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# Biochemical and Radiological Changes in Non Alcoholic Fatty Liver Diseases Compare with Obesity

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**Abstract**
**Background:** *NAFLD is considered the most common cause of chronic liver disease worldwide. In the general US population, the prevalence of NAFLD is estimated to be approximately 30%, but much higher estimates are reported in selected high-risk populations, such as Hispanics, obese persons, and patients with type 2 diabetes mellitus (T2DM) or with metabolic syndrome. The purpose of this study to correlate the biochemical & radiological changes in non alcoholic fatty liver disease patients compare with obese patients.*
**Material & Methods:** *41 cases out of which 25 were male and 16 females recruit for this study. In this study biochemical and radiological parameters were determined.*
**Statistical Analysis:** *Comparison of radiological grade of fatty liver and biochemical parameters we used Pearson Chi square test.*
**Results:** *All the biochemical parameters were increased. When the radiological grade was compared with the biochemical findings (FBS, TG and SGPT) individually through Pearson's formula the p value (>0.05) thus found were not statistically significant for any of the biochemical tests.*
**Conclusion:** *In this study we concluded that Non-alcoholic fatty liver disease (NAFLD), radiological and biochemical findings give a good correlation and are equally helpful in assessing the severity of NAFLDS.*
**Keyword:** *NAFLD, obesity, body mass index, CHD, Diabetes Mellitus.*

## Introduction

Non alcoholic fatty liver disease (NAFLD) is the most common liver disease since its prevalence is estimated to be 20-30% in general population of Western countries[(1)]. Studies introduced that NAFLD may progress to cirrhosis, liver failure, and hepatocellular carcinoma[(2)]. It has been shown that NAFLD is strongly associated to the features of metabolic syndrome. Insulin resistance is a key pathogenic factor in both NAFLD and metabolic syndrome. Available data from clinical, experimental and epidemiological studies indicate that NAFLD may be the hepatic manifestation of metabolic syndrome[(3)]. The prevalence rate of NAFLD increases with body mass index (BMI)[(4)]. An analysis of liver histology obtained from liver donors,[5] automobiles crash victims,[6] aytopsy findings[7] and cilinical liver biopsies[8] suggest that the prevalence rates of steatosis and steatohepatitis are approximately 15% and 13%, respectively, in non-obese persons, 65% and 20%, respectively, in persons with class I and II obesity(BMI30.0-39.9 kg/$m^2$), and 85% and 40%, respectively, in extremely obese patients (BMI ≥40 kg/m2). The relationship between BMI and NAFLD is influenced by racial/ethnic background and genetic variation in specific genes.[9,10,11]. The natural history of NAFLD is not well defined. It is clear that some patients with steatosis follow a progressive clinical course whereas others remain stable. It appears that 50% of cases with steatosis do not show any significant change in histology on follow-up biopsies, whereas 27% show fibrosis and 19% cirrhosis.[12] It has been suggested that age above 45 years, obesity, diabetes and an AST/ALT ratio >1 are associated with an increased risk of fibrosis. These are criteria which may guide clinicians towards undertaking a liver biopsy[13]. Since there was a variety of presentation and findings (biochemical, radiological and histological) in various studies done, this study was taken in order to find a correlation between biochemical and radiological change in patients with non-alcoholic fatty-liver having obesity

**Material and Methods**

Non-alcoholic fatty liver disease was considered in those patients with clinical characteristics, laboratory findings suggestive of NAFLD, Ultrasound/CT scan showing fatty changes, and no findings on investigations suggestive of viral, metabolic or other specific etiologies of liver diseases. Apart from alcoholic patients, certain patients were excluded from the study even though they showed one or more features suggesting fatty changes in liver. The exclusion criteria were as follows.

1. Recent gastrointestinal surgery.
2. Pregnancy.
3. Usage of drugs known to cause steatosis including glucorticoids, synthetic estrogens, aspirin, tamoxifen, amiodarone, calcium channel blockers and methotrexate.
4. Investigations suggestive of viral, metabolic or other specific etiologies of liver diseases.
5. Malignancy

**Method and Evaluation**

**1. Medical History:** A detailed medical history was taken of patients attending the OPD (Out Patient Department), Department of Gastroenterology and Hepatology, S.R.N Hospital, Allahabad. This include name, age, sex, clinical history (chief complaint especially right hypochondrial pain), history of alcohol intake and other drugs, family history (especially of diabetes and hypertension), past history of any viral infections especially hepatitis virus, and other relevant history.

