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ORIGINAL ARTICLE

Too Many Calories, Refined Carbohydrates, and Saturated Fat Consumption Endow to Nonalcoholic Fatty Liver Disease in Pakistani Adults

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ABSTRACT

Background: Nonalcoholic Fatty Liver Disease (NAFLD) is one of the leading causes of liver disease worldwide. A healthy diet plays a significant role in the prevention of NAFLD. Few studies have been done in Pakistan to evaluate the dietary intake of patients suffering from NAFLD. This study aimed to look into the dietary intake of NAFLD patients being treated at a tertiary care hospital in Karachi, Pakistan

Objective: To determine the nutritional status of NAFLD patients.

Method: 118 NAFLD patients, aged 18 to 60, male and female, were enrolled. Patients with advanced liver or kidney failure, decompensated liver disease, hepatocellular carcinoma, acute flare, and chronic liver disease were excluded. This cross-sectional study used an interview-administered questionnaire to collect data on sociodemographic characteristics, anthropometric measurements, nutrition-related biochemical measurements, and dietary intake (24-hour diet recall and validated food frequency questionnaire). Data were analyzed using SPSS (VERSION) Statistics v26

RESULTS: Out of 118 subjects; 69% were female, Anthropometric data revealed that 41% were morbidly obese (BMI 29 >kg/m^2). The average daily calorie and protein intakes were 2135 kcal and 64.2 gm, respectively. Dietary recall indicates a high consumption of saturated fat foods including paratha (34%), cake (16.9%), pizza (17.8%), banaspati ghee (11%), and consumption of high glycemic fruits like Mango (42%) and dates (32.2%).

Practical implication: this study will benefit that healthy diet plays a significant role prevention of NAFLD,and can reduce the burden of obesity and its complication in later life. Low carbohydrate intake, limiting saturated fat and increased physical activity play a vital role in management of NAFLD

Conclusion: Participants with NAFLD had insufficient dietary patterns. This may be associated with lower consumption of fruits and vegetables, and increased intake of high saturated fat and glycemic index foods; behavioral strategies should be implemented to change this patient's overall dietary intake.

Keywords: Non Alcoholic Fatty Liver Disease, nutritional status, dietary intake, glycemic food

INTRODUCTION

The global prevalence of Non-Alcoholic Fatty liver disease (NAFLD) is approximately 25% in the general population [1]. The most prevalent chronic, progressive liver disease, NAFLD, starts with benign steatosis, a buildup of extra fat cells in the liver without any damage to the liver cells themselves. Steatohepatitis, is an inflammation of the liver's cells that impairs the organ's functionality and can result in cirrhosis and its side effects, liver failure, and hepatocellular carcinoma follows. [2, 3].

NAFLD has an unknown specific cause [4]. However, research indicates that unhealthy dietary patterns (rich in saturated fat and processed carbohydrates), inactivity, and diabetes are key risk factors [1, 4, 5]. In high and Low Middle-Income nations, NAFLD is recognized as a major public health issue because of the growth in obesity and diabetes. However, non-obese individuals make for roughly 40% of NAFLD cases worldwide [6].

Asia houses contain 60% of the world's population the region with the highest population density. In South Asia, Pakistan has the second-highest population density. Due to low literacy, poverty, and a lack of preventative healthcare, the country witnessed coexistent undernutrition, overnutrition, and infectious and chronic diseases, including NAFLD. few investigations have been done to determine the prevalence of NFLAD in Pakistan [6].

Literature review suggests that unhealthy lifestyles play a role in the development and progression of NAFLD. This includes eating a high-calorie diet, consuming excessive amounts of saturated fats, refined carbs, and beverages sweetened with sugar, exercising insufficiently, and smoking [7]. A balanced diet appropriate for one's stage of life can onset delay the onset of NAFLD [8]. Individualized dietary management is now the primary recommended management strategy for NAFLD because there are no FDA-approved pharmaceutical medications for the condition [9]. A balanced nutritious diet and regular physical activity continue to be the cornerstones of NAFLD treatment [10]. It is advised for NAFLD patients to participate in structured programs aiming at changing their lifestyles to include a nutritious diet and regular exercise. Lifestyle interventions for overweight or obese people with NAFLD aim to lose 7 to 10 percent of their body weight, improving liver enzymes and histology [11].

