Waist circumference is a Useful Indicator for Non-alcoholic Fatty Liver Disease Patients Visiting Gastro and Liver Care Hospital in Ongole City, Prakasam District, Andhra Pradesh

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ABSTRACT

NAFLD is commonly develops among 40-50 years and even with non consumption of alcohol patient with any component of metabolic syndrome may develop hepatic steatosis. Waist circumference is the cost effective clinical tool to assess the obesity and NAFLD. Cross sectional study was conducted in Vijaya Sree Hospitals Gastro and Liver care centre; in Ongole city, Prakasam District of Andhra Pradesh. Ultrasonographically confirmed fatty liver cases visiting to hospital for the purpose of gastrointestinal and liver problems were enrolled in the study from January 2016 to May 2016. Pre tested, pre structured, validated questionnaire was used to get the information from the patients: Continuous variables were presented with descriptive analysis like mean ± standard deviation (SD). Pearson's correlation analysis was carried out between waist circumference and waist to hip ratio with body mass index. Among the total 184 study participants 142 (77.1%) were males and 42 (22.9%) were females. Out of total 184 NAFLD cases 70 (42.9%) were obese patients with BMI of more than 30kg/m2, whereas 54 (33.1%) were pre obese patients with BMI between 25 to 29.9 kg/m2. Positive correlation noticed between waist circumference and Body mass index with p value <0.05 and r value of 0.466 and Waist to Hip ratio showed a negative correlation with body mass Index (P>0.05). It was found that 62 (33.69%) cases were with Type 2 Diabetes Mellitus Waist circumference was found to be useful indicator for obesity with NAFLD patients in comparison with the   waist to hip ratio. Significant association noticed between type 2 Diabetes Mellitus and Obesity of NAFLD patients. Strategies need to be planned to train health care workers and teachers about measuring the waist circumference and the body mass index and also interpretation

Keywords: Body Mass Index, Waist Circumference, Waist to Hip Ratio, Hypertension

INTRODUCTION

The prevalence of NAFLD is a global public health problem and it is characterized by more than 10% of fat accumulation in the liver cells without excessive intake of alcoholism. As per few epidemiological studies prevalence of NAFLD in around 9% to 32% of common population in India [1]. NAFLD prevalence in the general population of Western countries is about 20-30% and it is higher in males and increases with increasing age, and it is influenced especially by various lifestyle habits [2]. The most important risk factors for NAFLD are male gender, age, obesity, insulin resistance and the cardio metabolic alterations that define the metabolic syndrome. The prevalence of NAFLD is 80-90% in obese adults, 30-50% in patients with diabetes and up to 90% in patients with hyperlipidemia. [3]

Even with non consumption of alcohol patient with any component of metabolic syndrome may develop hepatic steatosis due to increased lipolysis and increased delivery of fatty acids from adipose tissue to liver [4]. The commonest age group for development of NAFLD from 40-50 years and it can occur in children [5]. Public of our country are more prone to develop insulin resistance followed by non Alcoholic fatty liver disease. Central or abdominal obesity is more commonly associated insulin resistance and few studies revealed that it was the cause of NAFLD [6].

The prevalence of this disease is increasing with the age and it is common among obese subjects (75%) and among the subjects with type 2 Diabetes mellitus. For each 1 centimeter increase in visceral obesity is associated with two fold greater risk of NAFLD in Obese adolescents. NAFLD is strongly associated with insulin resistance and the metabolic syndrome. [7] The current epidemic of the metabolic syndrome is closely linked to the prevalence of obesity and the presence of abdominal or visceral adiposity has been strongly implicated in development of the metabolic syndrome.

