Original Article

THE RELATIONSHIP BETWEEN APOB/A1 RATIO AND MEASURES OF ADIPOSITY AMONG ADULTS IN NIGERIA

[1]Akinyemi Temitope Michael and [2]Oluwaseun Grace Ifeoluwa

Department of Pharmacology, University of Medical Sciences, Ondo

Department of Chemical Pathology, University College Hospital, Ibadan.

DOI: https://doi.org/10.5281/zenodo.17144049

Abstract: Background: The apolipoprotein B/A1 (apo B/A1) ratio has been shown to outperform conventional lipid markers in predicting cardiovascular disease (CVD). Body Mass Index (BMI) and Waist Circumference (WC) serve as indicators of total body and central adiposity, respectively, and are closely linked to obesity-related risk factors. This study aimed to evaluate the association between these adiposity indicators and apo B/A1 ratio, and to further assess its relationship with other cardiovascular risk factors.

Methods: A total of 245 apparently healthy individuals (84 males, 161 females) aged 30–65 years were recruited from the health workforce of University College Hospital Ibadan over six months. Serum lipids, apolipoprotein A1, and apolipoprotein B were measured using enzymatic and immunoturbidimetry methods.

Results: The mean apo B/A1 ratio was 0.71 in men and 0.68 in women. Female participants had significantly higher BMI and WC compared to males. Apo B/A1 ratio showed significant correlations with BMI and WC in both sexes. Additionally, it was strongly associated with age, total cholesterol, triglycerides, LDL-C, and non-HDL-C levels.

Conclusion: The findings demonstrate a clear relationship between apo B/A1 ratio and indicators of adiposity. Elevated apo B/A1 ratio is linked to a more atherogenic lipid profile and worsened cardiovascular risk factors. These results support the potential utility of apo B/A1 ratio in cardiovascular risk assessment, particularly in populations with varying adiposity levels.

Keywords: Apolipoprotein B/A1, BMI, Waist Circumference, Cardiovascular Risk, Lipid Profile

INTRODUCTION

Several recent epidemiologic studies and randomized clinical trials has clearly demonstrated apo B/A_1 ratio as superior predictor of atherosclerotic cardiovascular disease (ASCVD) [1,2,3]. The AMORIS study show that the ratio is a superior marker of prediction of cardiovascular (CVD) assessment and a more informative lipid risk factor with greater prognostic value than conventional lipid markers[4].

Apo B/A_1 ratio reflects the balance between artherogenic and anti-artherogenic particles and the incidence of cardiovascular risk is directly proportional to the value of this ratio which makes it a strong predictor of CVD than traditional lipid profile[5].

Original Article

The burden of excess adiposity among Nigerian adults is increasing at alarming rate with significant health and economic implications. The growing prevalence of obesity in Nigeria ranges between 8.1 – 22.2% while overweight is between 20.3 – 35.1%[6]. This has constituted serious health concern with associated increase in insulin resistance and sharp rise in incidence of cardiovascular disease.

BMI is the most commonly used indicator to estimate body fat and define obesity in adults, there are concerns that it might underestimate because it can't differentiate fat and lean body mass and also it does not take into consideration body size and body fat distribution [7-8]. Waist circumference has shown to be strongly associated with obesity related risk factors better accurate assessor of abdominal obesity[9].

There is paucity of data regarding the relationship between apolipoprotein B, A, apo B/A_1 ratio and cardiovascular risk factor especially indicators of adiposity (waist circumference and BMI) among Nigerians. The objective of this study is to describe the relationship / assess the association between total body, central body adiposity (WC) apo B/A_1 ratio and indicators of adiposity with cardiovascular risk factors.

Method

This is a cross sectional study done at University College Hospital Ibadan. The study was approved by UI/UCH. Health Research Ethics committee a total 245 apparently healthy adults between the ages of 30 – 65 years were recruited over a period of 6 months. They are made up of 84 males and 161 females. Subjects with history of cardiovascular disease, diabetes, renal disease or lipid lowering drugs were excluded. Weight, height and BP measurements were recorded.