Dietary advice should be given to reduce high calories, sugary drinks, and processed foods, Resistance training, and aerobic exercise both successfully reduce liver fat. In order for patients' preferences to be upheld over the long run, counseling should be specifically chosen for them [11]. The aim of this study is to determine the nutritional status of NAFLD patients among the NAFLD Pakistani population. Our study is the first of its kind to look into the association between diet and NAFLD in the Pakistani population, to the best of our knowledge and understanding.

METHODOLOGY

Between May 2020 and January 2021, a cross-sectional study design was used to recruit 118 patients who were seeking treatment for NAFLD in a public tertiary care hospital in Karachi, Pakistan, a low-income South Asian country.

Ethics Review: the study was conducted according to the guidelines laid down in the Declaration of Helsinki involving human

subjects and received approval from the Ethics Review Committee for Written informed consent (Ref: IRB-1653/DUHS/Approval/2020).

Sample size and design: Patients were recruited according to a non-probability consecutive sampling design, which was calculated to be sufficient and allowed for an incremental 5% to account the for loss of follow-up and unwillingness to participate in the study

Inclusion criteria: The inclusion criteria for this study were male and female patients aged 18-65 years who had come to the outpatient department for the treatment of NAFLD.

Exclusion criteria: Patients with advanced liver or kidney failure, decompensated liver disease, hepatocellular carcinoma, acute flare, acute or chronic liver disease, pregnant and lactating women, patients with limited mobility, and those with mental health disorders were excluded.

Data collection: Registered dietitians gathered the data through a single self-structured questionnaire that was administered in either Sindhi or Urdu, depending on the participants' preferences and content validity was checked by the two senior faculty members. Each questionnaire took about 20 to 30 minutes to administer (after informed consent was provided by the participant). Socio-Demographics: Age, gender, education level, ethnicity, occupation, and health-related data were collected as baseline demographics. The data variables collected are listed below.

Anthropometrics. To determine BMI, both weight and height measurements were taken. Weights were measured using an electronic platform (Tanita) on a dummy weighing scale to the nearest 0.1 kg without shoes. A handheld stadiometer was used to measure heights to the nearest 0.1 cm (Seca 213). Patients were categorized into BMI groups based on WHO population cutoffs for Asians and BMI was calculated using the formula (kg/m2)[12].

Biochemical parameter biochemical Values such as first blood sugar or glucose, glycosylated hemoglobin (HbA1C), total cholesterol (TC), triglycerides (TG), high-density lipoprotein cholesterol (HDL-C), and low-density lipoprotein cholesterol (LDL-C) were recorded.

Ultrasonography: A Radiologist performed a lower abdominal ultrasound. Steatosis severity is subjectively classified as mild, moderate, or severe. Normal and moderate (score 0) (score 1) hepatic echotexture: When the diaphragm and portal vein wall are normal and the liver's echogenicity gradually increases, Moderate (score 2), somewhat impaired appearance of the diaphragm and portal vein wall, moderate rise in hepatic echogenicity (score 3), and poor or visibility of the diaphragm, portal vein wall, and posterior part of the right liver lobe are all signs of liver echogenicity[13].

Dietary Intake: two techniques were used Participants are asked to recall their previous 24-hour dietary intake in order to compile the food groups they consumed, either a list-based method or an open recall (where respondents recall all foods they ate during the previous day and the dietitian determines which food groups these foods belong to). The Diabetic Exchange List was used to calculate their energy intake in kilocalories and protein intake in grams [14].

Subjects' dietary information was gathered using a Harvard FFQ format 57-item food frequency questionnaire [15, 16] modified to match the basic food habits of the Pakistani population. Each participant was asked how often they had consumed each meal item without specifying the portion size. Daily, weekly, or monthly visits could be specified by participants. The frequency of food intake was then standardized to a certain number of times per day.

Lifestyle assessment: Information on physical activity was obtained Participants were asked to list their most recent seven days' worth of moderate and vigorous activity, as well as their frequency and duration of walking.

