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# ASSESSMENT OF RISK FACTORS ASSOCIATED WITH ALCOHOLIC AND NON ALCOHOLIC FATTY LIVER DISEASE WITH RESPECT TO OCCUPATIONS, PHYSICAL ACTIVITY AND LIFE STYLE FACTORS

Life Sciences

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## ABSTRACT

The fatty liver disease (FLD) considered as major health problem worldwide but its prevalence related to occupation and lifestyle habits is seldom assessed. The present study was conducted to assess of risk factors likelihood associated with fatty liver disease with respect to occupations, physical activity and life style factors. Mean age of the study participants were comparable among three study groups. Mean BMI of NAFLD, AFLD and normal subjects were 25.39±0.38, 20.13±0.3 and 19.47±0.25 respectively. Similarly, WC was also proportionate as NAFLD patients had 89.76±0.8 cm, AFLD had 77.09±0.77 cm and normal subjects had 78.03±0.72 cm waist size. The occupational history of participants indicates that all occupation is at nearly equal risk of developing AFLD taking labour as a reference standard. The salaried person was at 2.5 fold higher risk of developing NAFLD in comparison to normal subjects. The sedentary physical activity workers have 2.1 fold higher risk (OR: 2.09, 95% CI 1.10–3.95) for AFLD group as compared to normal group which was statistically significant ($p<0.05$). However, the risk for development of NAFLD cases among sedentary physical workers (OR 3.49 95% CI 1.78 – 6.83) was found significantly higher ($p<0.05$) as compared to normal subjects. In conclusion, the results of present study highlighted the increased risk of development of NAFLD in profession of business and salaried class occupations. AFLD is mainly observed in person with heavy physical work activity while NAFLD is associated with both moderate and sedentary physical work activity.

## KEYWORDS

Alcoholic fatty liver disease; Non-alcoholic fatty liver disease; Occupation; Physical work activity, life style

## INTRODUCTION:

Alcoholic fatty liver disease (AFLD) is the most common type of chronic liver disease. Alcoholic liver ailment is a consequence of over consumption of alcohol even for a short duration that can damages the liver cells, leading to a build-up of fats, inflammation, and scarring in liver.[1] Numerous reports are available on high doses of alcohol drinking and occurrence of fatty liver diseases.[2,3] AFLD can progress from alcoholic fatty liver (consuming >40g/d of alcohol) to alcoholic steatohepatitis (with or without cirrhosis), which is characterized by hepatic inflammation and is associated with liver failure with high mortality.[4] However, the incidence of AFLD with stage 2 or greater fibrosis and AFLD with stage 3 or greater fibrosis significantly increased which affecting ~1.5% and ~0.2%of adult population, respectively, in 2015-16.[5]

As far as we know, non-alcoholic fatty liver disease (NAFLD) has also become an emerging global health apprehension and is characterized by the storage of fat in the liver due to other than alcohol aetiology. It is the utmost common form of chronic liver illness in western as well as in Asian countries, affecting adults as well as children and even adolescents. An estimated manifestation of NAFLD is ~20%–30% in Western countries while ~15% in Asian countries.[6] In other, hospital-based study on NAFLD among Chinese occupational populace in Taipei, Taiwan and found the occurrence of NAFLD was ~48.4% and it increases significantly with increasing age. Males exhibited a more prevalence of NAFLD compared to females. The differences in occupational professions were noted and concluded that occupational populations were asymptomatic, and the diagnosis of NAFLD should be considered with older age, hyperuricemia, higher aspartate aminotransferase and alanine aminotransferase level, and metabolic risk factors.[7] Moreover, the rising trend of prevalence of NAFLD world-wide might be accounted owing for the changes in dietary habits and sedentary lifestyle.[8]

Several etiological factors might be involved in the manifestation of NAFLD, but data are scanty to draw meaningful conclusion or to pinpoint actual cause of NAFLD. Therefore, the present study was conducted to assess of risk factors likelihood associated with fatty liver disease with respect to occupations, physical activity and life style factors.

## MATERIALS AND METHODS:

### Study design:

The present cross-sectional study was conducted at the Medicine Department of Civil Hospital, Ahmedabad, India, between September 2016 and October 2019. The enrolled participants were further categorized into three groups (Normal, AFLD and NAFLD) according to their abdominal ultrasonography and consumption of alcohol.

