan. The objectives of this report are: 1) to describe the distribution of measures of underweight, overall obesity (weight and body mass index) and central obesity (waist circumference and waist/hip ratio) in a lower middle class urban community in Pakistan; 2) to define the relationship of obesity measures to major coronary disease risk factors; and 3) to compare obesity and fat pattern in an urban community with Pakistan National Health survey (PNS) population data and data from other developed and developing populations to identify both regional variations of fat pattern.

Methods

The Metroville Health Study (MHS) was a community population-based intervention study employing outreach from a teaching institution to plan, initiate and evaluate strategies and to develop the community infrastructure.^{12,13} It was conducted in Metroville, a socioeconomically and ethnically diverse urban residential sector of Karachi, Pakistan, comprising about 4954 households. Seventy per cent of the men were engaged in small businesses and government work; over 90% of the women were not employed outside their home. Invitation letters to participate in a preventive study were sent to all the households of Metroville. Four hundred fifty (9.1 percent) of the household population of Metroville responded to participate, however 400 households were plotted on the map of Metroville and were randomly selected as control and intervention groups. Reasons for loss before randomization included household refusal and moving out of Metroville. Details of the intervention are reported elsewhere.¹² The present study concerns with the household data which was collected prior to randomization at a baseline examination which was carried out on all household members age 2 and above, thus the population sample was not a random sample.

Measurements were made by physicians using a standard protocol. The baseline examination included socio-demographic variables, anthropometric characteristics, health history, ECG, serum total cholesterol, blood glucose, hemoglobin, blood pressures, knowledge and attitudes about CVD and self reported household consumption of cooking fats, oils and salt (household cook only).

Height was measured without shoes with the participant standing erect and looking straight ahead with his/her head in the Frankfort horizontal plane. Height was recorded to the nearest 0.5 cm. Weight was measured on a spring balance with the participant wearing light clothing. Weight was recorded to the nearest kg. BMI was calculated as kg/m^2 . BMI was classified according to WHO criteria: Underweight, $\text{BMI} < 18.50 \text{ kg/m}^2$; normal, $\text{BMI} 18.50\text{--}24.99 \text{ kg/m}^2$; grade 1 overweight, $\text{BMI} 25.00\text{--}29.99 \text{ kg/m}^2$; grades 2 and 3 overweight, $\text{BMI} \geq 30 \text{ kg/m}^2$.

Waist circumference was measured with an anthropometric tape applied horizontally at a level laterally midway between the iliac crest and the lowest lateral portion of the rib cage and anteriorly the umbilicus. Hip circumference was measured at the level of the symphysis pubis anteriorly and posteriorly at the level of the maximal protrusion of the gluteal muscles. Waist to hip ratio (WHR) was calculated as the ratio of waist to hip measurements. High risk WHR was defined as $\text{WHR} \geq 0.80$ (women) and ≥ 0.95 (men).¹⁴⁻¹⁶

Fasting serum cholesterol and blood glucose were measured using the Reflotron® method.¹⁷ High cholesterol was defined as serum total cholesterol $> 200 \text{ mg/dl}$. Blood pressures were measured by trained observers using a standard sphygmomanometer according to a standard protocol.¹⁸ Two readings were taken. Hypertension was defined as having $\text{SBP} \geq 140$ or $\text{DBP} \geq 90$ or current use of antihypertensive medications. Diabetes was defined by self-report.

Three other existing data sets were used for comparison purposes. The data on prevalence of underweight and obesity for Pakistan were obtained from PNS data (1990-94).¹ The 1994 Chinese National Nutrition Survey^{19,20} and the 1987-1994 U.S. Third National Health and Nutrition Survey (NHANES III) data sets were used to obtain obesity data for these countries.

The study data included 462 men and 476 women aged 18 and above. Of these, 15 pregnant women were excluded and 12 other subjects were excluded for unreliable BMI ($\text{BMI} < 14 \text{ kg/m}^2$, $> 50 \text{ kg/m}^2$). This report is based on 456 men and 456 women. Sample sizes for linear models were slightly different because of additional exclusions for missing data.

