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ORIGINAL ARTICLE

# Is within-normal range liver enzymes associated with metabolic syndrome in adults?

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## KEYWORDS

Metabolic syndrome;  
Liver markers;  
Iranian adults

## Summary

**Background:** Considering the clear association between metabolic syndrome and future cardiovascular disease, early detection of metabolic syndrome is important. This study was conducted to assess the correlation between metabolic syndrome components and within-normal-range of liver enzymes in Iranian adults.

**Methods:** This cross-sectional study was comprised of 700 Iranian adults in the districts of East Azerbaijan-Iran in 2015. The levels of lipid profile and glucose were measured by enzymatic colorimetric methods. Weight, height, waist circumferences were measured with standard protocols. Aspartate aminotransferase (AST) and Alanine aminotransferase (ALT) were assessed using the ultraviolet method. The Pearson correlation and Logistic regression were used to for statistical analysis.

**Results:** With increasing the number of metabolic abnormalities, the mean ALT level was increased significantly ( $P_{\text{trend}}=0.04$ ). In women, the increase in AST and ALT with increasing the number of metabolic abnormalities was statistically significant ( $P_{\text{AST}}=0.01$ ;  $P_{\text{ALT}}<0.001$ ). In men, ALT level had significantly positive correlation with waist circumference ( $r=0.14$ ,  $P<0.05$ ), serum TG ( $r=0.16$ ,  $P<0.05$ ) and fasting plasma glucose ( $r=0.17$ ,  $P<0.01$ ). In women, there was a significant correlation between AST level and serum TG ( $r=0.15$ ,  $P<0.05$ ). A significant positive and negative correlation were found respectively between serum ALT and AST/ALT

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ratio and waist circumference, serum TG and fasting blood glucose. Women in the 4th quartile of ALT were 4.43 fold at an increased risk for metabolic syndrome outcome when compared to those in the first quartile [OR (95% CI): 4.43 (1.69, 11.63)]. In women, with increasing the quartiles of ALT within normal limits, the percent of participants with metabolic syndrome also increased significantly ( $P_{\text{trend}} = 0.04$ ).

**Conclusions:** Based on the results, the use of ALT and AST:ALT ratio as continuous biomarkers for early signaling of dysmetabolism especially in women could be encouraged.

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## Introduction

The “metabolic syndrome” also known as insulin resistance syndrome is a clustering of components that reveal over-nutrition, sedentary lifestyles, and excess adiposity. It is a cluster of four major factors, including obesity, hyperglycemia, dyslipidemia, and arterial hypertension [1]. The prevalence of metabolic syndrome varies greatly among countries; with a similar distribution for men and women [2]. The prevalence of metabolic syndrome in Asian countries, mostly in Middle Eastern societies, seems to be high [1,3]. Many factors are associated with increased prevalence of metabolic syndrome including alcohol consumption, smoking, diets high in highly refined carbohydrates and saturated fats and a sedentary lifestyle [4].

Currently, there is an increasing interest for the role of liver enzymes as predictors of non-liver-related disease. In this regard, some studies have reported a possible link between elevated serum aminotransferase levels and metabolic syndrome [5–10]. Serum aminotransferases including alanine aminotransferase (ALT) and aspartate aminotransferase (AST) are the common liver enzymes, which together comprises liver function tests and well-known markers of liver damage [11]. ALT is the most specific marker of liver function. The elevated level of ALT is directly associated with liver fat accumulation, [12] considered as a surrogate marker of non-alcoholic fatty liver disease (NAFLD) [13–15].

NAFLD and metabolic syndrome both are associated with dyslipidemia, central obesity and insulin resistance. Therefore, NAFLD has been identified as the liver manifestation of metabolic syndrome [16]. Subjects with NAFLD have been reported to have high prevalence rates of metabolic syndrome and associated disorders [17,18]. Moreover, elevated levels of liver markers have been revealed to be associated with metabolic syndrome variables in large representative samples of the general population [19,20]. However, to the best of our knowledge little is known about the association between the metabolic syndrome and its component with the within-normal-range liver enzymes.

According to the clear association between metabolic syndrome and future cardiovascular disease, early detection of metabolic syndrome is of importance. Since, Asians are ethnically predisposed to the HDL-C disorder and metabolic syndrome [21], finding an association between within the normal range of liver markers and metabolic syndrome may have clinical significance in terms of early recognition of metabolic abnormalities. Therefore, this study was conducted to assess the correlation between

metabolic syndrome component and within-normal-range of liver enzymes in Iranian adults.

## Materials and methods

The data for this study were collected in 2015 as a part of the major lifestyle promotion project conducted in the districts of East Azerbaijan (urban and regional parts), one of the large province of Iran. Probability proportional to size (PPS) multistage stratified cluster sampling was used as a sampling method of the present study. The method of sampling is described in detail elsewhere [22]. Briefly, 150 clusters were selected. For the present study, in each cluster, 5 participants were enrolled (750 participants). The participants within normal range of ALT and AST were included in the present study and the ones with self-reported chronic liver disease were excluded. Research survey and examination teams visited households, according to previously arranged appointments. Exclusion of incomplete information and the participants with higher than normal range of AST and ALT, yielded 700 final samples, subjected to statistical analysis.

The ethical approval for this study was obtained from Ethic Committee of Tabriz University of Medical Sciences.

The outcomes for analyses were serum level of AST, ALT, triglyceride (TG), high-density lipoprotein-cholesterol (HDL-C), low-density lipoprotein-cholesterol (LDL-C), fasting blood glucose, waist circumference and blood pressure. After a 12-hour overnight fast, 10 ml blood sample was obtained. The serum samples were separated from whole blood by centrifugation at 2000 rpm for 10 min at room temperature. Lipid profile and serum glucose level were measured on the day of sampling. The levels of serum HDL-C, TG and glucose were measured by enzymatic colorimetric methods with a commercially available kit (Pars Azmone, Tehran, Iran) on an automatic analyzer (Abbott, model Alcyon 300, USA). Blood pressure was measured with a standard manual sphygmomanometer in sitting position. AST and ALT were assessed using the ultraviolet method. The reference normal range for ALT in men and women are considered  $< 40$  and  $< 34$  U/l respectively [23] and for AST, it was considered  $< 34$  U/l. Waist circumference was measured at the minimum circumference between the iliac crest and the rib cage with an anthropometric tape while the subjects were wearing light clothing. Participants were classified as having metabolic syndrome according to the adult panel III (ATP III) criteria: if a subject met more than three of the following criteria: elevated waist circumference  $\geq 102$  cm in men and  $\geq 88$  in women, TG  $\geq 150$  mg/dl or on drug treatment for elevated triglycerides; HDL-C  $< 40$  mg/dl in

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