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Comparison of Diet Records between Patients with Non-alcoholic Fatty Liver Disease and Controls

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ABSTRACT

Introduction: Non-alcoholic fatty liver disease (NAFLD) is considered to be a severe health threat across the world, the prevalence of which has significantly increased in recent years. Considering the role of diet in the pathogenesis of NAFLD, the present study aimed to evaluate and compare the dietary intakes of patients with NAFLD with healthy subjects.

Methods: This case-control study was conducted on 120 participants aged more than 18 years. The case group included 60 patients who were diagnosed with NAFLD based on Fibroscan assessment. The diet records of the subjects were analyzed using a three-day dietary record questionnaire.

Results: After modulation based on energy intake, the total intakes of energy, fiber, vitamin D, and vitamin E were significantly lower in the patients with NAFLD compared to the control group. In addition, the level of trans-fatty acids after energy adjustment was significantly higher in NAFLD patients compared to the controls. However, analysis after the energy adjustment indicated no significant difference between the case and control groups in terms of protein, carbohydrate, saturated fatty acid, monounsaturated fatty acid, and polyunsaturated fatty acid intakes.

Conclusion: According to the results, the diet records of the patients with NAFLD and healthy subjects differed in terms of the intakes of energy, fiber, trans-fatty acids, vitamin D, and vitamin E. Therefore, special attention must be paid to the dietary patterns of these individuals in order to improve their lifestyle and prevent the occurrence and progression of NAFLD.

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Introduction

Non-alcoholic fatty liver disease (NAFLD) is characterized by the accumulation of fats in the liver. The prevalence of NAFLD has been reported to be on the rise across the world (1). According to the literature, 20-30% of the adult population (2, 3) and 10% of children and adolescents (1) are affected by NAFLD. NAFLD involves changes ranging from simple steatosis to non-alcoholic steatohepatitis, followed by fibrosis and cirrhosis in the absence of chronic alcohol consumption (4).

NAFLD is a multifactorial disease with several risk factors, including male gender, metabolic syndrome, obesity, prolonged starvation, total parenteral nutrition, polycystic ovarian syndrome, insulin resistance, type II diabetes mellitus, dyslipidemia, sleep apnea syndrome, and genetic susceptibility (5). The majority of the patients with NAFLD are asymptomatic, while the symptomatic patients mainly have non-specific manifestations (e.g., right upper-quadrant pain, fatigue, and malaise) (5). In addition, the laboratory results of these patients may be normal.

Liver biopsy is considered to be the 'gold standard' method for the diagnosis of NAFLD. Nevertheless, steatosis could be identified using non-invasive diagnostic methods, such as transient elastography (fibroscan) (6). Dietary

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and lifestyle modifications are widely recognized as effective therapeutic approaches to the treatment of NAFLD (7).

Considering the key role of diet in the pathogenesis of NAFLD, the present study aimed to evaluate and compare the dietary intakes of patients with NAFLD with healthy subjects.

Materials and Methods

This case-control study was conducted on 120 patients with NAFLD aged more than 18 years, who referred to a nutrition clinic. The participants were selected via simple random sampling. Written informed consent was obtained from all the selected subjects prior to participation, and the study protocol was approved by the Ethics Committee of Mashhad University of Medical Sciences, Iran.

None of the participants were pregnant, and they were all serologically negative for viral hepatitis B and C. In addition, none of the participants had autoimmune/congenital liver diseases or cancer. Anthropometric measurements were performed in suit settings with a flexible ribbon tape with the accuracy of 0.01 meter, and the body weight of the patients was measured using a digital scale (SECA 704, made in Germany) with the accuracy of 100 grams and recorded in kilograms. The height of the patients was measured in a standing position with elevated shoulders and in inspiration using a wall tape and recorded in centimeters. In addition, body mass index (BMI) was calculated by dividing the weight (kg) by the square of height (m).

After 12 hours of overnight fasting, 10 cc of blood was collected from the subjects, and the serum was separated using the Selectra autoanalyzer. The blood samples were placed in potassium-EDTA tubes and centrifuged at 3,000 rpm for 15 minutes. Liver function tests were also carried out to measure several variables, including alanine aminotransferase (ALT), aspartate aminotransferase (AST), gamma-glutamyl transpeptidase, fasting blood sugar (FBS), total cholesterol, and triglyceride (TG).

