Alanine aminotransferase indicates excess weight and dyslipidemia

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Abstract

Background: There may be some hepatic indicators of metabolic syndrome. We tried to understand whether or not there is an association between alanine aminotransferase (ALT) value and excess weight.

Methods: We took consecutive patients below the age of 70 years to avoid debility induced weight loss in elders. Patients were divided into three groups as normal weight, overweight, and obesity.

Results: The study included 47 females and 82 males, totally. Although the nonsignificant differences according to the mean age between the three groups ($p>0.05$ for all), female ratio showed significant increases from the overweight towards the obesity groups (28.3% versus 50.0%, $p<0.001$). Although the presence of significant differences according to the body mass index and body weight between the three groups ($p<0.000$ for all), there was a significant increase according to the mean ALT value only from the normal weight towards the overweight groups (39.7 versus 53.5 U/L, $p<0.001$), but not from the overweight towards the obesity groups (53.5 versus 53.5 U/L, $p>0.05$). Interestingly, the same trend was also present for dyslipidemia, and prevalence of dyslipidemia was higher in the overweight than the normal weight groups (45.2% versus 25.0%, $p<0.001$), but there was a nonsignificant difference between the overweight and obesity groups (45.2% versus 37.5%, respectively, $p>0.05$).

Conclusion: Higher ALT value in serum may indicate excess weight and dyslipidemia. On the other hand, there were nonsignificant differences according to mean ALT value and prevalence of dyslipidemia between the overweight and obesity groups.

Key words: Alanine aminotransferase, overweight, obesity, hepatosteatosis, dyslipidemia, metabolic syndrome

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Introduction

Excess weight is becoming a major health problem all over the world, particularly in developed countries. For example, almost one third of adults in the United States can be classified as obese (1). Obesity is a disorder characterized by increased mass of adipose tissue that results from a systemic imbalance between food intake and energy expenditure. Excess weight comes with significant health problems (2-14), and the risk of death from all causes increases with an increasing body mass index (BMI) (4). For example, blood pressure (BP) pattern was changed from the sustained normotension (NT) towards white coat hypertension (WCH) and hypertension (HT) parallel to the increasing BMI in the same direction (15). In addition to the WCH and HT, type 2 diabetes mellitus (DM), hyperbetalipoproteinemia, dyslipidemia, and coronary artery disease (CAD) also showed significant increases parallel to the increasing BMI (15). Additionally, obesity is highly correlated with dietary intake of increased calories and fat, both of which were linked to various cancers (16). For instance, a recent study of 900,000 people found that obese patients are more likely die from a number of cancers (17). Similarly, there may also be some hepatic consequences of excess weight. Nonalcoholic fatty liver disease (NAFLD) is a term used to define a spectrum of disorders characterized by macrovesicular steatosis which occurs in the absence of consumption of alcohol in amounts considered to be harmful to liver. Because the chance of NAFLD is directly proportional to body weight and presence of a higher prevalence of excess weight in society, NAFLD is also becoming an important health problem all over the world. According to the literature, sustained liver injury will lead to progressive fibrosis and cirrhosis in 10% to 25% of affected patients (18). We tried to understand whether or not there is an association between alanine aminotransferase (ALT) value and excess weight in the present study.

Material and methods

The study was performed on routine check up patients in the Internal Medicine Polyclinic of the Dumlupinar University between August 2005 and March 2007. We took consecutive patients below the age of 70 years to avoid debility induced weight loss in elders. Their medical histories including smoking habit and alcohol and already used medications were learnt, and a routine check up procedure including serum ALT, aspartate aminotransferase, gamma glutamyl transpeptidase (GGT), alkaline phosphatase (ALP), direct and indirect bilirubins, low density lipoprotein cholesterol (LDL-C), triglyceride (TG), and high density lipoprotein cholesterol (HDL-C) values, hepatitis B surface antigen (HBsAg), anti-hepatitis C virus antibody (anti-HCV Ab), and anti-human immunodeficiency antibody (anti-HIV Ab) was performed. In HBsAg or anti-HCV Ab positive individuals, HBV DNA and HCV RNA were studied by quantitative polymerase chain reaction (PCR) methods, respectively. PCR positive cases were excluded from the study. Current daily smokers at least for the last 12-months and cases with a history of five pack-years were accepted as smokers. Regular daily drinkers without any limitation in amount and social drinkers with a drink in the last week, patients with anti-HIV Ab positivity or prominent GGT and ALP elevations, and multi-drug users with any cause were excluded from the study. BMI of each case was calculated by the measurements of the Same Physician instead of verbal expressions. Weight in kilograms is divided by height in meters squared, and obesity is defined as a BMI of 30 or greater, overweight between 25–29.9, normal weight between 18.5-24.9, and underweight as lower than 18.5 kg/m2 (19). Insulin using diabetics, and patients with devastating illnesses including malignancies, acute or chronic renal failure, hyper- or hypothyroidism, and heart failure were excluded to avoid their possible effects on weight. Additionally patients with dyslipidemia were detected by using the National Cholesterol Education Program Expert Panel's recommendations for defining dyslipidemic subgroups (19). Dyslipidemia is diagnosed with the LDL-C value of 160 or greater or TG value of 200 or greater or the HDL-C value of lower than 40 mg/dL. Eventually, mean age, female ratio, BMI, body weight, and ALT values and prevalences of smoking and dyslipidemia were detected in the underweight, normal weight, overweight, and obesity groups and the results were compared in between. Mann-Whitney U test, Independent-Samples T test, and comparison of proportions were used as the methods of statistical analyses.

