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ANTHROPOMETRIC INDICES, LIPID PROFILE AND HS CRP LEVELS IN ADULTS (25-60 YEARS) IN AN URBAN SETTING.

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ABSTRACT : India- a country undergoing developmental transition is facing dual burden of malnutrition leading to increased incidence of CVDs. Apart from traditional risk factors, hs CRP a nonspecific marker of inflammation is associated with cardiovascular risk and knowledge about distribution in population may help in direct preventive efforts. Thus the present study was planned to map the regional prevalence of obesity, dyslipidemia, hs CRP and and its interrelationship on 292 adults (25-60years) in an urban set up. Individuals on lipid lowering drugs, thyroid treatment and hormone replacement therapy were excluded from the study. Anthropometric measurements were taken using standard procedure. Fasting blood sample was collected for estimating lipid profile and CRP levels of the subjects using diagnostic kit methods. According to the cutoffs used for BMI, 18% of the subjects were overweight and 53% obese. Abdominal obesity in terms of WC, WHR and WhtR was found among 58%, 44% and 75% of the subjects respectively using genderwise appropriate cutoffs. High LDL and high TG were found among 26% and 19% of the subjects respectively while 51% had low HDL levels. hs CRP estimations showed 38% of the subjects at higher risk of any kind of inflammation. Anthropometric indices except for WHR correlated significantly with lipid profile and hs CRP levels. However no significant correlation was obtained between lipid profile and hs CRP. Thus the present study indicated that abdominal obesity (in terms of WHtR) can be regarded as the best predictor of cardiovascular diseases followed by WC and BMI.

Key-words: Anthropometric, Lipid profile,

INTRODUCTION

India is undergoing a dual transition namely, nutritional and epidemiological transition. The epidemiological transition refers to a shift in morbidity and mortality from communicable to non-communicable diseases (NCDs). We have not yet been able to address the problem of under nutrition and infectious diseases on one hand and obesity and other NCDs are on rise on the other. The increase seen in NCDs is due to the nutritional transition i.e. an atherogenic diet and the presence of traditional risk factors like hypertension, dyslipidemia, behavioral/emerging risk factors and physical inactivity. Under nutrition is being addressed and looked into as a major public health problem and relevant advocacy measures have also been designed in order to tackle it. However, the NCDs are not regarded as a public health problem.The disease common few years ago in the geriatric population have shifted to adults increasing the mortality rate in adult population. New biomarkers like C reactive protein, fibrinogen, and homocysteine help in early detection of the diseases. C-reactive protein (CRP) is made by the liver and secreted into the bloodstream. CRP increases with inflammation and infection as well as following a myocardial infarction (MI, heart attack), surgery, and trauma. Although CRP acts as an inflammatory marker, it has been shown that CRP levels begin to rise as early as during formation of macrophages from monocyte. Thus it can form a strong independent marker to assess the risks.(Ridker et al, 2003; Clearfield M, 2005; Guille et al, 2008; and Lagrand et al, 1999). High sensitivity CRP (hs- CRP) is a kind of CRP which is detected at a very low level i.e. less than 1 mg/dl. Several studies support hs- CRP being the only stand alone marker, while few studies suggest hs- CRP to be carried out along with lipid profile for CVD risk detection. (Ridker et al, 2000, Yeh et al; 2003). Therefore, the present study was planned with the following objectives.

Broad objective-

- To predict the future risk towards diseases by assessing the current biochemical and nutritional profile in adult population (25- 60 yrs) in an urban setting.

Specific objectives-

- To assess the nutritional status by anthropometric parameters like height, weight, BMI, waist to hip ratio (WHR), waist stature ratio (WHtR) and assess the prevalence of obesity among adults.
- To estimate the CRP levels and lipid profile in blood.
- To correlate the anthropometric indices with lipid profile and hs CRP levels.

