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RESEARCH ARTICLE

VARIATIONS IN SERUM LIPID AND LIPOPROTEIN CHOLESTEROL LEVELS IN FATTY LIVER WITH OR WITHOUT ALCOHOL INTAKE IN NORTH WEST PUNJABI POPULATION

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ABSTRACT

The present study was designed to investigate the variations in lipid and lipoprotein cholesterol levels in fatty liver with or without alcohol intake. The main factors responsible for developing fatty liver were alcohol intake, type 2 diabetes mellitus, dyslipidemia and obesity. Fatty liver disease has been broadly classified into alcoholic fatty liver disease (AFLD) and non-alcoholic fatty liver disease (NAFLD). Extensive variations in lipid and lipoprotein cholesterol levels have been reported in fatty liver. It was observed that serum total cholesterol, serum triglycerides (TG), LDL-cholesterol and VLDL-cholesterol were increased and HDL-cholesterol was decreased in NAFLD and AFLD patients as compared to the controls. It was observed that change in mean serum lipid and lipoprotein cholesterol levels in all the groups of NAFLD when compared to each other were not significant ($p>0.0001$). All the subjects were evaluated for serum total cholesterol, serum triglycerides, serum HDL-cholesterol, LDL-cholesterol and VLDL-cholesterol.

INTRODUCTION

Accumulation of abnormal quantity of lipids in the liver causes fatty liver. Fatty liver is asymptomatic and the most common condition assessed by ultrasonography at health checkups[1]. Fatty liver disease based on etio-pathogenesis is divided into alcoholic fatty liver disease (AFLD) and non-alcoholic fatty liver disease (NAFLD) [2]. AFLD is due to the consumption of large amount of alcohol which leads to fat deposition within liver cells due to toxic effects of alcohol and impaired lipid and carbohydrate metabolism. Numerous studies have demonstrated that obesity, type-2 diabetes, dyslipidemia, hypertension, and insulin resistance are strongly associated with NAFLD[3].

Fatty liver disease, whether it is AFLD or NAFLD, encompasses a morphological spectrum consisting of hepatic steatosis (fatty liver) and steatohepatitis that has the inherent propensity to progress toward the development of cirrhosis and hepatocellular carcinoma[4]. Accumulation of fat in the liver may occur due to the excessive delivery of free fatty acids from the peripheral tissues to the liver, increased endogenous synthesis of triglycerides (TG), cholesterol esters and free fatty acids (FFA) in the liver and decreased secretion of very low-density lipoprotein (VLDL) that carries triglycerides from the liver[5].

Nonalcoholic fatty liver disease (NAFLD) is progressively diagnosed worldwide and is considered to be the most common liver disorder in Western countries, estimated to affect at least one-quarter of the general population. The prevalence of fatty liver is now 20–30% in Japan and other countries[1]. The prevalence of NAFLD has increased over the last two decades and it affects approximately 30% of adults in the United States[6].

In our study, serum mean levels of total cholesterol, triglyceride and LDL-cholesterol in patients with non alcoholic steatohepatitis (NASH) were significantly higher than those of the control group and serum HDL-cholesterol level was less than that of the control group. According to previous studies on Asian people, fatty liver is more prominent in men. However, in our study, the male-to-female ratio was almost equivalent. However, ultrasound examination is by far the commonest way of diagnosing NAFLD in clinical practice. Disturbances of VLDL assembly in NAFLD could be causal to the development of hepatic steatosis. Importantly, impaired VLDL secretion also results in a lower number of circulating particles that are large, triglyceride-rich, and highly atherogenic [7].

According to Rimm *et al*. (1999), consuming 30 g of alcohol per day increases HDL cholesterol levels by 4 mg/dl, which in turn is equivalent to an estimated 17% reduction in CHD risk[8].

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LDL has recently attracted attention since small, dense LDL is the most atherogenic subclass of LDL, and this subclass is elevated in metabolic syndrome and fatty liver. Association of fatty liver and small dense LDL concentration is now well documented. All the risk factors of fatty liver are common in north west punjabi population, having a rich life style associated with fatty diet and chronic alcoholism. Hence it will be interesting to investigate the variations in lipid and lipoprotein cholesterol levels as predictors of developing fatty liver disease (AFLD and NAFLD) in north west punjabi population.

MATERIAL AND METHODS

The present study was undertaken in the Department of Biochemistry in collaboration with Department of Radiology, Govt., Medical College, Amritsar. It was a case control randomized prospective study. A total of 200 subjects were included in the present study. These subjects were divided into 3 groups:-

Group 1: Hundred (n=100) age and sex matched healthy individuals were recruited as control from the general population.

