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DIETARY PATTERNS AMONG PATIENTS WITH NEWLY DIAGNOSED DIABETES TYPE 2 AND FATTY LIVER DISEASE IN AL MUTHANA CITY: A CROSS SECTIONAL STUDY

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ABSTRACT

Objectives: The aim of this study was to assess the dietary patterns of Iraqi patients with non- alcoholic fatty liver disease (NAFLD) and newly diagnosed DM2. **Subjects and methods:** A cross sectional study, that include 70 Iraqi patients (35 patients for each gender), aged between (30 and 70 years) with new(below one year duration DM2) with NAFLD., The assessment of their dietary intake during the last 6 months was done through utilizing. NAFLD was diagnosed by using ultrasonography showing specific changes of that disease with its grade. **Results:** A 18 out of 70 patients was found to have NAFLD. There were statistically significant higher rates of consumption of (western diet items)with (p-value 0.004) corresponding to(32.8%) with differing grades followed by DM2 diet (8.5%), as well as there were statistically significant association with BMI (p-value 0.01) and gender (p-value 0.082). **Conclusion:** The current study has found that the diet type is a great influencer to developing NAFLD in diabetes paitent beside other variables shortly after having the disease with higher rates to those following western diet in adult Iraqis.

INTRODUCTION

Nonalcoholic fatty liver disease (NAFLD) is currently the most prevalent chronic liver disease, with a global burden of 17 % to 46% of chronic liver disease cases.[1] NAFLD can be asymptomatic and remain undetected during the initial stages of the disease, but approximately 20% to 30% of patients with NAFLD can experience nonalcoholic steatohepatitis(NASH), which can progress to significant hepatic fibrosis or cirrhosis and occasionally to hepatocellular carcinoma in the long term.[2,3] Patients with type 2 diabetes mellitus (DM2) have a very high prevalence of NAFLD, which can vary from 40% to 60%.[4]

Several studies have confirmed the role of specific macronutrients in the onset and progression of NAFLD especially in diabetics, However, it is very difficult to separate the role of each macronutrient to be especially blamed,(in relation to the amount of energy provided, portion size, and their proportion in the diet and the food they contain. The macronutrient composition of a diet is associated with NAFLD/NASH(non alcoholic steatohepatitis), Macronutrients such as saturated fatty acids (SFA), trans fats, simple sugars (sucrose and fructose) and animal protein can accelerate these changes in contrast monounsaturated fatty acids (MUFA), PUFA(poly unsaturated fatty acids), plant based proteins and dietary fibers which appear to be protective (figure 1).[7] Numerous studies have found a strong association between the risk of NAFLD and high-fructose products (cakes, soft drinks …etc).

Furthermore, fructose metabolization in the liver is much higher than that of glucose, numerous epidemiological studies have presented convincing evidence that there is an association between added sugars (sucrose, fructose and high fructose corn syrup) and NAFLD.[5], The liver is the primary site of fructose metabolism, with nearly 60% oxidation of fructose ingestion. Furthermore, fructose metabolization in the liver is much higher than that of glucose. The hepatic metabolism of fructose stimulates de novo lipogenesis in the liver, increasing liver fat.[6]