MATERIALS AND METHODS

Out of the thirteen faculties of the Maharaja Sayajirao University of Baroda, seven faculties were randomly selected. Three hundred subjects in the age group of 25- 60 yrs who were willing to participate in the study were enrolled for the study. During the course of the study there were dropouts and the final sample size of the study was 292 comprising of 146 females and 146 males. Pregnant female subjects and individuals on lipid lowering drugs, thyroid treatment or any other hormone replacement therapy were excluded from the study. The study was approved by the Department Medical Ethical Committee. Weights of the subjects were measured using bathroom weighing scale, height using height meter, waist circumference and hip circumference was measured using fiber glass tape. Body Mass Index (BMI), Waist Hip Ratio (WHR) and Waist Height Ratio (WHtR) was calculated using standard formulae. Venous fasting blood sample was collected in clot activator tubes. Serum was separated through centrifugation at 2000 RPM for 12 minutes and stored at -20°c temperature till assayed. Lipid profile and hs- CRP levels of the subjects was estimated using enzymatic kit method. Results are expressed as mean ± standard error (SE). Student's t-Test and partial correlation were performed. All data analysis was done using Microsoft Excel (ver. 2007) and the Statistical package for the Social Sciences (SPSS, Inc. 16.0) software for Windows.

RESULTS

Anthropometric parameters

The mean BMI, WC, WHR and WHtR for females was 26.52 kg/m^2, 84.13 cm , 0.83 and 0.54 respectively and that for males was 24.98 kg/m^2, 90.25 cm, 0.90, 0.53 respectively. (Table 1). After dividing the subjects age wise it was seen that the mean BMI, WC and WHtR increased with increasing age in both females and males, however no such trend was observed with respect to WHR in both the genders. (Table 2).

Table1: Anthropometric Indices, lipid profile, and hs CRP levels in the subjects of the study.

Variable	Age (25-60 years)		
	Total (N=292)		
	Female (N=146)	Male (N=146)	't' value
BMI	26.52±4.67	24.98±3.88	3.062**
WC	84.13±10.02	90.25±9.03	5.479****
WHR	0.83±0.07	0.90±0.04	10.112****
WHtR	0.54±0.06	0.53±0.05	0.727^{NS}
TC	148.56±40.22	154.53±44.83	1.198^{NS}
TG	93.15±45.64	122.41±79.12	3.871****
LDL	84.88±38.82	84.80±41.10	0.016
HDL	45.01±9.43	45.17±8.84	0.154
VLDL	18.67±9.10	24.55±16.00	3.861****
hs-CRP	2.71±2.49	2.02±1.90	2.665*

****significantly different at p≤0.000 *** significantly different at p≤0.001

**significantly different at p≤0.01 *significantly different at p≤0.05

Table 2: Age wise distribution of Anthropometric parameters, lipid profile, atherogenic indices and hs CRP levels in the participants under study

Variable	25-34 years		35-44 years		45-54 years		>55 years	
	Female (N=53)	Male (N=60)	Female (N=43)	Male (N=30)	Female (N=44)	Male (N=45)	Female (N=6)	Male (N=11)
BMI	24.54±4.70	24.27±3.80	27.08±4.09	25.00±4.22	28.27±4.43	25.60±3.71	27.27±4.65	26.34±3.77
WC	79.09±9.56	87.15±7.85	86.12±9.68	91.25±10.02	87.84±8.45	92.61±9.36	87.25±11.23	94.77±5.82
WHR	0.81±0.06	0.88±0.03	0.86±0.09	0.90±0.04	0.82±0.04	0.92±0.04	0.83±0.07	0.94±5.82
WHtR	0.50±0.06	0.51±0.04	0.55±0.06	0.54±0.05	0.56±0.05	0.55±0.05	0.56±0.07	0.57±0.04
TC	132.47±33.45	143.6±43.01	147.16±32.87	160.10±47.48	166.77±45.50	163.35±47.32	167.17±47.91	162.91±24.55
TG	76.30±39.91	108.01±59.99	96.77±48.49	125.17±61.70	103.61±42.84	134.06±90.44	139.33±40.89	145.82±141.58
LDL	70.64±30.95	77.38±38.24	84.65±34.82	89.73±41.18	100.91±44.55	89.75±45.76	94.67±44.50	91.55±34.28
HDL	46.47±9.13	44.65±8.94	43.16±8.92	44.87±9.09	45.09±10.65	46.82±9.24	44.83±4.16	42.18±4.77
VLDL	15.36±8.07	21.56±12.06	19.35±9.60	25.50±13.19	20.77±8.53	26.77±18.12	27.67±8.33	29.18±28.34
hs-CRP	1.90±2.16	1.83±1.74	2.77±2.47	2.63±2.24	3.58±2.62	1.82±1.88	3.20±2.77	2.20±1.70

