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ORIGINAL ARTICLE

Correlation of Serum Alanine Aminotransferase with Anthropometric and Biochemical Obesity Indices in Apparently Healthy Males- A Descriptive Study

UZMA ZAFAR[1], ATTIQA KHALID[2], SADIA NAZIR[3], SABA KHALIQ[4]
[1,2,3]Lahore Medical & Dental College, Lahore,
[4]University of Health Sciences, Lahore
Correspondence to Dr. Uzma Zafar, Email: uzma.zargham@gmail.com, Cell: 0300-4058682

ABSTRACT

Background: The anthropometric obesity indices in this study included; body mass index, waist circumference, waist to hip ratio, mid arm circumference and triceps skin fold thickness. Biochemical obesity indices included; serum high density lipoprotein (HDL), serum triglycerides and serum cholesterol.
Aim: To find the correlation of serum alanine aminotransferase (ALT) levels with anthropometric and biochemical obesity indices in apparently healthy male subjects.
Methodology: This was an observational descriptive study. Study population included 60 healthy male subjects. They were between 30-50 years of age. All subjects were apparently healthy having no history of diabetes mellitus, hypertension or intake of antihypertensive or lipid/glucose lowering agents. Study data was gathered by a structured questionnaire after written informed consent. Anthropometric measurements, blood pressure and venous blood sample was taken by the standard methods. Data interpretation was carried by SPSS-21.
Results: Significant positive correlation of serum ALT was observed with waist circumference (rho=0.371; p=0.008*), mid arm circumference (rho=0.410; p=0.000*), triceps skin fold thickness (rho=0.360; p=0.011*), serum triglycerides (rho=0.493; p=0.005*) and serum HDL (rho=0.423; p=0.000*). Linear regression analysis was applied. Serum ALT was taken as the dependent variable whereas other covariates such as age , serum HDL, triglycerides, cholesterol, body mass index, waist circumference, waist to hip ratio, mid arm circumference and triceps skin triceps skin fold thickness were taken as the predictor variables. Correlation of the mid-arm circumference with serum ALT remained significant after controlling all the given co-variates (p=0.004*).
Conclusion: There is significant positive correlation of serum ALT with anthropometric obesity parameters such as waist circumference, mid arm circumference and triceps skin fold thickness. Correlation of anthropometric indices with ALT can provide us with a convenient and an inexpensive tool for prediction of serum ALT levels.
Keywords: Serum alanine aminotransferase, biochemical obesity, body mass index

INTRODUCTION

Alanine aminotransferase (ALT) also previously named as serum glutamic pyruvate transaminase (SGPT) is present in plasma as well as in various body fluids but is most abundantly found in the hepatic tissue. The ALT half-life in plasma is about 47 hours and sinusoidal hepatic cells clear it from the circulation. Serum ALT, aspartate aminotransferase (AST) and AST to ALT ratio are considered as biochemical indicators of hepatic well-being. Reference limits of ALT in plasma for males is less than 45 IU/L and for females is less than 34 IU/L[1]. Serum ALT levels are significantly raised in; virus induced hepatitis, metabolic liver disease such as diabetes mellitus and obesity, congestive cardiac failure, retaliation to various drugs and obstructive biliary pathologies. However serum ALT levels may also show a transient rise after strenuous bodily activity and also display diurnal variations. Activity of serum ALT is higher in the afternoon as compared to the morning[2].

In acute liver damage there is an abrupt rise in AST levels. After 1-2 days ALT levels show a persistent rise in the plasma as it has longer half-life compared to AST. In chronic liver injury ALT levels are higher than that of AST; in terminal hepatic fibrotic stage ALT levels fall and AST to ALT ratio increases. In alcohol induced liver damage AST levels are higher than the ALT ones. Several conditions not associated with liver tissue necrosis also results in higher plasma ALT values. Males have higher ALT levels compared to the females. Other factors that affect ALT activity and increases its levels in plasma include; body fat indices such as body mass index, waist circumference, blood concentration of triglyceride and cholesterol[1,2].

