The Effect of Weight Reduction on Ultrasonographic Findings of Nonalcoholic Fatty Liver

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ABSTRACT

BACKGROUND

Non-alcoholic fatty liver (NAFL) includes a spectrum of diseases ranging from simple hepatic steatosis to nonalcoholic steatohepatitis (NASH) and cirrhosis. NAFL is typically seen in association with obesity, diabetes and hypertriglyceridaemia. In order to seek the role of diet therapy in treatment of NAFL, we compared the ultrasonographic findings of patients with fatty liver disease before and after standard diet therapy.

METHODS

Twenty-three overweight or obese subjects with incidental fatty liver discovered during ultrasonography were included. Subjects underwent 3 months of diet therapy, and anthropometric data including weight, height, BMI, waist circumference, and hip circumference were measured. Ultrasonographic findings were graded from 0 to 3. Changes in ultrasonographic findings and anthropometric data were studied.

RESULTS

After three months of dieting, the ultrasonographic grade of all patients decreased by one or two grades. Fifteen patients decreased one grade while 8 others decreased by 2 grades. We observed a significant correlation between the decrease in ultrasonographic grade and the decrease in weight and BMI.

CONCLUSION

Our study indicates that standard diet therapy could be used as an effective treatment for NAFL patients.

KEYWORDS

Weight; Ultrasonography; Nonalcoholic fatty liver

INTRODUCTION

Nonalcoholic fatty liver disease (NAFL) is a term applied to the accumulation of fat in the liver in the absence of alcohol consumption.[1] NAFL refers to a wide spectrum of liver damage ranging from simple steatosis to non-alcoholic steatohepatitis (NASH) to advanced fibrosis and finally, cirrhosis.

The clinical significance of NAFL is derived mostly from its high prevalence in the general population and in its possible progression to liver failure.[2,3]

Obesity, type 2 diabetes mellitus and hyperlipidemia are the

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major risk factors associated with NAFL. A bulk of evidence suggests that insulin resistance plays a major role in the pathogenesis of NAFL and NASH.[3-7]

Most patients with fatty liver disease are asymptomatic. However with meticulous questioning, more than half would mention fatigue, right upper quadrant pain and occasional discomfort, although the significance of these symptoms is uncertain[3-5,8] Most cases initially come to medical attention by the incidental finding of increased liver echogenicity during ultrasonography performed for other reasons.

Ultrasonography could be used as a non-invasive predictor of liver histology in both moderate and severe steatosis, and advanced fibrosis with acceptable sensitivity and specificity.[9,10]

A universally accepted medical treatment is lacking for NAFL. Even the need for treatment is doubted. Nevertheless, gradual and sustained weight reduction and exercise are most frequently recommended for overweight NAFL patients.

Weight reduction can not only improve symptoms, but also the risk of progression of NAFL to cirrhosis.[3,6,8,11-20]

In the present study we compare the effect of a weight reduction diet on liver ultrasonographic findings in overweight NAFL patients. To our knowledge, only one study has thus far researched weight reduction in NAFL adults.[21]

MATERIALS AND METHODS

From July 2003 to December 2005 all patients incidentally found to have fatty liver by ultrasonography who referred to radiology and gastroenterology clinics were included.

Fasting blood sugar (FBS), and liver transaminase were checked for all patients. Anthropometric data including weight, height, waist and hip circumference were recorded.

Waist circumference was measured using a measuring tap placed in a horizontal plane around the abdomen at the level of the iliac creast.

The measurement was made at the end of expiration. Hip circumference was measured similarly at the level of hip bone.

Patients with body mass index (BMI) above 25 and of the ages 16 to 60 were included in the study. Exclusion criteria are given in Table 1.

Patients not consenting to the study or not able to refer for regular follow-up were also excluded.

Table 1: Exclusion criteria.

Overt diabetes (FBS >125 mg/dL)
Abnormal AST or ALT (>40 IU/dL)
Chronic medical condition (e.g., renal, cardiac)
Use of drugs known to cause fatty liver in the recent three months
Alcohol consumption >40 gr/week
Not consenting to the study

The degree of steatosis was graded by ultrasonography from 0 to 3 according to Table 2.[22] All subjects were placed on a standard low calorie diet for three months.

Table 2: Ultrasonographic fatty liver grades.

Grade 0	Normal parenchymal liver ecogenicity
Grade 1	Increased liver echogenicity without haziness of vessel walls
Grade 2	Increased liver echogenicity with haziness of vessel walls
Grade 3	Increased liver echogenicity leading to loss of normal contrast between liver and diaphragm

The diet contained 50 percent carbohydrates, 30 percent fat and 20 percent protein given in three meals with a deficit of 500 calories planned to ideally reduce weight by 2 kg per month. Patients were followed monthly by a nutritionist.