On classifying the subjects according to the cutoffs used for anthropometric parameters, higher numbers of females were found to be overweight and obese than males. (Table 3). Prevalence of abdominal obesity was higher in females than in males. Fifty nine percent of the females and 46% of the males were obese according to the Asia Pacific Classification used for BMI, 17% of the females and 19% males were overweight and only few participants were underweight. Abdominal obesity in terms of WC was found in 67% females and 50% males, that in terms of WHR was found in 69% of the females and 18% of the males. Highest numbers of participants were found to be obese according to WHtR i.e. 74% of the females and 76% of the males. The prevalence of general obesity (BMI) as well as abdominal obesity (WC, WHR and WHtR) was high in both males and females as mentioned in table 3.

Table 3: Subjects at risk of by various anthropometric indices

Variable	Total (N=292)		Female (N=146)		Male (N=146)	
	N	%	N	%	N	%
BMI (Asia-Pacific Classification)						
Underweight (<18.5)	11	4	6	4	5	3
Normal (18.5-22.9)	73	25	28	19	45	31
Overweight (23-24.9)	53	18	25	17	28	19
Obesity (=25)	155	53	87	59	68	46
WC (MS-IDF classification)						
Normal (<80 female/<90 male)	120	41	48	33	72	49
At Risk (=80 female/=90 male)	172	58	98	67	74	50
WHR (MS-IDF classification)						
Normal(<0.8 female/<0.95 male)	164	56	44	30	120	82
At Risk(=0.8 female/=0.95 male)	128	44	102	69	26	18
WHtR (Hsieh et al, 2003 & Bertsias et al, 2003)						
Normal (<0.5)	71	24	37	25	34	23
At Risk (=0.5)	221	75	109	74	112	76

Lipid profile of the participants under study

The mean TC, TG, LDL, HDL and VLDL was 148.56 mg/dl, 93.15 mg/dl, 84.88 mg/dl, 45.01 mg/dl, 18.67 mg/dl in females and 154.53 mg/dl, 122.41 mg/dl, 84.80 mg/dl, 45.17 mg/dl, 24.55 mg/dl respectively. (Table 1). Age wise distribution of the subjects showed that there was an increase in mean TC, TG and VLDL with age but there were no trends with respect to LDL and HDL. (Table 2). Hypertriglyceridemia was found in 16% of the females and 24% of the males. Twenty eight percent of the females and 27% of the males had high LDL however low HDL was found among 73% of the females and 30% of the males with an average of 51% of the total participants.(Table 4)

Table 4: Distribution of subjects into categories of lipid profile

VARIABLE (mg/dl)	TOTAL (N=292)		FEMALE (N=146)		MALE (N=146)	
	N	%	N	%	N	%
TC						
Desirable (<200)	263	89	134	92	129	88
Borderline High (200-239)	16	5	8	5	8	5
High (>240)	13	4	4	3	9	6
TG						
Normal (<150)	236	80	124	84	112	76
Borderline High (150-199)	33	11	20	15	13	9
High (200-499)	22	7	2	1	20	14
Very High (>500)	1	1	0	0	1	1
LDL						
Optimal (<100)	211	72	105	71	106	72
Above Optimal (100-129)	45	15	22	15	23	16
Borderline High (130-159)	22	7	15	10	7	5
High (160-189)	7	2	2	1	5	3
Very High (>190)	7	2	2	1	5	3
HDL						
Low (<50 female/<40 male	151	51	107	73	44	30
Normal (50-59 female/40-49 male)	97	33	27	18	70	48
High (>60 female/>50 male)	44	15	12	8	32	22