Statistical Analysis: Data was entered and analyzed using IBM SPSS Statistics version 26.0 software (IBM Inc., Armonk, NY, USA). The descriptive statistics (frequency and percentages) were reported for the demographic variables (age groups, gender, marital status, ethnicity, education, occupation), clinical features (physical activity score, fatty liver on ultrasound, present symptoms), and food consumption products (including dairy, fat, meat, high glycemic fruits, cereals, miscellaneous). Mean and standard deviation was reported for continuous variables (including anthropometric features, body mass index, calories, protein, and blood biomarkers (TB, SGPT, ALP, GGT, SGOT, Cholesterol, HDL, LDL, TG, RBS, FBS, HbA1c)). Food consumption of products at different levels (not at all, daily, weekly, or monthly) was compared using the chi-square goodness of fit test. A p-value of 0.05 or less is considered significant

RESULT

Out of total of 118 NAFLD patients, 68.6% were mostly female, 74.6% were married, 54.5% were housewives, 30.5% were illiterate or uneducated, 41.2% were morbidly obese, and more than half (54.2%) were physically inactive. Most of the patients (65.3%) had mild fatty liver on ultrasound as compared to moderate (34.7%). Mean± SD of calories and protein were 2135±260.8 kcal, and 64.2±14.3 gm respectively. (Table 01)

Table 1: Descriptive Statistics for Demographic Characteristics

Characteristics	N = 118 (%)	Characteristics	N = 118 (%)
Age (years)[a]	44.6±11.1	Anthropometric features	
11-20	0	Height (cm)	164.3±7.2
21-30	9 (7.6)	Weight (kg)	75.79±15.31
31-40	27 (22.9)	Ideal body weight	59.7±8.3
41-50	45 (38.1)	Body mass index (kg/m^2) [a]	
51-60	27 (22.9)	Underweight (<18.5)	3±2.6
>60	10 (8.5)	Normal (18.5-22.9)	18±15.8
Gender		Overweight (23 to 27)	30±26.3
Male	37 (31.4)	Obese (27.1-28.9)	16±14.0
Female	81 (68.6)	Morbidly obese (>29)	47±41.2
Marital Status		Calories & Protein	
Married	88 (74.6)	Calories (kcal)	2135±260.8
Single	25 (21.2)	Protein (gm)	64.2. 14.3
Widow	5 (4.2)	Physical Activity Score	
Ethnicity		In active	66 (54.2)
Sindhi	37 (31.4)	Minimally active	46 (40.4)
Urdu speaking	29 (24.6)	Highly active	6 (5.0)
Pakhtoon	25 (21.2)	Fatty Liver on Ultrasound	
Punjabi	15 (12.7)	Mild	77 (65.2)
Other (Balochi, Bangali)	12 (10.5)	Moderate	41 (34.7)
Occupation		Present Symptoms	
Housewife	64 (54.5)	Dyspepsia	61 (51.6)
Skilled labors	27 (22.9)	GERD	38 (12.5)
Professional	12 (10.2)	Asymptomatic	9 (8.8)
Retired/Jobless	7 (5.9)	cholecystectomy	10 (12.5)
Others (Businessman, Unskilled labor, student)	8 (6.7)		
Education			
Uneducated	36 (30.5)		
Read-only	8 (6.8)		
Primary	10 (8.5)		
Matriculation	22 (18.6)		
Intermediate	23 (11)		
Graduation	13 (11)		
Post-graduation	6 (5.1)		

[a]Values represented as Mean±SD, SD: Standard deviation, GERD: Gastroesophageal reflux disease

Table 2: Descriptive Statistics for nutritional parameters and laboratory parameters

Blood Biomarker (unit)	N	Mean±SD	Cut off value or reference Range (RR)
TB (mg/dl)	118	0.61±0.42	(0.2-1.2mg/dl)
SGPT(U/L)	118	50.1±36.20	(<45U/L)
ALP(U/L)	118	110.5±49.3	(53-128U/l)
GGT (U/L)	118	62.9±90.9	(<55U/l)
SGOT(U/L)	118	39.2±26.6	(<35U/l)
Cholesterol(mg/dl)	71	200.3±82.7	(<200 mg/dl)
HDL (mg/dl)	69	39.3±9.1	(>55 mg/dl)
LDL (mg/dl)	68	135.1±41.3	(<130 mg/dl)
TG (mg/dl)	69	185±75.1	(<150 mg/dl)
RBS (g/dl)	54	163±62.63	(180 g/dl)

FBS (g/dl)	68	107.4±21.1	(110 g/dl)
HbA1c	59	6.3(1.62)	6.5

TB: Total Bilirubin; ALP: Alkaline phosphatase; SGOT: Serum Glutamic-Oxaloacetic transaminase; SGPT: Serum Glutamic-Pyruvic Transaminase; US: Ultrasound; GGT: Gamma-Glutamyl Transpeptidase; HDL: High-density lipoprotein; LDL: Low-density Lipoprotein; TG: Triglycerides; SD: Standard deviatione HbA1c