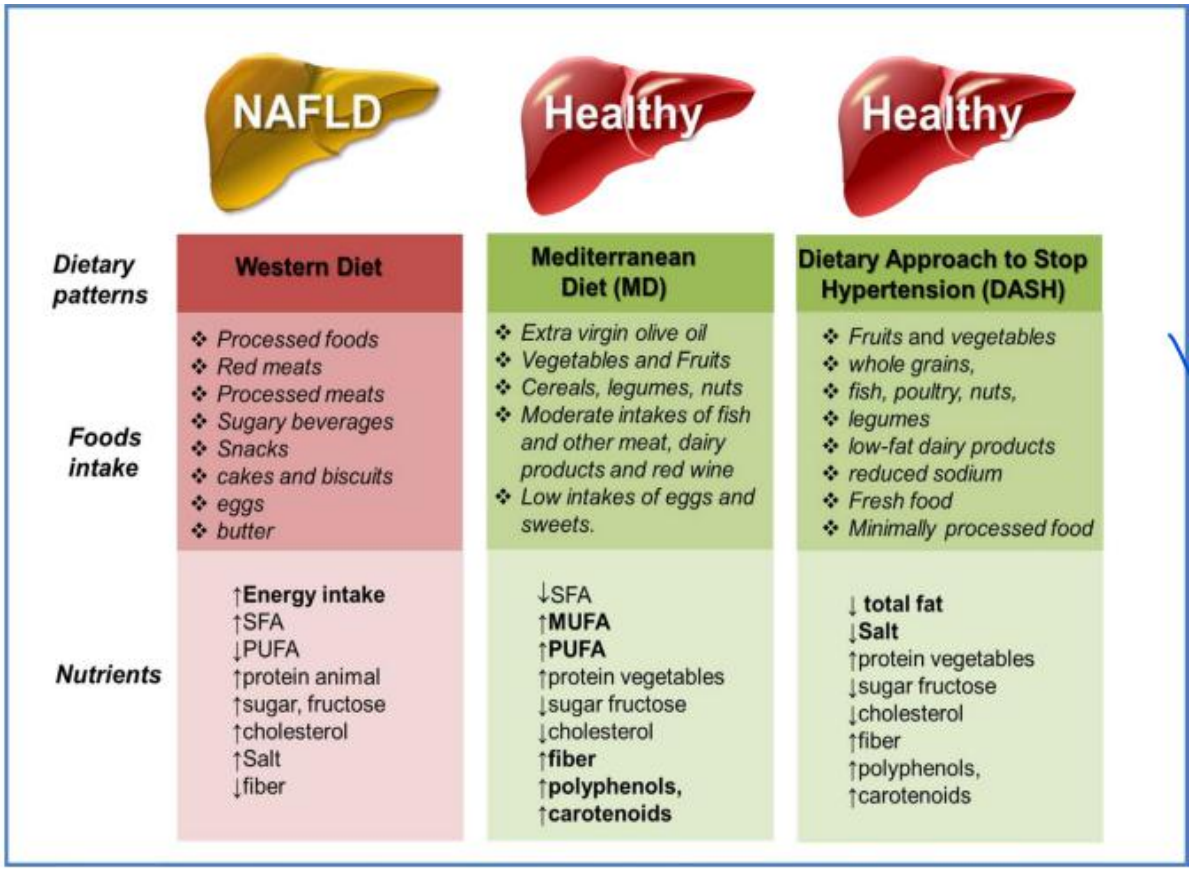


FIGURE 1 Non-alcoholic fatty liver disease (NAFLD) dietary patterns/food/nutrients chart. The Western diet is associated with NAFLD. This type of diet contains excessive amounts of refined and processed foods, red meat, processed meat, sugary drinks, snacks, cakes, biscuits, eggs and butter. It involves an excess of calorie consumption, saturated fats, animal protein, sugar, cholesterol and salt. The Mediterranean diet has beneficial effects on NAFLD. This diet is based on the high intake of extra virgin olive oil, vegetables, fruits, cereals, nuts and legumes; moderate intakes of fish and other meats, dairy products and red wine and low intakes of eggs and sweets. So, it provides a large amount of monounsaturated fatty acids, polyunsaturated fatty acids, vegetable proteins, fibre and antioxidants; and low amounts of sugar, cholesterol and saturated fats. Dietary approach to stop hypertension has beneficial effects on NAFLD. This diet is rich in fruits, vegetables, whole grains, fish, poultry, nuts, legumes and low-fat dairy products; it has low levels of sodium, added sugars and fat. Finally, this diet emphasizes on the consumption fresh food. This diet provides low intakes of total fat, salt, sugar and cholesterol; and high intakes of vegetable protein, fibre, and antioxidants.

An alteration of gut microbiota has been observed in NAFLD patients. Prebiotic intake has also been shown to improve liver phenotype in NAFLD patients (Figure1) which is demonstrate the Relationship between food group intake and non-alcoholic fatty liver disease Nutrients are contained in the foods that people eat, thus a more physiological approach is an analysis of the intake of food groups and their relationship with NAFLD. There is a general consensus that the intake of a variety of foods is important to prevent the development of NAFLD.[8], The foods that are considered to be beneficial for the prevention and progression of NALFD are whole grain cereals, fruits and vegetables, fatty fish (mainly high in ω3) and EVOO(extra vergin olive oil). On the other hand, foods that are considered to adversely effect NAFLD include red meat and processed meats, soda, processed foods, cakes and biscuits[9], Patients with NAFLD have been shown to consume fewer cereals, grains,

fruits and vegetables than healthy subjects. NAFLD patients have a higher intake of cooking oils, candy, pastry, desserts, salty food, spicy food, sauce, dressings and soft drinks.