Sample Collection and Storage

After informed consent were taken, 5 m/o of blood was drawn from each participant after overnight fast of 8-10 hours and collected in plain tube, allowed to clot and separated and the serum sample for Apolipoprotein A_1, B and lipid profile was stored at -20^{o}C until assay were run.

Biochemical Analysis

The lipid profile (Total Cholesterol, TG, and HDL) was done using the enzymatic method (CHODPAP) on Landwind C 100 Plus Auto analyzer. LDL was calculated using the Friedewald formula[15]. Serum Apolipoprotein B and Al concentrations were determined using immunoturbidimetry methods on Landwisd C. 100 plus automated analyzer (Shenzen Landwind Industry Co. China)

Data Analysis

All statistical analysis were done using IBM statistical package for social science (SPSS) version 20 software. All tests of statistical significance were 2 sized with 95% confidence interval. Continuous data are presented as mean (SD) while proportions are presented as numbers (percent). Comparison of means were performed using the student t-test while proportions were compared using the chi–square test. Correlations between contrary variables were assessed using Pearson's correlation Coefficient. Linear regression was also performed.

RESULTS

A total of 245 apparently healthy adults between the ages of 30 to 66 years were recruited over a period of six month. They were made up of 161 women (65.7%) and 84 men (34.3%). Table 1 shows demographic, clinical and biochemical characteristics of the study participants. The mean apoB/A1 ratio was 0.71 for men and 0.68 for women. Female participants had a significantly higher BMI and WC than the male participants.

Original Article

Table 2 shows the results of correlation analysis between apoA1, apo B, apo B/A1 ratio and other variables. Apo B/A1 ratio was significantly correlated with indicators of adiposity (BMI and WC) in both men and women. It also strongly associated with age, total cholesterol, TG, LDL-C and non-HDL-C. Apo B was strongly associated with WC,BMI, Total Cholesterol, TG, LDL-C and non-HDL-C. Plasma LDL-C is the only determinants of plasma apo B/A1 levels in both men and women as indicated by linear regression analyses (Table 3)

Table 1. Characteristics of the study Participants

Variables	Men n - 84	Women n -161	P - Value
Age	42 ± 9	47 ± 10	0.07
BMI	24.8 ± 3.0	26.3 ± 4.4	0.06
WC	88.4 ± 6.8	90.5 ± 7.3	0.01*
TC	1.79 ± 36	186 ± 32	0.859
TG	66 ± 26	69 ± 29	0.144
HDL – C	38 ± 7	41 ± 7	0.374
LDL – C	126 ± 30	131 ± 32	0.911
Non HDL – C	141 ± 35	145 ± 35	0.734
APO A1	137 ± 25	147 ± 26	0.373
APO B	94 ± 24	98 ± 26	0.861
APO B/ A1	0.71 ± 0.23	0.68 ± 0.22	0.933
Systolic BP	121 ± 15	120 ± 15	0.531
Diastolic BP	77 ± 10	76 ± 11	0.573
RPG	96 ± 43	96 ± 31	0.942

**P < 0.05. LDL-C=Low density lipoprotein cholesterol; HDL-C=High density lipoprotein cholesterol; Apo B=Apolipoprotein B; Apo A1=Apolipoprotein A1; TG=Triglycerides; BMI=Basal mass index; RPG=Random plasma glucose; WC=Waist circumference; TC=Total cholesterol; BP=Blood pressure*

Table 2 Correlation coefficients between APO A1, APO B, APO b/A1 ratio and other lipid parameters

	APO A1		APO B		APO B / A1	
	r	P level	r	P value	R	P - value
TC	0.728	0.000*	0.943	0.000*	0.664	0.000*
TG	-0.260	0.000*	0.263	0.000*	0.404	0.000*
HDL - C	1.00	0.000*	0.047	0.460	-0.512	0.000*
LDL - C	0.062	0.335	0.992	0.000*	0.792	0.000*
Non HDL	0.026	0.687	0.958	0.000*	0.789	0.000*
WC	-0.236	0.614	0.192	0.003*	0.182	0.004*
BMI	-0.039	0.548	0.127	0.047	0.133	0.038*
Age	0.035	0.588	0.190	0.003*	0.133	0.038*
RPG	-0.118	0.064	0.089	0.167	0.165	0.010