### Ethics statement and subject enrolment:

The study was ethically approved from the Institutional Ethical Committee of ICMR-National Institute of Occupational Health, Ahmedabad, India. A total 328 male participants were enrolled in the study and written consent was taken from each participant after explaining the aims and objectives of the present study. The data about personal demographic characteristics, occupation, personal habits such as tobacco chewing, smoking and alcohol abuse and medical history such as hypertension, diabetes, chronic liver diseases etc. were recorded through pre-tested questionnaire. The participant with alcohol intake >20 g/day (140g/week) were considered as alcoholic habits.[9,10]

### Anthropometric measurement and clinical assessment:

Height and weight were measured to the nearest of 0.5 cm and 0.1 kg, respectively and body mass index (BMI) was calculated by using formula $kg/m^2$. The abdominal obesity was calculated as BMI ≥25kg/m2 according to WHO guidelines.[11] Waist circumference was measured to the nearest 0.1cm at the midpoint between the bottom of the rib cage and the top of the iliac crest with the subjects standing position, their weight uniformly dispersed on both feet, their arms at their sides and head facing straight forward. Blood pressure (BP) was measured using a digital automated BP instrument (Omron HEM-7203, Kyoto, Japan), while patients were asked to sit in relaxed position with the arm supported at heart level. Total three readings were recorded from left arm at the intervals of five minutes, and the average of last two readings was considered for analysis.

### Fatty liver assessment:

Abdominal sonography for detection of fatty liver was done in all participants in Radiology department at Civil Hospital, Ahmedabad, India. Radiological imaging was performed by using Toshiba Aplio 400 (MedCorp, USA) machine with 3.5 MHz transducer by an experienced radiologist who was blinded to all clinical and biochemical characteristics of patients. Fatty liver was confirmed with increased echogenecity of the liver in comparison to the right kidney and the spleen, blurring of intra-hepatic veins and diaphragm and attenuation of the ultrasound beam.[12,13]

### Physical activity:

Calorie deficit for each patient was considered by subtracting the

calorie ingestion of a particular study subjects from his total calorie necessity (based on their age, sex, and nature of work, i.e. sedentary, moderate and heavy work). Physical activity was determined with ICMR classification of activities based on occupational history.[14]

**Statistical Analysis:**

The results were expressed in Mean ± standard error of mean (SEM) and statistical analysis was performed using R 3.4.3 for Windows (R Project for Statistical Computing). We summarized the data using frequency and percentages. Independent Student's t-test (two groups) was performed to compare between groups. We used multivariable logistic regression to identify covariates of NAFLD. Using the logistic regression model to estimate the odd ratio (OR) 95% confidence interval (CI) for each covariates to indentify risk factors for AFLD and NAFLD. A *p*-value <0·05 was considered as statistically significant.

**RESULTS:**

Total 328 subjects were enrolled in the study and categorized into three groups' viz. Normal, AFLD and NAFLD based on abdominal sonography and alcoholic history of participants. Mean age of the study participants were comparable among three study groups. The participants in NAFLD group had significantly higher weight followed by AFLD and Normal group participants. Height of participants between the groups was comparable; however, there was substantial difference in BMI and waist circumference (WC) of subjects between the study groups. Mean BMI of NAFLD, AFLD and normal subjects were 25.39±0.38, 20.13±0.3 and 19.47±0.25 respectively. Similarly, WC was also proportionate as NAFLD patients had 89.76±0.8 cm, AFLD had 77.09±0.77 cm and normal subjects had 78.03±0.72 cm waist size. There was considerable difference observed in BMI and WC of patients between the three study groups. The systolic and diastolic blood pressures were significantly higher ($p$<0.05) in AFLD and NAFLD patients compared to normal subjects as shown in table 1.

**Table 1: Baseline characteristic of clinical and anthropometric parameters of Normal, AFLD and NAFLD subjects**

| Variables | Normal (N=117) | AFLD (N=99) | NAFLD (N=112) |
|---|---|---|---|
| Age (Years) | 44.6±0.9 | 43.4±0.9 | 45.8±1.0 |
| Weight (Kg) | 51.7±0.8 | 52.8±0.9 | 66.9±1.0 [b,c] |
| Height (M) | 162.8± 0.6 | 161.8±0.7 | 162.7±0.7 |
| BMI (Kg/ $M^2$) | 19.5±0.2 | 20.1±0.3 | 25.4±0.4 [b,c] |
| Waist Circumference (cm) | 77.8±0.7 | 79.1±0.8 | 88.7±0.8 [b,c] |
| Systolic BP (mmHg) | 119.2±1.9 | 124.7±2.0 [a] | 134.7±2.6 [b,c] |
| Diastolic BP (mmHg) | 75.4±1.0 | 79.6±1.3 [a] | 84.9±1.5 [b,c] |
| Pulse (beat/min) | 78.5±0.8 | 77.9±0.9 | 82.4±1.0 [b,c] |
| Work exposure (Years) | 14.7±0.7 | 15.1±0.7 | 15.3±0.8 |