Healthy dietary patterns help reduce the risk factors of non-alcoholic fatty liver disease Another approach is to analyse the role of diet in NAFLD. data are based on paitents habitual food consumption, which is therefore more realistic. Western dietary patterns are often associated with the development of NAFLD independence of physical activity.[17] This diet is generally hypercaloric with low intake of fruits, vegetables, whole grains, legumes, fish and low-fat dairy products and excessive and processed foods, alcohol, salt, red meats, sugary beverages, snacks, eggs and butter. In addition to the role of the different foods found in the diet, the excess amount of calories are a major risk factor for NAFLD.[18]

The DASH(Dietary approach to stop hypertention) diet; is designed to regulate blood pressure, but has also been found to have beneficial effects on NAFLD. The DASH diet is rich in fruits, vegetables, whole grains, fish, poultry, nuts, legumes and low-fat dairy products. Moreover, there is reduced sodium, added sugars, as well as saturated and total fats. DASH emphasizes the consumption of minimally processed and fresh foods.[10]

Evaluation

Table 1: Liver steatosis grades (lS) according to histopathologic classification. Percentage (%) is related to the fat content within the hepatocytes as shown in table.[1]

Grade0	Healthy (<5%)
Grade1	Mild (5–33%)
Grade2	Moderate (34–66%)
Grede3	Severe (>66%)

A lifestyle change aimed at increasing weight loss and physical activity is critical for those with NAFLD. It is possible that patients will be advised to lose 10% or more of their body weight. This state is associated with an improved cardiovascular risk profile and steatosis in the patients.[12] Hepatic inflammation and a reduction in hepatocellular damage can be seen even with a 7-9% weight loss.[13,14] In studies, patients who got dietary treatment and engaged in moderate physical activity for 200 minutes per week for 48 weeks had less steatosis and inflammation in their liver biopsy, as well as a decrease in body weight.[13]

Exercise

Aerobic exercise improves skeletal muscle insulin sensitivity and decreases insulin resistance, both of which are important mechanisms in the development of NAFLD. Independent of weight loss, studies examining moderate-violence, high-violence, and resistance exercise found improvements in liver enzymes and a reduction in steatosis. Individuals suffering from NAFLD should be encouraged to increase their physical activity. Some approaches advocate 30 minutes of moderate exercise five times per week. It has been discovered that people with NAFLD are less active than healthy people.[15,16] According to studies, they do not exercise much and are less prepared to make lifestyle changes. content in a timely and efficient manner!

METHODOLOGY

Objective: To assess the prevalence of nonalcoholic fatty liver diseases **(NAFLD**) in newly diagnosed diabetes type 2 in relation to their dietary patterns.

Patients and methods

The study will include a cross sectional methodology involving the patients in the(endocrine diseases center) of southern provinces of Iraq in Al hussain teaching hospital in Al-Muthana govern ate from April to may 2023.

We include patients with the below mentioned criteria and screened to NAFLD by ultrasound and investigated for the diet pattern they follow.

Inclusion criteria.

- Age more than 25 years
- T2 DM for not more one year

Exclusion criteria

1. Patients less than 25 years.
2. Patients with history of alcohol intake.
3. Patients with a history of jaundice or HBsAg positive and Hepatitis “C” positive.
4. Patients with a history of following drug intake steroids, synthetic oestrogens, heparin, calcium channel blockers, amiodarone, valproic acid, arsenic, mercury, homeopathic drugs, antiviral agents.
5. Patients having autoimmune hepatitis.
6. History of drug abuse, opium, and nicotine.

7. Patients with history of bariatric surgery.

Data collection

Data were collected by direct interviews using a preconstructed questionnaire which include the history of socio-demographic characteristics (age, gender, residence, occupation, and educational level). In addition to the the main treatment of DM2, comorbidities, duration of DM2, physical activity.and other parameters, the related anthropometric measures was also included like (weight and height, WC (waist circumference)and(BMI).in addition to HBAIC %. the questionnaire was preceded by a pilot study to estimate the patient response.