(Table 3a and 3b) shows patients' most commonly consumed, high saturated fatty products were butter (19%), margarine (92%), French fries (22%), nimco (25%), pizza (19%), ice cream (23%), paratha (34%), chocolate (21%), high glycemic fruit was mango (36%), dates (32%), watermelon (52%). Dairy products were yogurt (61%), milk shake (29%), cheese (11%), ghee (36%), meat products were fish (47%), organ meat (46%), fried chicken (10%), kabab (23%), cereals products were juices (41%), oat (13%), breakfast (9%), beans (27%), and other miscellaneous products were soda or drink (18%), pickles (13%), nuts (47%). Patients had whole wheat flour (74%), cooked vegetables (67%), tea (82%) lentils (58%), and cooked rice (53%) All food products were having different consumption levels and were found to be significantly different (p<0.01). (Table 03a & Table 03b)

Table 3a: Food Consumption of Dairy & Fat Products

Products	No Consumption N (%)	Per Day N (%)	Per Week N (%)	Per Month N (%)	P-value[α]
Dairy products					
Milk	25 (21.2)	65 (55.1)	19 (16.1)	9 (7.6)	<0.001
Yogurt	18 (15.3)	25 (21.2)	72 (61)	3 (2.5)	<0.001
Whole Fat Milk	54 (45.8)	37 (31.4)	11 (9.3)	16 (13.6)	<0.001
Ice Cream	91 (77.1)	2 (1.7)	4 (3.4)	21 (17.8)	<0.001
Milk Shake	84 (71.2)	5 (4.2)	7 (5.9)	22 (18.6)	<0.001
Skim Milk	77 (65.3)	22 (18.6)	13 (11)	6 (5.1)	<0.001
Cheese	105 (89)	3 (2.5)	3 (2.5)	7 (5.9)	<0.001
Fat & Saturated fat					
Butter	95 (80.5)	6 (5.1)	5 (4.2)	12 (10.2)	<0.001
Margarine	108 (91.5)	1 (0.8)	5 (4.2)	4 (3.4)	<0.001
French Fries	92 (78)	7 (5.9)	6 (5.1)	13 (11)	<0.001
Fried Items	98 (83.1)	5 (4.2)	7 (5.9)	8 (6.8)	<0.001
Nimco	89 (75.4)	5 (4.2)	14 (11.9)	10 (8.5)	<0.001
Pizza	96 (81.4)	1 (0.8)	3(0)	21 (17.8)	0.02
Chocolate	93 (78.8)	3 (2.5)	10 (8.5)	12 (10.2)	<0.001
Bakery or Chips	89 (75.4)	6 (5.1)	17 (14.4)	6 (5.1)	<0.001
Paratha	29 (24.6)	31 (26.3)	40 (33.9)	18 (15.3)	0.04
Cake	85 (72)	4 (3.4)	9 (7.6)	20 (16.9)	<0.001
Dessert Mithai	64 (54.2)	9 (7.6)	8 (6.8)	37 (31.4)	<0.001
Nuggets	109 (92.4)	1 (0.8)	3 (2.5)	5 (4.2)	<0.001
Broast	105 (89)	7 (5.9)	1 (0.8)	5 (4.2)	<0.001
Packed Chips	87 (73.7)	8 (6.8)	9 (7.6)	14 (11.9)	<0.001
Oil	6 (5.1)	101 (85.6)	9 (7.6)	2 (1.7)	<0.001
Ghee	75 (63.6)	12 (10.2)	18 (15.3)	13 (11)	<0.001

[α]Chi-sqaure goodness of fit test

Table 3b: Food Consumption of High Glycemic Fruits, Meat, Cereals, & Miscellaneous Products

