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**ORGINAL REASEARCH**

# PREVALENCE OF NON-ALCOHOLIC FATTY LIVER DISEASE IN YOUNG BOYS AND ITS CORRELATION WITH LIFESTYLE FACTORS AND OBESITY

**Meghna Annie Philip [1]* , Suresh MK[2],Suryalakshmi Kala C Thankom[3]**

1.Junior Resident,Department of General Medicine Sree Mookambika Institute of Medical Sciences College Kanyakumari, Tamil Nadu, India.

2. Professor, Department of General Medicine, Sree Mookambika Institute of Medical Sciences Kanyakumari, Tamil Nadu, India,

3. Senior Resident, Department of General Medicine, Sree Mookambika Institute of Medical Sciences Kanyakumari, Tamil Nadu, India.

**Corresponding Author**: meghna Annie Philip

## ABSTRACT

**Objective:** Currently understood to be a complex disease involving environmental factors, genetic predisposition, and lifestyle modifications, non-alcoholic fatty liver disease (NAFLD) is characterized by hepatic fat accumulation with no apparent aetiology and high prevalence among children and adolescents.

**Methods and Material:** A population-based cross sectional, descriptive study was conducted among 500 adolescent boys studying high schools in town of kulasekaramTamilnadu. Ultrasonography was the diagnostic tool usedto identify NAFLD.

**Results:** In teenage boys, the prevalence of fatty liver disease is 4.2%. It was discovered that there was no significant correlation between BMI and abdominal circumference and NAFLD when the risk factors were compared. Modifiable lifestyle factors, such as amounts of soft drinks, junk food, and non-vegetarian food consumed, were considerably higher in NAFLD patients when compared to the normal group. Additionally, the NAFLD group had a lower mean number of hours spent exercising, and this difference was found to be statistically significant.

**Conclusions:** It is imperative to educate schoolchildren about the primary preventive measures, such as adopting healthy eating habits and increasing physical activity, early in life, regardless of their weight, in order to manage non-alcoholic fatty liver disease (NAFLD).

## INTRODUCTION:

Due to the lack of clinical symptoms and radiological tests that can be done on children, non-alcoholic fatty liver disease (NAFLD), which is highly prevalent in children, is rarely recognized. Without a clear cause, it is typified by fat buildup in the hepatocytes. NAFLD is the umbrella term for a group of chronic liver diseases that affect people without any known secondary causes for the accumulation of fat in the liver, such as hepatitis C, excessive alcohol

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consumption, genetic or metabolic disorders, lipodystrophy, steatogenic medications (like amiodarone, valproate, etc.), malnutrition, or inborn errors of metabolism.

One NAFLD is a group of abnormalities that includes steatosis, which is an increase in liver fat without inflammation, non-alcoholic steatohepatitis (NASH), which is an increase in liver fat with inflammation, and advanced fibrosis, which can lead to cirrhosis and endstage liver disease and hepato cellular carcinoma.[2] NAFLD is thought to be a serious health issue that has become much more prevalent worldwide over the past few decades—up to 1 billion people, according to estimates. 3. Even more recent research has demonstrated that the prevalence has been increasing in kids, mostly in the 15–19 year old adolescent age group, as a result of kids who are obese and the influence of pubertal hormones. 4, 5, 6, Because androgens exacerbate non-alcoholic steatohepatitis or because oestrogens may be protective, boys appear to be affected more frequently than girls.

Despite the fact that NAFLD is not officially recognized as a part of the metabolic syndrome, many of the risk factors associated with the syndrome—including hypertriglyceridemia, insulin resistance, diabetes, and hypertension—as well as polycystic ovarian syndrome and obstructive sleep apnea—are closely linked to the syndrome, regardless of the degree of obesity. 7, 8 Its cause is also largely attributed to the rising incidence of sedentary lifestyles and poor eating habits. 9. It is estimated that the prevalence of non-alcoholic fatty liver disease (NAFLD) ranges from 3 to 10% in children of normal weight, but it is alarmingly high (8 to 80%) in overweight/obese children. 10 Medical professionals are taking notice of the rising incidence of childhood obesity and associated comorbidities, and it is necessary to document the consequences. Research on the prevalence and natural history of non-alcoholic fast-fatigue disorder (NAFLD) in adolescent children in south India is scarce.