The statistical analysis was through spss version 24.

The food group used in the study are shown below (table 2)

Table 2: Food grouping used in the dietary pattern analyses.

Food groups	Food item
Refined grain	White bread, rice, flour, macaroni, noodle, biscuit, cake
Whole grains	Barely bread, whole wheat, wheat germ, oat, bulgur, corn flakes
Red meat	Beef, lamb, camel, sausages, hamburger, processed meats, organ meat
White meat	Chicken, turkey, ostrich, fish, seafood
Potato	Potato
Soft drinks	Carbonated drinks, artificial juice
High-fat dairies	Cream, butter, ice cream, pizza cheese
Low-fat dairies	Yogurt, dough (yogurt drink), milk, cheese, curd
Legumes	Beans, chickpeas, lima beans, broad beans, lentil, soy
Nuts	Peanut, almond, pistachio, walnut, hazelnut
Eggs	Eggs
Vegetable oils	Vegetable oils
Hydrogenated fats	Animal fats, hydrogenated vegetable oils
fruits	Apple, cherries, grapefruit, apricots, plum, kiwi, strawberry, oranges, grapes, berries, dates, barberry, banana, pomegranate, melon, naringin, lemon, raisin,, peach, cantaloupe, watermelon, pear, fruit juice
Coffee and tea	Black tea, green tea, coffee
Sugars	Jam, honey, candy, sugar, chocolate
vegetables	Cucumber, tomato, spinach, pepper, mushroom, garlic, carrot, onions, mixed vegetables, lettuce, cabbage, eggplant, celery, green peas, green beans, corn, tomato paste

RESULTS

A total of 70 patients with newly diagnosed T2DM aged from 30 to more than 60 years old (50% females, 50% males) were included in this study. Table (3) represent The characteristics of the study population by sex For the following factors (age, educational level, BMI, physical activity, diabetes duration, type of diabetes medications used, smoking

history, other comorbidities and HBA1C%) with p value for association, showing significant association between BMI and prevalence of NAFLD with P value of (0.01). While the table 4 demonstrates the main means in term of (duration of DM2,BMI and WC). Then, the characteristics of the study population were evaluated within the scores reliable for each type of dietary pattern that the patents were follow in the last six month in order to study the influence of the effect of the diet habit on the acceleration of fatty liver diseases beside other treatment modalities, the results show the western diet was the most blamed one with (14 out of 18 patients) corresponding to (77%), with a significant association with p value of (0.004).Lastly the figures 1 and 2 show the the distributions of NAFLD prevalence of total number of the study population,the percent of each diet that the patients follow respectively.

Table 3: General characteristics of NAFLD patients.

Variable	Subdivision(n=70)	Male(n=35) (50%)	Female(n=35) (50%)	NAFLD	P.value
Age(years)	30 to 45 yr.	16	12	6	0.4
	45 to 60 yr.	15	22	11	
	Above 60 yr.	4	1	1	
Educational level	Illiterate	7	8	3	0.06
	primary	13	9	6	
	Secondary	9	7	7	
	Higher	6	11	2	
Duration of DM2 month	Below 6	22	20	11	0.6
	Above 6	13	15	7	
Treatment of DM2	No treatment	6	8	0	0.13
	Oral anti diabetes	8	15	7	
	insulin	18	5	3	
	Mixed treatment	5	3	3	
	Others	8	4	5	
Smoking	no	19	24	11	0.1
	yes	16	11	7	
Other comorbidetes	Nill	8	9	2	
	cardiovascular	8	13	4	
	endocrine	10	9	6	
	Neuro psychiatric	5	3	2	
	other	4	1	4	
BMI (kg/m2)	Less 18.5	2	3	0	0.01
	18.5 to 24.9	4	5	4	
	25,0 to 29.9	10	4	1	
	30 to 34.4	12	15	8	
	35 to 39.9	2	5	0	
	40 and above	5	3	5	
HBA1C%	Below 6.5	2	3	2	0.47
	6.5 to 7.0	4	3	1	

	Above 7.0	29	29	15	
Physical activity mnt per week	Sedentary	4	10	5	0.4
	Less than 90	14	18	8	
	90 to 150	12	7	5	

Table (4): the main means of the study group.