Associations of systolic and diastolic blood pressures and total cholesterol with weight, BMI, waist circumference and WHR (and associations among the obesity variables themselves) were estimated with Pearson inter-class correlation coefficients adjusted for age. Increments in systolic and diastolic blood pressures, glucose and total cholesterol for a one standard deviation increment in weight, BMI, waist circumference and WHR were

estimated in men and women using linear regression adjusting for age. Increments associated with waist circumference and WHR were additionally adjusted for BMI. For comparisons of continuous variables Student t test was used.

Results

Prevalence of hypertension and high cholesterol was substantial in Metroville and increased with age. More than a quarter of the cohort had hypertension with the greatest prevalence, about 50%, in those aged 50 and above. High cholesterol was present in 16-20% for men and women, respectively. Self-reported diabetes was present in 8% of subjects and also increased with age.

The dual burden of under-weight and overweight/obesity in MHS are evident in Table 1.

Prevalence of underweight in all ages was 12% in men and 9% in women, and was greatest at the youngest ages. Prevalence of overweight was 27% in men and 29% in women, and increased with age, at least up to 50 years. Prevalence of obesity was more than twice as high in women as in men (20% vs. 7%, $P<0.0001$) and also increased with age up to 50 years. Underweight was roughly half as prevalent and combined overweight/obesity was roughly twice as prevalent in MHS as in PNS. In contrast, roughly 70% of Chinese men and women were normal weight with low prevalence of underweight and negligible prevalence of obesity, while US adults had the highest prevalences of overweight and obesity and negligible prevalence of underweight. Prevalences of overweight and obesity in Metroville were higher than in China, but were similar to the US.

Comparison of prevalence rates of obesity in MHS

with urban PNS population in men and women showed prevalence rates in 18-29 year age groups did not show significant statistical difference, however, from 30 till over 70 years of age there was significantly higher prevalence of over weight in MHS ($P<0.0001$). The overall mean (31% in MHS men VS 6.5 % in PNS women) were significant at $P=0.0059$ and 0.0348 respectively .

High risk WHR was present in MHS in 41% of men and 72% of women at all ages and increased in prevalence with age. As with prevalence of overweight, MHS men had nearly twice the prevalence of high risk WHR as did PNS men overall and each age ($P<0.0001$) (Table 2).

Prevalence of high risk WHR was high but similar in MHS and PNS women except in the youngest age group, where it was nearly twice as prevalent in PNS women ($P<0.0001$). The result of age adjusted correlation coefficients of anthropometry and cardiovascular risk factors for both men and women are shown in (Table 3a). The correlations for weight with TC (0.83), weight with BMI and WC (0.89, 0.84), BMI with WC (0.82) and WHR (0.4) were statistically significant. Correlation of BMI, weight and WC with SBP and DBP were statistically weak.

The clinical significance of risk factor correlation with WHR, WC and BMI were calculated by using age adjusted increment in CVD risk factors for one standard deviation increment in anthropometric indices separately for men and women (Table 3b). In both men and women WHR was independently associated with TC. In men WC was a better predictor of DBP, SBP and TC than WHR. In women WHR was a better predictor of TC than WC. In general WHR, WC and BMI were better correlated to risk

Table 1. Prevalence of underweight, normal and overweight1 in MHS adults.

Gender	Age	WHO Weight Grade							
		Underweight		Normal		Overweight		Obese	
		N	%	N	%	N	%	N	%
Men	All	56	12.3	244	53.6	123	27.0	33	7.2
	18-29	28	8.6	78	60.9	16	12.5	6	4.7
	30-39	15	13.8	61	56.0	27	24.8	6	5.5
	40-49	7	5.6	57	45.2	50	39.7	12	9.5
	50+	6	6.5	48	51.6	30	32.3	9	9.7
Women	All	39	8.6	194	42.5	133	29.2	90	19.7
	18-29	27	20.0	66	48.9	27	20.0	15	11.1
	30-39	5	3.7	60	44.4	42	31.1	28	20.8
	40-49	3	3.0	30	30.3	40	40.4	26	26.3
	50+	4	4.6	38	43.7	24	27.6	21	24.1

1. WHO BMI Criteria: < 18.5, underweight; 18.5 - < 25, normal; 25 - < 30, overweight; > 30, obese

Men vs Women	P values
Under weight;	0.14145
Normal weight;	0.0009
Over weight;	0.12222
Obese;	0.0001

Table 2. Percent with High Risk WHR (>0.80 for women, >0.95 for men) by gender, age group and study.

