Study of association and correlation of cardio-metabolic risk in diabetics and hypertensive patients with established anthropometric surrogate

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Abstract

The pandemic of essential hypertension, obesity, Type 2 diabetes, and there associate dislipidemia (HOD complex) have set a new benchmark in disease epidemiology.[1-3] Their concordance is magnanimous and multifaceted but not universal. Thus the need arises to explore their geo-cultural associates.

Aim: This cross sectional study explored this dimension for rural Indian inpatients in a Central Indian tertiary healthcare facility. Established anthropometric tools are explored for their association with the HOD complex in order to shortlist the valued ones.

Result: BMI (body mass index) and WC (waist circumference) were found to be strong associates with HTN (essential hypertension) (X^2 = 0.0034 d.f =1, P<0.001). Type 2DM (diabetes Mellitus) showed strong association with positive family history ($\chi2$ value 8.47 d.f=1 p=0.003). Risky vices like smoking, alcohol consumption, high fat and sugar diet, and lack of exercise had a pretty strong association with HOD complex as a whole ($\chi2$ value 41.69, d.f=2, p<0.0001). Lipid profile was above the standard cut-off for all risk assessing parameters.

Conclusion: All recommended guide lines specially with respect to HOD complex demonstrates geo-cultural variation. There for it is pragmatic to test them for their suitability with reference to local population.

Keywords: HOD complex, Anthropometric variables, Geo-cultural population.

Introduction

Diabetes, hypertension, and dyslipidemia have been identified as major risk factors for Cardio Vascular Disease (CVD). It has been well documented that the Body Mass Index (BMI), waist and hip circumferences, and waist-to-hip ratio (WHR) are related to the risk factors for CVD. However, inconsistencies have been reported. Waist circumference had a stronger correlation with risk factors for CVD in Europeans, and in practice was a more reliable measurement than WHR. Welborn et al suggested that WHR is a better predictor of coronary heart disease and CVD mortality than waist circumference and BMI in an Australian population. WHR was identified as a dominant cardiovascular risk factor in Swedish populations. Waist circumference or WHR thus appear to be the most frequently used measures to identify individuals at risk of CVD and diabetes in large epidemiological studies. The results derived from populations of European descent may not be applicable to other populations. Wang et al observed that waist circumference was the best predictor for the risk of CVD and type 2 diabetes in an indigenous Australian population.[4]

There is still ambiguity about the use of various anthropometric measures among Asians to predict risks of cardiometabolic diseases in patients suffering from diabetes and hypertension. There is an urgent need to evolve methods of secondary prevention in these populations to save the community from the burden of their complications. There is compelling evidence that indicates that maintenance of ideal BMI by lifestyle modifications helps in controlling the diseases and delaying their complications. Since universal cut off values do not hold good, identification of normal cut off values in each population is the primary step. Because upper body adiposity is also an important risk indicator for insulin resistance, the cutoff values for WC and WHR have also been determined for Asian Indians. There are various anthropometric parameters that suggest the risk of developing complications. This has created confusion among clinicians, so this study is being proposed to establish the best anthropometric measures in hypertensives and diabetics with special reference to Indian rural populations.

Aim

The study aimed at estimating the best associated and correlated anthropometric measurements with cardiometabolic risk from available surrogates and had the following objectives in mind:

1. To measure BMI, WC, and WHR in diabetic and hypertensive patients with and without complications having Blood reports (FBG and Lipid Profile)
2. To estimate the strength of association among anthropometric variables and the disease conditions.
3. To find the correlations of different surrogate anthropometric variables with cardiometabolic risk of disease conditions in the study.
4. To comment on the quality of different anthropometries with respect to Cardiometabolic risk estimation.

Materials and Methods

Cross-sectional study was carried out to determine the best anthropometric variable in Diabetes and Hypertensive subjects in rural central India with 200 inpatients over 3 months time with due permission from IEC(institutional Ethical Committee).

Inclusion Criteria

All wilful consenting diabetic and hypertensive patients with and without complications with available Fasting Blood Glucose and Serum Lipid Profile report admitted to different wards of PRH in the age range of 45-65 years.

Exclusion Criteria

In-patients suffering from Type 1 DM and Secondary hypertension with pregnancy-induced hypertension, gestational diabetes, and in Moribund and bedridden conditions were kept out of the study.

Data Collection and Analysis

Information's relating to study was collected in semi-structured questionnaire from participants admitted to different wards over the study period. Standard procedure was adopted in measuring anthropometric and biochemical variables. Asian gender specific cut-offs were adopted for anthropometric measurements (Table 1).[5] Information was coded and entered to SPSS 20 matrix. Descriptive and inferential analysis was carried out and reported in standard line keeping the nature of data in mind.