	Age	time to have DM2	BMI	Waist circumferance
N	70	70	70	70
Mean	46.5286	1.4000	29.9357	100.3571
Std. Deviation	8.97617	.49344	6.28477	15.60475

Table (5): association between NAFLD and diet types in the study group.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	28.988[a]	12	.004
Likelihood Ratio	30.777	12	.002
Linear-by-Linear Association	2.225	1	.136
N of Valid Cases	70		

Chi-Square Tests						
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	28.988[a]	12	.004	.040		
Likelihood Ratio	30.777	12	.002	.000		
Fisher's Exact Test	30.461			.000		
Linear-by-Linear Association	2.225[b]	1	.136	.147	.087	.016
N of Valid Cases	70					

	Diet type	No NAFLD	Grade 1	Grade2	Grade 3	total	P value
1	Healtyy diet	36(94%)	2(5%)	0	0	38	0.004
2	Western diet	9(39%)	6(26%)	3(13%)	5(21%)	23	
3	DASH diet	1(100%)	0	0	0	1	
4	DM2 diet	5(83%)	1(16%)	0	0	6	
5	FAD diet	1(50%)	1(50%)	0	0	2	
total		52	10	3	5	70	

Table 6: Gender * Diet Type Association.

Count						
		Fatty liver				Total
		No NAFLD	grade 1	grade2	grade3	
Gender	male	24	7	0	4	35

	female	28	3	3	1	35
Total		52	10	3	5	70

Table 7: fatty liver and gender crosstabulation.

Chi-Square Tests			
	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	6.708[a]	3	.082
Likelihood Ratio	8.040	3	.045
Linear-by-Linear Association	.907	1	.341
N of Valid Cases	70		

figure 1 :NAFLD distribution

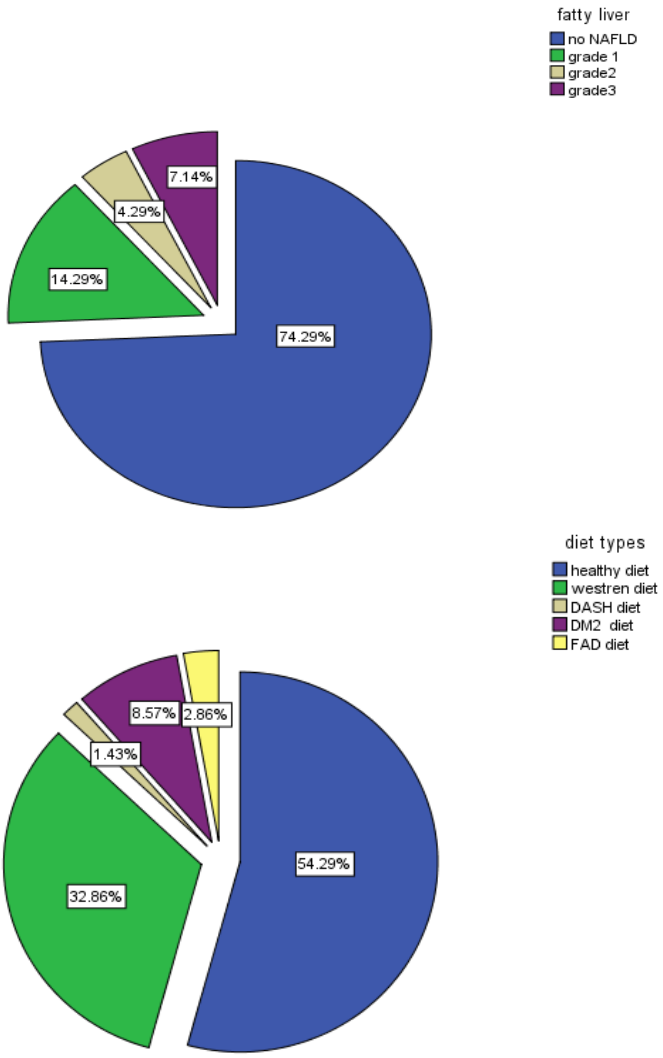


Figure 2: diet type (diet type distribution).