After three hours of fasting and removing the magnetic and electronic devices, each patient was examined for liver steatosis via fibroscan using the Echosens 504 device. Dietary data were obtained using three-day dietary records. The eligible patients were instructed to complete the three-day dietary records consecutively. The intake of various nutrients and foods were calculated based on Iranian household measures. Afterwards, each food item was converted into an energy value, and the other nutrients were analyzed using the Nutritionist IV software (N-Squared Computing, Salem, OR, USA). The calculated energy intakes that were not within the normal range (800-4,200 kcal/day) were excluded from further evaluation.

Statistical Analysis

Data analysis was performed in SPSS version 16.0 (SPSS, Inc., Chicago, IL, USA), and the normal distribution of the continuous variables was assessed using the Kolmogorov-Smirnov test. In addition, independent samples t-test was applied for the data with normal distribution, and Mann-Whitney U test was used for the data with non-normal distribution. In all the statistical analyses, P-value of less than 0.05 was considered significant.

Results

The general characteristics of the subjects are presented in Table 1. The mean age of the subjects in the case and control groups was 43.39±12.34 and 37.23±13.46 years, respectively (P<0.05). No significant differences were observed between the groups in terms of body weight, height, and BMI. According to the results of laboratory tests, only FBS was significantly higher in the patients with NAFLD compared to the controls (P=0.009).

Table 1. General Characteristics of NAFLD Patients and Control Group

Variables	Control	Case	P-value
Age (year)	37.23±13.46	43.39±12.34	0.009
Weight (kg)	80.01±26.81	79.5±13.59	0.89
Height (cm)	166.18±10.71	167.1±9.93	0.62
Body Mass Index (kg/m^2)	28.80±8.79	28.45±4.00	0.77
Fasting Blood Sugar (mg/dl)	90.02±19.11	99.48±19.11	0.009
Triglyceride (mg/dl)	130.5±82.6	128.1±82.6	0.87
Total Cholesterol (mg/dl)	182.5±52.26	176±52.26	0.54

Alanine Aminotransferase (IU/dl)	27.02 (20.6-42.87)	23.68 (19.96-44.15)	0.69
Aspartate Aminotransferase (IU/dl)	23.37 (21.4-30.56)	22.38 (21.25-30.45)	0.61
Gamma-glutamyl Transferase (IU/dl)	26.49 (19.13-37.42)	29.65 (25.48-33.98)	0.26

According to the information in Table 2, the intakes of total energy, fiber, vitamin D, and vitamin E were significantly lower in the patients with NAFLD after modulation based on the energy intake compared to the control group. Moreover, the intake of trans-fatty acids after energy adjustment was significantly higher in the patients with NAFLD compared to the control group. After energy adjustment, the obtained results indicated no significant differences between the groups in terms of proteins, carbohydrates, saturated fatty acids (SFAs), monounsaturated fatty acids (MUFAs), and polyunsaturated fatty acids (PUFAs).

Table 2. Dietary Intakes of NAFLD Patients and Control Group

Dietary Intakes	Control	Case	P-value
Energy (kcal/day)	2132±662.0	1730±571.0	0.001
Protein (g/day)	66.5±14.04	65.43±14.04	0.69
Carbohydrate (g/day)	258.0±54.0	260.0±54.0	0.82
Fat (g/day)	60.1±20.28	57.42±20.28	0.48
SFAs (g/day)	23.84±9.9	22.64±9.9	0.51
TFAs (g/day)	1.92 (1.33-2.48)	2.23 (1.85-3.3)	0.02
MUFAs (g/day)	20.2±8.3	19.36±8.3	0.56
PUFAs (g/day)	10.7±8.26	10.14±8.26	0.71
Fiber (g/day)	12.56 (10.67-15.57)	10.65 (8.57-12.5)	<0.001
Vitamin D (mg/day)	91.7 (84.33-103.3)	84 (75.5-91.6)	0.001
Vitamin E (mg/day)	6.69 (5.5-8.63)	5.4 (4.1-67.1)	0.001

MUFAs: *monounsaturated fatty acids; PUFAs: polyunsaturated fatty acids; SFAs: saturated fatty acids; TFAs: trans-fatty acids*

Discussion

Given the importance of NAFLD and its burden, the nutritional status of NAFLD is essential in the examination of the patients. According to the results of the present study, the intakes of total energy, fiber, vitamin D, and vitamin E were significantly lower in the patients with NAFLD after modulation based on energy intake compared to the control group. Moreover, the amount of energy-adjusted trans-fatty acids was significantly higher in the patients with NAFLD compared to the controls. However, the analysis after energy adjustment indicated no significant differences in the proteins, carbohydrates, SFAs, MUFAs, and PUFAs between the case and control groups.