Non-alcoholic fatty hepatic disease (NAFLD) which is found to be present in 3% of population is the most prevalent cause of high ALT levels in plasma. Predisposing factors for NAFLD are obesity, diabetes mellitus and hyperlipidemia. Previous studies show strong association between serum ALT and overall survival[2,3]. In the previous epidemiology based studies body mass index was taken as the predictor of general obesity state whereas waist circumference and waist to hip ratio were considered as reflection of the central or abdominal adiposity.[4] Abdominal adiposity was also found to predict NAFLD even in normal weight subjects[5,6]. Previous studies have provoked the idea of 1) metabolic obesity in lean individuals (based upon anthropometric measurements); and 2) metabolically healthy however showing obesity based upon anthropometric measurements. Hepatic well-being and metabolic health in obese individuals unmask the protective factors having catalytic effect against hepatic steatosis such as role of hemo-oxygenase-1 and intestinal bacteria. Whereas certain genetic nucleotide polymorphisms predispose to hepatic steatosis even in lean subjects[7].

The purpose of this study was to find the correlation of serum ALT levels with anthropometric and biochemical obesity indices in apparently healthy male subjects. Operational definition of obesity indices:

- Following anthropometric obesity indices were used in this study; body mass index (BMI), waist circumference, waist to hip ratio, mid arm circumference and triceps skin fold thickness.
- Biochemical obesity indices included; serum high density lipoprotein (HDL), serum triglycerides and serum cholesterol.

SUBJECTS AND METHODS

This was an observational and descriptive study conducted at University of Health Sciences Lahore in the Department of Cell Biology and Physiology. This study (part of Ph.D., project) was approved by Ethical Review Board of University of Health Sciences, Lahore. Study population included 60 healthy male

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subjects. They were between 30-50 years of age. All subjects were apparently healthy having no history of diabetes mellitus, hypertension or intake of antihypertensive or lipid/glucose lowering agents. Study data was gathered by a structured questionnaire after written informed consent. Exclusion specs included: positive for hepatitis serology, chronic liver disease, alcohol intake, associated endocrinology or systemic or metabolic dysfunction.

Methodology: Anthropometric measurements, blood pressure and venous blood sample was taken by the standard methods. Weight was measured by calibrated digital weighing scale with light clothes without shoes; height was recorded with the use of stadiometer mounted on the wall. Weight in kilograms was divided by height in meter square to get BMI. Waist circumference was taken with measuring (non-stretchable) tape between lower border of the last rib and anterior superior iliac crest at the end of expiration. Mid arm circumference was taken from right arm midway of olecranon and acromion process. Triceps skin fold thickness was recoded with Harpenden caliber. Fasting serum ALT, HDL, triglycerides and cholesterol were determined by Colorimetric method with Randox kits[8,9].

Statistical analysis: Data interpretation was carried by SPSS-21. Data was non-normally distributed as P value was less than 0.05 by Shapiro-Wilk statistics. Central tendency with dispersion of data was presented by median with interquartile range. Spearman test was applied to determine the correlation of Serum ALT with:

1. anthropometric obesity indices in this study such as; body mass index (BMI), waist circumference, waist to hip ratio, mid arm circumference and triceps skin fold thickness
2. biochemical obesity indices including; serum high density lipoprotein (HDL), serum triglycerides and serum cholesterol.