Group 2: 50 NAFLD Patients. The subjects in this group were further stratified on the basis of risk factors of fatty liver such as diabetes mellitus type 2, dyslipidemia and obesity.

Group 3: 50 AFLD Patients. This group shall comprise of patients with only alcoholic fatty liver disease (AFLD).

The Subjects suffering from other conditions that may alter the lipid profile were excluded from the study such as thyroid disorders, genetic disorders of lipid metabolism, tuberculosis, coronary artery disease, malignancies, renal diseases or subjects on hormone therapy and lipid lowering drugs etc.

The subjects included in the study were assessed for Serum total cholesterol, Serum triglycerides, Serum HDL-C, LDL-C and VLDL-C. A comparison of Serum total cholesterol, Serum triglycerides, Serum HDL-C, LDL-C and VLDL-C was done in patients of AFLD, NAFLD and normal healthy individuals.

Statistical analyses

The groups were individually compared by applying Students T test and ANOVA test was applied to calculate significance of difference in means of various parameters between the groups included under NAFLD patients. MS-office 2010 was used to perform the analysis.

Aims and Objectives

1. To investigate variations in lipid and lipoprotein cholesterol levels in alcoholic fatty liver disease in North West Punjabi Population.
2. To investigate variations in lipid and lipoprotein cholesterol levels in non- alcoholic fatty liver disease associated with diabetes mellitus type 2, obesity and dyslipidemia in North West Punjabi Population.
3. To compare the level of difference in lipid and lipoprotein cholesterol levels in AFLD and NAFLD in the given population.

RESULT

Table 1 Variations in serum lipid levels in patients of NAFLD, AFLD and normal healthy individuals

Group	N	Total Cholesterol		Triglycerides	
		Range	Mean ± SD (in mg%)	Range	Mean ± SD (in mg%)
Group-I (Normal subjects)	100	121-211	160.85±21.11	104-230	156.37±22.08
Group-II (NAFLD)	50	105-278	185.02±37.29	128-402	195.74±49.84
Group-III (AFLD)	50	130-272	183.36±27.79	124-470	212.74±56.90
T&P value	Gp I vs II	p<0.0001, HS t= 5.0669		P<0.0001, HS t= 6.7071	
	Gp I vs III	p<0.0001, HS t= 5.5226		P<0.0001, HS t= 8.7042	
	Gp II vs III	p>0.0001, NS t= 0.2524		p>0.0001, NS t= 1.5892	

Table – 1 shows comparison of total cholesterol and serum triglycerides in normal individuals and patients suffering from NAFLD and AFLD. It was observed that total cholesterol and serum triglycerides were increased in NAFLD and AFLD patients. The difference in the levels of total cholesterol and triglycerides in group I and group II were significant ($p<0.0001$) with the levels of total cholesterol and triglycerides increased in group II (NAFLD). The difference in the levels of total cholesterol and triglycerides in group I and group III were significant ($p<0.0001$) with the levels of total cholesterol and triglycerides increased in group III (AFLD). Whereas the difference in the levels of total cholesterol and triglycerides in group II and group III were not significant ($p>0.0001$).

As shown in the Table 3, out of 50 NAFLD patients, 19 subjects had Type-2 DM, 7 were obese and 17 were dyslipidemic. Whereas, 2 subjects had only fatty liver without any associated risk factor while 5 subjects had >1 risk factors.

Table – 4 shows comparison of serum total cholesterol and serum triglycerides in patients suffering from NAFLD. Statistical analysis revealed that the change in mean total cholesterol and triglyceride levels in all the groups of NAFLD were not significant ($p>0.0001$).

Table – 5 shows comparison of VLDL-C, LDL-C and HDL-C in patients suffering from NAFLD. Statistical analysis revealed that the change in mean serum VLDL-C, LDL-C and HDL-C levels in all the groups of NAFLD were not significant ($p>0.0001$).

DISCUSSION

Fatty liver disease (steatosis) is a build-up of excess fat in the liver cells. Risk factors for fatty liver disease include overweight and obesity, diabetes, hyperlipidemia and alcohol consumption. Alcoholic fatty liver is.an early and reversible consequence of excessive alcohol consumption. Often, as

people continue to drink heavily, they progress from fatty liver to hepatitis to cirrhosis.

