ININDIAN DIABETES RISK SCORE FOR NONALCOHOLIC FATTY LIVER DISEASE

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ABSTRACT

BACKGROUND
Nonalcoholic fatty liver disease is one of the commonest liver disorders with a prevalence of 20-30% in western population. Cases range from asymptomatic to nonalcoholic steatohepatitis to cirrhosis of liver.

The aim of the study is to apply Indian diabetes risk score as a screening test for identification of hidden cases of nonalcoholic fatty liver.

MATERIALS AND METHODS
An observational study conducted in a tertiary care hospital among 412 adult cases subjected to ultrasound examination of abdomen for various reasons fulfilling inclusion criteria. Indian diabetes risk score is based on simple questionnaires like age, physical activity level, family history of diabetes mellitus and measurement of waist circumference and the score is classified as low risk <30, medium risk 40-50 and high risk >60. Nonalcoholic fatty liver disease was diagnosed on the basis of ultrasonographic criterion and statistical analysis done.

RESULTS
Out of 412 cases with a male-female ratio of 1.64:1, 37.5% had fatty liver, maximum incidence in the age group 21-60 years. The mean blood pressure systolic and diastolic were 132.6±14.6 and 82.7±9.0 mm of Hg and mean age, body weight, BMI and IDRS were 41.5±14.0 years, 59.4±11.4 Kg, 22.8±4.1 kg/m² and 43.4±17.9, respectively. A score of 60 or more and 70 or more predicted fatty liver with a sensitivity and specificity of 73.5% vs. 73.2% and 95.2% vs. 68.6%.

CONCLUSION
The study concluded with the inference that a simple scoring system relating to Indian diabetes risk score when used judiciously can be used to diagnose high-risk individuals with nonalcoholic fatty liver disease.

KEYWORDS
Fatty Liver, Body Mass Index, Diabetes Mellitus, Waist Circumference, Body Weight.

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BACKGROUND
The term Nonalcoholic Fatty Liver Disease (NAFLD) includes a wide spectrum of liver disorders ranging from steatosis to Nonalcoholic Steatohepatitis (NASH) and cirrhosis.1,2 NAFLD is the most common liver disease since its prevalence is estimated to be 20-30% in general population of western countries.3 Patients are usually asymptomatic with mild elevations in liver enzymes.4 However, many patients can have NASH with normal liver enzymes.5 Moreover, in the developing countries, imaging tests or evaluation of liver enzymes on a population basis can prove expensive and hence may not yield the desired results. As such, there is a need to develop a simple and inexpensive screening tool to identify high-risk individuals in the community or in a mass population who may harbour NAFLD.

India’s epidemic of chronic Non-Communicable Diseases (NCDs) has passed its early stages.5 The prevalence of NAFLD is also quite high among urban Indians.7 Nonalcoholic fatty liver disease shares risk factors with other non-communicable diseases such as diabetes (e.g. age, physical inactivity, waist circumference, insulin resistance, dyslipidaemia and high blood pressure).4,8

The Indian Diabetes Risk Score (IDRS) was derived using four simple parameters, namely age, abdominal obesity, family history of diabetes and physical activity. The IDRS was classified as low (<30), medium (30-50) and high (>60) risk categories and an IDRS of >60 was initially shown to be useful to identify individuals with undiagnosed diabetes in the community.9 The present study was undertaken to evaluate whether application of IDRS is helpful to identify individuals at high-risk of having NAFLD in hospitalised patients or those attending the outpatient clinic.
AIMS AND OBJECTIVES
To apply scoring system based on IDRS designed to identify high-risk individuals with T2DM in the community as a simple screening test for identification of hidden cases of NAFLD.

MATERIALS AND METHODS
This is a hospital-based, single centred observational study conducted for period of one year in a tertiary care teaching hospital in north eastern India.

Cases were selected at random among those where ultrasound examination of the abdomen was done irrespective of indications. Patient’s cohort consisted of those admitted in the medicine department or attending outpatient clinic during the study period.

Inclusion Criteria
Patients attending the outpatient clinic or admitted in the medicine indoor who underwent B-mode ultrasonography of the abdomen due to any cause.

Exclusion Criteria
1. Those with features of acute viral hepatitis or known hepatitis B or C.
2. Those suffering from chronic debilitating illness like tuberculosis, malignancy, diabetes, malnutrition, chronic kidney disease or other co-morbid conditions.
3. Chronic ethanolic and diagnosed cirrhosis of liver.
4. Conditions with congestive hepatomegaly, drug-induced hepatitis, liver abscess were excluded from the study.

Anthropometric measurements were obtained using standardised techniques. Body Mass Index (BMI) was calculated as weight in kilogram divided by square of height in meters.

