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ASSOCIATION BETWEEN ALCOHOL INTAKE, OBESITY WITH LIVER ENZYME LEVELS

Medicine

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ABSTRACT

Introduction: Alcohol intake and obesity are seldom associated with increased level of liver enzymes. Only few studies focused the threshold of alcohol intake with elevated liver enzymes and its relationship with obesity.

Objectives : To determine the prevalence of elevated serum Alanine transaminase (ALT), Aspartate transaminase (AST) and Gamma Glutamyl Transferase (GGT) levels in alcoholics with and without obesity and to evaluate the association between alcohol intake, Body Mass Index(BMI) and Waist circumference (WC) and their combined effect with serum ALT, AST and GGT levels.

Materials and Methods : One hundred and fifty-four males of alcoholic aged 30 years and above with and without obesity were included in study group. Serum ALT, AST and GGT levels were estimated by UV kinetic method. BMI and WC were recorded in the study group. Variables were expressed as mean ± standard deviation. Serum liver enzymes, BMI and WC were correlated using Pearson's correlation.

Results : The mean age of study population was 41.8 ± 6.2. The prevalence of individuals (29.57%) with obese and alcohol consumption had raised AST levels (52 ± 3.4) than non-obese alcoholics (33 ± 3.2). The prevalence of increased liver enzymes in obese alcoholics was more when compared to non-obese alcoholics. AST and increased WC were highly correlated with `r` value of 0.72. AST and high BMI were correlated with `r` value of 0.41.

Conclusion : Alcohol consumption and the obesity symbiotically raise serum ALT and AST. AST is highly correlated with WC and BMI. The impact of alcohol consumption on liver enzymes increases with measures of obesity.

KEYWORDS

Alcohol Consumption, Aspartate Transaminase, Fatty Liver, Gamma Glutamyl Transferase, Obesity.

Introduction

Alcohol consumption seems to be one of the risk factors in the development of obesity [1]. Both alcohol consumption and obesity impose health burden to the community. Among adults, approximately every sixth individual have been estimated to consume alcohol, exceeding the limits (24 standard drinks of alcohol for men and 16 drinks for women per week) [2]. Alcohol consumption is the commonly noted risk factor for premature death among males aged 15 to 59 years [3]. Although few research articles suggest the intake of safe limit of alcohol, adverse effects of alcohol intake may vary among the individuals because of genetic polymorphisms and safe limit remains as controversy. Heavy alcohol use accounts for about 1/3rd of all cases of non-ischemic dilated cardiomyopathy, atrial fibrillation and apparently increases the risk of stroke [4]. Heavy drinking has also been linked with neurological disease [5], liver disease, disorders of the digestive tract [6] and diseases from alcohol-related injuries. Alcohol consumption and obesity can cause fatty liver, and it is associated with the elevation of serum ALT and AST levels [7]. It is evident that fatty liver disease is linked with obesity [7], alcohol use, diabetes [7], and cardio-metabolic risk factors. The alteration of liver enzymes was identified during routine screening and fatty liver disease was suspected based on the liver function tests. The prevalence of obesity and excessive alcohol consumption are high and physicians are currently faced a large number of laboratory reports with abnormal liver function tests which may pinpoint silent liver diseases. Vadstrup et al [8] evaluated the relationship among the alcohol consumption and waist circumference in which individuals who consumed beer had increased waist circumference, on the contrary, those who drank wine tended to have a lower waist circumference.

Only a few studies studied the relationships between mild to moderate levels of alcohol drinking, and the changes in the activity of liver enzymes. The prevalence of obesity is high and habit of consuming alcohol for recreational purpose is common across the world, and it is mandatory to comprehend the ill effects of alcohol consumption. Both obesity and habit of alcohol consumption are modifiable risk factors. Hence, the study between the alcohol intake, BMI, WC and activity of liver enzymes in alcoholic individuals is needed so that earlier changes in liver function test are evidently warranted. This present study proposed to identify the abnormal liver enzyme findings in apparently healthy individuals in alcoholics. This study was aimed to examine the association between alcohol consumption, adiposity, and alterations of liver enzymes in rural population which would have important implications for public health.