Alcohol dehydrogenase and acetaldehyde dehydrogenase cause the reduction of nicotinamide adenine dinucleotide (NAD) to NADH (reduced form of NAD). The altered ratio of NAD/NADH promotes fatty liver through the inhibition of gluconeogenesis and fatty acid oxidation[10]. In the present study, it was observed (Table 1) that the serum total cholesterol and triglycerides were increased in NAFLD and AFLD patients as compared to the controls.

Table 2 Variations in serum lipoprotein cholesterol levels in patients of NAFLD, AFLD and normal healthy individuals

Group	N	VLDL-C		LDL-C		HDL-C	
		Range	Mean±SD (in mg%)	Range	Mean±SD (in mg%)	Range	Mean±SD (in mg%)
Group-I Normal Subjects	100	20.8-46	31.36±4.49	50.6-125.2	84.21±18.15	34-52	45.38±3.74
Group-II (NAFLD)	50	25.6-80.4	39.14±9.97	22-201	106.47±34.66	28-52	40.02±5.41
Group-III (AFLD)	50	24.8-94	42.71±11.25	40-172.8	99.60±24.58	29-52	41.04±6.11
T&P value	Gp I vs II	p<0.0001 HS t= 6.5945		p<0.0001 HS t= 5.1694		P<0.0001 HS t= 7.0908	
	Gp I vs III	p<0.0001 HS t= 8.8050		p<0.0001 HS t= 4.3336		P<0.0001 HS t= 5.3769	
	Gp II vsIII	p>0.0001 NS t= 1.6793		p>0.0001 NS t= 1.1433		p>0.0001 NS t= 0.8838	

Table 3 Distribution of subjects having non alcoholic fatty liver diseases (NAFLD)

Subjects	No of subjects
DM Type-2	19
Obese	7
Dyslipidemic	17
Patients having only Fatty Liver	2
Patients having > I risk factor	5

Table 4 Variations in serum lipid levels in NAFLD patients

Group	N	Total Cholesterol		Triglycerides	
		Range	Mean ± SD (in mg%)	Range	Mean ± SD (in mg%)
DM type - 2	19	135-278	187.57±40.10	162-402	209.52±61.25
Obese	07	148-242	189.57±29.35	140-210	172.5±26.49
Dyslipidemic	17	105-236	172.82±34.34	155-252	188.76±28.81
Patients having only fatty liver	02	154-168	161±9.89	128-146	137±12.72
Patients with > 1 risk factor	05	186-278	220±35.37	162-330	222±68.77
ANOVA		F= 1.9506, P=0.1185 NS		F= 2.0063, P= 0.1097 NS	

Table 5 Variations in VLDL-C, LDL-C AND HDL-C levels in NAFLD patients

Group	N	VLDL-C		LDL-C		HDL-C	
		Range	Mean±SD (in mg%)	Range	Mean±SD (in mg%)	Range	Mean±SD (in mg%)
DM type - 2	19	32-80.4	41.90±12.25	56.2-201	106.2±39.15	29-52	41.05±5.79
Obese	07	28-42	34.5±5.29	65.8-159	112±31.16	36-47	40.5±3.88
Dyslipidemic	17	32-50.4	37.75±5.76	22-150.6	95.24±31.08	28-52	39.82±5.89
Patients having only fatty liver	02	25.6-29.2	27.4±2.54	89-100.8	94.9 ± 8.34	38-40	39±1.41
Patients with > 1 risk factor	05	32.4-66	44.32±13.82	107-175	139.48±24.56	32-44	36.2±4.91
ANOVA		F= 1.9911 P= 0.1121		F= 1.7681 P= 0.1520		F= 0.8137 P= 0.5232	

The association between alcohol intake and alcohol-induced liver disease in humans is well known. The Italian Dionysos study showed that alcohol is suspected to cause the 23% of all cases of liver disease, with a dose-dependent increase in the risk of developing liver disease (Bellentani *et al*., 1997).[8]

Fatty liver is a common histologic finding in human liver. It affects 10% to 24% of the general population and is believed to be a marker of risk of later chronic liver disease. Nonalcoholic fatty liver disease (NAFLD) is the most common cause of liver dysfunction, as determined by liver function testing, and it has been estimated that, with increasing levels of obesity in the United States, 20 million patients are affected[9].

The liver is the main site of alcohol metabolism. Liver damage occurs through several interrelated pathways.

