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Is Lipid Accumulation Product (LAP), a better obesity index in diagnosing cardiovascular disease?

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Abstract:
Background: *It has been shown that low grade inflammatory state is associated with cardiovascular risk. High sensitive C-reactive protein (hs-CRP), a nonspecific inflammatory marker has been shown to be increased in metabolic syndrome a risk state for the development of cardiovascular disease. Obesity is a predisposing condition to metabolic syndrome. Therefore, this study was intended to compare the indices available to measure obesity such as BMI and "lipid accumulation product" (LAP) with respect to risk for development of cardiovascular.*
Methodology: *The study design was cross sectional with sample size of 120. Anthropometric measurements (BMI and LAP) and biochemical estimations (blood glucose, lipid profile & hsCRP) were carried out.*
Results: *we compared the values of LAP and BMI with Hs-CRP levels, (the established marker for CVD) the ROC curve for LAP and BMI was of not much difference. But higher values of LAP were significant. The area under the curve of LAP & BMI being 0.70 and 0.74 respectively. The cut off for BMI is 22.94 with Sensitivity of 0.69, Specificity of 0.87& youden index 0.564.The cut off for LAP is 39.70 with Sensitivity of 0.69, Specificity of 0.87 & youden index 0.374*
Conclusion: *LAP was not able to perform better in comparison to BMI in assessing the risk of cardiovascular disease in our study subjects.*
Keywords: *Obesity, Lipid Accumulation Product (LAP), High sensitive C-reactive protein (hs-CRP), Body Mass Index (BMI)*

I. Introduction

Obesity is a chronic disorder prevalent in both developed and developing countries. It has been found that, in India 55% of the population between the age group of 20 and 69 years are overweight [1].Obesity is associated with a state of chronic low grade inflammation which brings about alterations in adipose tissue metabolism and endocrine function leading to an increased release of hormones and proinflammatory molecules that contribute to associated complications of obesity, including metabolic syndrome, type-2 Diabetes mellitus and cardiovascular disorders (CVD) [2]. Studies show evidences in obesity events such as modification of proteins and DNA, alteration in gene expression, promotion of inflammation, and deterioration in endothelial function in the vessel wall either trigger or exacerbate the atherosclerotic process in obese individuals[3].hs-CRP a nonspecific inflammatory marker is synthesized by liver in response to stimulation by proinflammatory cytokines derived from several sources including adipocytes [4]. hs-CRP is an established marker in identifying a risk for the development of cardiovascular disease in obese[5].

Central obesity is the most prevalent manifestation of metabolic syndrome. Obesity is measured mainly with BMI but it does not measure central adiposity whereas indices such as waist circumference (WC) are known to be better index for central adiposity or visceral adiposity[6]. According to various studies researchers have explored another index known as "lipid accumulation product" (LAP). LAP is based on a combination of waist circumference and fasting triglyceride[7]. LAP is known to be a good marker of lipid accumulation in ectopic sites like the liver, skeletal system and in the beta cells of pancreas[8,9]. LAP is easily obtainable obesity index; if it shows good correlation with hsCRP then LAP can be termed as a better obesity index able to diagnose cardiovascular risk. Therefore, this study was intended to compare the performance of LAP and BMI with hs-CRP levels in our subjects.

Materials and Methods: The study was a cross sectional study conducted on patients attending the Endocrinology Department at M S Ramaiah Medical College, Bangalore in South India. Ethical clearance was taken from the Institute .The study subjects who signed the informed consent and who met the inclusion criteria were included in the study. Subjects with history of diabetes mellitus, endocrinal disorders, smoking, hypertension, cardiac diseases, bronchial asthma, acute or chronic inflammatory diseases, autoimmune diseases, on medications like steroids, antipsychotic drugs, women with menstrual disorders and PCOD & all known parameters that may affect hsCRP & lipid profile were excluded from the study. Weight, Height, Waist circumference & Hip circumference; BMI (body weight in Kg/height in m2) were recorded. Systolic (SBP) and diastolic blood pressures (DBP) were measured three times in the seated position after 10 min of rest by use of a

