Correlation between Anthropometric Indices and Lipid Profile in Adults.

Anil Kumar Sharma[1], Shikha Sharma[2], Bhawani Shankar Modi[3], Tejendra Singh[4]

[1]Associate Professor, Dept of General Medicine, FH Medical College, Tundla, UP
[2]Associate Professor, Dept of Anatomy, FH Medical College, Tundla, UP
[3]Demonstrator, Dept of Anatomy, FH Medical College, Tundla, UP
[4]Assistant Professor, Dept of Anatomy, FH Medical College, Tundla, UP

ABSTRACT

Introduction: Obesity is a worldwide health issue, associated with excessive fat accumulation in the body to the extent that health and well-being are adversely affected. Obesity may increase the risk of many diseases such as diabetes, atherosclerosis, hypertension dyslipidemia, gallbladder diseases and cardiovascular diseases. Anthropometric measurements can easily reflect any changes in the lipid concentration in the human body. Intra-abdominal fat has been identified as being the most clinically relevant type of fat in humans. Abnormal visceral fat produces physiological changes that alter lipid profile, leading to dyslipidemia, which in turn increases the risk of cardiovascular events. Body mass index, waist and hip circumferences were found to be useful anthropometric predictors for cardiovascular risk. The aims and objectives of the study are Body mass index, waist and hip circumferences were found to be useful anthropometric predictors for cardiovascular risk. To evaluate the correlation between lipid profiles and anthropometric indices of total and central obesity. **Methods:** The present study was conducted among 90 adults (45 male, 45 female) in FH Medical College. All subjects were apparently healthy. The serum lipid profile included total cholesterol (TC), high-density lipoprotein (HDL), low-density lipoprotein (LDL) and triacylglycerols (TG). BMI (kg/m2) was calculated using Quitelet's index. Adults were classified according to their BMI into three groups. **Results:** Average age of males is 40.02 years and females 36.46 years. On the basis of BMI, there was 14.44% of normal weight persons, 26.67% overweight and 58.89% obese. Abnormal levels for TG in 35, TC in 20, LDL in 3, HDL in 27 of the total sample were found. Overall correlations were found between anthropometric analysis and lipid profiles. **Conclusion:** We found good correlations between anthropometric indices of general and central obesity and lipid profiles. Among, the anthropometric indices WHR proved to be a good predictor of dyslipidemia, showing the importance of using it in clinical practice and for screening of cardiovascular risk. Prospective studies using different parameters to assess abdominal obesity and its relationship to metabolic profile and with larger population are needed to quantify the results for application to community health lifestyle modifications.

Keywords: Obesity, BMI, WHR, WC, Lipid Profile (HDL, LDL, TG)

INTRODUCTION

Obesity is a worldwide health problem. It is associated with excessive fat accumulation in the body to the extent that health and well being are adversely affected.[1] The association between overweight and many diseases have been established. Body-fat distribution could possibly identify subjects with the highest risk of disturbed lipid profile.[2]Obesity may increase the risk of many diseases such as diabetes, atherosclerosis, hypertension, hyperlipidemia, gall bladder diseases and cardiovascular diseases.[3]Cardiovascular disease (CVD) is the leading cause of mortality and morbidity in adults; it is responsible for 16.7 million deaths per year worldwide according to the World Health Organization (WHO).

Name & Address of Corresponding Author
Dr. Anil Kumar Sharma,
Associate Professor, Dept of General Medicine,
FH Medical College, Tundla, UP, India
E-mail: anilsharma4160@gmail.com

Risk factors for the development of CVD can be divided into categories: non modifiable (such as age, gender, family history and genetic inheritance) and modifiable factors (sedentary lifestyle, smoking, physical inactivity, poor diet, obesity and dyslipidemia). Anthropometric measurements can easily reflect any changes in the lipid concentration in the human body. Intra-abdominal fat has been identified as being the most clinically relevant types of fat in humans.[1] Abnormal visceral fat deposition produces physiological changes that alter lipid profile, leading to dyslipidemia, which in turn increases the risk of cardiovascular events. This is particularly true of alterations in low-density lipoprotein cholesterol (LDL-C), an independent causal factor in atherosclerosis. Body mass index, waist and hip circumferences were found to be useful anthropometric predictors of cardiovascular risk, and have the advantages in daily clinical practice of being simple to measure and reproducible.[4]