DISCUSSION

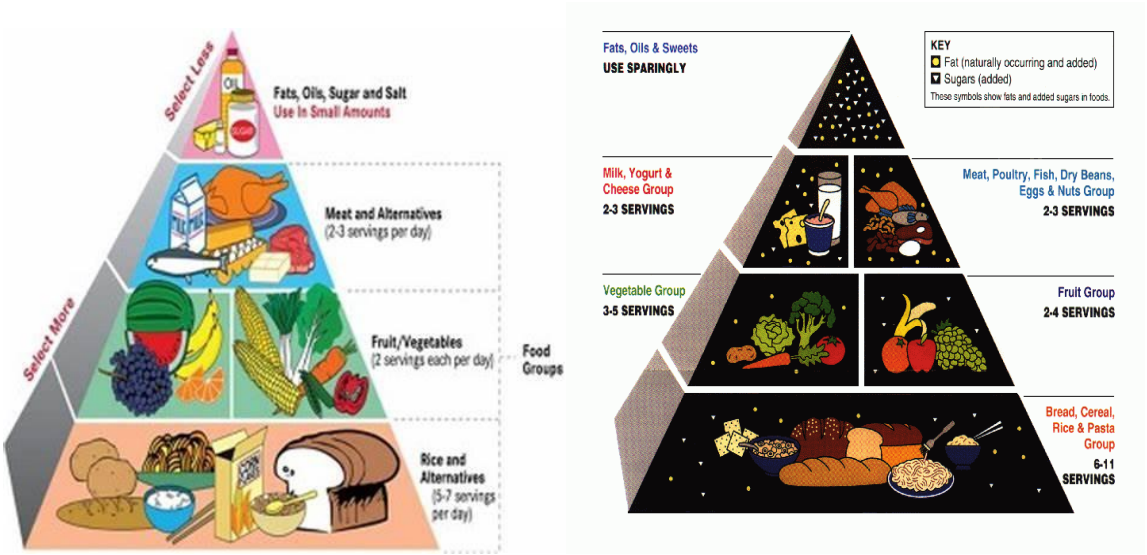
In the recent years, there has been growing interest in understanding the mechanisms leading to the accumulation of excessive fat within skeletal muscle and liver in those with obesity and

type 2 DM and in the role that this might have in the pathogenesis of insulin resistance. The current study investigate the association of five dietary patterns of "western dietary pattern", “healthy dietary pattern”, "diabetic dietary pattern”, DASH dietary pattern, ” and "FAD dietary pattern in adult iraqis with NAFLD.each diet related item is shown below figure2 in the "western dietary pattern", which mainly consists of a high intake of fast foods, soft drinks, processed meat, high-fat dairy products, hydrogenated fats,, salty snacks, sugar-sweet desserts, organ meats, and refned grains was signifcantly associated with increase the risk of NAFLD. This association was independent of age, gender, BMI, smoking, physical activities, (Nawal Mehdi Al Khalidi et al.,2022) carried out in baghdad supported this finding,which demonstrates the negative role of diet which is enriched by fats and sweeteners.

A previous study by Ritchiev et al.[19] also supported these results the "western dietary pattern" had the highest risk of NAFLD in comparison to the lowest percent in association with other types, especially diabetic and healthy dairy patterns., it was explained by that high consumption of soft drinks increases the risk of NAFLD due to the high caloric content and/or the excessive amount of fructose in these drinks. Which in turn, increase the risk of metabolic syndrome and its components, such as dyslipidemia, insulin resistance, and hypertension.[20] in addition, refined grains, white bread, and sugar-sweets desserts, which are constituents of the "western dietary pattern", rapidly increase the insulin and glucose levels in blood, which cause insulin resistance, diabetes, and obesity[21] beside, rapid increase in blood sugar enhances the rate of “de-novo” synthesis and increases fat in liver cells.[22] and human studies[24] that high glycemic index diet increases the fat accumulation in the liver cells and leads to hepatic steatosis. In addition "western dietary pattern" known to have high amounts of both saturated and trans fatty acids, which in turn may affect the hepatic cells steatosis via chylomicron uptake after consuming fatty meals.