*Data expressed as Mean SEM; Level of Significance p≤0.05, ([a,b] p≤0.05 Vs Normal, [c] p≤0.05 Vs AFLD)*

*Normal, Without Fatty Liver Disease; AFLD, Alcoholic Fatty Liver Disease; NAFLD, Non-alcoholic Fatty Liver Disease.*

**Table 2: Distribution and comparison of study subjects with respect to educations, occupations and physical work activity**

| Variables | Normal[a] N (%) | AFLD[b] N (%) | NAFLD[c] N (%) | Pearson's $X^2$ ($p$-value) | | |
|---|---|---|---|---|---|---|
| | | | | a vs. b | a vs. c | b vs. c |
| **Educations** | | | | | | |
| Illiterate (n=29) | 8 (27.6) | 17 (58.6) | 4 (13.8) | 11.9 **(0.036)** | 22.5 **(0.000)** | 25.0 **(0.000)** |
| Primary class (n=69) | 28 (40.6) | 27 (39.1) | 14 (20.3) | | | |
| Middle class (n=57) | 21 (36.8) | 17 (29.8) | 19 (33.3) | | | |
| Secondary class (n=94) | 23 (24.5) | 21 (22.3) | 50 (53.2) | | | |
| Graduate (n=53) | 20 (37.7) | 13 (24.5) | 20 (37.7) | | | |
| Post Graduate (n=26) | 17 (65.4) | 4 (15.4) | 5 (19.2) | | | |
| **Occupations** | | | | | | |
| Labour (n=79) | 21 (26.6) | 46 (58.2) | 12 (15.2) | 20.8 **(0.000)** | 10.2 **(0.017)** | 40.7 **(0.000)** |
| Farmer (n=39) | 20 (51.3) | 11 (28.2) | 8 (20.5) | | | |
| Business (n=111) | 42 (37.8) | 26 (23.4) | 43 (38.8) | | | |
| Salaried (n=99) | 34 (34.3) | 16 (16.2) | 49 (49.5) | | | |
| **Physical Work Activity** | | | | | | |
| Sedentary (n=116) | 37 (31.9) | 16 (13.8) | 63 (54.3) | 12.1 **(0.007)** | 15.4 **(0.002)** | 45.3 **(0.000)** |
| Moderate (n=94) | 39 (41.5) | 26 (27.7) | 29 (30.9) | | | |
| Heavy (n=118) | 41 (34.8) | 57 (48.3) | 20 (17.0) | | | |

Table 2 shows the majority of illiterate belongs to AFLD groups whereas most of the NAFLD subjects had secondary education. Pearson's Chi-square test shows significant (p<0.05) variation of educational qualifications in normal vs. AFLD, normal vs. NAFLD and AFLD vs. NAFLD respectively. The occupational history of study participant showed that most of the AFLD patients were laborers and nearly half of the salaried persons belong to NAFLD group. The business occupation revealed that almost equal distribution of subjects in normal and NAFLD group i.e about 38% and 23.4% was belongs to AFLD group. Significant difference in occupational history was found between the groups as shown in table 2. The results indicate that highest frequency of NAFLD patients (54.3%) were found in sedentary physical work activity whereas lowest (17.0%) was observed in heavy physical work activity. In contrast to NAFLD; highest number of AFLD patients (48.3%) were belongs to heavy physical work activity whereas lowest number (13.8%) was noticed in sedentary physical work activity group. The statistically significant difference (p<0.05) in physical work activities was found between the groups.