The following scoring system was followed using the anthropometric measurement and history.

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;35</td>
<td>0</td>
</tr>
<tr>
<td>35-49</td>
<td>20</td>
</tr>
<tr>
<td>&gt;50</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waist circumference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waist &lt;80 cm (female), &lt;90 cm (male)</td>
</tr>
<tr>
<td>Waist &gt;80-89 cm (female), &gt;90-99 cm (male)</td>
</tr>
<tr>
<td>Waist &gt;90 cm (female), &gt;100 cm (male)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vigorous exercise (regular) or strenuous (manual) work at home/work</td>
</tr>
<tr>
<td>Moderate exercise (regular) or moderate physical activity at home/work</td>
</tr>
<tr>
<td>Mild exercise (regular) or mild physical activity at home/work</td>
</tr>
<tr>
<td>No exercise and sedentary activities at home/work</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Family history of diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>No diabetes in parents</td>
</tr>
<tr>
<td>One parent has diabetes</td>
</tr>
<tr>
<td>Both parents have diabetes</td>
</tr>
</tbody>
</table>

Blood sugar, serum ALT and AST, bilirubin, creatinine were estimated in each patient. HBsAg and anti-HCV were done in all cases. Other co-morbid conditions were excluded by necessary relevant investigations.

On the basis of B-mode ultrasonography (USG), “fatty liver was defined as the presence of bright liver with evident contrast between hepatic and renal parenchyma, vessel blurring and narrowing of the lumen of the hepatic veins in absence of chronic liver disease findings.”

Statistical analysis was done using MaxStat Life Version 3.6 software and p value <0.05 were taken as statistical significance.

RESULTS AND OBSERVATIONS
A total of 412 cases were included in the study of which 156 (37.86%) had fatty liver on the basis of USG examination. Total number of males were 256 (62.14%) and females 156 (37.86%), the male-female ratio being 1.64:1.

The age range of the cases varied from 14 to 80 years with mean of 41.5±14.5 years. The age distribution was as follows.
Maximum cases, 108 (26.2%) were of age group 41-50 years and the age group 21-60 years representing the highest number, 356 (86.4%).

Distribution of religion showed 212 (51.46%) participants as Hindus and 200 (48.54%) were Muslims.

The mean of Systolic Blood Pressure (SBP) and that of Diastolic Blood Pressure (DBP) of all patients were 132.6±14.6 and 82.7±9.0 mmHg, respectively. The mean age, body weight, Body Mass Index (BMI) and Indian Diabetes Risk Score (IDRS) were 41.5±14.0 years, 132.6±14.6 and 82.7±9.0 mmHg respectively.

The difference of the characteristics observed in groups having fatty liver in USG and those with normal liver in USG is given in the table.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Fatty Liver in USG</th>
<th>Normal Liver in USG</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Cases</td>
<td>156</td>
<td>256</td>
<td>0.9166</td>
</tr>
<tr>
<td>Males</td>
<td>96</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>60</td>
<td>96</td>
<td></td>
</tr>
<tr>
<td>Mean age (years)</td>
<td>43.2±12.3</td>
<td>40.4±15.0</td>
<td>0.0503</td>
</tr>
<tr>
<td>Mean SBP (mmHg)</td>
<td>138.7±14.9</td>
<td>128.8±13.2</td>
<td>0.0001</td>
</tr>
<tr>
<td>Mean DBP (mmHg)</td>
<td>86.6±9.8</td>
<td>80.3±7.5</td>
<td>0.0001</td>
</tr>
<tr>
<td>Mean BMI (Kg/m²)</td>
<td>25.7±4.0</td>
<td>21.2±3.1</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

### Table 2. Showing Characteristics in Fatty Liver and Normal Liver Group

Out of 256 males, 96 (37.5%) had fatty liver and 60 (38.5%) out of 140 females had fatty liver with p value of 0.9166.

Mean BMI in patients with fatty liver was 25.7±4.0 and those without fatty liver were 21.2±3.1 Kg/m² with p value of 0.0001. Similarly, mean IDRS score in the group with fatty liver was 54.4±16.3 and those without fatty liver was 36.6±15.3 with p value of 0.001 indicating significant association of higher BMI and IDRS score with occurrence of fatty liver. Similarly, mean higher SBP, DBP, WC and ALT showed higher incidence of fatty liver in comparison with their contemporaries as shown in the table 2, which is statistically significant.

The residential status of the cases have a significant bearing viz. 84 (71.2%) of 118 cases with urban background had fatty liver in contrast to 72 (24.5%) out of 294 rural group developed fatty liver with p value of 0.0001. It reflects that urban based population is at significant risk of development of fatty liver than that of rural population.

