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Original Research Article

Prevalence of non-alcoholic fatty liver disease among obese children in North Kerala, India

Reetha G.[1]*, Mahesh P.[2]

[1]Department of Pediatrics, [2]Department of Radiology, Pariyaram Medical college, Kannur, Kerala, India

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***Correspondence:**
Dr. Reetha G.,
E-mail: drreethag20@gmail.com

ABSTRACT

Background: Obesity and related co-morbidities are increasing at an alarming pace all over the world. Non-alcoholic fatty liver disease (NAFLD) is the asymptomatic involvement of the liver mainly seen in obese individuals. NAFLD can progress to chronic liver disease and has to be identified early. The aims of our study were to determine the prevalence of nonalcoholic fatty liver disease among obese children in our local population. To determine the prevalence of abnormal liver enzymes in obese children.
Methods: Cross sectional descriptive study in a tertiary care center among children aged 5-18 years for a 1 year period. NAFLD was diagnosed based on ultrasonography. Alanine amino transferase more than 40IU/l was taken as abnormal.
Results: A total of 65 patients were enrolled in the study. The prevalence of NAFLD in the study group was 60%. 20% had elevated alanine amino transferase levels.
Conclusions: The prevalence of fatty liver in Kerala is comparable to that in the West. Since this is a public health issue more population based studies are needed on a larger group to find out the exact magnitude of the problem.

Keywords: Alanine amino transferase, Non-alcoholic fatty liver disease, Obesity

INTRODUCTION

The prevalence of overweight or obese children globally increased from 31 million in 1990 to 42 million in 2013 as per World Health Organization update in 2015 and is expected to rise to 70 million by 2025 if the current scenario continues.[1]

Overweight children are more likely to become obese adults than are thinner children.[2] Due to the alarming rise in obesity in children and adolescents and its implications on adult life, the complications that can arise as a consequence has been studied extensively. Along with the metabolic syndrome, asymptomatic liver involvement which is very well documented in obese adults, is being increasingly recognized in children as well.[3,4] Non-alcoholic fatty liver disease (NAFLD)is characterized by hepatic fat accumulation without an apparent etiology. It ranges from (a) simple steatosis -fat in the liver, (b) non-alcoholic steatohepatitis (NASH) fat with inflammation and/or fibrosis (c) advanced fibrosis and cirrhosis. The risk factors for NAFLD include obesity, diabetes, insulin resistance (IR), and hypertriglyceridemia.[5] Nonalcoholic fatty liver disease (NAFLD) is now the most common cause of chronic liver disease in children and adolescents in the western counties.[6] Prevalence studies on this alarming disease are very few from India.

The aims of our study were to determine the prevalence of nonalcoholic fatty liver disease among obese children in our local population. To determine the prevalence of abnormal liver enzymes in obese children.

METHODS

Cross sectional descriptive study was used. Study setting: Pediatric endocrine clinic of a tertiary care hospital in Kerala. Study population: Obese children between the ages of 5 to 18 years attending the pediatric endocrinology clinic. Study duration: 1 year.

Inclusion criteria

All children with exogenous obesity between 5 to 18 years of age, who gave consent to participate in the study.

Exclusion criteria

Children with syndromic obesity and other primary liver disorders that could account for steatosis were excluded. Study participants denied consumption of alcohol and use of steatogenic medications.

Operational definition

Obesity was diagnosed based on revised IAP 2015 reference percentiles that has been proposed for Asian Indian children with a BMI >27kg/m2 adult equivalent cut off taken as obesity.[7]

The study was conducted over a period of 1 year from January 2016 to December 2016.

The patients who attended the pediatric endocrinology clinic during the study period who fulfilled the inclusion criteria were included. A detailed medical history and physical examination was done. Height was measured in standing position using a stadiometer and was measured by a single observer.

Weight was taken on an electronic weighing scale and was measured by the same observer. Body Mass Index (BMI) was measured as weight in kilograms divided by height in meter^2. Those who were obese were enrolled at their first visit. Diagnosis of fatty liver was based on ultrasonography. Ultrasonography was done using voluson 730 expert machine(GE) using 2-5 MHz convex probe by a senior radiologist with 20 years of experience in doing abdominal ultrasound.