In the other hand “Healthy dietary pattern” had the lowest risk of affecting to NAFLD. “Healthy dietary pattern” is defined by high intake of fruits, vegetables,, olive oil, low-fat dairy products, fish and garlic. The current study found an inverse relation between the “healthy dietary pattern” and the risk of NAFLD, which was independent of many variables such as age, gender, BMI, physical activities,, and energy intake. This effect could be as a result of high intake of fruits and vegetables, which increases the intake of antioxidant vitamins, such as vitamins A, E, and C. Studies have shown that intake antioxidant vitamins has a protective role against oxidative stress.[25]

Fruits and vegetables in the "Healthy dietary pattern" represent good sources of dietary fibers, which have an inverse association with insulin resistance and, thus, thus conceivably reduce the risk of NAFLD emergence.[26] Fish consuming have high amounts of poly unsaturated fatty acids (Omega 3) which in turn are capable of reducing total cholesterol and has a protective role against NAFLD.[27], [28] Similar to the "Healthy dietary pattern", by a protective effect of the Mediterranean diet, which is explained as a diet rich in olive oil, fresh fruits, nuts, and vegetables; moderate in dairy products, fish, poultry and red wine; and low in red meat, eggs, sweets and other processed foods.[29], has been shown previously by prospective[30] and intervention studies. this dietary pattern, which is formed by diferent dietary components, may have precluded significant associations. The "traditional dietary pattern" which may comprises healthy and unhealthy foods; and whilst healthy foods have a protective role against the emergence of NAFLD, and unhealthy foods increase the risk of NAFLD. In other words, this dietary pattern included several food items which have been reported to have negative impact on NAFLD risk factors such as red meat, organ meat, broth[31], sugar-sweets-desserts[32] and salt[33] however, there are also food items with anti-inflammatory and anti-oxidative function. Curcumin, cinnamon, cardamom and ginger have potentially liver protective effect.[34][35] In addition, tea is the habitual drink among Iraqi people. Which could prevent incidence of NAFLD by its catching and polyphenol components.[36]



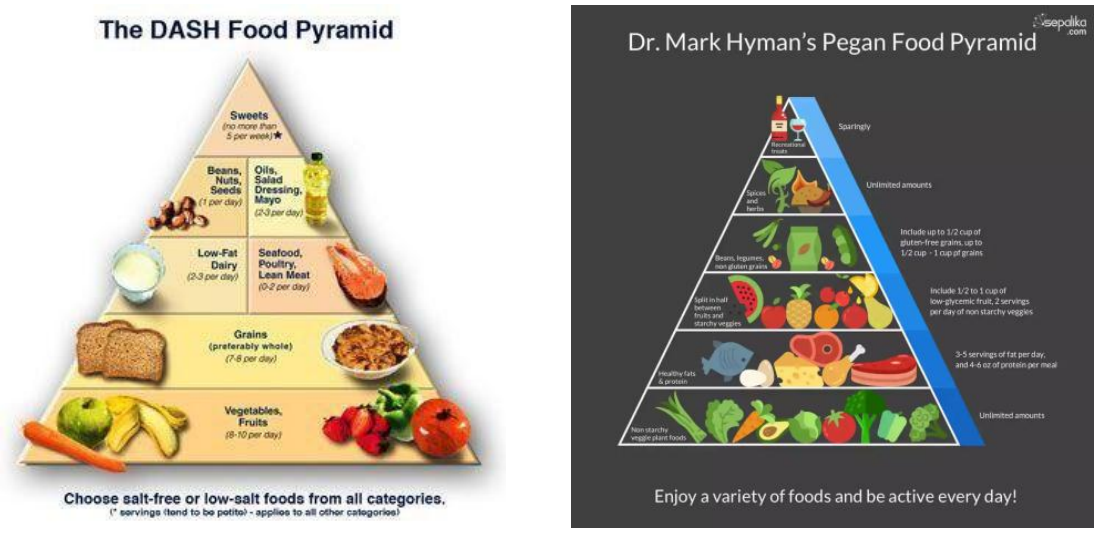


Figure 3: different diet types pyramids.

A fad diet is can be defined as a popular dietary pattern known to be a quick fix for obesity. Such diets are often marketed with specific claims that defy the basic principles of biochemistry and nutritional adequacy. These diets may have protective effects against obesity and certain chronic diseases like cardiovascular diseases, metabolic syndrome, and certain cancers. Limited evidence exists to support the proposed claims; rather certain studies suggest the negative health consequences of long-term adherence to such dietary patterns. Many fad diets have emerged in the previous few decades. as shown by figure (37).