Waist circumference will use as one of the cost effective clinical tool to assess the central obesity in clinical practice and useful to assess NAFLD [8]. Waist circumference is a measure of central obesity, was strongly associated with elevated SGPT concentration and has the significant association between body fat distribution and metabolic diseases. Waist circumference is one of the most accurate anthropometrical indicators of abdominal fat. Risk factors associated with NAFLD were age above 40 years, male gender, central obesity, high BMI (>25), elevated fasting blood sugar, and high AST and ALT levels. [9] Many research studies explained that abdominal obesity had a greater impact on the severity of NAFLD. [10]

This study was planned to find out various risk factors causing the non alcoholic fatty liver disease (NAFLD) and also to study whether waist circumference was useful indicator for

assessing the obesity and non alcoholic Fatty Liver Disease in comparison with body mass index (BMI)

MATERIALS AND METHOD

This cross sectional study was conducted in the Vijaya Sree Hospitals Gastro and Liver care center; 60 feet road in Ongole city, Prakasam District of Andhra Pradesh. Ultrasonographically confirmed fatty liver cases have been included in this study. Total 184 patients have been visiting to hospital for the purpose of gastrointestinal and liver problems were enrolled in the study during January 2016 to May 2016 period. Pre tested, pre structured, validated questionnaire was used to get the information from the patients. Two workers were trained for measurement of weight, waist circumference and also waist to hip ratio. Their quality of measurements were also validated by two expert doctors independently and certified for their standards. Individuals with any of the following were excluded from the study: alcohol consumption ≥140 g/week in men or 70 g/week in women, presence of hepatitis B surface antigen or antihepatitis C virus antibodies, fatty liver suspected to be secondary to hepatotoxic drugs, prior surgery that could cause fatty liver, inflammatory bowel disease or celiac disease. Information was gathered on personal and demographic details of the patients, their alcoholic status was also enquired for the purpose of excluding them from the study. Various risk factors related to metabolic syndrome like obesity, Type 2 Diabetes Mellitus, Hypothyroid status, Hypertension, were also enquired. All participants were given a written informed consent to participate in this study. Anthropometric measurements were taken from all the participants of this study. Height was measured using stadiometer and weight was measured using a weighing machine without the footwear and minimal clothing. Body Mass Index (BMI) is also called as Quetlet's index is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in meters (kg/m^2) [11].

For measuring the waist circumference initially marking was done at midpoint between lower rib and top of the hip bone. By using the measuring tape, waist circumference was taken in centimeters exactly at that point in expiratory phase and one should not squeeze the skin. Risk of getting fatty liver disease is more if the waist circumference is more than102 cm in case of men and more than 88cms in case of females. (M E J Lean et al). The measurement was taken at the end of a normal expiration, without the tape compressing the skin, to the nearest 0. 1cm. Waist to Hip ratio was also assessed after identifying the widest part of buttocks with help of tape measure around the circumference of hips and buttocks [13]. Abdominal obesity results in an "apple-shaped" body type, which is more common among men. Women typically accumulate fat around the hips and thighs to develop a "pear shaped" body

Blood was collected for the assessment of Total Bilirubin, Direct Bilirubin and indirect Bilirubin and these were measured by DCA method, and also SGOT and SGPT were estimated by using SGPT reagent IFCC kinetic method. Details regarding presence of Diabetes Mellitus, hypertension, hypothyroidism hyperlipidemia, and other relevant information were taken from the history and already existing biochemical   reports.

Statistical analysis was performed with the use of statistical package of social science (SPSS) ver. 20.0. Pearson's correlation analysis was carried out between waist circumference waist to hip ratio and body mass index. Continuous variables were presented with descriptive analysis like means ± standard deviation (SD). Association was also assessed between classification of obesity based on body mass index and also waist circumference.

RESULTS AND DISCUSSION

Among the total 184 study participants 142 (77.1%) were males and 42 (22.9%) were females. Prakasam District is one of the backward District of new Andhra Pradesh in India , it consists of 56 Mandals, These fatty liver cases have been visited to our hospital from 46 (82.1%) Mandals of this District. Maximum numbers of cases were reported from Ongole (23.3%), Kandukuru (7.06%) and Kanigiri (6.52%) Mandals. Out of all these cases 79 (42.93%) were reported from urban areas and 105 (57.06%) were belong to rural areas . Mean age of males was found to be 44.34 ± 12.39 years and in case of females it was 44.4 ±12.45. Mean value of Body Mass Index (Quetelet Index) was observed to be high in male patients 32.05±4.807 in comparison with the female patients. Waist circumference is almost same in both males and females and the values are 95.21±11.17 cms , 95.11±11.38 cms respectively. Mean Liver enzymes and Bilirubin levels values were observed to be almost same in both the sexes (Table-1)