RESULTS

The current study included 60 male subjects between the age of 30-50 years. Clinical, anthropometric and biochemical characteristics of the study population have already been published.[8, 10] On application of Spearman test significant positive correlation (Table-1) of serum ALT was observed (Figures: 1 to 4) with waist circumference (rho=0.371; p=0.008*), mid arm circumference (rho=0.410; p=0.000*), triceps skin fold thickness (rho=0.360; p=0.011*), serum triglycerides (rho=0.493; p=0.005*) and serum HDL (rho=0.423; p=0.000*). Linear regression analysis was applied. Serum ALT was taken as the dependent variable whereas other covariates such as age , serum HDL, triglycerides, cholesterol, body mass index, waist circumference, waist to hip ratio, mid arm circumference and triceps skin triceps skin fold thickness were taken as the predictor variables. Correlation of the mid-arm circumference with serum ALT remained significant after controlling all the above given co-variates (p=0.004*).

Figure-1: Correlation of serum ALT with waist circumference

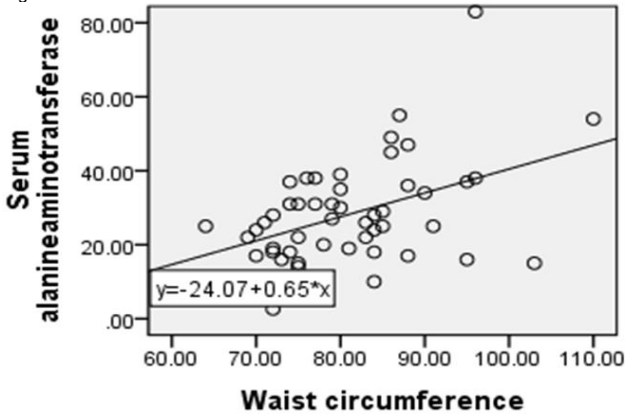


Table 1: Correlation of serum ALT with study variables

Correlation of serum ALT with following study variables	value of rho	p-value
Body mass index	0.109	0.472
Waist circumference in cm	0.371	0.008*
Mid arm circumference in cm	0.410	0.000*
Triceps skin fold thickness in mm	0.360	0.011*
Waist to hip ratio	0.100	0.520
Serum triglycerides in mg/dl	0.493	0.005*
Serum cholesterol in mg/dl	0.086	0.572
Serum high density lipoprotein in mg/dl	0.423	0.000*

Correlation is determined by Spearman test. A p < 0.05 is of significance.