**Table 3: Distribution and comparison of study subjects with respect to dietary and life style habits**

| Variables | Normal[a] N (%) | AFLD[b] N (%) | NAFLD[c] N (%) | Pearson's $X^2$ ($p$-value) | | |
|---|---|---|---|---|---|---|
| | | | | a vs. b | a vs. c | b vs. c |
| **Dietary Habits** | | | | | | |
| Vegetarian (n=118) | 44 (37.3) | 35 (29.7) | 39 (33.1) | 0.1 (0.731) | 0.2 (0.611) | 0.1 (0.935) |
| Mixed (n=210) | 73 (34.8) | 64 (30.4) | 73 (34.8) | | | |
| **Smoking Habits** | | | | | | |
| Smoker (n=219) | 57 (26.0) | 77 (35.2) | 85 (38.8) | 22.5 **(0.000)** | 19.1 **(0.000)** | 1.8 (0.616) |
| Ex-smoker (n=12) | 10 (83.3) | 0 (0.0) | 2 (16.7) | | | |
| Non-smoker (n=97) | 50 (51.6) | 22 (22.7) | 25 (25.8) | | | |
| **Chewing Habits** | | | | | | |
| Tobacco chewer (n=219) | 78 (35.6) | 75(34.3) | 66 (30.1) | 2.8 (0.428) | 1.6 (0.668) | 7.0 (0.071) |
| Ex-tobacco chewer (n=14) | 6 (42.9) | 2 (14.2) | 6 (42.9) | | | |
| Non-chewer (n=95) | 33 (34.7) | 22 (23.2) | 40 (42.1) | | | |
| **Alcoholic Habits** | | | | | | |
| Alcoholic (n=99) | 0 (0.0) | 99 (100.0) | 0 (0.0) | 216.0 **(0.000)** | 4.5 (0.212) | 99.0 **(0.000)** |
| Ex-alcoholic (n=14) | 11 (78.6) | 0 (0.0) | 3 (21.4) | | | |
| Non-alcoholic (n=215) | 106 (49.3) | 0 (0.0) | 109 (50.7) | | | |

Table 3 shows highest (37.3%) frequency of normal subjects were pure vegetarian diet followed by NAFLD (33.1%) and AFLD patients (29.7%). However, non-significant difference in dietary habits was observed between the different study groups. Smoking habit was mainly observed in NAFLD (38.8%) and AFLD (35.2%) patients compared to normal (26.0%) subjects. The data further revealed significant differences with regards to smoking habit between normal vs AFLD and normal vs NAFLD groups whereas tobacco chewers was not considerably different in normal, AFLD and NAFLD groups. The

comparison of study groups with reference to alcoholic habits indicated that significant difference was observed between normal vs. AFLD and AFLD vs. NAFLD groups

The distribution and comparison of study subjects with respect to body mass index and type 2 diabetic mellitus is shown in Table 4.

**Table 4: Distribution and comparison of study subjects with respect to body mass index and type 2 diabetes mellitus**

| Variables | Normal[a] N (%) | AFLD[b] N (%) | NAFLD[c] N (%) | Pearson's $X^2$ (*p*-value) | | |
|---|---|---|---|---|---|---|
| | | | | a vs. b | a vs. c | b vs. c |
| **Body Mass Index** | | | | | | |
| Under weight (<18.5) (n=91) | 51 (56.0) | 38 (41.8) | 2 (2.2) | 85.3 **(0.000)** | 107.4 **(0.000)** | 85.3 **(0.000)** |
| Normal (18.5-22.9) (n=118) | 51 (43.3) | 43 (36.4) | 24 (20.3) | | | |
| Overweight (23.0-24.9) (n=46) | 9 (19.6) | 11 (23.9) | 26 (56.5) | | | |
| Obese (≥25.0) (n=73) | 6 (8.2) | 7 (9.6) | 60 (82.2) | | | |
| **Type 2 Diabetes Mellitus** | | | | | | |
| With T2DM (n=81) | 17 (21.0) | 9 (11.1) | 55 (67.9) | 1.5 (0.220) | 31.7 **(0.000)** | 39.8 **(0.000)** |
| Without T2DM (n=247) | 100 (40.5) | 90 (36.4) | 57 (23.1) | | | |

The result with regard to obese category indicates that maximum number (82.2%) of patients were NAFLD while lowest frequency (8.2%) was observed in normal group. Similarly, in overweight category, majority (56.5%) of patients belongs to NAFLD group followed by AFLD and normal group. The comparison of body mass index in study groups revealed that a significant difference in BMI was observed between normal vs. AFLD, normal vs. NAFLD and AFLD vs. NAFLD groups. Further data revealed that maximum number of T2DM cases was found in NAFLD group followed by normal and AFLD groups. Furthermore, comparison of study groups with occurrence of T2DM indicates significant alteration between normal vs. NAFLD and AFLD vs. NAFLD groups while no significant changes were noticed amid normal vs. AFLD groups.