Products	No Consumption	Per Day	Per Week	Per Month	P-value[α]
High Glycemic Fruits (>70)					
Fruits	9 (7.6)	69 (58.5)	35 (29.7)	5 (4.2)	<0.001
Mango (51)	37 (31.4)	15 (12.7)	24 (20.3)	42 (35.6)	0.002
Dates (42-64)	37 (31.4)	14 (11.9)	29 (24.6)	38 (32.2)	0.006
Juices	70 (59.3)	10 (8.5)	14 (11.9)	24 (20.3)	<0.001
Watermelon (72)	32 (27.1)	10 (8.5)	15 (12.7)	61 (51.7)	<0.001
Raisin (64)	45 (38.1)	9 (7.6)	9 (7.6)	55 (46.6)	<0.001
Meat					
Fish	63 (53.4)	5 (4.2)	18 (15.3)	32 (27.1)	<0.001
Chicken	7 (5.9)	38 (32.2)	66 (55.9)	7 (5.9)	<0.001
Mutton	63 (53.4)	5 (4.2)	29 (24.6)	32 (27.1)	
Organ Meat	64 (54.2)	5 (4.2)	6 (5.1)	43 (36.4)	<0.001
Fried Chicken	106 (89.8)	6 (5.1)	4 (3.4)	2 (1.7)	<0.001
beef	91 (77.1)	3 (2.5)	9 (7.6)	15 (12.7)	<0.001
Cereals					
Whole Wheat Flour	14 (11.9)	87 (73.7)	14 (11.9)	3 (2.5)	<0.001
White Bread	48 (40.7)	21 (17.8)	40 (33.9)	9 (7.6)	<0.001
Oat	103 (87.3)	5 (4.2)	8 (6.8)	2 (1.7)	<0.001
Breakfast cereals	107 (90.7)	3 (2.5)	4 (3.4)	4 (3.4)	<0.001
Lentils	18 (15.3)	22 (18.6)	68 (57.6)	10 (8.5)	<0.001
Beans	86 (72.9)	6 (5.1)	22 (18.6)	4 (3.4)	<0.001
Cooked Rice	15 (12.7)	37 (31.4)	63 (53.4)	3 (2.5)	<0.001
Vegetable					
Raw Vegetables	76 (64.4)	31 (26.3)	11 (9.3)	0 (0)	<0.001
Cooked Vegetables	9 (7.6)	79 (66.9)	29 (24.6)	1 (0.8)	<0.001
Miscellaneous					
Soda or Drinks	97 (82.2)	4 (3.4)	11 (9.3)	6 (5.1)	<0.001
Tea	6 (5.1)	97 (82.2)	12 (10.2)	3 (2.5)	<0.001
Pickles	103 (87.3)	4 (3.4)	8 (6.8)	3 (2.5)	<0.001
Nuts	62 (52.5)	12 (10.2)	8 (6.8)	36 (30.5)	<0.001

[α]Chi-square goodness of fit test;

Out of total patients, the majority of the patients were inactive 56% (n=66) followed by minimal active 39% (n=46), and very few were highly active 5 %(n=6). (Figure 01).

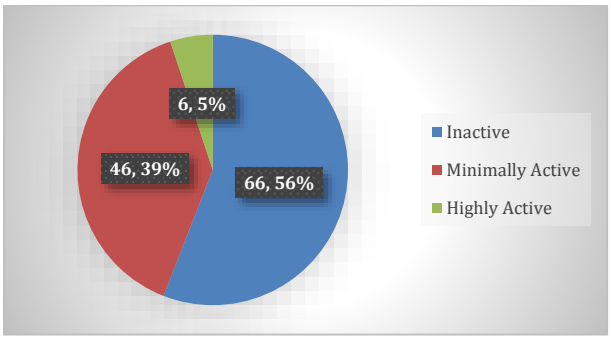

Figure 1: Physical Activity Distribution

DISCUSSION

To the best of our knowledge, this is the first research to investigate the specific food habits of NAFLD patients among low-income urban Pakistanis and assess their associations with their sociodemographic, anthropometric, and behavioral characteristics. Our research was carried out by a multidisciplinary team that gathered information from Karachi, Pakistan-based NAFLD patients.

Rising obesity rates, unhealthy lifestyles, a lack of physical activity, high-calorie diets, and sedentary behavior all contribute to an increase in the prevalence of NAFLD in the urban population [17]. This research has revealed conflicting results regarding body mass index (BMI) as a modifiable factor related to NAFLD, among other factors linked to NAFLD. The World Health Organization considers Asians with BMIs between 22.5 and 27.5% to be at a higher risk of acquiring obesity-related diseases [18]. African Americans who were assessed to be at low risk for NAFLD (BMI 25 kg/m2, no diabetes, and normal fasting blood glucose and alanine aminotransferase concentrations) participated in cohort research. In morbidly obese individuals, there is a correlation between the severity of fatty liver and the degree of impaired glycemic status. [19]. NAFLD risk factors include dyslipidemia. Our study's key finding is that the majority of the participants had conditions frequently linked to NAFLD, including central obesity, hypertension, hypertriglyceridemia, and hypercholesterolemia. According to a study by Santhoshakumari, patients with NAFLD had lower HDL and higher TC, LDL, and TG levels [24]. Numerous studies with significant samples have proven that food impacts ALT levels. Studies have shown that weight loss alone improved liver biochemistry despite histological change[25].