The performance of different anthropometric measurements and indices in predicting obesity-related outcomes has been addressed in several reports.[5-7] There is, however, controversy regarding which anthropometric indicator best defines obesity and conveys the highest risk of hypertension. The present study was therefore undertaken to determine and evaluate the overweight/obesity and hyperlipidemia status in people of FH Medical College and to evaluate the correlation between lipid profiles and anthropometric indices of total and central obesity.

MATERIALS AND METHODS

The present study was conducted among 90 (45 male, 45 female) adults with an age range of 20 to 64 years in FH medical college. The participants were chosen randomly from college premise. All subjects were apparently healthy. The lipid profile included total cholesterol (TC), high-density lipoprotein-cholesterol (HDL-C), low-density lipoprotein-cholesterol (LDL-C) and triacylglycerols (TG). Fasting venous blood samples had been obtained from each participant for biochemical screening test. 5ml blood sample was taken in aseptic tubes and was allowed to be collated and then centrifuged to separate the serum in the biochemistry lab of the hospital where the actual biochemical analyses were performed. Erba Kits were used for TG, HDL-C and TC analysis. The LDL-C was calculated by the Friedewald and colleagues' formula [LDL-C= TC - (HDL-C + (TG/5))]. All anthropometric measurements were done in the department of anatomy of FHMC, Tundla, with participants wearing light clothes and no shoes. Body weight was measured in kg by a mechanical scale to the nearest kg. Height was measured to the nearest one cm with a wall-mounted stadiometer. BMI (kg/m^2) was calculated using Quitelet's index. Body mass index (kg/m^2) was calculated by weight in kilograms divided by the square of height in meters. Adults were classified according to their BMI into three groups: normal weight (BMI: <22.9 kg/m^2),overweight (BMI: 23-24.9 kg/m^2) and obese (BMI≥25kg/m^2).[8] Waist circumference was measured above the iliac crest and below the lowest rib marginat minimum respiration. Hip circumference (HC) was measured at the widest part of the hip at the level of the greater trochanter to the nearest half centimeter[13]. The waist and hip circumferences were measured with a flexible tape. The WHR equals WC divided by hip circumference. Pregnant females, hypertensive/diabetic patients/cardiac patients were excluded from this study. Written informed consent was taken from every participant.

Statistical Analysis: The data analysis was carried out using SPSS version 14.

RESULTS

Complete sets of data were collected from 90 individuals (45 Males and 45 Females), none of the subjects were found to use lipid-lowering drugs. Average age of males is 40.02 years and females 36.46 years. On the basis of BMI, there was (43.3%) of normal weight persons, (24.4%) overweight and (32.3%) obese. With regards to laboratory parameters assessed, abnormal levels of TG in 35, TC in 20, LDL in 3, HDL in 27 of the total sample were found. Overall correlations were found between anthropometric analysis and lipid profiles as depicted in [Table 1]. TG was found to correlate with WC (p=0. 022) and WHR was correlated with TG (p=0. 001) and TC (p=0. 009). On the basis of normal and abnormal levels, all the parameters were found to be highly significant [Table 2]. In [Table 3 and 4] gender specifically significance was found in the TG, TC, WHR, WC and HDL. Overall, also gender specific significant values are found in TC, TG and WHR.

