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RESEARCH ARTICLE

FREQUENCY OF NAFLD IN BANGLADESHI SUBJECTS WITH METABOLIC SYNDROME AND ITS ASSOCIATION WITH COMPONENTS OF METABOLIC SYNDROME

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ABSTRACT

Objective: Nonalcoholic fatty liver disease (NAFLD) is considered as the principal cause of chronic elevated liver enzymes. The components of metabolic syndrome are found to be significantly associated with NAFLD. The study was carried out to determine association between nonalcoholic fatty liver diseases and components of metabolic syndrome.

Methods: This cross sectional observational study was conducted with ethical permission, between April 2015- September 2015, among randomly collected 203 Bangladeshi subjects with Metabolic Syndrome, aged >18 years, who visited Out Patient Department (OPD) of MARKS Medical College & Hospital, Dhaka. In the study, Adult treatment Panel (ATP) III criteria was used to diagnose metabolic syndrome and 4D abdominal ultrasonography were performed to detect fatty infiltration in the liver. Data were collected in pre-formed record form, analyzed with SSPS for Windows version 16.

Results: Presences of NAFLD among subjects with metabolic syndrome were evaluated by abdominal 4D ultrasonography. Frequency of NAFLD was 26.60%. Women had more NAFLD (55.55%) than men. Men were more overweight than female and female were more obese than male [p0.023]. Waist-hip ratio (WHR) were more in subjects with NAFLD [0.96±0.02 vs 0.94±0.04, p0.001) and High Density Lipoprotein (HDL) cholesterol were significantly less in subjects with NAFLD (36.97±3.52 vs 40.93±6.89, p0.002) than subjects with non-NAFLD.

Conclusion: The components of metabolic syndrome are found to be closely linked with NAFLD. In this study, high WHR and low HDL cholesterol were significantly associated with NAFLD.

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INTRODUCTION

Nonalcoholic fatty liver encompasses a wide spectrum of fat induced liver injury, ranging from relatively benign steatosis to cirrhosis and liver failure. It is a condition in which there is deposition of fat especially triglycerides in the liver cells. This condition is causing increasing alarm in healthcare because of its marked prevalence. (Chitturi *et al*., 2004) The prevalence of NAFLD has been estimated in 2.8% to 88%, depending on population and investigative methods (Angulo, 2007; Bedogni *et al*., 2005; Browning *et al*., 2004; Clark *et al*., 2003; Clark, 2006; Jimba *et al*., 2005).

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Available data from clinical, experimental and epidemiological studies describe the NAFLD as the hepatic manifestation of metabolic syndrome (MS) (Marchesini *et al*., 2001). Main risk factors associated with metabolic syndrome are abdominal obesity, insulin resistance, diabetes and dyslipidemia (Rivera, 2008). The relationship between NAFLD and metabolic syndrome is becoming increasingly recognized. Approximately 90% of patients with NAFLD have ≥1 characteristic feature of metabolic syndrome and about 33% have the complete diagnosis. (Marcherini *et al*., 2003) Numerous studies have demonstrated that obesity, type-2 diabetes, dyslipidemia, hypertension and insulin resistance components of metabolic syndrome are strongly associated with NAFLD (Marcherini *et al*., 2003). The present study was carried out to determine the extent nonalcoholic fatty liver diseases among metabolic syndrome.

Table 1. Demographic, Clinical and Biochemical Features of Subjects (n=203) with Metabolic Syndrome

	Male [N= 71(34.97%)]	Female [N= 132 (65.02%)]	P value
Age (Mean ±SD)	52.15±1.05	48.53±1.04	.020
Height(cm)	1.64±.06	1.54±.07	.000
Weight(kg)	66.78±9.11	64.54±1.05	.131
BMI(kg/m2)	24.85±3.28	26.84±4.36	.001
Overweight (%)[BMI]	46.47	35.60	.023
Obesity (%)[BMI]	8.48	25.75	.023
WC(cm)	88.50±8.31	92.22±1.28	.029
HC(cm)	91.02±9.07	95.51±1.09	.003
WHR	0.95±.02	0.95±.04	.151
SBP(mmHg)	135.92±1.22	138.18±9.05	.842
DBP(mm Hg)	83.09±7.62	85.25±9.05	.089
T. Cholesterol (mg/dl)	193.14±4.34	179.20±4.08	.025
HDL(mg/dl)	36.97±3.52	40.93±6.89	.000
LDL(mg/dl)	120.41±3.47	116.66±3.12	.435
TG(mg/dl)	191.70±6.25	170.07±6.29	.020
FPG(mmol/L)	6.71±1.96	6.12±1.98	.042

N.B.: Among 203 subjects having metabolic syndrome, 71(34.97%) were male and 132 (65.02%) were female. BMI (kg/m^2), WC, HC, HDL were significantly more in female subjects. Total cholesterol, TG and FPG were significantly more among male subjects. As per BMI criteria, male were more overweight than female and female were more obese than male [p0.023].