According to a current study, physical activity levels are low or insufficient to improve patients' conditions. Compared to what was discovered No of where a patient falls on the NAFLD disease spectrum, physical activity and exercise should be a part of overall clinical care because they have both been found to reduce hepatic steatosis in NAFLD [20]. general health recommendations for the primary prevention of CVD, and NAFLD, and to lower the risks of metabolic disorders, encourage at least 150 minutes per week of brisk leisure-time physical activity or 10,000 steps per day[21,22]. One study showed that people who engaged in more physical activity for at least 60 minutes per week lost a significant amount of weight (2.4 kg on average) and saw improvements in all liver enzymes. However, it is probably going to have a favorable impact on exercise, which remains a crucial treatment goal for those with NAFLD[23].

A healthy diet is beneficial for NAFLD patients, and unhealthy dietary patterns are associated with the development and progression of NAFLD [27, 28] Our study participants recalled eating a high-calorie diet with moderate protein intake, few dairy products, and insufficient amounts of carbohydrates. They also reported eating roughly twice as many meals per day that included fatty foods and foods with high glycemic indexes as is advised. In a study, healthy, young students who consumed at least two fast-food meals per day for a month saw increases in their caloric intake, and body weight, as well as a parallel rise in their liver's triglyceride levels and serum ALT concentrations [29].

Analyzing dietary patterns can help you assess how multidimensional a diet is. The hydrogenated, saturated, and vegetable oil patterns of the West Bengali population were similar to the fat and sweet pattern of the current study. It is well knowledge that a diet heavy in carbohydrates is essential for the emergence of NAFLD[30]. In order to compare western dietary patterns with the fat and sweet pattern of Pakistan, we discovered increased intake of paratha, fried foods, nimco, Mithai, pizza, French fries, and packaged chips in the processed diet pattern and sweets, bakery goods, and chocolate in the confectionery diet pattern of the British people[31]. According to the study's findings, consuming more meat and soft drinks were significantly linked to a higher risk of developing NAFLD. Researchers noted that while a diet rich in low-fat dairy, nuts, fruit, and coffee or tea protects against fibrosis as seen by elastography, a diet high in red meat, hydrogenated fats, and soda beverages increased the chance of fibrosis as seen by elastography[32]. Typical Pakistani foods including paratha, biryani/pulao, mithai, fried foods, French fries, milk desserts, Pakistani sweets, bakery products, and dishes from abroad like pizza, nuggets, nimco, etc. were all included in the study's fat and sweet pattern. These foods share many of the same unhealthy dietary components as those previously noted [33]Western [34,35] or processed food[36] eating patterns in various cross-sectional and prospective studies. Therefore, nutritional management is important for the prevention of NAFLD and its complications.

There were several limitations of our study. As this study was a cross-sectional investigation, it is not possible to associate dietary patterns with the relative risk of NAFLD. However, the study offers the first account of the dietary habits of NAFLD patients from Pakistan. Second, two 24-hour recall interviews were used to calculate the diet data, which could have resulted in recall bias. Our study has the strength of being the first to assess the relationships between various dietary patterns and the risk of NAFLD in the Pakistani population.

CONCLUSION

Hippocrates famously advised patients with NAFLD to "let food be your medicine." All NAFLD patients should be counseled that eating a healthy diet has advantages besides just weight loss. Patients with NAFLD overconsumed on foods high in calories, saturated fat, and total lipid. These eating characteristics, as well as inadequate long-term consumption of cereals, fruits, dairy products, and legumes, may all contribute to NAFLD (beans). To identify the potential role of each nutrient shortage in the development of NAFLD, more research is necessary. Despite significant investment in this area, there are currently no pharmacologically approved agents for NAFLD, and weight loss continues to be the only effective treatment for this incredibly common condition.

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REFERENCES

1 Araújo AR, Rosso N, Bedogni G, Tiribelli C, Bellentani S. Global epidemiology of non-alcoholic fatty liver disease/non-alcoholic steatohepatitis: What we need in the future. Liver International. 2018 Feb;38:47-51.