Results

The study included 47 females and 82 males, totally. There were 20 patients (20.0% female) in the normal weight, 53 patients (28.3% female) in the overweight, and 56 patients (50.0% female) in the obesity groups without any detected case in the underweight group. So 84.4% of the study cases were either overweight or obese with a mean age of 44.2 years. Although the nonsignificant differences according to the mean age between the three groups ($p>0.05$ for all), female ratio showed significant increases from the overweight towards the obesity groups (28.3% versus 50.0%, $p<0.001$) (Table 1). Although the presence of significant differences between the three groups according to the BMI and body weight ($p<0.000$ for all), there was a significant increase according to the mean ALT value only from the normal weight towards the overweight groups (39.7 versus 53.5 U/L, $p<0.001$), but not from the overweight towards the obesity groups (53.5 versus 53.5 U/L, $p>0.05$). As a similar trend, prevalence of dyslipidemia was significantly lower in the normal weight than the overweight groups (25.0% versus 45.2%, $p<0.001$), but there was a nonsignificant difference between the overweight and obesity groups (45.2% versus 37.5%, $p>0.05$). On the other hand, prevalence of smoking increased from the normal weight (25.0%) towards the overweight (35.8%) and obesity groups (33.9%), but the differences were nonsignificant ($p>0.05$ for both) probably due to the small sample sizes of the groups.

Table 1: Characteristic features of the study cases

Variables	Normal weight	*p*-value	Overweight	*p*-value	Obesity
Number	20		53		56
Mean age (year)	42.7 ± 17.7 (20-69)	Ns*	43.3 ± 12.1 (18-67)	Ns	45.6 ± 10.0 (18-65)
Female ratio	20.0% (4)	Ns	*28.3% (15)*	*<0.001*	*50.0% (28)*
Mean BMI†	*22.5 ± 1.3 (20-24)*	*<0.000*	*27.2 ± 1.4 (25-29)*	*<0.000*	*33.7 ± 4.0 (30-49)*
Mean body weight (kg)	*66.2 ± 8.0 (52-77)*	*<0.000*	*78.1 ± 9.2 (62-95)*	*<0.000*	*90.4 ± 14.4 (61-124)*
Mean ALT‡ value (U/L)	*39.7 ± 13.4 (15-66)*	*<0.000*	*53.5 ± 14.1 (14-88)*	Ns	53.5 ± 11.9 (20-87)
Prevalence of dyslipidemia	*25.0% (5)*	*<0.001*	*45.2% (24)*	Ns	37.5% (21)
Prevalence of smoking	25.0% (5)	Ns	35.8% (19)	Ns	33.9% (19)