Table 1: Cut-off values for anthropometric measurements

Criteria*	Asian Males	Asian Females
Cut off BMI	>23 Kg/M^2	>23 Kg/M^2
Cut off WHR	0.88	0.81
Cut off WC	85 cm	80 cm

Results

The gender based anthropometric profile of study participants in terms of number and % is presented in table 2.

Table 2: Anthropometric profile of study participants

Criteria	Gender	
	Male (%)	Female (%)
BMI		
Under nourished	5(8%)	0 (0%)
Normal	9(14%)	27(40%)
Obese	48(78%)	41(60%)
Total	62(100%)	68(100%)
Waist Circumference		
Obese	25(40%)	39(57%)
Non obese	37(60%)	29(43%)
Total	62(100%)	68(100%)
Waist hip ratio		
Obese	45(73%)	60(88%)
Non obese	17(27%)	8(12%)
Total	62(100%)	68(100%)

Descriptive presentation of abnormal blood lipid profile of participants like total cholesterol >200 mg/dl (>5.2 mmol/L), LDL-cholesterol >130 mg/dl(>3.36 mmol/L), HDL-Cholesterol <60 mg/dl(<1.15 mmol/L), Triglycerides >160 mg/dl(>1.8 mmol/L), and VLDL >40 mg/dl are presented in table 3.

Table 3: Blood lipid profile of high risk patients/patients (with values greater than the cut off)

Blood lipid profile (cut off values)	Male	Female	Total
Triglyceride	11(39%)	17(61%)	28(100%)
LDL	4(20%)	16(80%)	20(100%)
VLDL	7(39%)	11(61%)	18(100%)
HDL	49(46%)	57(54%)	106(100%)
Total cholesterol	10(36%)	18(64%)	28(100%)

In terms of overweight and obesity it was observed that 53(41%) of the overweight and obese were diabetic and 30(23%) of non obese were diabetic. But Fischer's exact test value (P value 0.169) showed statistical non-significance. Whereas highly significant association was observed between BMI and hypertension ($X^2 = 0.0034$ d.f =1, P<0.001). Here it was observed that 68(52%) of hypertensives were overweight or obese while only 21(16%) were of Non hypertensives type. (Table 4)

Table 4: Association between BMI and hypertension

BMI (Kg/m^2)	Hypertensive	Non Hypertensive	Total
Non Obese	20 (15%)	21 (16%)	41 (32%)
Overweight + Obese	68 (52%)	21 (16%)	89 (68%)
Total	88 (67%)	42 (32%)	130(100%)

($X^2 = 0.0034$ d.f =1, P<0.001)

Association between waist circumference and Diabetes in male and female participants with respective cut-off values at WC >85cm and WC ≥80cm reported statistical non-significance (χ2 yates correction= 0.02167 d.f=1 p=0.88) and Fischer's Exact test, p=0.06 respectively. But we observed a valid statistical association for waist Circumference and Hypertension in both the gender. (Table 5)

Table 5: Association between waist circumference and hypertension in males and females

Waist Circumference	Hypertensive	Non-Hypertensive	Total
WC (Male) ≥85	22(35%)	3(5%)	25(40%)
WC (male)≤84	22(35%)	15(25%)	37(60%)
Total	42(68%)	18(30%)	62(100%)
WC (Female) ≥80	21(31%)	18(26%)	39(57%)
WC (Female)≤79	24(34%)	6(9%)	29(43%)
Total	45(65%)	14(35%)	68(100%)

*Fischer's Exact test, p=0.02 Significant for males
** χ2 Yates correction 4.025, p<0.05 for females

The result showed no statistical association for type 2 diabetes with waist hip ratio with respect to the reference cut-off for both the gender. For males Fisher's exact test reports p=1 and for females Fischer's Exact test, p value was 0.06 but presence of positive family history was very strong among diabetic participants (χ2 value 8.47 d.f=1 p=0.003).

Table 6: Association between diabetes, hypertension, smoking, alcohol, diet, and exercise

Criteria	Diabetes	Hypertension	Diabetes+ Hypertension	Total
Smoking	3(6%)	21(43%)	25(51%)	49(100%)
Alcohol	15(25%)	21(34%)	25(41%)	61(100%)
Smoking+ alcohol	15(29%)	14(27%)	23(44%)	52(100%)
Diet	35(38%)	21(24%)	35(38%)	91(100%)
Exercise	24(57%)	0	23(56%)	47(100%)
No exercise	18(43%)	47(100%)	18(44%)	83(100%)
Total	42(100%)	47(100%)	41(100%)	130(100%)

*χ^2 value 41.69, d.f=2, p<0.0001 for exercise group and **χ^2 value 18.472 d.f=6 p=0.0052 for others.