Table 1: Descriptive Analysis of Study Participants

| S.No	Mean	Males	Females
1	Age (years)	44.34 ± 12.39	44.4 ±12.45
2	Weight (Kgs)	73.14±12.69	72.86±12.84
3	Height(meters)	1.605±0.086	1.60±0.08
4	BMI	32.05±4.807	28.38±4.87
5	Waist circumference (Cms)	95.21±11.17	95.11±11.38
6	Hip circumference(Cms)	97.19±12.1	97.16±11.31
7	Waist to Hip Ratio	0.98±0.102	0.984±0.1
8	SGOT	33.35±20.23	33.2±20.36
9	SGPT	34.59±23.44	34.52±23.74
10	Total Bilirubin	1.16±0.53	1.109±0.537
11	Direct Bilirubin	0.631±0.34	0.629±0.342

It was noticed that 36 (30.4)% of Non Alcoholic Fatty Liver Disease cases were occurred below 40 years of age group, where as 64 (54%)of these cases were   noticed between 40 and 59

years age group. Only 18 (15.18%) of NAFLD cases were observed above the 60 years (Graph-1).
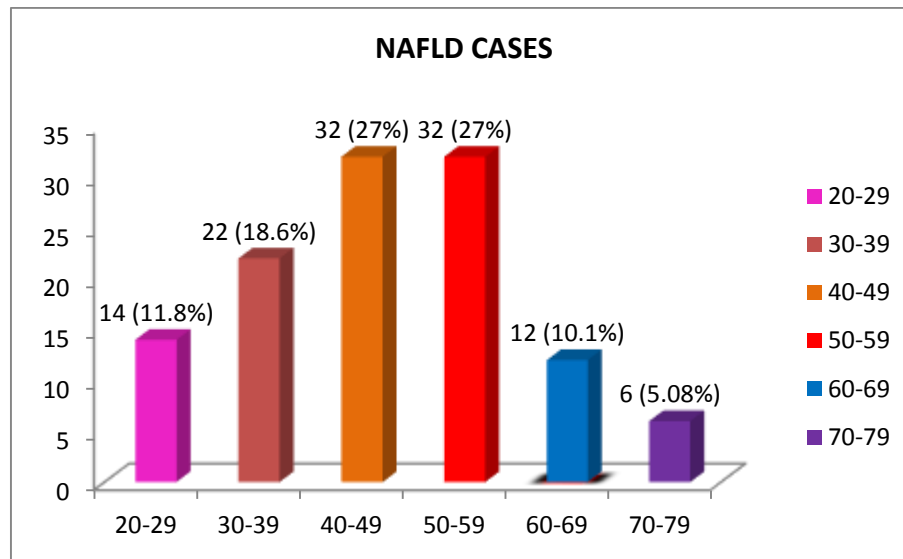
Graph-1: Age Wise Distribution of NAFLD Cases