Atherogenic indices namely, TC/HDL and LDL/HDL were also calculated. The mean values for TC/HDL, LDL/HDL were 3.48 mg/dl and 2.05 mg/dl in females and 3.55mg/dl and 1.99 mg/dl in males. However, the mean values for both lipid profile and atherogenic indices were not significantly different in the two genders except for TG and VLDL which was significantly higher in males than in females. (Table 1). The mean values for atherogenic indices were found to increase with age in both the genders. (Table2).

hs CRP levels in the participants under study

The mean hs CRP levels were higher in females (2.71) than in males (2.02). No trends were observed with increase in age after dividing the participants into age groups. (Table 1 and 2). Thirty three percent of the females and 23% of the males were at high risk of CVDs, 37% of both females and males were at moderate risk and 30% of the females and 40% of the males were at low risk according to the classification used for hs-CRP.(Table5).

Table 5: Classification of subjects according to hs CRP

VARIABLE	hs CRP LEVELS (mg/L)					
	TOTAL N=292	%	FEMALE N=146	%	MALE N=146	%
<1 (Low Risk)	102	35	44	30	58	40
1-3 (Moderate Risk)	108	37	54	37	54	37
3-10 (High Risk)	82	28	48	33	34	23

Correlation between anthropometric indices and various cardiovascular risk factors

Anthropometric indices namely BMI, WC and WHtR correlated significantly with lipid profile and hs CRP levels. (Table 6a and Table 6b). However, no significant correlation was obtained between lipid profile and hs CRP.

Table 6a: Correlation of anthropometric indices with lipid profile and atherogenic indices by age and gender in the participants

VARIABLE	TC			TG			LDL			HDL		
	Total	Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male
	Correlation Coefficient			Correlation Coefficient			Correlation Coefficient			Correlation Coefficient		
BMI	0.159**	0.217**	0.133	0.204**	0.335**	0.224**	0.128*	0.180*	0.075	-0.109	-0.139	-0.073
WC	0.190**	0.180*	0.177*	0.352**	0.289**	0.343**	0.104	0.157	0.059	-0.076	-0.158	0.007
WHR	0.125*	0.005	0.241**	0.314**	0.101	0.425**	0.034	0.015	0.082	-0.019	-0.096	0.089
WHtR	0.216**	0.222**	0.222**	0.290**	0.291**	0.352**	0.160**	0.024*	0.114	-0.112	-0.170	-0.038

****significantly different at p≤0.000 *** significantly different at p≤0.001
**significantly different at p≤0.01 *significantly different at p≤0.05

Table 6b: Correlation of anthropometric indices with lipid profile and atherogenic indices by age and gender in the participants

VARIABLE	VLDL			TC/HDL			LDL/HDL			hs - CRP		
	Total	Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male
	Correlation Coefficient			Correlation Coefficient			Correlation Coefficient			Correlation Coefficient		
BMI	0.200**	0.335**	0.220**	0.196**	0.228**	0.171*	0.158**	0.188*	0.114	0.428**	0.364**	0.388**
WC	0.349**	0.287**	0.339**	0.181**	0.202*	0.159	0.111	0.167*	0.071	0.292**	0.386**	0.396**
WHR	0.309**	0.101	0.414**	0.089	0.059	0.147	0.026	0.044	0.045	-0.173*	-0.099	0.163
WHtR	0.287**	0.288**	0.339**	0.234**	0.249*	0.217**	0.179**	0.217**	0.128	0.380**	0.320**	0.438**

****significantly different at p≤0.000 *** significantly different at p≤0.001
**significantly different at p≤0.01 *significantly different at p≤0.05