2 Peiseler M, Schwabe R, Hampe J, Kubes P, Heikenwälder M, Tacke F. Immune mechanisms linking metabolic injury to inflammation and fibrosis in fatty liver disease–novel insights into cellular communication circuits. Journal of Hepatology. 2022 Jun 22.

3 Maheshwari, S., Kumar, S., Nakshiwala, B.V., Srivastav, A., Chavan, V., Raut, A. and Maheshwari, A., 2022. Fatty Liver Disease: Pathophysiology and Imaging Features.

4 Lazarus, J.V., Mark, H.E., Anstee, Q.M., Arab, J.P., Batterham, R.L., Castera, L., Cortez-Pinto, H., Crespo, J., Cusi, K., Dirac, M.A. and Francque, S., 2022. Advancing the global public health agenda for NAFLD: a consensus statement. Nature Reviews Gastroenterology & Hepatology, 19(1), pp.60-78.

5 Pak J Pharm Sci. 2018 Jan;31(1):193-198. Prevalence of nonalcoholic fatty liver and Nonalcoholic Steatohepatitis in Peshawar Cantonment, Khyber Pakhtunkhwa, Pakistan.

6 El-Kassas M, Cabezas J, Coz PI, Zheng MH, Arab JP, Awad A. Nonalcoholic Fatty Liver Disease: Current Global Burden. InSeminars in Liver Disease 2022 Aug (Vol. 42, No. 03, pp. 401-412). Thieme Medical Publishers, Inc..

6 Wang, W., Chen, J., Peng, L., Gao, X., Lin, L., Xiong, Y., Zhang, F., Ma, Y., Qin, F. and Yuan, J., 2022. Food Insecurity May be an Independent Risk Factor Associated With Erectile Dysfunction in the United States: Analysis of the National Health and Nutrition Examination Survey Data. Sexual Medicine, 10(5), p.100549.

7 Abu Bakar, N.A.F., Ahmad, A., Wan Musa, W.Z., Shahril, M.R., Wan-Arfah, N., Abdul Majid, H., Piernas, C., Ramli, A.W. and Naing, N.N., 2022. Association between a dietary pattern high in saturated fatty acids, dietary energy density, and sodium with coronary heart disease. Scientific reports, 12(1), pp.1-11.

8 Vancells Lujan, P., Viñas Esmel, E. and Sacanella Meseguer, E., 2021. Overview of non-alcoholic fatty liver disease (NAFLD) and the role of sugary food consumption and other dietary components in its development. Nutrients, 13(5), p.1442.

9 http://patients.gi.org/topics/fatty-liver-disease-nafld/

10 Henry L, Paik J, Younossi ZM. the epidemiologic burden of non-alcoholic fatty liver disease across the world. Alimentary Pharmacology & Therapeutics. 2022 Jul 26.

11 tphts://www.aasld.org/sites/default/files/NAFLD%20Guidance%202018.pdf

12 World Health Organization (WHO). BMI classification. 2006: Available at: http://apps. Who. Int/bmi/index. jsp? introPage= intro_3. Html. Accessed August. 2013;31(//apps.who.int/bmi/index.jsp?introPage=intro_3.html)

13 Ferraioli G, Monteiro LB. Ultrasound-based techniques for the diagnosis of liver steatosis. World journal of gastroenterology. 2019 Oct 28;25(40):6053.

14 American Diabetes Association. The diabetic exchange list [Internet]. Arlington: American Diabetes Association; [cited 2017 Jun 2 (diabetesed.net/page/_files/THE-DIABETIC-EXCHANGE-LIST.pdf)

15 Stark, A., 2002. An historical review of the Harvard and the National Cancer Institute food frequency questionnaires: their similarities, differences, and their limitations in assessment of food intake. Ecology of Food and Nutrition, 41(1), pp.35-74.

16 Deurenberg-Yap, M.; Li, T.; Tan, W.L.; van Staveren, W.A.; Deurenberg, P. Validation of a semiquantitative food frequency questionnaire for estimation of intakes of energy, fats and cholesterol among singaporeans. Asia Pac. J. Clin. Nutr. 2000, 9, 282–288.