Similar studies have investigated the nutritional status of NAFLD patients, and the findings in this regard are mainly regional. Patients with NAFLD across the world have specific dietary regimens, which mainly depend on cultural and regional nutritional habits. Therefore, accurate findings could be obtained through the comparison of similar regions, followed by the comparison of these results with other countries.

Similar to the present study, another research conducted in Mashhad (Iran) aimed to evaluate and compare the nutritional status of NAFLD patients with normal controls (8). Consistent with our findings, the patients in the mentioned study had increased levels of FBS. On the other hand, the findings of Mosallaei et al. denoted that NAFLD patients had significantly higher levels of total cholesterol, TG, and low-density lipoprotein, as well as lower level of high-density lipoprotein. In addition, the levels of AST and ALT were reported to be significantly higher in the NAFLD patients compared to the controls. The difference in this regard was not considered statistically significant in the present study. The mentioned research was conducted on a larger sample size, and the obtained results demonstrated that the levels of vitamin A, folate, and fat intake were inversely correlated with NAFLD, and these patients had lower intakes of folate and vitamin E. This finding is in congruence with the study by Mosallaei et al. and the current research (8), highlighting the importance of attention to the proper intake of micronutrients in the dietary routine of NAFLD patients.

According to the findings of Mosallaei et al., adherence to a healthy diet could reduce the risk of NAFLD by 52%, while an unhealthy diet is associated with the two-fold increase in the risk of the disease (8). Another study in this regard was conducted by Hashemi et al. in Tehran (Iran), and the findings demonstrated that NAFLD patients had increased ALT, cholesterol, and other lipids, which is inconsistent with the results of the present study as our NAFLD patients showed no elevation in the level of FBS. Moreover, the results obtained by Hashemi et al. demonstrated no differences between NAFLD patients and controls in terms of fiber and vitamin D status (9).

In another research, Zelber et al. evaluated the nutritional status of a larger sample population (10), reporting no differences between NAFLD patients and controls in terms of the intakes of calories, fats, carbohydrates, proteins, and fiber. However, the intake of calories, fats, carbohydrates, and proteins was reported to be higher in female patients with NAFLD compared to the other female participants. Moreover, male NAFLD patients had higher calorie intake from protein compared to the male subjects without NAFLD.

In the present study, the case and control groups had no significant difference in terms of BMI, while Zelber et al. reported a significant difference in the BMI of the subjects with and without NAFLD. Furthermore, the findings of the mentioned study indicated that the patients with NAFLD had higher BMI (30 kg/m^2) compared to the subjects without NAFLD (25 kg/m^2). Among the other discrepancies between the current research and the study by Zelber et al. were the differences in gender, nationality, and sample size (10).

The mentioned research also highlighted the importance of nutritional habits based on regional effects. In addition, Zelber et al. reported that NAFLD patients were more likely to consume non-alcoholic beverages and meat and less likely to consume fish (source of omega-3) (10). Similarly, Yasutake et al. has associated the consumption of such beverages with the risk of NAFLD, denoting that the consumption of non-alcoholic beverages is twice more common in patients with NAFLD compared to normal individuals. Moreover, they reported that the consumption of complex carbohydrates (especially whole grains) could prevent NAFLD progression (11). In addition, the consumption of whole grains has been associated with the improvement of obesity, FBS, and cardiovascular events. On the other hand, the excessive consumption of fats and saturated fats has been associated with increased insulin resistance and development of NAFLD (11).

In the current research, deficiencies were observed in the nutritional status of the NAFLD patients, which must be properly considered in clinical practice. Other studies in this regard have also demonstrated that these patients may be deficient in other micronutrients, such as calcium, vitamin D, and pyridoxine (12). Such deficiencies are mostly due to nutritional diets, which have been addressed in the study by Ferolla et al. Accordingly, the Brazilian population were more likely to use fruits, diaries, and meals enriched with meat, fats, sugar, and grains (12).

Conclusion

The present study aimed to evaluate the dietary status of patients with NAFLD. According to the findings, the dietary record of the NAFLD patients differed with the healthy subjects in the control group. In addition, the differences in the intake of energy, fiber, trans-fatty acids, vitamin D, and vitamin E between the case and control groups emphasized on the fact that the dietary status of these patients requires special attention in order to control the course of NAFLD. Furthermore, lifestyle improvement could prevent and control NAFLD, along with the use of other therapeutic drug regimens.

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