The graduates and post graduates despite having lower OR have significant risk of developing AFLD in comparison to normal. The subjects up to secondary education had 4 times higher odds for developing NAFLD in comparison to normal. Whereas odds for NAFLD increased significantly in patients having middle, secondary and graduate level education when compared to AFLD group. The data with respect to occupational history indicates that all occupation is at nearly equal risk of developing AFLD taking labour as a reference standard. The salaried person was at 2.5 fold higher risk of developing NAFLD in comparison to normal subjects. Whereas the business and salaried class both are at significant risk of developing NAFLD in comparison to AFLD.

The sedentary physical activity workers have 2.1 fold higher risk (OR: 2.09, 95% CI 1.10–3.95) for AFLD group as compared to normal group which was statistically significant (p<0.05). However, the risk for development of NAFLD cases among sedentary physical workers (OR 3.49 95% CI 1.78 – 6.83) was found significantly higher (p<0.05) as compared to normal subjects (Table 5).

The result indicates that smoking was associated with higher likelihood for AFLD as well as NAFLD in comparison to normal. However, chewing of tobacco is significantly associated with NAFLD in comparison to AFLD. The patients with overweight were nearly at 5 times and 23 times at higher risk for developing NAFLD in comparison to AFLD and normal respectively. T2DM was at higher risk (5.7 times) of developing NAFLD in comparison to normal and about 10 times in comparison to AFLD. Whereas, when AFLD compared with NAFLD; risk of NAFLD was higher for healthy as well as overweight (Table 6).

**Table 5: Odds ratio for risk of alcoholic and non-alcoholic fatty liver disease with respect to educational status, occupational history and physical work activity**

| Variables | Risk Factor | | | | | |
|---|---|---|---|---|---|---|
| | NORMAL vs AFLD | | NORMAL vs NAFLD | | AFLD vs NAFLD | |
| | OR (95% CI) | *p* value | OR (95% CI) | *p* value | OR (95%CI) | *p* value |
| **Educations** | | | | | | |
| Illiterate | reference | | | | | |
| Primary class | 0.45 (0.17-1.22) | 0.119 | 1.01 (0.26 - 3.90) | 0.130 | 2.20 (0.62 - 7.82) | 0.221 |
| Middle class | 0.38 (0.13 - 1.10) | 0.073 | 1.81 (0.47 - 6.99) | 0.390 | 4.75 (1.33 - 16.92) | **0.016** |
| Secondary class | 0.43 (0.15 - 1.20) | 0.107 | 4.35 (1.19 - 15.92) | **0.026** | 10.12 (3.04 - 33.68) | **<0.001** |
| Graduate | 0.31 (0.10 - 0.91) | **0.034** | 2.00 (0.52 - 7.72) | 0.315 | 6.54 (1.79 - 23.84) | **0.004** |
| Post Graduate | 0.11 (0.03 - 0.44) | **0.002** | 0.59 (0.12 - 2.80) | 0.505 | 5.31 (0.96 - 29.29) | 0.055 |
| **Occupations** | | | | | | |
| Labour | reference | | | | | |
| Farmer | 0.25 (0.10 - 0.62) | **0.003** | 0.70 (0.24 - 2.07) | 0.519 | 2.79 (0.92 - 8.46) | 0.070 |
| Business | 0.28 (0.14 - 0.58) | **<0.001** | 1.79 (0.78 - 4.10) | 0.167 | 6.34 (2.85 - 14.12) | **<0.001** |
| Salaried | 0.21 (0.10 - 0.47) | **<0.001** | 2.52 (1.10 - 5.80) | **0.030** | 11.74 (5.02 - 27.46) | **<0.001** |
| **Physical Work Activity** | | | | | | |
| Heavy | reference | | | | | |
| Moderate | 0.48 (0.25 - 0.91) | **0.024** | 1.52 (0.74 - 3.13) | 0.250 | 3.18 (1.52 - 6.63) | **0.002** |
| Sedentary | 2.09 (1.10 – 3.95) | **0.001** | 3.49 (1.78 - 6.83) | <0.001 | 11.22 (5.31 - 23.73) | **<0.001** |