Materials and methods

This was the cross-sectional study conducted in the tertiary care teaching hospital. One hundred and fifty-four males of known alcoholic aged 30 years and above were included in the study group. Known liver disease and those who consume drugs which alter liver enzymes were excluded from this study. A detailed history regarding frequency, type, and amount of alcohol consumed per week, occupation, and smoking habits were recorded with the help of questionnaire. Based on the questionnaires and personal interview, the study group was categorized into three groups (mild drinker, moderate drinker and heavy drinker) by the baseline amount of alcohol consumption. Anthropometric measures like weight, height, BMI and WC were measured. BMI was calculated from the formula, weight in kg divided by height squared in m^2. According to Asian-Pacific cutoff points of BMI, it was categorized with normal weight (18.5–22.9 kg/m^2), overweight (23–24.9 kg/m^2) and obese (≥25 kg/m^2) [9]. Based on BMI, alcoholics were classified into obese and non- obese for the purpose of the study. A waist circumference of female ≥ 80 cm and of male ≥ 90 cm was taken as central obesity [10]. After obtaining necessary informed written consent from the study group, blood samples were taken for the analysis. Serum ALT, AST and GGT levels were estimated by UV kinetic method. The reference ranges of AST, ALT and GGT were 15-35 U/L, 15-40U/L and < 38 U/L respectively. Calibration of instruments and reagents had been done before entering the study. Laboratory assistants were blinded to sample sources and clinical information until the end of the study. Oral and written consent was obtained from the study population before proceeding with the study. Data were analyzed statistically using SPSS software, version 21. Values were expressed as mean ± standard deviation. The variables were compared using the Mann-Whitney test or Kruskal-Wallis test. For all analyses, `p` values <0.05 was considered significant. Serum

liver enzymes, BMI and WC were correlated using Pearson's correlation. Ethical clearance was obtained from the Institutional ethical committee.

Results

The demographic characteristics of the study population as given in Table 1. The mean age of study population was 41.8 ± 6.2. In this study, 53% and 47% participants were smokers and nonsmokers respectively. Average daily alcohol consumption was framed as continuous variable and categorized according to the recommendations of the World Health Organization (WHO) as low-risk drinking (all per day; men: 1–40 g), medium-risk drinking (men: 41–60 g) and high-risk drinking (men: >60 g) [11,12]. The study subjects were divided into 3 groups as given in Table 2. Alcohol drinks are often measured in ounces (oz), 1 oz equals 29.57 ml or 28.35 g. Beer: 12 fluid ounces of 5 % beer = 355 ml fluid = 17.5 ml 100 % alcohol; Wine: 5 fluid ounces of 12 % wine = 148 ml fluid = 17.76 ml of 100 % alcohol; Distilled spirits: 1.5 fluid ounces of ~40 % liquor = 44 ml = 17.6 ml of 100 % alcohol [13]. The mean values of AST, ALT and GGT were given in Table 3. The altered liver enzyme pattern of AST, ALT and GGT in obese-alcoholics were 29.57%, 16.9 %, and 21.12% respectively (Table 4). Mean and standard deviation of AST, ALT and GGT levels of individuals with and without obesity were given in table 5. Pearson`s correlation was used to study the correlation among the liver enzymes with BMI and WC as shown in Table 6. AST and WC were highly correlated with `r` value of 0.72. AST and BMI were highly correlated with `r` value of 0.41. The type of alcohol consumed was predominantly beer (59.7% of units), spirits accounted for 35.1%, and wine consumption was low (5.2%).

Table 1 Demographic characteristics of the study population

Characteristics	N (%)
Age in years	
31-40	45 (29.22)
41-50	78 (50.64)
51-60	31 (20.12)
Occupation	
Unemployed	11 (7.14)
Plumber, Painter, Construction works	65 (42.2)
Petti shop owners	18 (11.68)
Office clerks, Teachers	48 (31.16)
Health care workers	12 (7.79)
BMI (kg/m^2)	
Non-obese	83 (53.8)
obese	71 (46.1)
WC (cm)	
>90	80 (51.94)
<90	74 (48.05)
Smoking (pack-week)	
>5	36 (23.37)
2-5	30 (19.48)
< 2	53 (34.41)
None	35 (22.72)

Table 2 Classification of study group based on drinking habits

Characteristics	Alcohol Consumption/day	N (%)
Mild drinkers	30g	25 (16.23)
Moderate drinkers	55g	62 (40.25)
Heavy drinkers	70g	67 (43.50)

Table 3 Mean and standard deviation of AST, ALT, GGT levels, BMI and waist circumference

Characteristics	AST	ALT	GGT	BMI	WC
Mild drinkers	28 ± 3.5	25 ± 4	30 ± 6.3	25 ± 1.9	90 ± 2.2
Moderate drinkers	42 ± 3.2	39 ± 2.6	38 ± 5.5	26 ± 2.3	94 ± 2.8
Heavy drinkers	51± 5.4	46 ± 1.2	47 ± 9.8	27 ± 1.3	101 ± 3.5