Each case was graded as follows: normal-homogenous texture, exhibited fine-level echoes and was minimally hyperecoeic or isoechoeic compared with normal renal cortex; Grade 1-characterized by mildly increased liver echogenicity and clear depiction of hepatic and portal vein walls; Grade 2-with increased liver echogenicity obscuring the hepatic and portal vein walls; and Grade 3-with increased liver echogenicity and significant posterior shadowing that impairs evaluation the diaphragm.[8] The consent for including data for the purpose of study was obtained from each patient at the time of enrollment. Serum alanine amino transferase (ALT) was measured in all the children and a value >40 IU/l was taken as abnormal.

Statistical analysis

All data were analyzed on computer using SPSS version 11.5 package (Chicago, IL, USA). Continuous variables are presented as mean ± standard deviation (SD). Comparison of continuous variables was performed with the chi-square test. Data were rechecked and verified for accuracy and inconsistent values.

The risk factors for NAFLD were calculated by using the Pearson's correlation coefficient of variables.

RESULTS

A total of 65 patients were enrolled in the study during the study period. Of which 30 were males (46.2%) and 35 were females (53.8%).

The weight ranged from 31.6 to 147 kilograms with a mean of 73.47 and a standard deviation of 19.75. The BMI of the study subjects ranged from 20.7 to 48.6 the mean being 29.1 and standard deviation 4.82 (Table 1).

Table 1: Descriptive statistics of the anthropometric measurements.

	Number	Minimum	Maximum	Mean	Standard deviation
Weight (kg)	65	31.6	147	73.47	19.75
Height (cm)	64	113.5	180	157.16	13.85
Bmi (kg/m2)	65	20.7	48.6	29.18	4.82
Wc (inches)	64	25.5	55	35.84	6.06

The prevalence of NAFLD in the study group was 60% (39 children). Out of the children with fatty liver, 61% (24) had grade 1 and 39% (15) children had grade 2 fatty liver. Out of this 56.4% (22) were females and 43.6% (17) were males.5 of the study subjects had extreme obesity (BMI ≥35 kg/m2 and all of them had fatty liver (Table 2). Among 65 patients, 13 (20%) had elevated alanine amino transferase, the male female ratio being 1.1:1.

One subject had SGPT more than twice the upper limit of normal (1%) and this child had grade 2 fatty liver (Table 3). In the group with normal liver on ultrasound, 80.8 % (21 children) had normal ALT and 5 children had

abnormal liver enzymes. In the group with fatty liver only 20.5% had abnormal ALT giving a sensitivity of 20.5% and a specificity of 80.8 % (Table 4).

Table 2: Number of children with fatty liver.

	Frequency	Percent
Normal	26	40.0
Abnormal	39	60.0
Total	**65**	**100**

Table 3: Number of children with abnormal ALT.

	Frequency	Percent
Normal	52	80.0
Abnormal	13	20.0
Total	**65**	**100**

Applying the Pearson's correlation co-efficient a significant correlation could be demonstrated between increasing BMI and abnormal ALT (r=0.269, p= 0.03).

Table 4: Relationship between Fatty liver and AST.

		Fatty liver group		
ALT group		**Normal**	**Abnormal**	**Total**
Normal		21	31	52
	% within ALT group	40.4	59.6	100.0
	% within Fatty liver group	80.8	79.5	80.0
Abnormal		5	8	13
	% within ALT group	38.5	61.5	100.0
	% within Fatty liver group	19.2	20.5	20.0
Total		**26**	**39**	**65**

Sensitivity = 20.5%, Specificity = 80.8%

DISCUSSION

NAFLD in children is a public health issue that is increasing due to the global increase in the prevalence of obesity, but largely remains undiagnosed. Its histologically proven prevalence in children in the United States (as revealed at autopsy after accidents) ranges from 9.6% in normal weight individuals up to 38% in obese ones.[9] The gold standard for diagnosis of fatty liver is liver biopsy which in not ethical to use in healthy populations. The other diagnostic modalities used are magnetic resonance imaging, ultrasonography and biochemical markers of liver function like alanine aminotransferase and aspartate aminotransferase.[8,9]