Out of total 184 Non Alcoholic Fatty Liver Disease cases 70 (42.9%) were obese patients with BMI of more than 30kg/m2, whereas 54 (33.1%) were pre obese patients with BMI between 25 to 29.9 kg/m2. Fatty liver cases (24.3%) were also occurred in patients with normal Body mass index and this clearly indicates that NAFLD cases were also occurring in patients without obesity (Grapgh-2).
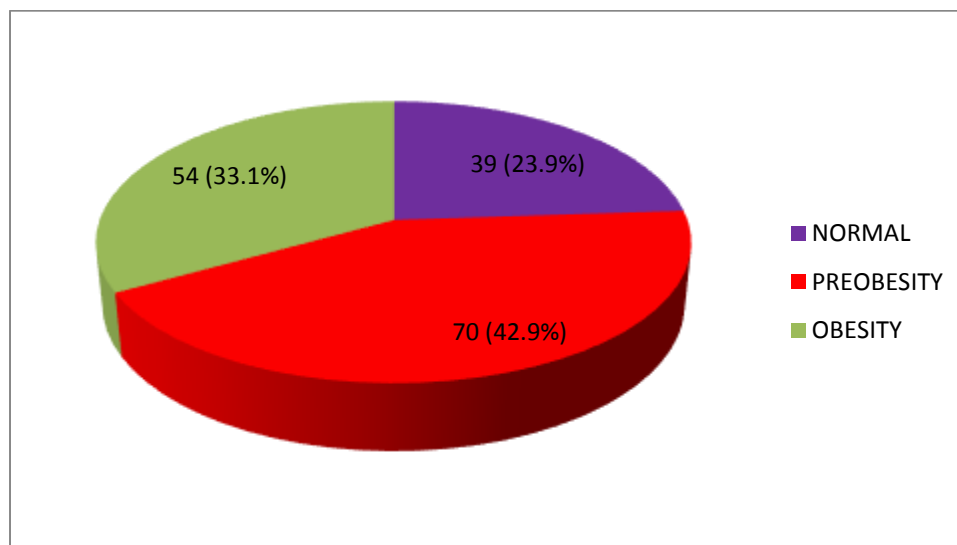
Graph-2: BMI and Non Alcoholic Fatty Liver Disease Cases

3% of NAFLD cases and 34.23% cases were under increased category. It was observed that 21.73% cases were comes under high risk classification and 20.1% cases were classified as very high risk classification. It was found that percentage (30.95%) of the females were more in very high risk category waist circumference classification in comparison with the males (16.9%) (Table-2)

Table-2: WHO categorization of Waist Circumference

Risk	Males (N=142)	Females (N=42)	Total (N=184)
Normal	33(23.2%)	8 (19.04%)	41 (22.3%)
Increased	52(36.6%)	11(26.1%)	63(34.23%)
High	30(21.1%)	10 (23.8%)	40(21.73%)
Very High	24 (16.9%)	13(30.95%)	37(20.1%)
Extremely High	3 (2.1%)	0(0%)	3(1.6%)

It was observed that among the total 184 Non Alcoholic Fatty Liver (NAFLD) Disease Cases 168 (91%) cases were belonging to Grade-1 variety , fourteen (8%) cases were of Grade –2 variety and only 2 (1%) Cases were belonging to Grade-3 variety (Graph-3)
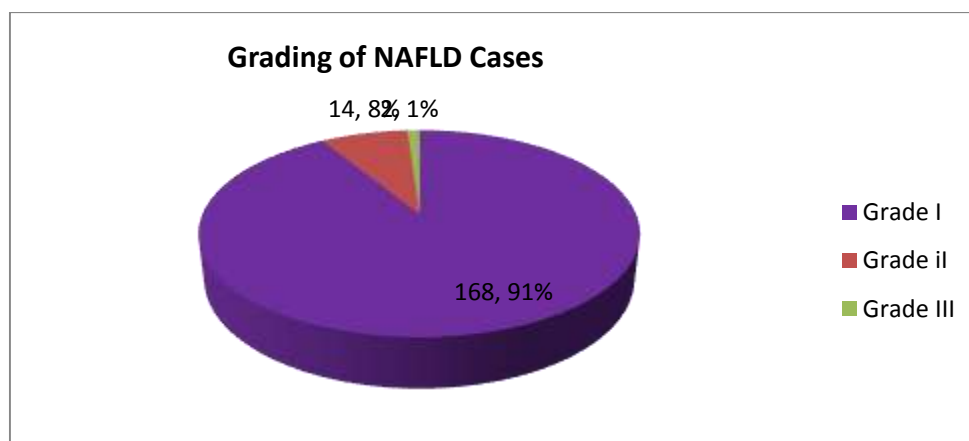
Graph-3: Grading of Non Alcoholic Fatty Liver Disease Cases (N=184)

According to Pearson correlation waist circumference correlated with Body mass index with p value <0.05 and r value of 0.466 and it was shown significant positive correlation. Waist to Hip ratio showed a negative correlation with body mass Index and no significant (P>0.05) association among those variables (Table-3).