**Table 6: Odds ratio for risk of alcoholic and non-alcoholic fatty liver disease with respect to with respect to life-style, body mass index and type 2 diabetic mellitus**

| Variables | Risk Factor | | | | | |
|---|---|---|---|---|---|---|
| | NORMAL vs AFLD | | NORMAL vs NAFLD | | AFLD vs NAFLD | |
| | OR (95% CI) | *p* value | OR (95% CI) | *p* value | OR (95% CI) | *p* value |
| **Life Style Habits** | | | | | | |
| Veg. reference | | | | | | |
| Mixed | 1.10 (0.63 - 1.92) | 0.732 | 1.13 (0.66 -1.94) | 0.661 | 1.02 (0.55 –1.84) | 0.901 |
| Non-smoker | reference | | | | | |
| Smoker | 3.08 (2.03 - 6.69) | **<0.001** | 3.31 (1.88 - 5.83) | **<0.001** | 0.90 (0.47 -1.71) | 0.746 |
| Non-tobacco chewer | reference | | | | | |
| Tobacco chewer | 1.44 (0.86 - 2.84) | 0.144 | 0.72 (0.42 - 1.23) | 0.226 | 0.46 (0.25 - 0.83) | **0.010** |
| **Body Mass Index** | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Underweight | 0.88 (0.51 - 1.54) | 0.66 | 0.05 (0.01 - 0.20) | **<0.001** | 0.05 (0.01 - 0.22) | **<0.001** |
| Healthy weight | reference | | | | | |
| Overweight | 4.15 (0.83 - 20.81) | 0.062 | 23.85 (5.52 - 103.17) | **<0.001** | 5.75 (2.37 - 13.94) | **<0.001** |
| **Type 2 Diabetes Mellitus** | | | | | | |
| No | reference | | | | | |
| Yes | 0.59 (0.25 - 1.39) | 0.225 | 5.68 (3.01 - 10.70) | **<0.001** | 9.65 (4.43 - 21.03) | **<0.001** |

## DISCUSSION:

The present study was conducted to assess of risk factors likelihood associated with fatty liver disease with respect to occupations, physical activity and life style factors. It is well known that excessive alcohol abuse is the maximum common cause of fatty liver illness in human, but it is now obvious that fat accumulation in the liver, and its hostile consequences, may occur even without alcohol abuse also. The primary risk factors for the fatty liver disease are obesity, non-insulin-dependent diabetes mellitus, and hyperlipidemia etc. The liver disorder has a wide range of clinical spectrum, ranging from asymptomatic steatosis to steatohepatitis, fibrosis, and cirrhosis.[15] The BMI and waist circumferences of NAFLD patients were significantly higheras compared to AFLD and normal subjects. These findings are similar with the earlier findings of Singh *et al*.[16] It was observed that the systolic and diastolic blood pressure was significantly higher in AFLD and NAFLD compared to ($p$<0.05). The pulse rate was higher in NAFLD than normal subjects ($p$<0.05) but it was comparable between AFLD and normal. The Older age and a higher BMI were associated with hypertension, consistent with the results of previous studies.[17,18] We found that work exposure in years was higher in NAFLD followed by AFLD and normal subjects.

The results with respect to educational status revealed that most of the AFLD patients were illiterate or with primary level of education. Generally, it was noticed that people with less educated are compelled to do daily wages work and might be addicted to alcohol and this could be the reason for higher number of illiterate/low education subjects in AFLD group. Furthermore, Fedeli *et al.* observed that overall chronic liver disease and proportional mortality was higher in both males and females' subjects with primary education than in subjects with higher educational level.[19] Earlier study reported that lengthy sitting duration and lower physical activity were found to be related with the manifestation of NAFLD in a study carried out among Korean, advocating the importance of declining of time spent in sitting and elevation of time on physical activity. The sedentary physical work activity behavior, might related with lack of muscle movement, might be responsible for dysfunction of cardio-metabolic activities.[20] In our study, the data with respect to physical work activity revealed that highest number of NAFLD cases were in sedentary physical work activity group whereas lower manifestation of NAFLD subjects was found in heavy physical work activity group. This corroborates with the findings of Joo *et al.*[21]