DISCUSSION

Anthropometric indices, lipid profile, and hs CRP levels increased with age. Prevalence of overweight and obesity was high among the participants and very few participants were in the undernourished category. Abdominal obesity was found higher in females than in males. A study conducted in Mumbai on 99598 adults aged ≥ 35 yrs showed that the mean height, weight, and BMI were 161.0 cm (SD ± 6.7), 56.7 kg (SD ± 11.0), and 21.8 kg/m^2 (SD ± 3.8) for men and 148.0 cm (SD ± 6.2), 49.8 kg (SD ± 11.2), and 22.7 kg/m^2 (SD ± 4.7) for women, respectively. (Shukla et al, 2002). Thus, it is seen that the subjects from the present study were shorter but heavier than the Mumbai population. The absence of abdominal obesity (in terms of WHR) in males can be attributed to large hip and waist circumference that may have normalized the WHR values while WC and WHtR continued to point at a high prevalence of abdominal obesity. Higher numbers of the participants were at risk by WHtR as compared to WC, indicating presence of short stature coupled with abdominal obesity. Thus, the study population can be depicted to have short fat phenotype.

Mc Carthy, (2006) reviewed different papers and concluded that obesity increases the risk for related morbidities, particularly the metabolic syndrome, which is defined as a clustering of CVD risk factors, including impaired glucose tolerance, dyslipidemia and hypertension.

Abdominal fatness leads to metabolic alterations and thus may lead to cardiovascular diseases in later life and thus it should be controlled at an early age to avoid future complications. Prevalence of low HDL is the most common form of dyslipidemia followed by elevated LDL levels and hypertriglyceridimea. Misra, Luthra and Vikram (2004) reviewed several studies to map dyslipidemias in Asian Indians. Lipid fractions other than total cholesterol, i.e. serum triglycerides and HDL cholesterol are important for the pathogenesis of atherosclerosis. A combination of hypertriglyceridemia, low HDL and high LDL cholesterol, termed as "atherogenic dyslipidemia', is particularly seen in Asian Indians. Recent data show that low levels of HDL-cholesterol may be particularly pronounced in migrant Asian Indian women as compared to Caucasians. Similarly in the present study the common form of dyslipidemia found among participants was low HDL value. Low HDL can act as an initiator of aberrations in other lipid parameters. High levels of HDL appear to protect against atherogenesis. HDL promotes efflux of cholesterol from foam cells in atherosclerotic lesions (reverse cholesterol transport). The antioxidant and anti-inflammatory properties of HDL also inhibit atherogenesis. Thus, low HDL can be regarded as the initiator of cardiovascular diseases.
A study conducted on 1774 subjects aged 20 yrs and more showed similar results. The prevalence of high hs CRP ranged from 16.0% (for those with TC within the recommended range) to 20.5% (for those with LDL-C within the recommended range) among those having normal BMI. (Ajani, Ford and Mokad, 2004).

A population based cross sectional study on 388 men aged 50-59 years from general practice registers of Merton, Sutton, and Wandsworth showed that increasing age, smoking, symptoms of chronic bronchitis, Helicobacter pylori and Chlamydia pneumonia infections, and body mass index were all associated with raised concentrations of C reactive protein. C Reactive protein concentration was associated with raised serum fibrinogen, sialic acid, total cholesterol, triglyceride, glucose, and apolipoprotein B values. C Reactive protein concentration was negatively associated with HDL cholesterol concentration. However, there was a weaker positive relation with LDL cholesterol concentration and no relation with apolipoprotein A I value. Thus, inconsistent results were seen in this study, which specified the need to carry out more such studies to establish relationship between CRP and cardiovascular diseases. (Mendall et al, 2009).

In the present study, CRP correlated significantly with anthropometric indices like BMI, WC and WHtR. Significant correlation was found between CRP and abdominal obesity indicators, thus indicating the use of CRP as an indicator for abdominal obesity which predisposes risk for cardiovascular diseases.

CONCLUSION

WHtR emerged as a simple, easy, accurate and age independent index with high applicability to screening overweight and obesity amongst the current study participants. Thus, from the present study abdominal obesity (in terms of WHtR) can be regarded as the best predictor of cardiovascular diseases followed by WC and BMI.

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