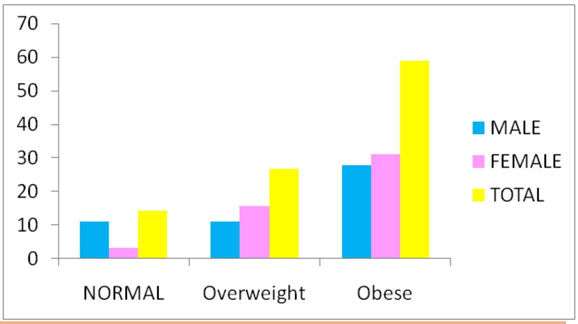

Figure 1:Classification of Bmi (Percentage) according to Gender

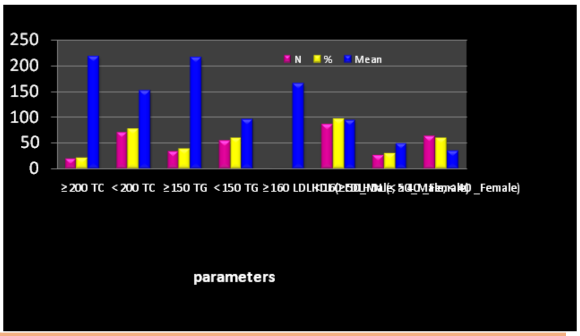

Figure 2:Depiction of normal and derranged Lipid Profile

Table 1: Pearson Correlatio

		TG	HDL	TC	VLDL	LDL
WC	r	0.172	-0.122	0.119	0.149	0.103
	p	0.022*	0.106	0.116	0.048*	0.17
WHR	r	0.248	-0.078	0.198	0.236	0.113
	p	0.001*	0.303	0.009*	0.002*	0.129
BMI	r	-0.041	-0.064	0.033	-0.0413	0.094
	p	0.589	0.398	0.663	0.591	0.211

Table 2: Statistics of Anthropometric Variables& Lipid Profile

Variables	N	%	Mean	SD	p Value
≥ 25 BMI (kg/m²)	53	58.89	31.3	5.19	0.0001*
< 25 BMI (kg/m²)	37	41.11	22.91	1.78	
WC (≥ 102Male, ≥ 88 Female) cm	46	51.11	106.72	11.62	0.0001*
WC (< 102Male, < 88 Female) cm	44	48.89	85.96	7.65	
> 0.5 WHR_ Male	45	50	0.96	0.08	0.0004*
> 0.5 WHR_ Female	45	50	0.89	0.08	
≥ 200 TC (mg/dl)	20	22.22	219.05	17.14	0.0001*
< 200 TC (mg/dl)	70	77.78	151.75	24.75	
≥ 150 TG (mg/dl)	35	38.89	216.85	66.34	0.0001*
< 150 TG (mg/dl)	55	61.11	96.47	34.21	
≥ 160 LDL (mg/dl)	3	3.33	166.27	4.29	0.0001*
< 160 LDL (mg/dl)	87	96.67	94.95	25.46	
HDL (≥ 50_Male, ≥ 40 _Female)	27	30	49.68	7.29	0.0001*
HDL (< 50_Male, < 40 _Female)	63	60	35.87	6.09	

Table 3: Statistics of Anthropometric Measurements According To Male & Female

Variables	N	%	Mean	SD	SEM	t	df	p Value
≥ 25 BMI_Male	23	25.56	31.98	6.33	1.32	0.843	49	0.4035
≥ 25 BMI_Female	28	31.11	30.75	4.06	0.77			
< 25 BMI_ Male	22	24.44	22.61	2.05	0.44	1.22	37	0.2298
< 25 BMI_ Female	17	18.89	23.31	1.3	0.32			
> 0.5 WHR_ Male	45	50	0.96	0.08	0.012	3.72	88	0.0004*
> 0.5 WHR_ Female	45	50	0.89	0.08	0.012			
≥ 102 WC_Male	16	17.78	113.97	11.55	2.89	3.308	43	0.0019*
≥ 88 WC_Female	29	32.22	103.36	9.56	1.76			
< 102 WC_Male	29	32.22	87.78	8.7	1.615	2.21	43	0.0324*
< 88 WC_Female	16	17.78	82.78	3.09	0.773			