Furthermore, majority of NAFLD subjects usually adopt diets comprising of more simple carbohydrates, total and saturated fat, lower intake of dietary fibers and omega-3 rich food.[22] Although lifestyle variations with weight loss and workout remain to be the basis of NAFLD management, amendment in dietary configuration with or without a calorie-restricted diet and work strategy might be useful for NAFLD treatment. Numerous studies suggested that cigarette smoking is related with several serious liver complications such as hepatic tumor, chronic liver disease and metabolic disorders etc.[23] We also observed that highest numbers of NAFLD patients were with the habit of smoking. Smoking induces the production of pro-inflammatory cytokines (IL-1, IL-6 and TNF-α) that would be involved in liver cell injury.[24] Alcohol especially ethanol consumption induces fatty liver by increasing the ratio of reduced form of nicotinamide adenine dinucleotide to oxidized form of nicotinamide adenine dinucleotide in hepatocytes.[25]

The overall prevalence rate of NAFLD varies from 30 to 100% among obese subjects. In addition, the linear relationship between BMI and the prevalence of NAFLD existed, resulting in greater prevalence of NAFLD in people with higher BMI. (26) Our findings also indicated that significantly higher number of NAFLD patients was observed among overweight and obese participants. The basic mechanisms of regulation of systemic metabolism of lipid oxidation are not completely defined, but it involves in hepatic fat deposition, alterations of energy metabolism and inflammatory signals derived from a variety of cell types including immune cells.[27] The results of present study indicates that the higher prevalence of NAFLD cases was found to be associated with T2DM which reinforced earlier finding in which they reported that the incidence of NAFLD was significantly linked with a twofold elevated risk in diabetes patients.[28]

Earlier, it was reported that few of the cultural and social influences on alcohol use and places individual alcohol use within the contexts and environments where people live and interact.[29] We also observed that the odd risk of fatty liver disease with respect to educational qualification indicates that participant with higher qualifications (graduates and postgraduates) is associated with significant risk of fatty liver inflammation in AFLD group as compared to normal and NAFLD groups. Another study also explained that family background with respect to income, wealth and parental education converged in describing unique patterns for smoking as well as alcohol and drug abuse among young adults. Further, they also described that young adults with higher socio-economic family background were mainly passionate to addiction of alcohol and drug abuse.[30]

The modern lifestyle, unhealthy eating habits, working stress, physical inactivity, and sedentary work in these professions may be major problems and moderately contribute the high prevalence of NAFLD. In addition, the various factors related to NAFLD in each occupational profession implied that multiple strategies for the health promotion of occupational professions are necessary to reduce the risk of NAFLD.[31] Very recently, Lee *et al.* reported in a large-scale cohort study that individuals with long working hours (more than 60 working hours per week) were independently associated with occurrence of NAFLD.[32] In recent, one study also explained that sedentary life style habits emerged as an independent risk factor for progression of NAFLD. They further stated that overall observance with the physical activity guidelines was minor in the cohort with NAFLD, with sex- and ethnicity-based differences.[33] In our study, the findings indicates that the sedentary physical activity workers had two fold higher risk for AFLD and more than three times higher risk for developing NAFLD as compared to normal.

The smoking is a recognized risk factor for metabolic disorder and was found to be an independent hazard factor for the onset of NAFLD.[34] The present data are consistent with previous findings that explained a significant association between fatty liver inflammation and smoking habits.[35,36] The logistic regression analysis of present data showed that ORs for overweight subjects were significantly higher (OR: 23.85, 95% CI: 5.52 – 103.17, $p$ < 0.001), indicating to be an independent risk factor for NAFLD. Moreover, findings also suggests that overweight is also a significant risk factor for induction of liver steatosis because it was fact that fatty liver is predominant among subjects with increased BMI. The findings from previous studies established that strong relationship between NAFLD and elevated BMI (overweight and obesity) and diabetes mellitus.[15,37] Our finding confirmed the strong association between diabetes and fatty liver inflammation, showing agreement with the earlier findings of Anstee *et al*.[38]

In conclusion, the results of present study highlighted the increased risk of development of NAFLD in profession of business and salaried class occupations. AFLD is mainly observed in person with heavy physical work activity while NAFLD is associated with both moderate and sedentary physical work activity. Smoking is equally responsible for progression and development of AFLD and NAFLD in population. Overweight and presence of T2DM is major concern and risk factor for the development of NAFLD.

### Conflict of interests:

None declared.

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