**2. Physical examination:** A thorough physical examination was undertaken, which included height, weight, waist/hip ratio, blood pressure and general well being.

**Body mass index (BMI):** BMI is a gross estimate for the amount of fat in the body. It was calculated by taking weight in kg and dividing it by height in $m^2$.

$$\text{BMI}= \frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}$$

Waist was measured by a taking the circumference at the level of the navel in case of males and midway between the bottom of the ribs and top of the hip bone in case of females.

Hip was measured by taking the circumference at the tips of the hip bones in case of males and the widest point between the hips and buttocks is taken as hip circumference in cases of females. Again grading was done as mentioned in the table below.

**3. Investigations-**

- **Ultrasound abdomen-** Ultrasound abdomen was one of the most important investigations of the study. Grading of fatty liver was done according to the following findings:

- **Grade I-** Echogenecity of the liver is mildly increased.
- **Grade II-** Echogenecity of the liver is moderately increased, mild blurring of blood vessels.
- **Grade III-** Echogenecity of the liver is severely increased marked blurring of blood vessels, diaphragm not visualized properly.
- **Haematological test-** Haemoglobin, total leucocyte count and differential leucocyte count.
- **Biochemical tests-** SGOT, SGPT, ALP and Serum bilirubin, Lipid profile(triglyceride)

**Statistical Method:** Comparison of radiological grade of fatty liver and biochemical parameters (TG and SGPT) was done by Pearson Chi square test.

**Observation Table**

Body Mass Index (BMI)- This table shows the variation in BMI in NAFLD patients. Most of the patients (68%, had BMI>40(grade III obesity).

**Table 1:** Variations in BMI in NAFLD patients.

| BMI | Males | Females | Total |
|---|---|---|---|
| < 18.5 | 0 | 0 | 0 |
| 18.5- 24.9 | 0 | 1(6%) | 1(2.5%) |
| 25-29.9 | 0 | 0 | 0 |
| 30-34.9 | 1(4%) | 2(12) | 3(7.5%) |
| 35-39 | 6(24%) | 3(19) | 9(22%) |
| <40 | 18(72%) | 10(63) | 28(68%) |
| Total | 25 | 16 | 41 |

Correlation between biochemical and radiological findings: This table shows the correlation between biochemical and radiological changes.

**Table: 2** Correlation between biochemical and radiological findings.

| Biochemical finding | | TG>160mg/dl | SGPT>40IU/L | SGOT/SGPT ratio>1 |
|---|---|---|---|---|
| Radiological grade | Grade I (32) | 9(28%) | 22(69%) | 5(15.5%) |
| | Grade II (7) | 4(57%) | 6(86%) | 4(57%) |
| | Grade III(2) | 0 | 0 | 1(50%) |

**Results**

The study included 41 cases out of which 25 (61%) were male and 16(39%) females. The male: female ratio was thus 1.5:1. Maximum no of patients were between 31 to 40 years of age followed by patients of age group 50-60 yrs and 41-50 yrs. The mean age was found to be 42.5 years (range 18-70 yrs). The presenting symptoms in most of the patients (85%) in decreasing order of frequency were mild abdominal discomfort (85%), bloating (70%), anorexia (70%) and lethargy (65%). The rest 15% cases had other additional problems.7% of the cases were known diabetic. Most of the patients (68%) had BMI>40(grade III obesity).

The waist/hip ratio was calculated60% of the males had W/H ratio of 0.96-1, therefore were in moderate risk group which was followed by 20% who were at low risk (w/h ratio of 0.91-0.95). Regarding the females almost all of them were in severe risk group. Ultrasonography (USG) of the abdomen is an integral part of the diagnosis of fatty liver disease. All the patients were advised for an USG abdomen. We found that among the 41 patients studied 32 (78%) had grade I fatty liver, and only 5% with grade III while the rest had grade II fatty liver.