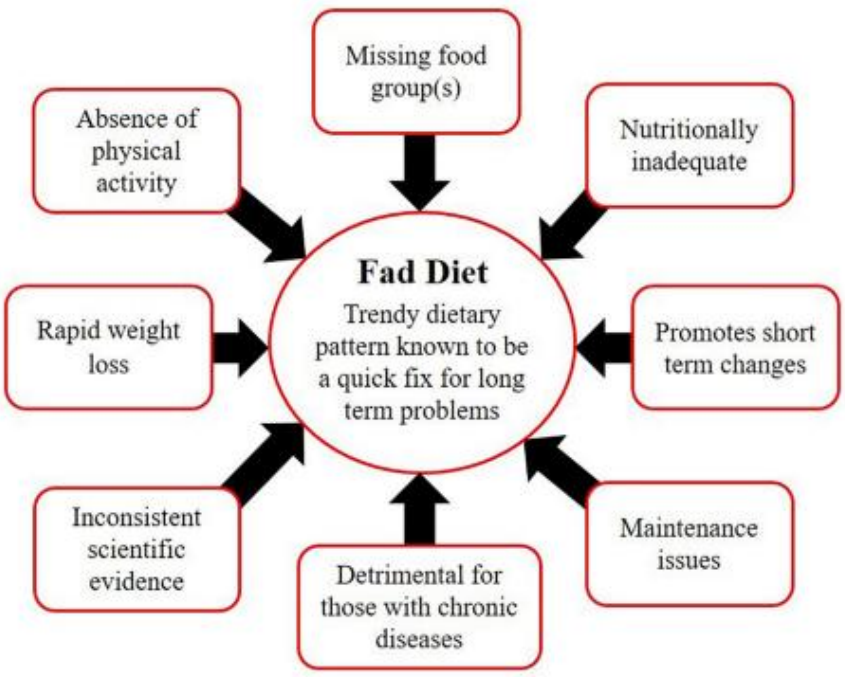


Figure 4: Characteristics of fad diets.

FD can be easily differentiated from a healthy and balanced diet based on its characteristic features: (i) promises rapid weight loss 18 (ii) absence of physical activity guidelines in it (iii) promotes shortterm changes rather than achieving lifelong sustainable goals for healthy weight loss (iv) focuses on one specific type of food or eliminates any food group (v) cannot be maintained for life long period diet (vi) nutritional adequacy is questionable (vii) fails to provide health warnings for those with chronic diseases (viii) lacks scientific evidence which support the claims[38, 39] (Figure 2)

The Dietary Approaches to Stop Hypertension (DASH) diet, and Mediterranean diet. Both These dietary patterns are rich in fruit, vegetables, whole grains, legumes, seeds, nuts, fish and dairy product. The DASH dietary pattern, is rich in fruits and vegetables, low fat dairy products, whole grains, fish, poultry, beans, seeds and nuts. And It is low in sodium, added sugars, sweets, fats and red meats. What make The DASH dietary pattern is a recognized treatment for hypertension, stroke and heart disease are associated with decreasing presence of NAFLD. A meta-analysis showed that the DASH diet score (DASH-DS) is significantly associated with an dramatic improvement in insulin sensitivity.[40] A few studies have suggest that the DASH diet was effective in improving circulating serum inflammatory biomarkers[41], in relieving IR (insulin resistance)[42], and in effective weight loss[43] or discouraging fat accumulation[42], all these factors being closely connected with NAFLD. Prevalence.

Our study has limitations that need to be taken into consideration. We distinguished dietary patterns by using food intake data only, while the inclusion of eating behaviors such as meal and snack patterns which recommended in future studies.

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Conflict of interests

There were no conflict of interest

CONCLUSIONS

NAFLD is a big health issue to be early diagnosed and treated especially for diabetics with non-healthy life style and must be managed with multidisciplinary team including a registered dietitians to prevent its life threating complications as the the patient starts anew life style with a full safe nutritionally based diet and a balanced approach by which the problem is completely resolved.

Recommendations

1. Routine screening of newly diagnosed DM2 patients for fatty liver diseases.
2. Electronic documentation of each patient's dietary habits and behaviors in order to pick up risky groups for early modifications.
3. Increase public education for NAFLD danger awareness.

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