Our current study was conducted to ascertain the prevalence of non-alcoholic fatty liver disease (NAFLD) in adolescent school boys in our local community, as well as its correlation with obesity and other lifestyle factors.

## MATERIALS AND METHODS:

Present study was a prospective cross-sectional study conducted in Government high school Kulasekharam for a period of 8months from May 2022 to December 2022.

This is a population-based cross sectional, descriptive study conducted to estimate the prevalence of non-alcoholic fatty liver among adolescentboys.For the purpose of the current study, a convenient sample of 500 adolescent boys are selected from the government schools in rural town of kulasekaram,tamilnadu.

Inclusion criteria:

All the boys of $8^{th}$, $9^{th}$ and $10^{th}$ classes studying in government school in Ambur who gave consent to participate in the study.

Exclusion criteria:

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Age > 18 years and students who did not give consent to participate in the study. Children with other primary liver disorders that could account for steatosis were also excluded. All the study participants denied consumption of alcohol and use of steatogenic medications

A detailed medical history and anthropometric measurements were taken. Abdominal circumference was measured at the midpoint of the line between the lower costal margin and iliac crest in the mid-axillary line using a measuring tape. The cut-off points suggested by Taylor RW et al [11] were used to identify abdominal obesity. Height was measured in standing position using a stadiometer and weight was taken on an electronic weighing scale by the same observer. Body Mass Index (BMI) was calculated as weight in kilograms divided by square of height in meters. The students were classified as "overweight" or "obese" based on Indian Academy of Pediatrics (IAP) age and gender-specific BMI guidelines.[12] Diagnosis of fatty liver was based on ultrasonography. Ultrasonography was done using Toshiba Appolo 500 expert machine using 2-5 MHz convex probe by a senior radiologist with 15 years of experience in doing Liver imaging.

## RESULTS:

A The study included 500 male adolescents. The study participants' ages ranged from 12 to 18 years old, with a mean (± standard deviation) of 15.44 (± 1.3) years. Table 1 displayed the anthropometric measurements' descriptive statistics. The study population's mean weekly consumption of soft drinks was 1.38 in terms of lifestyle factors. Conversely, the weekly mean consumption of junk food and non-vegetables was 1.61 and 3.64, respectively. 2.23 hours a day on average were reported by the study population to be spent watching TV. Moreover, the average amount of time spent exercising was 2.37 hours (Table 1). In the study population, there was an overall prevalence of 9.4% for overweight people and only 3% for obesity. While abdominal obesity was noted in 34.6% (173 students).

The prevalence of NAFLD in the study group was estimated to be 4.2% (21 adolescents). All of them had grade 1 fatty liver findings on ultrasonography as shown in Figure 1. Regarding BMI, this study found that, only 6.7% adolescents who were obese had NAFLD, and 4.3% adolescents who were overweight were diagnosedwith NAFLD. And abdominal obesity was noted in 2.9% of the children having NAFLD. On applying the Chi-square test, neither BMI

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nor Abdominal circumference had any significant association with NAFLD (Table 2). In the current study, on comparison of the risk factors in both the groups of normal and NAFLD patients, it was found that lifestyle factors like intake of soft drinks, consumption of non-veg and junk food and hours engaged in watching TV were significantly higher in NAFLD patients, compared to normal group. And the mean hours engaged in physical activity were lower in NAFLD group, and this was statistically significant, P = 0.0001* (Table 3).