At the end of month three, anthropometric data were recorded and ultrasonography repeated by the same radiologist.

Anthropometric and ultrasonographic measures before and after dieting were compared using student's paired t-test by SPSS version 14.

The study protocol was approved by the Institutional Review Board and Ethics Committee of the Digestive Disease Research Center (DDRC) of Tehran University of Medical Sciences (TUMS).

RESULTS

In this study, 23 patients (13 females, 10 males) were enrolled. Changes in anthropometric data are given in Table 3.

Table 3: Changes in anthropometric data before and after diet.

	Before diet	After diet	*p*-value
Weight (kg, Mean ± SD)	83.7 ± 12.2	75.1 ± 10.9	<0.001
BMI (kg/m², Mean ± SD)	30.0 ± 2.9	26.9 ± 2.9	<0.001
Waist circumference (cm, Mean±SD)	99.4 ± 7.4	90.4 ± 6.7	<0.001
Hip circumference (cm, Mean±SD)	108.7 ± 9.3	101.9 ± 8.4	<0.001

The decrease in weight, BMI, waist circumference and hip circumference were statistically significant. The ultrasonographic grade decreased in all patients; eight had a two grade reduction and 15 patients reduced one grade (Table 4).

Table 4: The ultrasonographic grade of steatosis before and after diet.

	Final sonography		Total
Initial sonography	Grade 0	Grade 1	
Grade 1	9	0	9
Grade 2	2	6	8
Grade 3	0	6	6
Total	11	12	23

The decrease in ultrasonographic grade had a significant correlation with decrease in weight and BMI, but not with changes in waist and hip circumferences (Table 5).

The amount of decrease in weight and BMI was significantly greater in patients whose ultrasonographic grades improved by two scores when compared to patients who only had a one score improvement.

Such significance was not observed for waist and hip circumferences. Men had a significantly greater weight loss ($p<0.01$), but changes in ultrasonographic grade, BMI, waist circumference and hip circumference were not significantly different among the two sexes.

Table 5: Changes in anthropometric data by decrease in ultrasonographic grade.

	One grade decrease (Mean±SD)	Two grade decrease (Mean±SD)	*p*-value
Weight loss (Kg)	7.0 ± 2.4	11.4 ± 5.2	0.009
BMI loss (Kg/m²)	2.6 ± 0.8	3.8 ± 1.5	0.017
Waist circ. loss (cm)	8.2 ± 3.9	10.0 ± 6.0	0.393
Hip circ. loss (cm)	6.6 ± 3.2	7.0 ± 4.2	0.799

DISCUSSION

The treatment of NAFL is controversial and even the necessity of treatment is doubted when there is no indication of liver damage. Even in NASH, where liver damage is well documented, there is no universally accepted treatment. When treatment is instituted, evaluation of treatment response is usually through transaminase levels or liver histology.[1, 23, 24]

In NAFL patients, where the transaminase levels are normal to begin with, histology is the only guide to treatment. But liver biopsy is a fairly invasive procedure and is difficult to justify in subjects with normal liver transaminase levels where the prognosis is generally considered to be very good. In such cases another non-invasive method, such as ultrasonography, could be a good substitute.

In this study we observed a significant improvement in ultrasonographic features of NAFL by a low calorie diet. Unfortunately, we did not have histologic confirmation but we believe it is safe to assume that improvement in histology parallels improvement in ultrasonography.[20,21]

Ultrasonography has an acceptable sensitivity and specificity in evaluating liver steatosis and provides a non-invasive predictor of liver histology and degree of steatosis in NAFL patients.[9,10]

How much weight loss is required to reverse steatosis is another area of controversy. Based on the current study, we suggest ultrasonography as a guide to weight loss.

We also observed that patients with a higher initial ultrasonographic grade had greater improvement. It can be concluded that more severe cases will respond better to weight loss.

In our study, the diet was designed with a modest calorie deficit aiming at a maximum weight loss of 2 kg per month. The gradual weight loss is important as rapid and severe weight loss, starvation, or even total parenteral nutrition, could result in or perpetuate fatty liver disease 3-5. Although slightly more rapid weight loss might also be safe, a modest diet would result in better patient compliance.

As mentioned above, the necessity of treatment for non-complicated NAFL with no indication of liver injury is in doubt. But considering the safety and other obvious benefits of gradual weight loss, we believe it should be offered to all overweight cases of NAFL. Ultrasonogaphy can be used to follow the progress of treatment.

We conclude that weight loss is effective in improving the ultrasonographinc grade of steatosis and ultrasonography may be used as a non-invasive indicator of improvement of liver steatosis in patients with NAFL during weight reduction.

CONFLICT OF INTEREST

None declared.

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