Table 4: Statistics of Lipid Profile According To Male & Female

Variables	N	%	Mean	SD	SEM	t	df	p Value
≥ 200 TC_Male	11	12.22	220.04	20.91	6.3	0.28	18	0.7845
≥ 200 TC_Female	9	10	217.84	12.17	4.05			
< 200 TC_Male	34	37.78	161.12	19.48	3.34	3.29	68	0.0016*
< 200 TC_Female	36	40	142.9	26.15	4.36			
≥ 150 TG_Male	21	23.33	218.02	78.57	17.15	0.126	33	0.9007
≥ 150 TG_Female	14	15.56	215.1	44.78	11.97			
< 150 TG_Male	24	26.67	112.15	32.15	6.56	3.24	53	0.002*
< 150 TG_Female	31	34.44	84.33	31.06	5.58			
< 160 LDL_Male	42	46.67	97.46	22.21	3.43	0.886	85	0.3784
< 160 LDL_Femle	45	50	92.61	28.2	4.2			
≥ 50 HDL_Male	5	5.56	55.61	5.78	2.58	2.15	25	0.04*
≥ 40 HDL_Female	22	24.44	48.34	7.01	1.49			
< 50 HDL_Male	40	44.44	37.38	6.61	1.04	2.71	61	0.009*
< 40 HDL_Female	23	25.56	33.26	4.01	0.84			

DISCUSSION

One of the most common problems related to lifestyle today is being overweight. Severe overweight or obesity is a key risk factor in the development of many chronic diseases such as heart and respiratory diseases, non-insulin-dependent diabetes mellitus or Type 2 diabetes, hypertension and some cancers, as well as early death.[9] Obesity and overweight are serious problems that pose a huge and growing financial burden on public resources. Evaluations of the effects of excess weight on health should consider the distribution of body fat as well as the amount of adipose tissue. Abdominal fat has been associated with insulin resistance, hyperlipidemia, hypertension, certain types of cancer and osteoporosis.[10-13]

World Health Organization recommends measurement of the BMI as a universal criterion of overweight (≥25) and obesity (≥30) while measures of abdominal fat distribution, such as WC or waist-to-hip ratio (WHR) are also advised.[14] There is evidence to support the use of BMI in risk assessment since it provides a more accurate measure of total body fat compared with the assessment of body weight alone. BMI does not however, distinguish fat from muscle. Excess abdominal fat is an important, independent risk factor for disease.

Men who have waist circumferences greater than 40 inches and women who have waist circumferences greater than 35 inches are at higher risk for developing diabetes, elevated cholesterol levels, hypertension, and CVD because of an excess of abdominal fat.[15]WC measurement is particularly useful in people who are categorized as normal or overweight in terms of BMI. For individuals with BMI>35, waist circumference adds little to the predictive power of the disease risk. A high WC is associated with an increased risk of type 2 diabetes, dyslipidemia, hypertension, and CVD in patients with a BMI between 25 and 34.9 kg/m. Evidence suggests that the prevalence of overweight and obesity is rising dramatically worldwide and that the problem appears to be increasing rapidly in children as well as in adults. In Korea and other Asian countries, more and more of the population are becoming obese and many people may be under increasing threat of developing metabolic syndrome.[1]

The third national health and nutrition survey conducted by the Korean Ministry of Health and Welfare in 2001 announced that the overall prevalence of obesity in Korean adults was 30.6% (32.4% in men, 29.4% in women). High prevalence of obesity was noted in our study compared to what has been noted in other urban studies on obesity.[16-18]Mean value of the BMI recorded in the present study was 25.26 ± 5.86 kg/m^2. This is akin to data derived from migrant Indians to the USA. The developments of the Saudi economy in recent decades and the consequent social and cultural changes have altered dietary habits in this country.