Table 1: Descriptive statistics of the study population

| **Variable** | **Minimum** | **Maximum** | **Mean** | **Standard deviation** |
|---|---|---|---|---|
| **1. Anthropometric findings** | | | | |
| Height (cms) | 133 | 185 | 159.88 | 10.55 |
| Weight (kgs) | 25 | 90 | 46.818 | 10.66 |
| BMI (kg/m$^2$) | 10.4 | 29.4 | 18.16 | 2.98 |
| Abdominal circumference (cms) | 35 | 121 | 76.26 | 11.52 |
| **2. Lifestyle factors** | | | | |
| Intake of soft drinks per week | 0 | 7 | 1.38 | 1.132 |
| Junk food consumed per week | 0 | 30 | 3.64 | 4.150 |
| Non-veg consumed per week | 0 | 22 | 1.61 | 1.468 |
| Number of hours watching TV perday | 0 | 8 | 2.23 | 1.197 |
| Number of hours engaged in physica activity per day | 0 | 6 | 2.37 | 1.312 |

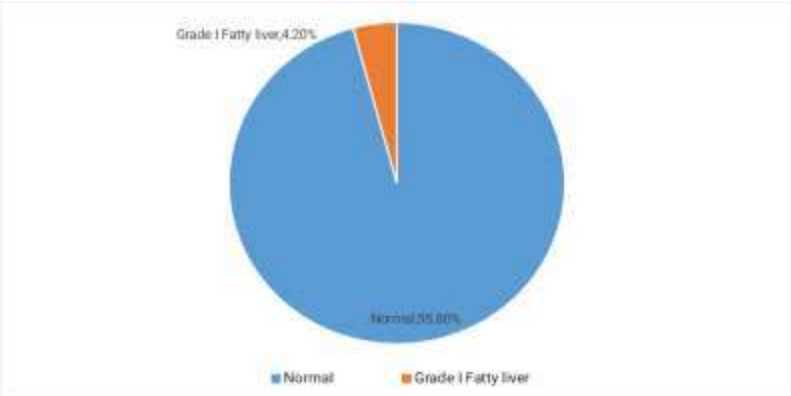


Figure 1: Ultrasonography findings

Table 2: Association between Anthropometric measurements and NAFLD

| **Variable** | **Normal** | **NAFLD** | **Total** | **P-value** |
|---|---|---|---|---|
| **1. BMI** | | | | |
| Underweight | 292 (96.1%) | 12 (3.9%) | 304 | |
| Normal | 128 (95.5%) | 6 (4.5%) | 134 | |
| Overweight | 45 (95.7%) | 2 (4.3%) | 47 | |
| Obese | 14 (93.3%) | 1 (6.7%) | 15 | 0.960 |
| **2. Abdominal circumference** | | | | |
| Normal | 311 (95.1%) | 16 (4.9%) | 327 | |
| Abdominal obesity | 168 (97.1%) | 5 (2.9%) | 173 | 0.288 |
| **Total** | 479 | 21 | 500 | |

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Table 3: Comparison of the means of the study variables in the two groups usingindependent samples t-test

| Variables | N | Mean | SD | P value |
|---|---|---|---|---|
| **1. Intake of soft drinks per week**<br>Normal NAFLD | 479<br>21 | 1.35<br>1.95 | 1.116<br>1.359 | **0.017*** |
| **2. Junk food consumed per week**<br>NormalNAFLD | 479<br>21 | 3.29<br>11.67 | 3.475<br>8.392 | **0.0001*** |
| **3. Non-veg consumed per week**<br>Normal NAFLD | 479<br>21 | 1.54<br>3.14 | 1.374<br>2.455 | **0.0001*** |
| **4. Number of hours watching TV perday**<br>Normal NAFLD | 479<br>21 | 2.17<br>3.50 | 1.169<br>1.162 | **0.0001*** |
| **5. Number of hours engaged in physicalactivity per day**<br>NormalNAFLD | 479<br>21 | 2.42<br>1.29 | 1.299<br>1.157 | **0.0001*** |

## DISCUSSION

NAFLD is a multi-factorial disease as a result of a composite interaction between environmental factors, genetic background and nutritional factors like high-calorie diet, excess intake of saturated fats, refined carbohydrates and a high fructose intake along with sedentary behaviour which form the major contributors to the development of NAFLD. The paediatric NAFLD is an under-studied subject and remains unrecognized, though approximately 10-20% of the general paediatric population is affected.[14] Large gaps exist in the screening, diagnosis and management particularly during the transitional phase between paediatric and adult medical services.