Table 2. Frequency of NAFLD According to 4 D Ultrasonography Findings

Subjects	NAFLD N (%)	Non-NAFLD N (%)	P value
Male	24 (44.44)	47 (31.54)	.063
Female	30 (55.55)	102 (58.45)	
Total	54 (26.60)	149 (73.39)	

N.B.: 54 (26.6%) subjects had NAFLD in 4D ultrasonography

Table 3. Relationship of demography, clinical and biochemical features of metabolic syndrome among NAFLD and non NAFLD subjects

	NAFLD [N=54 (26.60%)]	Non-NAFLD [N=149 (73.39%)]	p- value
Age(Mean ±SD)	46.59±1.08	50.95±1.02	.009
Height(m)	1.59±0.09	1.57±0.08	.258
Weight(kg)	65.05±1.08	65.42±9.81	.816
BMI(Kg/m2)	25.71±4.61	26.30±3.93	.367
Overweight (%)	40.7	38.93	.843
Obesity (%)	16.7	20.8	.843
WC(cm)	88.09±8.08	91.95±1.25	.036
HC(cm)	90.16±8.10	95.31±1.09	.002
WHR	0.96±0.02	0.94±0.04	.001
SBP(mm Hg)	130.89±1.31	140.03±8.94	.418
DBP(mm Hg)	83.05±1.09	85.02±7.60	.151
T. Cholesterol (mg/dl)	192.80±4.16	180.92±4.21	.076
HDL(mg/dl)	37.31±4.32	40.36±6.61	.002
LDL(mg/dl)	114.17±3.13	119.35±3.28	.317
TG(mg/dl)	189.83±8.18	173.21±5.50	.100
FPG(mmol/L)	5.97±1.96	6.45±1.98	.128

N.B.: WHR were more in subjects with NAFLD (p0.001) and HDL cholesterol were significantly less in subjects with NAFLD (p0.002).

MATERIALS AND METHODS

This cross sectional observational study was conducted with ethical permission, between April 2015- September 2015, among randomly sampled 203 Bangladeshi subjects [male=71(34.97%), female=132 (65.02%)], aged >18 years, having metabolic syndrome, who visited OPD of MARKS Medical College & Hospital, Dhaka. In our study Adult treatment Panel III (ATP III) (Després and Lemieux, 2006; Grundy, 2004) criteria was used to diagnose metabolic syndrome and according to that, patients having 3 or more of the following five components, i.e.; (1) fasting plasma glucose ≥110mg/dl or known type-2 diabetes, (2) abdominal/ central obesity; increased waist circumference (≥ 80cm in females and ≥90cm in males), (3) hyper-triglyceredemia (serum triglyceride ≥150 mg/dl), (4) low high density lipoprotein (HDL) cholesterol (≤40 for men's and ≤50 for women's), (5) increased blood pressure (systolic ≥ 130mm/Hg and diastolic ≥ 85 mg/Hg), were labeled to have the metabolic syndrome. Those having history of alcohol intake, acute or chronic liver disease, kyphosis, scoliosis, severe co-morbid conditions were excluded. According to WHO criteria, BMI ≥ 25 and ≥30 were the indicator of overweight & obesity respectively (WHO, 1995). Waist circumference (WC) measurement was performed with the patient in a standing position with abdomen relaxed, arms at the sides, and feet together, using a non extensible tape measure. The tape involved the individual in the largest abdominal diameter.