ALT-Alanine aminotransferase; Aspartate aminotransferase; GGT- γ-Glutamyl transferase; BMI-Body mass Index; WC-Waist circumference

Table 4 Prevalence of elevated liver enzymes among the study group

Parameters	Alcoholism with Obesity N (%) 71 (46.10%)	Alcoholism without Obesity N (%) 83(53.89%)
AST	21 (29.57)	15 (18.07)
ALT	12 (16.90)	8 (9.63)
GGT	15 (21.12)	9 (10.84)

ALT-Alanine aminotransferase; Aspartate aminotransferase; GGT- γ-Glutamyltransferase

Table 5 Mean and standard deviation of AST, ALT and GGT levels of individuals with and without obesity

Parameters	Alcoholism with Obesity	Alcoholism without Obesity	`p` value
AST	52 ± 3.4	33 ± 3.2	0.01*
ALT	46 ± 2.2	24 ± 4.6	0.01*
GGT	47 ± 9.8	30 ± 5.1	0.02*

*`p` value - significant

Table 6 Correlation of serum liver enzymes, BMI and WC using Pearson's correlation

Parameters	`r` value	`p` value
AST and BMI	0.41	0.01*
ALT and BMI	0.21	0.07
GGT and BMI	0.11	0.07
AST and WC	0.72	0.001*
ALT and WC	0.63	0.001*
GGT and WC	0.14	0.06

*`p` value - significant

Discussion

This cross-sectional study aimed to study the combined effects of obesity and alcohol consumption on liver enzymes in men. Among 154 alcoholics, 71(46.10%) were obese and 83(53.89%) were non-obese. Heavy drinkers and moderate drinkers were 43.50% and 40.25% respectively. The prevalence of altered serum AST, ALT and GGT in obese-alcoholics were 29.57%, 16.9 %, and 21.12% respectively. Serum AST levels (52 ± 3.4) were higher in obese-alcoholics than non-obese alcoholics (33 ± 3.2). Serum ALT and GGT levels were also raised in obese than non-obese group with significant `p` value. AST, ALT and GGT were also highly correlated with increased WC and BMI as given in Table 6.

In this study, heavy drinkers had increased waist circumference and BMI than moderate drinkers (101 ± 3.5; 94 ± 2.8). Coulson et al [13] observed higher BMI and WC in people had five or more alcoholic drinks per day. Sheldon and Knott [14] also added those individuals with increased intake of alcohol had their highest intake of foods. According to Mozaffarian D et al [15], obesity is related to the type of alcohol consumed.

Both obesity and alcoholism are responsible for the changes in the activity of liver enzymes. In our study, among the liver parameters, AST is elevated in more number of individuals than ALT and GGT. Ruhl and Everhart [16] and Alatalo et al [17] stated that obesity increases the risk of alcohol-related altered aminotransferase activity. In individuals with alcohol consumption, serum AST denotes the liver damage and it is increased to a greater extent in those with higher WC and BMI. Obesity cause steatohepatitis due to the actions on hepatic insulin sensitivity and the lipid solubility of alcohol makes adipose tissue a target for its effects [18]. The activity of serum aminotransferases is related to hepatic insulin resistance [19] and the biochemical changes occurring during hepatic gluconeogenesis, inflammation, or both. Serum AST and WC were highly correlated with `r` value of 0.72, and serum AST and BMI were correlated with `r` value of 0.41 as given in table 6. In this study, Alcohol consumption and waist circumference was highly correlated with WC than BMI. Excessive alcohol intake was related to high WC. This relationship persists unaccompanied even after adjustment for smoking, which is strongly related to abdominal obesity [20].

The alcohol intake was estimated based on the questionnaires and the intake may be under or overestimated and this may influence our findings. This study has its own limitations which include it is a single centered study and sample size is small. The other limitations were ultra sound findings of the liver was not included in this study. This study focused the major public concern of alcohol consumption and obesity and revealed that liver enzymes were elevated in the study group with no obvious symptoms and signs, which may indicate the silent liver disease. Reduction of alcohol drinking habits may be an effective measure to reduce the obesity. Health education is essential to emphasize the collated effects of obesity and alcohol in the development of liver disease.

Conclusion

The prevalence of altered serum AST, ALT and GGT are more in obese alcoholics than non-obese alcoholics. Alcohol consumption and the obesity symbiotically raise serum AST, ALT and GGT. AST is highly correlated with WC and BMI. The impact of alcohol consumption on liver enzymes increases with measures of obesity. Further studies are needed to elucidate these findings.

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