Table-3: association between BMI and Waist circumference

N=184	Body Mass Index (BMI)	
	r value	P value
Waist Circumference	0.466	<0.05
Waist to Hip Ratio	-0.029	>0.05

It was observed that proportion of pre obesity cases were high in males (42.25%) in comparison with the females (38.09%), where as proportion of obesity Grade-1 patients among females were found to be higher 33.3% in comparison with the male (20.04%) patients. No significant association was found between different grades of obesity and sex of the patients (P=0.311) (Table- 4).

rades of Obesity as per BMI

		Sex		Total
		Females	Males	
OBESITY	Normal	7(16.6%)	37 (26.05%)	44 (23.9%)
TYPE	Obesity Grade-I	14(33.3%)	29(20.04%)	43 (23.36%)
	Obesity Grade-II	5(11.25%)	13(9.1%)	18 (9.8%)
	Obesity Grade-III	0(0)	3(2.11%)	3 (1.63%)
	PreObesity	16(38.09%)	60(42.25%)	76 (41.3%0
	Total	42	142	184
Chi Square Value: 4.781, df=4 P=0.311				

There are several risk factors associated with the fatty liver disease. It was found that out of total cases 13 (16.8%) patients have been suffering with hypertension, 62 (33.69%) cases were with Type 2 Diabetes Mellitus and 70 (42.9%) cases were suffering with Obesity. It was also noticed that 43 (23.36%) cases were having hyperlipidemia and 14 (7.6%) cases have been suffered with a hypothyroidism (Table-5).

Table-5: Risk Factors associated with Fatty Liver disease

S.No	Risk Factor	N=184	Percentage
1	Hypertension	31	16.8%
2	Type2 Diabetes mellitus	62	33.69%
3	Obesity	70	42.9%
4	Hyper lipidemia	43	23.36%
5	hypothyroidism	14	7.6%

Statistically significant association was observed between normal, increased, high, very high and extremely high categories of waist circumference and different grades of obesity among fatty liver cases (P value <0.05) (Table-6).

Table-6: Association between Waist circumference and Obesity among Fatty Liver cases

Type	Waist Circumference Classification					
	Extremely High	Very High	High	Increased	Normal	Total
Normal	0	0	0	4	40	44
Obesity Grade-I	0	21	21	1	0	43
Obesity Grade-II	0	14	4	0	0	18
Obesity Grade-III	3	0	0	0	0	3
Pre Obesity	0	2	15	58	1	76
Total	3	37	40	63	41	184
Chi –Square Value: 421.64 df=20 P<0.5						

DISCUSSION

Lifestyle and dietary changes can result in alteration of body mass index and which in turn leads to development of NAFLD in the population. NAFLD is the third most common cause of chronic liver disease (20%), after alcoholic liver disease (40%) and chronic viral hepatitis (38%). Obesity was the most frequent risk factor to NAFLD, affecting 40% of the cases [14]. The prevalence of NAFLD is estimated to be 15%-20% in the general Asian population, one

population-based study on adults in northern Iran revealed that incidence of NAFLD was almost 44%. [15] Normal BMI (18.5–24.9 kg/m2) was associated with a 2-fold increased risk of NAFLD than in those with a BMI <18.5 kg/m2 [16].

In our study it was observed that out of total 184 NAFLD cases 142 (77.1%) were males and 42 (22.9%) were females. Mean value of body mass index was observed to be high in male patients 32.05±4.807 in comparison with the female patients. Waist circumference is almost same in both males and females and the values are 95.21±11.17 cms , 95.11±11.38 cms respectively. Research study conducted by G Li etal found that NAFLD group had significantly larger proportion of males (63.6%) and the mean body mass index (BMI) was 23.7 ± 3.3 kg /m2, and the mean of waist circumferences (WC) was 79.9 ± 10.1 c m [17]. It was high in both males and females of our study.