### Table 3. Different Indices According to IDRS Score in all Patients

### Table 4. Difference in Indices According to the Range of IDRS and With or Without Fatty Liver
The group with fatty liver showed higher ranges of BMI, SBP, DBP, ALT and WC than that of the group showing normal liver in USG. There has been a proportional rise of SBP, DBP, ALT and WC with increase in IDRS score. A higher BMI, ALT and WC is significantly associated with fatty liver group irrespective of IDRS range (Table 4).

The status of hepatic parenchyma (fatty and non-fatty) is depicted in the following table according to the IDRS score.

<table>
<thead>
<tr>
<th>IDRS</th>
<th>Fatty Liver</th>
<th>Non-Fatty Liver</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>1</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
<td>95</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>98</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

**Figure 3. Distribution of Fatty Liver According to IDRS Score**

No fatty liver cases were detected at IDRS <10 and 1.9% (8), 4.85% (20) and 8.74% (36) cases had fatty liver at the score <20, 30 and 40, respectively.

At the score of 50 and above, 56.6% (120) cases and 43.4% (92) presented with fatty and non-fatty liver, respectively. The sensitivity and specificity being 56.6% and 82%. At the score of 60 and above and 70 and above, the respective figures were 73.5% (72) vs. 26.5 (26) and 95.2 (40) vs. 4.8% (2) with sensitivity vs. specificity being 73.5% vs. 73.2% and 95.2% vs. 68.6%. On the other hand, with a score of 80 and above, all cases had fatty liver with sensitivity and specificity being 100% and 68.8% (Figure 3 and 4).

**Figure 4. Highlighting the Specificity and Sensitivity of Fatty Liver According to IDRS**

**DISCUSSION**

As the present study is a hospital-based one, the true picture of incidence of NAFLD in the community is not reflected. However, an incidence of 37.68% of cases of NAFLD is detected. The community prevalence of NAFLD in India varies from 5% to 28%.\(^{11,12,13}\) The overall prevalence of NAFLD was 32% (173/541) as per Mohan V. et al,\(^7\) whereas Singh S P et al\(^{14}\) showed ultrasonographic evidence of fatty liver in 24.5% (39/159).

In the present study, out of 412 patients 256 (62.13%) were males and 156 (37.87%) females with male-female ratio being 1.64:1, which is in agreement with the findings of Daryani N et al\(^{15}\) where the reported incidence in males and females were 60.4% and 39.6% respectively in a series of 53 patients of NAFLD on the basis of biopsy, whereas the study differed with that of Gaharwar, Rakesh et al\(^{16}\) who observed the male-female ratio of 3:4.

The age range of the cases varied from 14 to 80 years with mean of 41.5±14.5 years. The fifth decade showed the maximum number of cases, 108 (26.2%) and majority of the cases 356 (86.4%) were between 21-60 years of age. Gaharwar, Rakesh et al\(^{16}\) reported maximum number of patients in the 4th and 5th decades whereas Falck-Ytter Yngve et al\(^{17}\) observed most cases of NAFLD in the fifth and sixth decades of life.

Distribution on the basis of religion did not show any significant difference. Almost equal number of cases 212 (51.46%) vs. 200 (48.54%) were Hindus and Muslims, respectively. No data has been found to compare this finding after extensive literature search.

Out of 256 males, 96 (37.5%) had fatty liver and 60 (38.5%) out of 140 females were found to have fatty liver with p value of 0.9166. A study by Singh S. P et al\(^{14}\) from coastal regions of India found that 39 (24.5%) of 159 healthy attendants of patients had evidence of fatty liver on ultrason (males 27%, females 14%). In a larger series by Amarapurkar D, Kamani P, Patel N et al\(^{18}\) comprising of 1,168 participants found higher incidence in males than females (24.6% vs. 13.6%). Mohan V et al\(^7\) in a study of 541 subjects reported 35.1% males and 29.1% females.

The mean age of fatty liver group was 41.5±14.5 years and that of normal liver was 40.4±15.0 years in the present series (p value 0.0503), which is in agreement with the studies by Gaharwar, Rakesh et al\(^{16}\) and Bajaj, S et al\(^{19}\) who reported mean age in fatty liver group as 41.4±9.65 and 40.9±11.1 years, respectively.

In the present series, 84 (71.2%) out of 118 of the urban cases had fatty liver in contrast to 72 (24.5%) out of 294 in the rural group with p value of 0.0001. It reflects that urban population is at significant risk of fatty liver than that of rural population, which is in agreement with studies by Bajaj S et al\(^{19}\) who reported 87.2% of cases from the urban background.