Gender	Age (years)	Study	High Waist (n)	Hip Ratio (%)	P values
Men	All	MHS	186	41	0.0001
		PNS	556	20	
	18-29	MHS	11	9	0.2114
		PNS	44	6	
	30-39	MHS	40	37	0.0001
		PNS	113	17	
	40-49	MHS	79	63	0.0001
		PNS	146	31	
	50+	MHS	56	60	0.0001
		PNS	253	28	
Women	All	MHS	330	72	0.0001
		PNS	2314	86	
	18-29	MHS	61	45	0.0001
		PNS	564	81	
	30-39	MHS	101	75	0.0015
		PNS	574	86	
	40-49	MHS	88	89	0.4227
		PNS	466	86	
	50+	MHS	80	92	0.3903
		PNS	710	89	

Table 3a. Age-adjusted correlation coefficients of anthropometry and CVD risk factors in MHS.

	SBP	DBP	TC	Glucose	Weight	BMI	Waist	WHR
SBP	--	0.66	0.05	0.07	0.24	0.22	0.25	0.15
DBP		--	0.12	-0.03	0.23	0.21	0.23	0.14
TC			--	0.02	0.83	0.09	0.10	0.14
Glucose				--	0.05	0.05	0.07	0.06
Weight					--	0.89	0.84	0.32
BMI							0.82	0.40
Waist							--	0.68

Table 3b. Age-adjusted increment in CVD risk factors for one standard deviation increment in anthropometric indices in men and women, MHS adults.

Anthropometric Index ¹	Systolic Pressure (mmHg)		Diastolic Pressure (mmHg)		Total Cholesterol (mg/dl)	
	Men	Women	Men	Women	Men	Women
Weight						
BMI (4.5, 5.5 kg/m ²)	2.1*	1.5	2.5*	1.8**	2.8	3.2
Waist "(14.2, 13.4 cm) ²	4.1**	2.0**	3.5**	1.6	14.5*	-0.03
WHR (0.10, 0.08 units) ²	1.8	1.3	1.4*	1.0	7.3*	5.3*

1. Values in parentheses are standard deviations of anthropometric indices in men and women.

2. Also adjusted for BMI.

* < 0.05, ** < 0.01, ***<0.001

Table 3c. Inter correlation coefficients for anthropometry variables in MHS.

	<u>Men</u>	<u>Women</u>
WHR/BMI	0.39	0.40
WHR/WC	0.61	0.68
WC/BMI	0.79	0.80

p values < 0.001

SBP: Systolic Blood Pressure

DBP: Diastolic Blood Pressure

TC: Total Cholesterol

BMI: Body Mass Index

factors in men than women. Anthropometry variables were significantly correlated with each other in both men and women, WC, an independent CVD risk factor, was strongly correlated with BMI and WHR (Table 3c).

Discussion

Metroville has stable housing and food sources compared to the national picture. Under-weight does exist but overweight was prominent, particularly in women. International standards of high risk WHR and BMI were used. These are based primarily on risk evaluations in western populations that are generally heavier than populations in developing countries. The appropriateness of these cut points has been questioned for South Asian populations. A recent consensus statement from the Indian Consensus group for Prevention of Hypertension and CHD²¹⁻²³ recommends the desirable range of 18.5-23.0 kg/m² for BMI and <0.88 and <0.85 WHR for men and women respectively. These lower criteria are important because of the increased susceptibility to insulin resistance in these populations. If these criteria were applied to the MHS population, the percentages of overweight would be even higher.