Body mass index and WC have been considered as predictors of NAFLD severity [18] and these patients had significantly higher body mass index (BMI). The present study also supports all the previous studies and found that people with BMI >25 have higher risk for development of NAFLD with 66.9% in comparison with normal people with risk of 33.1%. A study conducted by Pan JJ etal found that NAFLD increased linearly with increasing BMI such that risk of NAFLD diagnosis was approximately 5- to 9-fold higher at BMI of 30–32.5 kg/m^2 rising to around 10- to 14-fold higher at BMIs of 37.5–40 kg/m^{2}compared with patients with BMI 20–22.5 kg/m^2 [19].

As per Omagari K, et al study, waist circumference (WC) was considered to be more physiologically valid indicator of obesity-related liver disease rather than BMI. Growing evidence suggests that the body fat distribution may be even more important than the grade of obesity as determined by the BMI in the relationship between body weight and potential liver damage) [20] . Several metabolic disorders are associated with nonalcoholic fat liver disease (NAFLD) characterized by accumulation of fat in the hepatocyte. [21] In our study it was observed that Waist circumference was found to be normal in 22.3% of NAFLD cases and 34.23% cases were under increased category. It was observed that 21.73% cases were comes under high risk classification and 20.1% cases were classified as very high risk classification Another similar study by Marchesini et al., 2003 reported that WC increased in 44% among NAFLD patients [22].

In our study according to Pearson correlation waist circumference correlated with Body mass index and it was found association was significant with r value of 0.466 waist to hip ratio showed a negative correlation with body mass index and no significant (P>0.05) association. Similar findings were noticed in the research study conducted in Nigeria [23]. Statistically significant association was observed between normal, increased, high, very high and extremely

high categories of waist circumference and different grades of obesity among fatty liver cases (P value <0.05) was also observed in our study.

The measure of WC is considered a new risk factor for metabolic syndrome, with advantages for the diagnosis and follow-up of the treatment in NAFLD patients [24].. The WC is considered more sensitive to metabolic alterations than the simple increase in body weight measured by BMI [25] Another study found that the increased WC and body mass index (BMI) were associated with a significant higher risk of insulin resistance and NAFLD in healthy Koreans adults .[26] It was found in our study that out of total 184 NAFLD cases 62 (33.69%) cases were with Type 2 Diabetes Mellitus. The prevalence of NAFLD in the globe is increased among type 2 diabetes mellitus (70%) [27] , where as in Asian continent , prevalence of NAFLD has been found in the range of 15% to 30% in the general population and over 50% in patients with diabetes patients [28]

It was also noticed that 14 (7.6%) cases have been suffered with a hypothyroidism , where as the prevalence of hypothyroidism in the united states is 3.7% as observed in the National Health and Nutritional Examination Survey conducted between 1999 and 2002 [29]. It was also observed that 13 (16.8%) patients have been suffering with hypertension, whereas study conducted by Dixon JB etal revealed that approximately 70% of patients with NAFLD have hypertension [30]. In combined Grade I, II and III were found to be 42.9% among the total NAFLD cases and 43 (23.36%) cases were having hyperlipidemia. Previous studies of NAFLD noted that prevalence in obesity 30-100%, hyperlipidemia 20-92%, respectively [31]

CONCLUSION

Significant association noticed between type 2 Diabetes Mellitus and Obesity of non alcoholic Fatty Liver disease patients. Waist circumference was found to be useful indicator for obesity with NAFLD patients in comparison with the waist to hip ratio. Significant association was not found between different grades of obesity and sex of the patients. It was found in our study that out of total NAFLD cases 33.69% were with Type 2 Diabetes Mellitus.. This is likely to occur as a result of its being a key factor associated with insulin resistance in naturally occurring conditions in humans. Strategies need to be planned to train health care workers and teachers about measuring the waist circumference and the body mass index and also their interpretation. Schools are potentially attractive settings in which students spend large amounts of time in the school environment. During school health programme students need to educate about the importance of pre obesity, obesity, metabolic syndrome and relation with nonalcoholic fatty liver disease. Further studies will be required to find out the best specific strategies and interventions by which we can reduce the morbidly and mortality metabolic syndrome and associated co morbidities.

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