The mean serum total cholesterol levels were 160.85±21.11, 185.02±37.29 and 183.36±27.79 mg% in normal healthy individuals, NAFLD and AFLD patients. The mean serum triglyceride levels were 156.37±22.08, 195.74±49.84 and 212.74±56.90 mg% in normal healthy individuals, NAFLD and AFLD patients. The difference in the levels of total cholesterol and triglycerides in group I and group II were significant (p<0.0001) with the levels of total cholesterol and triglycerides increased in group II. The difference in the levels of total cholesterol and triglycerides in group I and group III were also significant (p<0.0001) with the levels of total cholesterol and triglycerides increased in group III. Whereas, the difference in the levels of total cholesterol and triglycerides in group II and group III were not significant (p>0.0001). In a study done by Duseja A in 2010, it was observed that raised triglyceride level

was found in 53% of the patients with non alcoholic fatty liver disease[11].

In the present study, it was observed (Table 2) that VLDL-C and LDL-C were increased and HDL-C was decreased in NAFLD and AFLD patients as compared to the controls. The mean VLDL-C levels were 31.36±4.49, 39.14±9.97 and 42.71±11.25 mg% in normal healthy individuals, NAFLD and AFLD patients. The mean LDL-C levels were 84.21±18.15, 106.47±34.66, 99.60±24.58 in normal healthy individuals, NAFLD and AFLD patients. The mean HDL-C levels were 45.38±3.74, 40.02±5.41 and 41.04±6.11 mg% in normal healthy individuals, NAFLD and AFLD patients. The difference in the levels of VLDL-C, LDL-C and HDL-C in group I and group II were significant ($p<0.0001$) with the levels of VLDL-C and LDL-C increased and the levels of HDL-C decreased in group II. The difference in the levels of VLDL-C, LDL-C and HDL-C in group I and group III were also significant ($p<0.0001$) with the levels of VLDL-C and LDL-C increased and levels of HDL-C decreased in group III. Whereas, the difference in the levels of VLDL-C, LDL-C and HDL-C in group II and group III were not significant ($p>0.0001$). Similar mean LDL cholesterol was reported by Chawla Y *et al* in 2005[12].

Patients suffering from non alcoholic fatty liver disease (NAFLD) were further segregated into 5 groups according to the associated risk factors such as type-2 diabetes mellitus, obesity and dyslipidemia. In the present study, as shown in the (Table 3), 19 out of 50 non alcoholic fatty liver disease patients had DM Type-2, 7 out of 50 non alcoholic fatty liver disease patients were obese and 17 were dyslipidemic. Whereas, 2 subjects had only fatty liver without any associated risk factor while, 5 subjects had >1 risk factors.

In the present study, it was observed (Table 4) that mean serum total cholesterol level in patients of DFL was 187.57±40.10 mg%, whereas in patients of NAFLD associated with obesity it was 189.57±29.35 mg% and in dyslipidemic NAFLD patients it was 172.82±34.34 mg%. The mean serum total cholesterol level in patients having only fatty liver was 161±9.89 mg% whereas in patients of NAFLD with more than 1 risk factor it was 220±35.37mg%. The mean serum triglyceride levels in patients of DFL was found to be 209.52±61.25 mg%, whereas in patients of NAFLD associated with obesity it was 172.5±26.49 mg% and in dyslipidemic NAFLD patients it was 188.76±28.81mg%. The mean serum triglyceride levels in patients having only fatty liver was found to be 137±12.72 mg% whereas in patients of NAFLD with more than 1 risk factor it was 222±68.77 mg%. Statistical analysis revealed that the change in mean total cholesterol and triglyceride levels in all the groups of NAFLD were not significant ($p>0.0001$).

In the present study, it was observed (Table 5) that mean VLDL-C level in patients of DFL was found to be 41.90±12.25 mg%, whereas in patients of NAFLD associated with obesity it was 34.5±5.29 mg% and in dyslipidemic NAFLD patients it was 37.75±5.76 mg%. The mean VLDL-C level in patients having only fatty liver was found to be 27.4±2.54 mg% whereas in patients of NAFLD with more than 1 risk factor it was 44.32±13.82 mg%. The mean LDL-C level in patients of DFL was found to be 106.2±39.15 mg%, whereas in patients of NAFLD associated with obesity it was 112±31.16 mg% and in dyslipidemic NAFLD patients it was 95.24±31.08 mg%. The mean LDL-C level in patients having only fatty liver was found to be 94.9±8.34 mg% whereas in patients of NAFLD with more than 1 risk factor it was 139.48±24.56 mg%. The mean HDL-C level in patients of DFL was found to be 41.05±5.79 mg%, whereas in patients of NAFLD associated with obesity it was 40.5±3.88 mg% and in dyslipidemic NAFLD patients it was 39.82±5.89 mg%. The mean HDL-C level in patients having only fatty liver was found to be 39±1.41 mg% whereas in patients of NAFLD with more than 1 risk factor it was 36.2±4.91 mg%. Statistical analysis revealed that the change in mean serum VLDL-C, LDL-C and HDL-C levels in all the groups of NAFLD were not significant ($p>0.0001$).