Original Article

**P < 0.05. LDL-C=Low density lipoprotein cholesterol; HDL-C=High density lipoprotein cholesterol; Apo B=Apolipoprotein B; Apo A1=Apolipoprotein A1; TG=Triglycerides; BMI=Basal mass index; RPG=Random plasma glucose; WC=Waist circumference; TC=Total cholesterol*

Table 3: Linear regression analyses apo B/A1 ratio

VARIABLE	REGRESSION COEFFICIENT	P value
TOTAL **Apo B/A1** r^2=0.959		
Age	0.05	0.538
TG	0.064	0.000*
LDL-C	0.969	0.000*
HDL	0.027	0.091
Non-HDL-C	-0.014	0.471
BMI	0.021	0.546

**P < 0.05. LDL-C=Low density lipoprotein cholesterol; HDL-C=High density lipoprotein cholesterol; Apo B=Apolipoprotein B; Apo A1=Apolipoprotein A1; TG=Triglycerides; BMI=Basal mass index; RPG=Random plasma glucose; WC=Waist circumference*

DISCUSSION

In this present study, apo B/A1 was related to body mass index (BMI) and waist circumference (WC) and other cardiovascular risk factors (LDL-C,TG,HDL-C,non HDL-C). BMI is an obesity indicator which reflects overall adiposity while WC indirectly measures central adiposity.[10]

We observed that apo B/A1 is associated with both total body adiposity and central adiposity. This study also shows that increased apo b/a1 ratio in obese and overweight individuals which is similar to studies by Yusuf et al that shows that obesity is associated with higher levels of apoB/A1 ratio.[11] In the same way, study by Zhang et al found out that women with central obesity has higher apo B, apo B/A1 ratio and less apo A1 than apparently healthy participants.[12] Atherogenic lipid profile is a huge risk factor for cardiovascular disease. Most recent large observational studies and clinical trials have shown superiority of apo B/A1 ratio over traditional lipid profile CVD risk prediction and assessment.[13-15] In our study, the ratio is the only variable that is associated with other cardiovascular risk factors like LDL-C, TG, TC and systolic and diastolic BP, more than Apo B or Apo A1 alone . This reinforces the advantage the apo B/A1 ratio has over other lipoprotein markers in its potential clinical utility CVD risk assessment.

Conclusion

This study has demonstrated the relationship between apo B/A1 ratio and indicators of adiposity. Higher Apo B/A1 is associated with more atherogenic lipid profile and worse cardiovascular risk factors. This may provide basis for its use in assessment of cardiovascular disease

Original Article

Acknowledgement

The authors appreciate the assistance of resident doctors in the department of Chemical Pathology, UCH during the conduct of this study.

Disclosure Statement

The study was self-funded by the authors with no external funding or grants obtained. Conflict of Interest: The authors have no conflict of interest to declare.

REFERENCES

Ashwell, M., & Gibson, S. (2016). Waist-to-height ratio as an indicator of 'early health risk': Simpler and more predictive than using a 'matrix' based on BMI and waist circumference. *BMJ Open, 6*(3), e010159. https://doi.org/10.1136/bmjopen-2015-010159

Boekholdt, S. M., van der Steeg, W. A., Stein, E. A., et al. (2007). The ratio of apolipoproteins B to A-I and the risk of future coronary artery disease in apparently healthy men and women: The EPIC-Norfolk prospective population study. *Annals of Internal Medicine, 146*(9), 640–648. https://doi.org/10.7326/0003-4819-146-9-200705010-00007

Chukwuonye, I. I., Chuku, A., John, C., Ohagwu, K. A., Imoh, M. E., et al. (2013). Prevalence of overweight and obesity in adult Nigerians: A systematic review. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy, 6*, 43–47. https://doi.org/10.2147/DMSO.S38626