*Nonsignificant (p>0.05) †Body mass index ‡Alanine aminotransferase

Discussion

Excess weight, smoking, alcohol, and chronic infections and inflammations are related with an increased BP, dyslipidemia, HT, DM, CAD, cirrhosis, chronic renal disease (CRD), chronic obstructive pulmonary disease (COPD), peripheric artery disease (PAD), stroke, and an increased all-cause mortality rate, and this relationship has been known for many years under the title of metabolic syndrome (20-22). The syndrome can be reversed with appropriate non-pharmaceutical approaches including lifestyle changes, diet, and exercise before the development of irreversible fibrotic changes on vascular endothelium (23). Excessive fat accumulation in hepatocytes is called hepatosteatosis. It progresses to NAFLD, steatohepatitis, fibrosis, cirrhosis, hepatocellular carcinoma, and hepatic failure. There are two histologic patterns of NAFLD including fatty liver alone and nonalcoholic steatohepatitis (NASH). NASH represents a shift from simple steatosis to an inflammatory component. Excess weight may be the main factor in exacerbating hepatic inflammation and fibrogenesis in NASH. NAFLD affects up to a third of the world population, and it has become the most common cause of chronic liver disease even in children and adolescents (24, 25). The recent rise in the prevalence of excess weight likely explains the NAFLD epidemic, worldwide (26). NAFLD is a marker of pathological fat deposition combined with a low-grade chronic inflammatory state, which results with hypercoagulability, endothelial dysfunction, and an accelerated atherosclerotic process (26). NAFLD shares many features of the metabolic syndrome as a highly atherogenic condition, and may cause hepatic inflammation and cellular injury especially at the endothelial level. Beside terminating with cirrhosis, NAFLD is associated with a significantly greater overall mortality as well as with an increased prevalence of cardiovascular diseases (25). Authors reported independent associations between NAFLD and impaired flow-mediated vasodilation and increased carotid artery intimal medial thickness as the reliable markers of subclinical atherosclerosis (25), so NAFLD may also be a predictor of cardiovascular disease (27, 28). NAFLD may be considered as the common hepatic component of the metabolic syndrome since hepatic fat is highly correlated with all components the syndrome (29). Interestingly, although the presence of significant progressions according to the BMI and body weight (p<0.000 for all) from the normal weight towards the overweight and obesity groups and although the presence of a highly significant difference according to the ALT values between the normal weight and overweight groups (39.7 versus 53.5 U/L, p<0.001), the difference between the overweight and obesity groups was nonsignificant according to the mean ALT values in serum (53.5 versus 53.5 U/L, p>0.05). As a similar trend, prevalence of dyslipidemia was significantly lower in the normal weight than the overweight groups (25.0% versus 45.2%, p<0.001), but there was a nonsignificant difference between the overweight and obesity groups, too (45.2% versus 37.5%, p>0.05). These findings may be explained with the idea that excess weight, either overweight or obesity, probably causes similar risks for hepatosteatosis.

Smoking has major effects on systemic atherosclerotic processes including COPD, digital clubbing, cirrhosis, CRD, PAD, CAD, stroke, and cancers (30). Its atherosclerotic effects are the most obvious in COPD and Buerger's disease. Buerger's disease has never been reported in the absence of smoking in the literature. Smoking induced endothelial damage is probably seen in pulmonary vasculature much more than the other organs due to the higher concentration of its products in lungs. But smoking may even cause cirrhosis, CRD, PAD, CAD, stroke, and cancers by the transport of toxic products within the blood. On the other hand, beside the strong atherosclerotic effects, smoking in human beings and nicotine in animals may be associated with some weight loss (31). There may be an increased energy expenditure during smoking (32), and nicotine may decrease caloric intake in a dose-related manner (33). Nicotine may lengthen intermeal time, and decrease amount of meal eaten (34). Similarly, BMI seems to be the highest in the former and the lowest in the current smokers (35). Probably toxic substances of tobacco smoke cause a diffuse inflammation on vascular endothelium all

over the body, and it is the major cause of loss of appetite during circulation of the substances within the blood, since the body does not want to eat during fighting. So regular smoking causes a prominent weight loss, clinically. On the other hand, as a pleasure in life, smoking may also show the weakness of volition to control eating. For example, prevalences of HT, DM, and smoking were the highest in the highest TG having group as another significant parameter of the metabolic syndrome (12). Additionally, although CAD was detected with similar prevalences in both sexes, smoking and COPD were higher in males against the higher prevalences of BMI and its consequences including dyslipidemia, HT, and DM in females (13). The proportion of smokers is consistently higher in men in the literature (36). Although the decreased male prevalences from the normal weight towards the overweight and obesity groups, prevalence of smoking increased from the normal weight (25.0%) towards the overweight (35.8%) and obesity groups (33.9%) but the differences were nonsignificant ($p>0.05$ for both) probably due to the small sample sizes of the groups in the present study.

As a conclusion, higher ALT value in serum may indicate excess weight and dyslipidemia. On the other hand, there were nonsignificant differences according to ALT value and prevalence of dyslipidemia between the overweight and obesity groups.

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