Figure-2: Correlation of serum ALT with triceps skin fold thickness

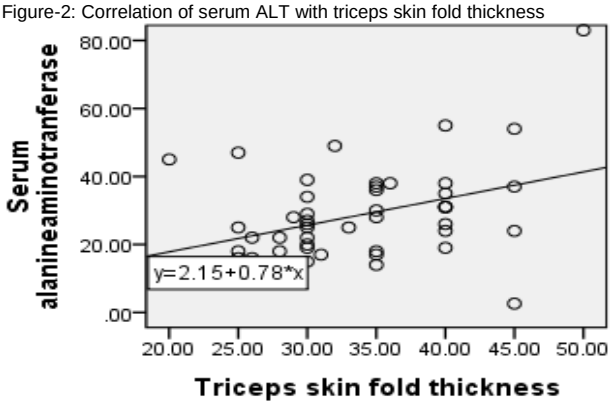


Figure-3: Correlation of serum ALT with mid arm circumference

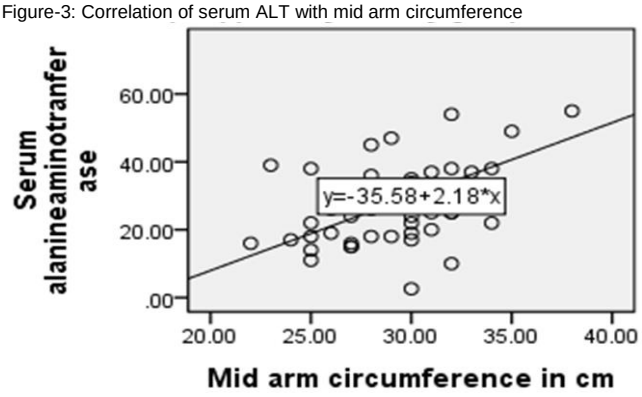
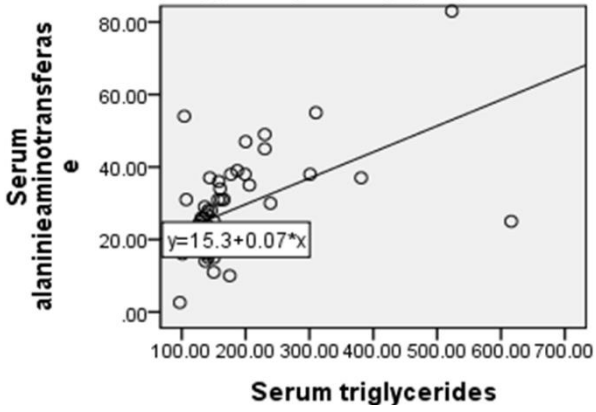


Figure-4: Correlation of serum ALT with serum triglycerides



DISCUSSION

The present study aimed to evaluate the correlation of serum ALT with anthropometric and biochemical indices of obesity in apparently healthy males. Various epidemiological studies

recommend body mass index and waist circumference as tools to identify obesity however their cut off levels in different ethnic groups of population are still not optimal.[11, 12] According to the different standards BMI is predictor of overall obesity whereas waist circumference and waist to hip ratio predict central obesity. Recently general and central adiposity related anthropometric measurements that can forecast adiposity mediated risk are; body mass index, waist circumference, waist to hip ratio and waist to height ratio[13,14]. With reference to "American Diabetes Association" guidelines; Asian Indian criteria for overall obesity is BMI of > 23kg/meter^2 and criteria for central obesity is waist circumference of > 85cm in males and > 80 cm in females and for waist to hip ratio is > 0.89 in men and > 0.81 in women[15].

In the current study, regarding anthropometric obesity parameters median BMI of the subjects was 23.65 Kg/m^2 with an IQR of 20.89 to 25.98 and waist circumference 80 cm with an IQR of 74 to 87.5cm.[8] The selected subjects in this study did not reveal any evidence of acute or chronic illness. Their serum ALT was also within the reference range i.e., <41IU/L.[10] However results of the present study revealed significant positive correlation of obesity parameters such as waist circumference, mid arm circumference and triceps skinfold thickness with serum ALT and this relation with mid arm circumference remained significant after controlling the confounder covariates as well. According to the National Cholesterol Education Program-Adult Treatment Panel 111, waist circumference is identified as a marker for central obesity.[16] Previous studies have identified waist circumference as a more predictable index for NAFLD. Abdominal/central adiposity results in free fatty acid release from peri-omental fat which infiltrate the hepatocytes-subsequently decreasing hepatic cellular integrity.[17, 18] Many other studies have also reported significant positive relation between serum ALT, waist circumference and body mass index.[19, 20] In another study on non-obese group of elderly subjects from United States; mid arm circumference was found to be the significant predictor of Insulin resistance (determined by HOMA-IR).[21, 22] In a study on Chinese type2 diabetics mid arm circumference was found to be an effective and simple tool to predict insulin resistance and central adiposity[23].

Serum ALT is a sensitive marker for hepatic necrosis and NAFLD. Confirmed diagnosis of fatty liver disease is by liver biopsy however blood ALT levels can contribute to identify the individuals at risk. Correlation of anthropometric indices with ALT can provide us with a useful and an inexpensive tool for prediction of serum ALT levels; these measurements can be conveniently observed at home as a part of self-examination[19].

CONCLUSION

There is significant positive correlation of serum ALT with anthropometric obesity markers such as waist circumference, mid arm circumference and triceps skin fold thickness. The correlation of serum ALT with mid arm circumference remained significant after controlling the confounder covariates.

Disclaimer: The text is based on a PhD thesis.
Conflict of Interest: None.
Source of Funding: None.

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