Kastelein, J. J., van der Steeg, W. A., Holme, I., Gaffney, M., Cater, N. B., et al. (2008). Lipids, apolipoproteins, and their ratios in relation to cardiovascular events with statin treatment. *Circulation, 117*(23), 3002–3009. https://doi.org/10.1161/CIRCULATIONAHA.107.713438

Mahabadi, A. A., Massaro, J. M., Rosito, G. A., Levy, D., Murabito, J. M., Wolf, P. A., et al. (2009). Association of pericardial fat, intrathoracic fat, and visceral abdominal fat with cardiovascular disease burden: The Framingham Heart Study. *European Heart Journal, 30*(7), 850–856. https://doi.org/10.1093/eurheartj/ehn573

McQueen, M. J., Hawken, S., Wang, X., Ounpuu, S., Sniderman, A., et al. (2008). Lipids, lipoproteins, and apolipoproteins as risk markers of myocardial infarction in 52 countries (the INTERHEART study): A case-control study. *The Lancet, 372*(9634), 224–233. https://doi.org/10.1016/S0140-6736(08)61076-4

Meisinger, C., Loewel, H., Mraz, W., & Koenig, W. (2005). Prognostic value of apolipoprotein B and A-I in the prediction of myocardial infarction in middle-aged men and women: Results from the MONICA/KORA Augsburg cohort study. *European Heart Journal, 26*(3), 271–278. https://doi.org/10.1093/eurheartj/ehi077

Nuttall, F. Q. (2015). Body mass index: Obesity, BMI, and health: A critical review. *Nutrition Today, 50*(3), 117–128. https://doi.org/10.1097/NT.0000000000000092

O'Donnell, M. J., Xavier, D., Liu, L., Zhang, H., Chin, S. L., et al. (2010). Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the INTERSTROKE study): A case-control study. *The Lancet, 376*(9735), 112–123. https://doi.org/10.1016/S0140-6736(10)60834-3

Ortega, F. B., Sui, X., Lavie, C. J., & Blair, S. N. (2016). Body mass index, the most widely used but also widely criticized index: Would a criterion standard measure of total body fat be a better predictor of cardiovascular disease mortality? *Mayo Clinic Proceedings, 91*(4), 443–455. https://doi.org/10.1016/j.mayocp.2016.01.008

Tamang, H. K., Timilsina, U., Singh, K. P., Shresth, S., Raman, R. K., Panta, P., et al. (2014). Apo B/Apo A-I ratio is statistically a better predictor of cardiovascular disease (CVD) than conventional lipid profile: A study from Kathmandu Valley, Nepal. *Journal of Clinical and Diagnostic Research, 8*(2), 34–36. https://doi.org/10.7860/JCDR/2014/7349.4006

Walldius, G., Jungner, I., Holme, I., Aastveit, A. H., Kolar, W., & Steiner, E. (2001). High apolipoprotein B, low apolipoprotein A-I, and improvement in the prediction of fatal myocardial infarction (AMORIS study): A prospective study. *The Lancet, 358*(9298), 2026–2033. https://doi.org/10.1016/S0140-6736(01)07098-2

Yusuf, S., Hawken, S., Ounpuu, S., Bautista, L., Franzosi, M. G., et al. (2005). Obesity and the risk of myocardial infarction in 27,000 participants from 52 countries: A case-control study. *The Lancet, 366*(9497), 1640–1649. https://doi.org/10.1016/S0140-6736(05)67663-5

Yusuf, S., Hawken, S., Ounpuu, S., Dans, T., Avezum, A., Lanas, F., et al. (2004). Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): Case-control study. *The Lancet, 364*(9438), 937–952. https://doi.org/10.1016/S0140-6736(04)17018-9

Zhang, J., Fan, P., Hongwei, L., Huai, B., Ying, W., & Feng, Z. (2012). Apolipoprotein A-I and B levels, dyslipidemia and metabolic syndrome in south-west Chinese women with PCOS. *Human Reproduction, 27*(8), 2484–2490. https://doi.org/10.1093/humrep/des205