17 Z. Younossi, Q.M. Anstee, M. Marietti, et al.Global burden of NAFLD and NASH: trends, predictions, risk factors and prevention Nat Rev

Gastroenterol Hepatol, 15 (2018), pp. 11-20, 10.1038/nrgastro.2017.109
18 Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004;363:157–163. doi: 10.1016/S0140-6736(03)152683.
19 Hsiao TJ, Chen JC, Wang JD. Insulin resistance and ferritin as major determinants of nonalcoholic fatty liver disease in apparently healthy obese patients. Int J Obes Relat Metab Disord. 2004;28:167–172.
20 European Association for the Study of The Liver, European Association for the Study of Diabetes (EASD. EASL-EASD-EASO Clinical Practice Guidelines for the management of non-alcoholic fatty liver disease. Obesity facts. 2016;9(2):65-90.
21 ACSM. American College of Sports Medicine Position Stand. Appropriate physical activity intervention for weight loss and weight regain for adults. Med Sci Sports and Exercise. 2009;41:459-71.
22 Department of Health. UK Physical Activity Guidelines. [cited 2012 February]; Available from: http://www.dh.gov.uk/en/Publicationsandstatistics/ Publications/PublicationsPolicyAndGuidance/DH_127931. 2011.
23 St George A, Bauman A, Johnston A, Farrell G, Chey T, George J. Independent effects of physical activity in patients with nonalcoholic fatty liver disease. Hepatology. 2009;50:68–76
24 Santhoshakumari TMJ, Radhika G, Kanagavalli P. A study of anthropometric and lipid profile parameters in non-alcoholic fatty liver disease patients attending a tertiary care hospital at puducherry. IOSR J Dent Med Sci (IOSR-JDMS) 2017;16:33–7
25 Andersen T, Gluud C, Franzmann MB, Christoffersen P. Hepatic effects of dietary weight loss in morbidly obese subjects. J Hepatol. 1991;12:224–229
26 S. Saadeh, Z.M. Younossi, E.M. Remer, T. Gramlich, J.P. Ong, M. Hurley, K.D. Mullen, J.N. Cooper, M.J. Sheridan The utility of radiological imaging in non-alcoholic fatty liver disease Gastroenterology, 123 (2002), pp. 745-750
27 W.H. Oddy, C.E. Herbison, P. Jacoby, G.L. Ambrosini, T.A. O'Sullivan, O.T. Ayonrinde, et al. The Western dietary pattern is prospectively associated with nonalcoholic fatty liver disease in adolescence Am J Gastroenterol, 108 (2013), pp. 778-785
28 E.S. Papamiltiadous, S.K. Roberts, A.J. Nicoll, M.C. Ryan, C. Itsiopoulos, A. Salim, et al. A randomised controlled trial of a Mediterranean Dietary Intervention for Adults with Non Alcoholic Fatty Liver Disease (MEDINA): study protocol BMC Gastroenterol, 16 (2016), p. 14
29 Kechagias S, Ernersson A, Dahlqvist O, Lundberg P, Lindstrom T, Nystrom FH; Fast Food Study Group. Fast-food-based hyper-alimentation can induce rapid and profound elevation of serum alanine aminotransferase in healthy subjects. Gut. 2008;57:649–654.
30 Basaranoglu M, Basaranoglu G, Bugianesi E. Carbohydrate intake and nonalcoholic fatty liver disease: fructose as a weapon of mass destruction. Hepatobiliary surgery and nutrition. 2015 Apr;4(2):109.
31 Hu T, Mills KT, Yao L, et al. Effects of low-carbohydrate diets versus low-fat diets on metabolic risk factors: a meta-analysis of randomized controlled clinical trials. Am J Epidemiol 2012;176:S44-54
32 Soleimani D, Ranjbar G, Rezvani R, Goshayeshi L, Razmpour F, Nematy M. Dietary patterns in relation to hepatic fibrosis among patients with nonalcoholic fatty liver disease. Diabetes Metab Syndr Obes. 2019;12:315–324. doi: 10.2147/DMSO.S198744.
33 Q. Jia, Y. Xia, Q. Zhang, H. Wu, H. Du, L. Liu, et al.Dietary patterns are associated with prevalence of fatty liver disease in adults Eur J Clin Nutr, 69 (2015), pp. 914-921
34 Rezazadeh A, Rashidkhani B, Omidvar N (2010) Association of major dietary patterns with socioeconomic and lifestyle factors of adult women living in Tehran, Iran. Nutrition 26, 337-341
35 Naja F, Nasreddine L, Itani L et al. (2011) Dietary patterns and their association with obesity and sociodemographic factors in a national sample of Lebanese adults. Public Health Nutr 1, 1-9
36 Schulze MB, Fung TT, Manson JE et al. (2006) Dietary patterns and changes in body weight in women. Obesity (Silver Spring) 14, 1444-1453.