sphygmomanometer. The index "lipid accumulation product" (LAP) was calculated. LAP for men was calculated using the formula (waist circumference [cm] - 65) × (triglyceride concentration [mmol/l]) and for women (waist circumference [cm] - 58) × (triglyceride concentration [mmol/l]) [7]. Blood samples were taken for the determination of the fasting blood sugar, post prandial blood sugar, hsCRP & lipid profile. Blood glucose was assayed by the glucose oxidase kit[10] (Vital Diagnostics Pvt. Ltd, Mumbai)method, Estimation of serum High-sensitivity C - reactive protein (hs-CRP) was carried out by turbidimetry latex-high sensitivity kit method[11] (Biosystems S.A. Costa Brava, Barcelona [Spain]) serum cholesterol by the end point enzymatic kit (Bio systems, S.A Barcelona [Spain]) method, HDL-cholesterol by phosphotungstate Precipitation kit (Bayer Diagnostics, Baroda) method[12] ,serum triacylglycerol by glycerol phosphate oxidase kit (vital diagnostics Pvt Ltd, Mumbai) method [13],LDL and VLDL were calculated from the estimated values of cholesterol, triglyceride and HDL-C, using Frieldwald equation[13] .

II. Statistical analysis

Data are represented as mean±SD. The area under the curve (AUCs) for ROC curves were determined for each continuous variable to identify the risk for CVDs compared to hsCRP. AUCs are provided with SEM and 95% confidence intervals(95%CI).ROCs curves ,a plot of the sensitivity (SEN) (true positive) versus 1-specificity(SP) (false positive) for each potential predictor tested, determine the ability of a screening measure for correctly identifying individuals based on their classification by a reference test.Values for each AUC can be between 0 and 1, with a value of 0.5 indicating that the diagnostic test is no better than chance. Analysis of SEN, SP and Youden's index were performed using principal cut-off values for hsCRP. Statistical analyses were done using SPSS version 11.5.

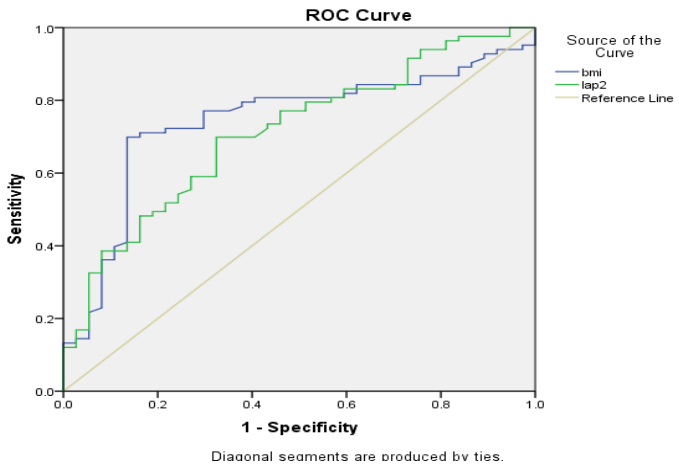
III. Results

The sample size of the study population included 120.The age of the subjects ranged between 20-70yrs.The mean and SD of BMI was 26.27kg/m^2 ±8.22.The baseline characteristics of the subjects are shown in Table 1.The subjects were normotensive and lipid profile were in the normal range. In 70% of the subjects the hsCRP values were ≥ 3mg/L. When we compared the values of LAP and BMI with Hs-CRP levels, (the established marker for CVD) the ROC curve for LAP and BMI was of not much difference. But higher values of LAP were significant. The area under the curve of LAP & BMI being 0.70 and 0.74 respectively. The cut off for BMI is 22.94 with Sensitivity of 0.69, Specificity of 0.87& youden index 0.564.The cut off for LAP is 39.70 with Sensitivity of 0.69, Specificity of 0.87 & youden index 0.374

Table 1: The Baseline Characteristics of the Subjects

	Mean	±SD
BMI(kg/m2)	26.29	±8.21
Waist(cm)	86.15	±14.67
FBS (mg/dL)	88	±12.79
TC(mg/dL)	175.87	±20.81
TGL (mg/dL)	152	±24.22
HDL (mg/dL)	41	± 3.25
hsCRP (mg/L)	6.32	± 3.79
LAP	47	± 31.58