CONCLUSIONS

Fatty liver was diagnosed in the patients by ultrasonographic examination. It was observed that serum total cholesterol, serum triglycerides, VLDL-C and LDL-C levels were increased and HDL-C was decreased in NAFLD and AFLD patients as compared to the controls. The difference in the levels of total cholesterol, triglycerides, VLDL-C, LDL-C and HDL-C in group I and group II were significant ($p<0.0001$) with the levels of total cholesterol, triglycerides, VLDL-C and LDL-C increased and HDL-C decreased in group II. The difference in the levels of Total Cholesterol, Triglycerides, VLDL-C, LDL-C and HDL-C in group I and group III were also significant ($p<0.0001$) with the levels of total cholesterol, Serum triglycerides, VLDL-C and LDL-C increased and HDL-C decreased in group III. Whereas the difference in the levels of total cholesterol, triglycerides, VLDL-C, LDL-C and HDL-C in group II and group III were not significant ($p>0.0001$).

It was observed that change in mean serum lipid and lipoprotein cholesterol levels in all the groups of NAFLD when compared to each other were not significant ($p>0.0001$). In NAFLD patients (n=50), 38 % patients had DM Type-2, 14 % patients had obesity and 34% patients had dyslipidemia, 4% patients had only fatty liver without any associated risk factor and 10% patient had >1 risk factor.

Reference

1. Okamoto M, Takeda Y, Yoda Y, Kobayashi K, Fujino MA, Yamagata Z. The association of fatty liver and diabetes risk. *J Epidemiol* 2003; 13: 15–21.
2. Collantes R, Ong JP, Younossi ZM. Nonalcoholic fatty liver disease and the epidemic of obesity. *Clevel and Clinical Journal of Medicine*. 2004; 78:657-60.
3. Bugianesi E, McCullough AJ, Marchesini G. Insulin resistance: a metabolic pathway to chronic liver disease. Hepatology 2005; 42:987-1000.
4. Browning JD, Szczepaniak LS, Dobbins R, Nuremberg P, Horton JD, Cohen JC, Grundy SM, and Hobbs HH. Prevalence of hepatic steatosis in an urban population in the United States: impact of ethnicity. Hepatology 2004; 40: 1387–95.

5. Mayes PA. Lipid transport and storage. In: Murry RK, Granner DK, Mayes PA, Rodwell VVV, editors. Harper's biochemistry. 24th edition. Norwalk, CT: Appleton and Lange 1996;254-76.
6. Wieckowska A, McCullough AJ, Feldstein AE. Noninvasive diagnosis and monitoring of nonalcoholic steatohepatitis: present and future. Hepatology 2007; 46:582-9. 2005;25:1045-50.
7. Chen QK, Chen HY, Wang ZY, Zhou XD. Associated risk factors of fatty liver in the patients with type 2 diabetes mellitus. Department of Gastroenterology 2004; 12(7):414-6.
8. Kolovou GD, Salpea KD, Anagnostopoulou KK, Mikhailidis DP. Alcohol use, vascular disease, and lipid lowering drugs. *JPET* 2006;318:1-7.
9. Ahmed MH.The Road Map for the Diagnosis of Nonalcoholic Fatty Liver Disease. *Am J Clin Pathol* 2007;127:20-22.
10. Stewart S, Jones D, Day CP: Alcoholic liver disease: New insights into mechanisms and preventative strategies. Trends Mol Med 2001;7(9):408-413.
11. Kalra N, Duseja A, Das A. Chemical shift magnetic resonance imaging is helpful in detecting hepatic steatosis but not fibrosis in patients with nonalcoholic fatty liver disease (NAFLD). Ann Hepatol 2009;8:21–5.
12. Chawla Y and Duseja A. Nonalcoholic steatohepatitis – Risk factors for significant liver disease. Proceedings of first consensus meet on NAFLD, 2nd July, 2005 pp.74.

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