These changes are characterized by a decrease in consumption of grain products, green vegetables and legumes, together with an increase in the consumption of meat, potatoes, fruit, fat and dairy products.[19-20]The most comprehensive data on the prevalence of obesity worldwide are those of the MONICA project (Monitoring of Trends and Determinants in Cardiovascular Diseases Study) of the World Health Organization. The data show that the prevalence of obesity in most European countries has increased by about 10-40% in the past 10 years, ranging from 10-20% in men and 10-25% in women. The most alarming increase has been observed in the United Kingdom, where nearly two thirds of adult men are overweight or obese.[21-23]

This is partly due the function of HDL-C, which acts in reverse cholesterol transport, i.e., it helps remove cholesterol from artery walls to the liver where it is re-used or converted into bile acids or discarded. Overweight prevalence among adolescents may be explained by changes in eating patterns (increased consumption of simple sugars, processed foods and an inadequate intake of fruits and vegetables) and by a progressive reduction of physical activity combined with more time dedicated to low-intensity activities (watching television, computer usage and playing video games).[24] Sedentary behavior may cause an increase in body weight and thus contribute to the increased prevalence overweight and obese adolescents.[25] It was observed that 32.2% of adolescents in this study were abdominally obese. Beck et al.[26] investigated adolescents aged 14–19 years in the city of Três de Maio, in the state of Rio Grande do Sul, by using the same cutoff points as in this study and found that 32.6% of adolescents had abdominal obesity. These data show the need for public policies aimed at reducing body fat in the central region of the body in children and adolescents, especially when considering its relationship with the occurrence of cardiovascular diseases in adulthood.[27]Adolescents who are overweight, as determined by BMI, are twice as likely to show increased triglyceride levels when compared to adolescents with normal weight. As for abdominal obesity, it was found that adolescents with high central adiposity are more likely to have elevated triglyceride levels. Weight and body fat are the main modulators of plasma lipid levels.

The present study has some limitations. The study was cross-sectional, preventing an assertion of a causal relationship between BMI, WC and lipid profile. The data were sampled from only one college, so there was a possibility of selection bias and some limitation in generalization of results. It should be stressed that this study, with the objective of searching for associations between anthropometric indicators and serum lipid profiles, was the first to be conducted on adolescents of FH Medical college, who are from the mixed population and who reside in rural and urban areas. The results shown in this study allow for the conclusion that a large proportion of adolescents have high serum lipid profile levels. Moreover, those with overweight and abdominal obesity are more likely to have elevated triglyceride levels.

CONCLUSION

In general, our study found good correlations between anthropometric indices of general and central obesity and lipid profiles, which is in agreement with other studies. Among, the anthropometric indices WHR proved good predictors of dyslipidemia, showing the importance of using these parameters in clinical practice and for screening of cardiovascular risk. Prospective studies using different parameters to assess abdominal obesity and its relationship to metabolic profile and with larger populations are needed to quantify the results for application to community health lifestyle modifications.