**Liver function tests-** Assessment were done for bilirubin, ALT and the most important being AST (SGOT), ALT (SGPT) and SGOT/SGPT ratio. 44% of the patients had normal SGOT levels irrespective of the gender. Rest had elevated SGOT levels out of which 5% had more than 200 IU/L. Compared to the SGOT levels only 32.5% of patients had normal SGPT levels.67.5% had elevated SGPT out of which 7% had more than 200 IU/L. The percentages are shown in table 6 which depicts that SGPT levels are elevated in higher number of cases as compared to SGOT levels. When the ratios of SGOT/SGPT were calculated the value was less than 1 in about 75.5% of patients and was more than 1 in only 24.5% of patients which shows a marked contrast to that of patients with alcoholic liver disease, in which the SGOT/SGPT levels are more than

1.Serum ALP was elevated (>100IU/L) in 73% with the mean being 143.73 IU/L and total bilirubin was raised(>1.2mg/dl) only in17% of the patients with mean being 0.82. Thus, as the grade of fatty liver in radiology increased the levels of biochemical parameters (FBS, TG and SGPT) also increased.

Triglyceride (TG)-68% of the patients were having normal triglyceride level and out of the patients having elevated levels 25% had triglyceride levels more than 200 IU/L.

**Correlation between clinical, radiological, biochemical and histological parameters**

When radiological findings and BMI of these patients were taken together about 97% of patients with fatty liver grade I were obese, out of which 62% showed grade III obesity. Similarly 100% of the patients with grade II and grade III fatty liver in radiology were obese.

When a correlation between Waist/ Hip ratio and radiological fatty liver were done we found that among males about 61 % and 80% of patients with grade I and grade II fatty liver showed moderate risk respectively but almost all the grade III patients demonstrated low risk. This was because of low number of grade III cases. However 100% females showed high risk irrespective of the grade of fatty liver on ultrasound.

When a correlation between biochemical and radiological grade of fatty liver were made among 32 grades I fatty liver patient only 15.5% showed elevated fasting sugar levels whereas 28.5 % of grade II patient showed elevated sugar levels. Elevated triglyceride levels were seen in 28% of grade I and 57% of grade II patients. Similarly 69% of patients with grade I fatty liver showed elevated SGPT levels whereas 86% of grade II had increased SGPT levels. SGOT/SGPT ratio which is usually > 1 in patients with alcoholic liver disease was seen in only in 15 % of grade I patients. 50% of both grade II and III patients had SGOT/SGPT ratio >1, may be because of lesser number of cases as compared to grade I patients. Thus it showed that as the grade of fatty liver increases the biochemical parameters (FBS, TG, and SGPT) also increased.

When the radiological grade was compared with the biochemical findings (FBS, TG and SGPT) individually through Pear sons formula the p value (>0.05) thus found were not statistically significant for any of the biochemical tests.

**Discussion**

The present study was conducted to study the biochemical and radiological correlation in patients with non-alcoholic fatty liver disease. A total of 41 cases were included in the study. The male: female ratio was 1.5:1. The mean age was 42.5 years (18- 80 yrs). Recent changes in life style like high fat in the diet and lack of exercise to which an individual is exposed right from childhood along with higher prevalence of diabetes, hypertension and genetic predisposition is responsible for occurrence of NASH at an earlier age. It was almost similar with the recent study done by Singh *et al*, (2010) [(13)] which showed a mean age of 35.07+ 8.06 years for NASH.

The physical examination included height, weight, BMI and W/H ratio. About 68% of patient had grade III BMI (> 40), which clearly shows that patients with high BMI are prone to develop NAFLD compared to people with normal BMI. Waist/Hip ratio when calculated showed that 60% of males had moderate risk and all the females of the study group had severe risk. Dixon *et al* (2004) [(13)] in their study demonstrated convincingly that steatosis, NASH and fibrosis were at least partially reversible after losing weight. A study by Lazo *et al* (2008)[(14)], showed a high prevalence of NAFLD in patients with BMI > 35kg/m$^2$.Yet another study by Bellentani *et al*, (2004)[(15)] found that NAFLD was present in 94% of obese patients(BMI>/= 30kg/m$^2$), 67% in overweight patients(BMI>/= 25kg/m$^2$) and 25% in normal weight patients. Taking all these studies in account we can surely say that BMI indeed plays a role in the development of NAFLD.

Of 40 patients 32(78%) had grade I fatty liver, 7(17%) had Grade II and only 2(5%) grade III fatty liver in radiology. Maximum cases comprised of grade I fatty liver because most of the patients included in the study were the ones who had come with the initial symptoms and were in their preliminary stage of the disease.