[15] Our study is one of its kind from South India which was designedto evaluate the prevalence of fatty liver in children, particularly in adolescents using ultrasonography as the sole diagnostic tool and to know its association with obesityand lifestyle factors adopted by them. Though cases of paediatric NAFLD are reported at a very young age, they are usually diagnosed clinically after the age of 10 years, as reported in the findings of Vajro P et al and Wildhalm K et al, where the mean age of diagnosis of NAFLD isreported to be 11-13 years. [15, 10] In the current study, the mean age of the study participants was estimated to be 15.44 (± 1.3) years. Among them, a total of 9.4% were overweight and only 3% were found to be obese. Abdominal obesity was noted in 34.6% children. On ultrasonography, fatty liver was documented in 4.2% of the selected children, of whom all hadGrade-I liver changes. This is comparable to the findings of hospital based study from Delhi, where the prevalence was found to be 3% among 100 children aged 5-12 years. [16] Another study conducted on Kashmiri school children of age 4-18 years revealed NAFLD in 7.4% of all children (26% in obese children) . [17] A study in Haryana reportedthe prevalence of fatty liver in 22.4% children; 18.9% in normal-weight and 45.6% in overweight category. [18]

In our study, the prevalence of fatty liver in overweight and obese children was 6.7% and 4.3% respectively, while it was only 2.9% in children with high waist circumference. Neither BMI nor Abdominal circumference was found to have significant association with

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NAFLD. This finding was in contrast to the observationsmade by Irshad AP et al [17] and Das MK et al [18], where higher BMI and increased waist circumference were observed to be a statistically significant risk factors for fatty liver. This variation in the study findings could be due to difference in the age, gender and BMI criteria of the study population adopted in various studies. The data on association between lifestyle factors and NAFLD were limited, so we endeavoured to study them, so that the clinical management can be modified and unhealthy behaviours can be prevented in children accordingly. In the current study, on comparison of the lifestyle factors in both the groups of normal and NAFLDpatients, it was found that intakeof soft drinks, consumption of non-veg diet and junk food and hours engaged in watching TV were significantly higher in NAFLD patients, compared to normal group. And the mean hoursengaged in physical activity were lower in NAFLD group. This difference was statistically significant witha P value of 0.0001. This is consistent with the observations of Zelber-Sagi et alfrom his seven year prospective follow-up study, which showed that excess caloric consumption, unhealthy diet, sedentary lifestyle leading to obesity and related comorbidities are leading risk factors for NAFLD, regardless of baseline body mass index (BMI).[19] Another study conducted by Zelber-Sagi et al reported that NAFLD patients consume a larger quantity of soft drinks and meat than controls.[20] Several other previous studies also showed a significant association between meat (red meat) consumption and NAFLD. [21, 22] In the systemic review and meta-analysis conducted by K.Wijarnpreecha et al demonstrated a statistically significantassociation between sugar-sweetened soda consumptionand NAFLD.[23]
Studies from various other countries like China [24], Israel [25] also reported similar results.

The risk of non-alcoholic fatty liver disease (NAFLD) was found to be positively correlated with the Western dietary pattern, which includes takeout, red meats, processed meats, full-fat dairy products, fried potatoes, refined cereals, cakes, biscuits, and confectionery.26 This suggests that, independent of the initial body mass index, lifestyle factors such as an unhealthy eating pattern and a sedentary lifestyle may be associated with an increased risk of non-alcoholic fatty liver disease (NAFLD) in adolescent children.

**Limitations:** The gold standard for diagnosis of fatty liver is liver biopsy, which is not done in the present study as it is not ethical to perform in healthy populations. The study results might vary if the study is conducted exclusively on overweight/obese children and included the private schools as well.

**Conclusion:** According to the study's findings, 4.2% of teenage boys have fatty liver disease. It was discovered that there was no significant correlation between BMI and abdominal circumference and NAFLD when the risk factors were compared. Modifiable lifestyle factors, such as amounts of soft drinks, junk food, and non-vegetarian food consumed, were considerably higher in NAFLD patients when compared to the normal group. Additionally, the NAFLD group had a lower mean number of hours spent exercising, and this difference was found to be statistically significant.

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**CONFLICTS OF INTEREST:**

There are no conflicts of interest

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