The measurement was carried out at the completion of the patient's normal expiration. WC ≥90 cm (male) and ≥80 cm (female) defined abdominal obesity (Lee *et al*., 2008). Hip circumference was measured over light clothing at the widest point over the buttocks when viewed from the side. Waist hip ratio was obtained by dividing the waist circumference by hip circumference. (WHO, 1998) Fasting lipid profile i.e.; total cholesterol, serum triglyceride (TG), high density lipoprotein (HDL), low density lipoprotein (LDL) cholesterol and fasting plasma glucose (FPG) level were measured. 4D Abdominal ultrasonography was performed to detect the presence of fatty infiltration in the liver. Primary outcome included Waist circumference (WC), hip circumference (HC), waist hip ratio (WHR), body mass index (BMI), blood pressure, fasting plasma glucose, fasting TG, HDL, fatty liver. With written informed consent, data were collected in pre-formed record form and analyzed with SSPS for Windows version 16.

RESULTS

A total of 203 subjects having metabolic syndrome were studied in this analysis and among them female [132 (65.02%)] subjects were more than male [71(34.97%)]. The demographic pattern & characteristics features of metabolic syndrome both clinical and biochemically were studied *[Table-1]*. BMI (kg/m^2), WC, HC, HDL were significantly more in female subjects. Total cholesterol, TG and FPG were significantly more among male subjects. As per BMI criteria, 35.6% female and 46.47% male were overweight [p0.023] and 25.75% female and 8.48% male were obese [p0.023]. Frequencies of fatty liver disease among studied subjects are shown in Table 2. Among studied subjects, 54 (26.6%, male=44.44%, female=55.55%) had NAFLD in 4D ultrasonography.

Relationship between demographic, clinical & biochemical features of subjects with metabolic syndrome in patients with NAFLD and non-NAFLD.

In the analysis stratified by demographic, clinical & biochemical features of subjects with metabolic syndrome were compared between subjects with NAFLD and non- NAFLD *[Table 3]*. Age as mean was more among subjects with non-NAFLD (p0.009). BMI was not significantly different among subjects (p0.36). WHR were more and subjects with NAFLD (p0.001) and HDL cholesterol were significantly less in subjects with NAFLD when compared with subjects with non-NAFLD (p0.002).

DISCUSSION

Nonalcoholic liver disease is considered the principal cause of chronic elevated liver enzymes with an increasing prevalence due to the association with overweight, dyslipidemia and diabetes. In a study, estimated prevalence of NAFLD in Western and Asian regions was 3% -20% (Angulo, 2002). In our study, the frequency of NAFLD among metabolic subjects was 26.60 %. Obesity is the most common entity associated with NAFLD and a significant risk factor for the development of fatty liver and is also predictive for the presence of fibrosis (Festi *et al*., 2004). Many epidemiological studies demonstrated a strong correlation between body mass index and the presence of fatty liver diagnosed by ultrasonography. 30 to 100% of patients diagnosed with NAFLD are obese (Angulo, 2002), in obese persons 76% have NAFLD compare with 16% in normal weight persons (Adams and Angulo, 2005). The prevalence of obesity in the patients with nonalcoholic fatty liver disease range from 30 to 100% (Ludwig *et al*., 1980). In our study, among patient presented with NAFLD 40.7 % were overweight and 16.7% were obese. As per WC, subjects having NAFLD had mean±SD:88.09±8.08. Type 2 diabetes is associated with NAFLD from 10 to 75% (Angulo, 2002). The results of a study (Kotronen *et al*., 2008) on 70 diabetic patients and 70 non-diabetic subjects show that type 2 diabetic patients had 80% more liver fat and 16% more intra-abdominal fat than the nondiabetic subjects at any value of BMI and waist circumference. Fasting plasma glucose, triglycerides, HDL cholesterol were correlated with fatty liver. Bedgoni *et al*. in a study on a representative sample of the general population demonstrated that NAFLD was associated with systolic hypertension (Bedogni, 2005). The presence of dyslipidemia (hypercholesterolemia, hypertriglyceridemia, or both) defined by the National Institute of Health (NIH) (NCEP, 2002) was reported in 20% to 80% cases associated with NAFLD (Baskin *et al*., 2005; Diehl *et al*., 1988; Loria *et al*., 2009). In our study, high WHR and low HDL level are strongly associated with NAFLD (p=0.001 & p=.002 respectively).

Conclusion

One of the limitations in the present study is that the diagnosis of fatty liver was based on ultrasound imaging, which was not confirmed by liver biopsy which is the gold standard for the assessment of liver histology and a key test to diagnose NAFLD. Present study found high WHR and low HDL cholesterol as significant association with NAFLD.

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