When biochemical parameters were analysed 17% had elevated fasting glucose and32% had hyper triglyceridemia. The mean fasting blood glucose was 88.41mg/dl and mean triglyceride level was 151.3mg/dl. This finding shows that most of the patients with NAFLD need not have elevated blood sugar or triglyceride level in contrary to various studies previously done which shows a strong association between NAFLD, obesity, type II diabetes and hyperlipidemia. Huang *et al*, (2008) [16] in their study found that metabolic syndrome, high fasting glucose and high blood pressure were independently related to increased risk of NASH. Bajaj *et al*(2009) [18], in their study showed a close relationship of NAFLD with multiple features of metabolic syndrome which comprises of central obesity, hypertriglyceridemia, hyperglycemia along with hypertension and low levels of HDL cholesterol. In contrast to the many studies, Singh *et al* (2010) also showed a similar finding of only 16.67% of NASH patients with hypertriglyceridemia as seen in our case.

SGPT was increased in about 67% patients, the mean being 78.9 IU/L. whereas SGOT levels were raised in 56%, the mean being 67.3 IU/L. SGOT/SGPT ratio in 24.5% of patients showed a ratio of >1, which was incontrast to that found in alcoholic patients with fatty liver where SGOT/SGPT ratio is usually >1. Thus it is a useful index in distinguishing NASH from ASH. The hypertransaminasemia in NASH was found to be SGPT dominant in our study. Similar findings were reported by Sugimoto *et al* (2003)[17]. Singh *et al*,(2010)in their comparative study between NASH and ASH clearly showed SGPT levels were more elevated in NASH as compared to ASH(mean being110.82IU/L in NASH and 79.69IU/L in case of ASH).Also showed a higher AST/ALT ratio in ASH as compared to NASH(mean of 1.24+0.81 in ASH and 0.68+0.33 in NASH)This study strongly supports our finding that SGPT is a more relevant marker than SGOT in NASH patients and AST/ALT ratio Is >1 in ASH rather than NASH, which indeed helps in distinguishing between ASH and NASH. This was also reported by Sorbi *et al* (1999)[18]In contrary to our findings Uslusoy *etal*,(April 2009)[19], in their study showed that amino transferase levels and AST/ALT ratio do not seem to be a reliable predictor for NASH as patients with normal and high amino transferases level had almost the same prevalence of NASH metabolic syndrome.

When BMI and grade of fatty liver in ultrasonography were compared then62% of patients with grade I fatty liver had BMI> 40(grade III obesity)and 43% of grade II had BMI >40. The disparity in percentage was because of the lesser number of grades II patients in the study group. Patients with grade III fatty liver couldn't be assessed as the number was too small. When W/H ratio were compared with grade of fatty liver in radiology we found that all the female patient were at high risk group, irrespective of grade of fatty liver while in the case of males 61% of grade I and 80% of grade II had moderate risk. Dixon *et al* (2001) [20], Clark*et al*(2002)[21], Ong *et al* (2005)[22] in their studies established the association of severe obesity leading to severe NAFLD.

When a Comparison was made between biochemical and radiological grade of fatty liver we found out that as the grade increases there was an increase in all the biochemical parameters (TG and SGPT). Despite the increasing percentages of the biochemical parameters SGPT, and TG ) with increase in grade of fatty liver in ultrasonography, we failed to establish any statistical significance, probably due to smaller number of cases studied. Further larger studies with adequate follow up may help in elucidating this failure.

When a Comparison was made between biochemical and radiological grade of fatty liver we found out that as the grade increases there was an increase in all the biochemical parameters (TG and SGPT). Despite the increasing percentages of the biochemical parameters (SGPT, and TG) with increase in grade of fatty liver in ultrasonography, we failed to establish any statistical significance, probably due to smaller number of cases studied. Further larger studies with adequate follow up may help in elucidating this failure.

**Conclusion**

NAFLD is strongly associated with obesity but body fat distribution appears to play a more important role in the pathogenesis of NAFLD. From this study it can be concluded that Non-alcoholic fatty liver disease (NAFLD), radiological and biochemical findings give a good correlation and are equally helpful in assessing the severity of NAFLD its management if a liver biopsy is not possible.

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