REFERENCES

1. Kusek EA. American academy of Periodontology. J Periodontol. 2000;71(5):56-9.
2. Abdul Rahman Al-Ajlan. Lipid Profile in Relation to Anthropometric Measurementsamong College Male Students in Riyadh, Saudi Arabia: A Cross-Sectional Study. International journal of biomedical science. 2011;(7)2:112-119.
3. Briel M, et al. Association between change in high density lipoprotein cholesterol and cardiovascular disease morbidity and mortality. BMJ. 2009; 16: 338: b92.
4. Troiano RP, Flegal KM, Kuczmarski RJ. Overweight prevalence and trends for children and adolescents. Arch. Pediatr. Adolesc. Med. 1995; 149: 1085-1091.
5. Rexrode KM, Manson JE, Hennekens CH. Obesity and cardiovascular disease. Curr. Opin. Cardiol. 1996; 11: 490-495.
6. Dalton M, Cameron AJ, Zimmet PZ, et al. Waist circumference, waist-hip ratio and body massindex and their correlation with cardiovascular disease risk factors in Australian adults. J InterncMed. 2003; 254: 555– 563.
7. Williams PT. Increases in Weight and Body Size Increase the Odds for Hypertension During 7vYears of Follow-up. Obesity.2008; 16: 2541–2548.
8. Guagnano MT, Ballone E, Colagrande V, Della Vecchia R, Manigrasso MR, Merlitti D, et al.Large waist circumference and risk of hypertension. International Journal of obesity.2001;25: 1360-1364.
9. Yildiran H, Acar TN, Koksal E, Gezmen KM, Akbulut G, Bilici S, Sanlier N, The association of anthropometric measurements and lipid profiles in Turkish hypertensive adults. African Health Sciences. 2011;(11)3:407-413
10. HO Expert Consultation. Appropriate body mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004; 363 (9403): 157-163.
11. Executive summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on detection, evaluation, andtreatment of high blood cholesterol in adults (adult treatment panelIII). JAMA. 2001; 285: 2486.
12. World Heath Organization. Physical status: the use and interpretationof anthropometry. Report of a WHO Expert Committee. WHO TechnicalReport Series. 1995; No 854.
13. Despres JP. Insulin resistance-dyslipidemic syndrome of visceral obesity:effect on patient risk. Obes. Res. 1988; 6: 8S-17S.
14. Gillum RF, Mussolino ME, Madans JH. Body fat distribution andhypertension incidence in women and men. The NHANES 1 epidemiologicfollow-up study. Int. J. Obes. Relat. Metab. Disord. 1998; 22:127-134.
15. Pujol P, Galtier-Dereure F, Bringer J. Obesity and cancer risk. Hum.Reprod1. (Suppl). 1997; 116-125.
16. Blaauw R, Albertse EC, Hough S. Body fat distribution as a risk forosteoporosis. S. Afr. Med. J. 1996; 86: 1081-1084.
17. Anonymous 2000 Obesity: preventing and managing the global epidemic:report of a WHO consultation. World Health Organ. Tech. Rep.Ser. 894: i-xii, 1-253.
18. Ruston D, et al. National Diet and Nutrition Survey: adults aged 19to 64 years. Volume 4, Nutritional status (anthropometry and bloodanalyses), blood pressure and physical activity. London: TSO. 2004.
19. Report on national health and nutrition survey 2001. Seoul (Korea):Korean Ministry of Health and Welfare. 2002.
20. Rao VK, Rau P, Thimmayamma BVS. Nutritional anthropometry ofIndian adults. Indian J. Nutr. Dietetics. 1986; 23: 239-256.
21. McKeigue PM, Shah B, Marmot MG. Relation of central obesity andinsulin resistance with high diabetes prevalence and cardiovascularrisk in South Asians. Lancet. 1991; 337: 382-386.
22. Serra-Manjem L, Ribas L, Tresserras R, Ngo J, et al. How could changesin diet explain changes in coronary heart disease mortality in Spain?The Spanish paradox. Am. J. Nutr. 1995; 61(Suppl):S1351-S1359.
23. Planell E, Sánchez C, Montellano MA, Mataix J, et al. Vitamin B6and B12 and folate status in an adult Mediterranean population. Eur. J.Clin. Nutr. 2003;57:777-785.
24. Han TS, et al. The influences of height and age on waist circumferenceas an index of adiposity in adults. Int J Obesity.1997;21:83-89.
25. Enes C, Slater B. Obesity in adolescence and its main determinants [in Portuguese]. Rev Bras Epidemiol 2010;13 (1):163–171.
26. Maffeis C., Aetiology of overweight and obesity in children and adolescents. Eur J Pediatr 2000;159(suppl. 1):S35–S44.
27. Beck CC, Lopes AS, Giuliano ICB, Borgatto AF. Cardiovascular risk factors in adolescents from a town in the Brazilian South: prevalence and association with sociodemographic variables [in Portuguese]. Rev Bras Epidemiol, 2011;14(1):36–49.
28. Park J, Hilmers DC, Mendoza JA, Stuff JE, Liu Y, Nicklas TA. Prevalence of metabolic syndrome and obesity in adolescents aged 12 to 19 years: comparison between the United States and Korea. J Korean Med Sci. 2010, 25 (1), 75–82.

How to cite this article: Sharma AK, Sharma S, Modi BS, Singh T. Correlation between Anthropometric Indices and Lipid Profile in Adults. Ann. Int. Med. Den. Res. 2016;2(2):68-72.

Source of Support: Nil, **Conflict of Interest:** None declared