Table 7: Lipid profile and anthropometric variables in studied population

Total participants	Cholesterol	BMI >23	BMI <23	Total
	Triglycerides	23(82%)	5(18%)	28(100%)
	LDL	14(70%)	6(30%)	20(100%)
	VLDL	16(89%)	2(11%)	18(100%)
	Decreased HDL	72(68%)	34(32%)	106(100%)
	Total Cholesterol	16(57%)	12(43%)	28(100%)
Males	Cholesterol	WC >85cm	WC <85cm	Total
	Triglycerides	5(45%)	6(55%)	11(100%)
	LDL	4(100%)	0	4(100%)
	VLDL	1(14%)	6(86%)	7(100%)
	Decreased HDL	16(34%)	31(64%)	47(100%)
	Total cholesterol	15(100%)	0(100%)	15(100%)
Females	Cholesterol	WC >80	WC <80	Total
	Triglycerides	15(88%)	2(12%)	17(100%)
	LDL	11(69%)	5(31%)	16(100%)
	VLDL	9(82%)	2(18%)	11(100%)
	Decreased HDL	33(58%)	24(42%)	57(100%)
	Total cholesterol	28(80%)	7(20%)	35(100%)
Males	Cholesterol	WHR >0.88	WHR <0.88	Total
	Triglycerides	8(73%)	3(27%)	11(100%)
	LDL	4(100%)	0	49(100%)
	VLDL	1(14%)	6(86%)	7(100%)
	Decreased HDL	33(67%)	16(33%)	49(1005)
	Total cholesterol	10(100%)	0	10(100%)
Females	Cholesterol	WHR >0.81	WHR <0.81	Total
	Triglycerides	16 (100%)	0	16(100%)
	LDL	16(100%)	0	16(100%)
	VLDL	11(100%)	0	11(100%)
	Decreased HDL	51(89%)	6(11%)	57(100%)
	Total cholesterol	16(89%)	2(11%)	18(100%)

On analysis to find any association between diabetes, hypertension, smoking, alcohol and dietary and exercise habits a very strong association was noticed (p<0.001). Table 6 represents these findings.

Description of lipid profile with respect to different anthropometric variables in the studied population is presented in table on 7. It was evident that risk cut-off for anthropometric variables also recorded lipid profiles on higher side.

On two tailed Pearson Correlation Significance analysis for the total 130 participants BMI reported very strong positive correlations with WC (r=0.588, p=0.000), but negative one with FBS level (r= -.235**, p=.007). WC was positively correlated with WHR (r=.593**, p-.000), and BMI. FBS was negatively related to BMI, systolic blood pressure (r=-.332**, p-000) and diastolic blood pressure (r=-.232**, p- 008). Systolic blood pressure had negative relationship with FBS but positive one with diastolic blood pressure (r=.766**, p- .000).

Discussion

130 inpatients from different wards were studied in accordance with the aim and objectives. An effort was made to estimate the best associated and correlated anthropometric measurements with respect to cardio-metabolic risk.

Established anthropometric tools were compared for their underlined associations and co-relationships with respect to diseases in question.

Essential HTN was found to be associated with BMI and WC but negatively correlated to FBS. Association of HTN with WC was reported in an Australian aborigine population.[2] Differing results with respect to HTN, BMI, WC and WHR are reported by different researchers thereby asking for development of geo-cultural tools for better assessment and management of HOD complex.[4-8]

Type 2 DM was found to be positively associated with family history of the disease and statistical association with BMI, WC, and WHR could not be established. Genetic concordance as a strong risk indicator is proved time and again.[9]

Type 2DM, essential HTN and co presence of both of the conditions were positively associated with vices like smoking, alcohol consumption, combination of these two habits, risk enhancing diet, and lack of exercises. Impact of risky habits on 'HOD complex' is not new to present day researchers.[10]

Cardio-metabolic risk assessment in terms of above normal (cut-off) lipid profiles showed higher levels with respect to all studied anthropometry and both gender. Though their significance could not be statistically established but it remains a proven fact at global level.[7-10,12]

WC and BMI were found closer associates for essential HTN in the concluded study thereby strengthening the call for more geo-cultural exploration and establishing locally valid standards rather than blind following recommendations from diverse arbitrations.[1,4-7]

Conclusion

Before generalizing any guidelines an attempt must be made to find its suitability form local context. Though there are different surrogate guidelines as proxy risk indicators for type2DM, essential HTN and the consequent cardio-metabolic risk assessment are in place, its practicality should be questioned and if needed adequacy established from local context. The concluded study stressed on this for local rural citizens from central India and is of the opinion that BMI and WC are better anthropometric measures for study of essential HTN. Positive family history for type 2DM is a reliable associate for that condition. Lipid profile above the recommended cut-offs showed higher prevalence in patients with reporting anthropometric risks.

Conflict of Interest: None.

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