Fig: 1 ROC curve of LAP and BMI for hsCRP



IV. Discussion

The expansion of the adipose tissue leads to the altered production of proinflammatory molecules and results in low-grade inflammation. The increase in hs-CRP levels indicates a state of low-grade inflammation in the obese group [2]. Cut-off limits >3 mg/L in Hs-CRP levels indicates low-grade inflammation, which in turn might be a prognostic marker for further cardiovascular events [4]. In the present study, 70% of the subjects had hs-CRP levels ≥3mg/L suggesting the ongoing inflammation in them. But these subjects had normal lipid profile and were normotensives. BMI is the most commonly used obesity index, but increase in BMI can be due to increase in lean tissue and increase in protective subcutaneous tissue or due to fluid retention, cannot measure central adiposity and may not be useful index which can detect cardiovascular risk[14].LAP is supposed to be a good index of visceral adiposity which is comprised of waist circumference and triglyceride reflects increase in the adipose tissue that has exceeded the capacity to buffer and store safely. The other methods available to quantify the visceral adiposity are either expensive or not reliable.Increase in LAP suggestive of increase of ectopic lipid tissue in in various organs like liver, skeletal system, blood vessels, pancreas,etc there by leading to associated comorbities like cardiovascular disease[14].

In our study when we compared the performance of LAP over BMI, the area under the curve of LAP & BMI being 0.70 and 0.74 respectively with respect to hs-CRP levels. Hence, LAP was not able to identify the risk for cardiovascular disease compared to BMI in our subjects. However previous studies have shown that LAP performed modestly compared to BMI with respect to cardiovascular disease risk factors like lipid profile, uric acid and heart rate. Study conducted by Tingting Du, Gang Yuan, et al showed that visceral adiposity marker such as LAP was not useful in assessing the risk for cardiovascular disease compared to TG/HDL-C[15].
We can conclude from our study that LAP a dichotomous index comprising of waist circumference and fasting triglyceride was not able to identify the subjects who were at cardiovascular risk compared to BMI. We can elicit better performance of LAP if the sample size is large and if it was a multicentric study. Prospective study is required to establish the association of LAP and other available obesity indices to detect the risk of CVDs. Thus more research work has to be undertaken to elucidate the role of LAP in identifying the cardiovascular risk compared to other obesity indices.

References

[1]. World Health Organization Controlling the global obesity epidemic. Available at: http:// www. who. int/nutrition/ topics/ obesity/en/index.html
[2]. Trayhurn, P., Wood, I.S., (2004), "Adipokines: inflammation and the pleiotropic role of white adipose tissue", Br J Nutr 92:347–355
[3]. Weisberg, S.P., McCann, Desai, M., et al.(2003), "Obesity is associated with macrophage accumulation in adipose tissue", J. Clin. Invest, 112:1796-1808
[4]. Li, J-J., Fang, C.H., (2004), "C -reactive protein is not only an inflammatory marker but also a direct cause of Cardiovascular diseases", Medical Hypothesis, 62:499-506
[5]. Sartipy, P., and Loskutoff, D.J. (2003), "Monocyte chemoattractant protein-1 in Obesity and insulin resistance", Proc. Natl. Acad. Sci. U. S. A, 100:7265-7270
[6]. McTigue KM, Hess R, Ziouras J. Obesity in older adults: a systematic review of the evidence for diagnosis and treatment. Obesity (Silver Spring) 2006;14:1485–1497
[7]. KahnHS.Thelipidaccumulationproduct is better than BMI for identifying diabetes: apopulation-basedcomparison. Diabetes Care 2007;29:151–153
[8]. B. L. Wajchenberg, "Subcutaneous and visceral adipose tissue: their relation to the metabolic syndrome," Endocrine Reviews, vol.21,no.6,pp.697–738,2000
[9]. J.E.Schaffer,"Lipotoxicity:whentissuesovereat,"CurrentOpinioninLipidology,vol.14,no.3,pp.281–287,2003
[10]. Trinder P. Determination of blood glucose. J Clin Path 1959; 22: 246.
[11]. Rifai, N., Tracy, R.P., Ridker, P.M.,(1999), "Clinical efficacy of an automated high sensitivity C-reactive protein assay",Clin Chem,45:2136-41
[12]. Allain CA. Determination of Total cholesterol and HDL-cholesterol. Clinical Chemistry 1974; 20: 470.
[13]. Tietz NW. Clinical chemistry and Molecular Diagnostics. , W.B. Saunders company 2006; 555-672
[14]. Kahn HS: The "lipid accumulation product" performs better than the body mass index for recognizing cardiovascular risk: a population-based comparison. BMC Cardiovasc Disord 5:26, 2005
[15]. Du T, Yuan G, Zhang M, Zhou X, Sun X, Yu X. (2014)," Clinical usefulness of lipid ratios, visceral adiposity indicators, and the triglycerides and glucose index as risk markers of insulin resistance", Cardiovasc Diabetol,**13**:146