The sensitivity of ultrasonography for diagnosing fatty liver was reported to be 85%-90%. Ultrasonography is considered to be consistent with biopsy results in diagnosing fatty infiltration in the liver.[10] The prevalence of NAFLD among obese children in United States was 40-70% and from other countries like China, Italy, Japan and Brazil was between 10% and 77%.[11-14] In a study from India using ultrasonography as a diagnostic tool the reported prevalence was 61%.[15] Our study also showed a similar prevalence of 60% among our local population of obese children. There have been several studies on the prevalence of fatty liver in the general pediatric population as well. In a study from India on 100 children aged 5-12 years the prevalence was found to be 3%.[16] In a recent study by Huang et al. among children aged 6 to 12 years, rates of NAFLD were 3% in the normal-weight, 25% in the overweight, and 76% in obese children.[17] Despite the diversity of diagnostic criteria used in population-based studies, obesity is the main risk factor for pediatric NAFLD.

NAFLD can occur in very young children also, but it is more prevalent in adolescents.[18] Factors that can explain the higher rate of NAFLD in adolescents include the role of pubertal hormones, increasing obesity, unhealthy eating habits and sedentary lifestyle.[19] In our study majority of children were in the adolescent age group and all the children who had fatty liver were above 11 years of NAFLD generally shows a male preponderance.[20] The sex differences implicate that estrogens are protective or androgens aggravate nonalcoholic steatohepatitis. In this study group NAFLD was slightly more in females (56.4%). The disparity could be due to the small sample size and the greater number of females in the study group.

Several biomarkers have been used as tools to diagnose NAFLD, though none of them is specific. Alanine amino transferase is the primary and inexpensive test for NAFLD. Mild elevation of serum aminotransferase levels is seen in patients with NAFLD, but liver enzymes may be normal in up to 78% of patients.[21] The ratio of AST/ALT is usually less than 1 in patients who have normal liver or minimal fibrosis, although this ratio may be greater than 1 with the development of cirrhosis.[22] It is a known fact that the degree of ALT elevation does not correlate with the presence or severity of histological findings of NAFLD.[23] The cut off of ALT for diagnosing NAFLD is also not well defined. Researchers have used 50, 40 IU/l as cutoffs. The Screening ALT for Elevation in Today's Youth (SAFETY) study shows that

conventional ALT cutoff values are set too high for the reliable detection of pediatric NAFLD.[24] In the National Health and Nutrition Examination Survey (NHANES) study, the 95th percentile levels for ALT in healthy weight, metabolically normal, liver disease-free patients were 25.8 U/L (boys) and 22.1 U/L (girls).

In the present study, we used a cut off of 40 IU/l. Among 65 patients in the study group, 13 (20%) had elevated alanine amino transferase. This is comparable to that of other studies.[25,26] The male: female ratio being 1.1:1. One subject had SGPT more than twice the upper limit of normal (1%) and this child had grade 2 fatty liver. In the group with normal liver on ultrasound, 80.8% (21 children) had normal ALT and 5 children had abnormal liver enzymes. In the group with fatty liver only 20.5% had abnormal ALT giving a sensitivity of 20.5% and a specificity of 80.8%. This finding supports the fact that AST is not a sensitive test for diagnosing NAFLD, though the specificity is high. The study also demonstrates that NAFLD is not the only reason for elevated liver enzymes in obese children as 38.5% of children with normal liver on ultrasound had abnormal ALT. These children should be evaluated for other causes of liver function abnormalities and also other imaging modalities like MRI for detection of fatty liver. There was also a significant correlation between increasing BMI and abnormal ALT applying the Pearson correlation co-efficient. (r=0.269, p=0.03). We could not demonstrate a significant correlation between increasing age and abnormal ALT (r=0.432, p=0.099).

Limitations

Our hospital is a tertiary care center and serves as a referral centre for childhood obesity. Our study had children mainly in the adolescent age group. Therefore, our data may not be representative of the general population of obese children.

CONCLUSION

Fatty liver is the most common liver abnormality in children age 2 to 19 years. The prevalence of fatty liver in Kerala is quite high, comparable to that in the West. Since NAFLD can progress to chronic liver disease early detection and prompt changes in the lifestyle and dietary habits is very essential. Since this is a public health issue more population based studies are needed on a larger group to find out the exact magnitude of the problem.

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