In the present series, mean BMI in patients with fatty liver group was 25.7±4.0 and 21.2±3.1 kg/m\(^{2}\) in group without fatty liver with p value of 0.0001, which is in agreement with various other studies. Gaharwar, Rakesh et al\(^{16}\) reported mean BMI in patients with fatty liver as 25.9±3.93. Similarly, Bajaj S et al\(^{19}\) in their study showed mean BMI in patients with fatty liver as 26.7±4.4 and in group without fatty liver as 22.7±3.9 kg/m\(^{2}\). Singh S P et al\(^{14}\) revealed that BMI of 39 cases with fatty liver varied from 17.44 kg/m\(^{2}\) to 40.01 kg/m\(^{2}\) with mean of 25.92 kg/m\(^{2}\), whereas mean BMI of cases without fatty liver was 22.07 kg/m\(^{2}\).
kg/m^2 and the differences between these two groups was found to be significant p<0.001. Amarapurkar D, Kamani P, Patel N et al^11 showed that mean BMI in patients with fatty liver was 26.6±5.1 kg/m^2.

In the present study, mean SBP (mmHg) in fatty liver group was 138.7±14.9 and that in normal liver was 128.8±13.2 (p=0.0001). Mean DBP (mmHg) in fatty liver group was 86.6±9.8 and that in normal liver was 80.3±7.5 (p=0.0001), which is comparable to the findings of Bajaj S et al^19 who reported mean systolic blood pressure and diastolic blood pressure (mmHg) in fatty liver group as 128.2±17.4 and 83.2±12.3 and that in normal liver as 126.2±14.9 and 81.6±9.8, respectively.

In present series, mean waist circumference was 89.73±12.54 cm in fatty liver group and that in normal liver was 76.01±9.66 cm (p=0.0001), which is in agreement with the study of Gaharwar, Rakesh et al^16 who reported mean waist circumference of 86.38±9.44 cm in fatty liver group. The study of Juneja and Archana^20 reported mean waist circumference in fatty liver group as 99.96±10.01 and that in normal liver as 93.22±11.04 cm.

In the present series, mean ALT (IU/L) in groups with and without fatty liver were 59.7±31.7 and 37.5±17.9, respectively (p=0.0001). The figures reported by Bajaj S et al^19 and Juneja and Archana^20 were 42.3±4.7 vs. 38.74±17.96 and 34.8±36.8 vs. 31.62±13.49 in groups with and without fatty liver, respectively. Agarwal S R et al^12 revealed that mild elevation of ALT as the most common biochemical abnormality.

In the present study, mean score as per IDRS in fatty liver group was 54.4±16.3 and that in normal liver was 36.6±15.3 with p value of 0.0001 indicating significant association of high IDRS score with occurrence of fatty liver.

In this study, the prevalence of NAFLD was significantly higher among participants with a high IDRS (73.46%) and medium IDRS (32.20%) compared with those of low IDRS (10.25%).

The conclusion derived in the study by Anbalagan, V. P. et al^21 showed the prevalence of NAFLD significantly higher among participants with high IDRS (30.4%) and medium IDRS (21%) compared with those with low IDRS (15.8%) (p=.022).

An interesting analogy in the present series showed that with a score of 60 or more incidence of fatty liver was 73.5% (72) and non-fatty liver was 26.5% (26) with a sensitivity and specificity of 73.5% and 73.2%, respectively, whereas with a score of 70 or more, the respective incidences were 95.2% (40) and 4.8% (2) with sensitivity and specificity being 95.2% and 68.6%, respectively. At a score of 80 or more, all the 20 patients (100%) developed fatty liver with sensitivity and specificity of 100% and 68.8%, respectively. However, this interesting phenomenon could not be compared with studies by other researchers due to paucity of literature in this field.

**CONCLUSION**

It was inferred in the present study that the prevalence of NAFLD was significantly higher in the high-risk IDRS group compared with participants with a medium- and low-risk IDRS.

The study highlighted the fact that "a simple clinical risk score originally designed to identify undiagnosed type 2 diabetes mellitus in the population" maybe used to identify individuals at high risk of NAFLD too at a negligible cost and can be recommended for use in the community as well as in the day-to-day practice. The high-risk individuals on the basis of IDRS may be subjected for estimation of ALT and ultrasonographic evaluation for a more comprehensive diagnosis.

NAFLD is an independent risk factor of type 2 diabetes and could have a significant impact in terms of public health, healthcare economics. The prevention of NAFLD requires a multipronged approach that begins with identification of high-risk individuals, evaluation with simple investigations and implementation of evidence-based strategies including non-pharmacological interventions and active partnership of all the stakeholders.

In conclusion, it is felt that we have travellers a relatively untraveled path and attempt to emphasize a simple screening tool for identification of hidden cases of NAFLD, which may have an impact in future.

**REFERENCES**