Our study showed significant prevalence of risk factors, 27% in men and 29% in women. The correlation of anthropometric indices showed high correlation of BMI and WC greater than with WHR, both independent risk factors for CHD. The BMI, WHR and WC were weakly correlated with SBP and DBP. These correlations were of low level of statistical significance, however, the clinical significance of these correlations was estimated separately for men and women and showed strongest effect of one unit change of WC on the SBP, DBP and TC in men. These correlations emphasize the adverse effect of obesity on the risk factors. While WHO Grade 1 overweight does not have the associated morbidity and mortality that Grade II carries, it can be prelude to moving into the higher risk categories. Nearly a third of Metroville adults were in Grade 1. Fewer men (7%) but nearly 1 in 5 Metroville women were in the higher risk category (Grade 2+). In Metroville, WC was significantly

associated with weight and cholesterol levels and weakly with blood pressure after adjusting for age. These results are in accordance with previous studies in other populations^{24,25} and indicate that substantial number of adults in Metroville are at high risk of coronary heart disease and could potentially benefit from weight control/ reduction.

Pakistan is confronted with risk of double burden of underweight and overweight. The PNS showed higher prevalence of urban overweight and obesity compared to the rural population. Our study showed that in comparison to PNS data, under weight was less common and overweight/obesity were more common in urban Metroville, so that under-weight was traded for over-weight and obesity. This shift from underweight to overweight can be expected to lead to an even greater prevalence of CVD risk factors, as reported in other similar communities in Pakistan.¹ Comparison of prevalence rates of over weight in urban PNS population and urban Metroville showed significantly higher rates in Metroville, both in males and females. Thus, these quantitative differences of prevalence of over weight between these two urban populations may be due to different socioeconomic populations, Metroville is a lower middle class community with higher than average socioeconomic status. In Pakistan the urban populations are, socio economically, non homogeneous. Therefore, individual community assessment of risk factors should be carried out before allocating resource for health promotion, as standardized nation-wide recommendations and similar policies may not be appropriate for every community.

The MHS baseline examination household data, which was the basis of this study, was not a random sample. Nevertheless, it represented 9.1 percent of the Metroville house hold population and provided an opportunity to assemble population-based data on anthropometric measurements and test their association with CHD risk factors in this community. The conclusions of the study may not be strictly applicable to all such communities in Pakistan.

In comparison with urban Chinese and USA, MHS residents are roughly in between in prevalence of healthy

weight. Potential explanations for greater obesity in MHS than in urban China may be related to type and amount of fat and meat consumption in traditional cooking and to more sedentary lifestyle, especially among women. Given a heterogeneous Pakistani population, risk factors of the communities should be identified and intervention specifically targeted, rather than adopting higher risk behavior modification for all the communities.

In Western populations, central obesity is shown to be a stronger predictor of CHD than BMI.⁶ Abdominal fat pattern is associated with glucose intolerance, hyperinsulinemia, hypertension, low plasma HDL cholesterol and high triglycerides. It has also been shown to be associated with CVD independently. In a lean population in south China, increased WHR was still found to be associated with CVD risk factors.^{19,20} We were unable to assess the association of WHR to triglycerides in this population because only non-fasting blood samples were collected. Although the relationship of WHR to risk is continuous, a guideline proposed by the USDA Advisory Committee define high risk WHR as >0.95 for men and >0.80 for women.²² In Metroville, most women exceeded this ratio, as did most men over 40. Whether these cutpoints carry the same risk in Pakistani populations remains to be determined.

Conclusions

Our study of an urban lower middle class community in Pakistan has shown that double burden of under weight and over weight was still present, although underweight was substantially less of a problem.

Prevalence of overweight/obesity in this community is reaching alarming levels and is significantly correlated with higher blood pressure and cholesterol levels. New urban communities similar to Metroville are rapidly emerging in other major cities of Pakistan and other developing countries and are at risk for CVD unless preventive strategies are put in place.

The potential value of targeting interventions to reduce overweight at newly emerging communities such as Metroville is clear. However, applying such strategies on a national level might be less effective or even counterproductive. This data provides strong support for assessment of risk factors status and application of prevention strategies at the community level.

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