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Review Article

REVIEW OF DIET QUALITY ASSESSMENT FOR PATIENTS WITH (T2DM)

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Abstract:

Nutritional factors are of vital significance in the management as well as prevention of type 2 diabetes. In this review, we will discuss about indexes and questionnaires which can be a valuable device for dietary evaluation and management of diabetics in medical application. We performed comprehensive search using biomedical databases; Medline, and Embase, for studies concerned with type 2 Diabetes mellitus (T2DM) disease published with English language up to, December, 2019. Dietary intake contributes in both the aetiology as well as managing of type 2 diabetes mellitus (T2DM), and also is a crucial modifiable danger element. Dietary intake, characterized by a high intake of energy as well as nutrients such as fat as well as sugar together with reduced intake of fiber, has actually been revealed to boost the threat of T2DM.In people with diabetes, medical nutrition treatment need to assist an individual to attain and keep normal blood sugar levels as well as a lipid/lipoprotein profile, along with blood pressure levels in the normal variety or as near to normal as is securely feasible. A patient's personal food preferences need to be considered when creating a medical nutrition therapy, in order to keep the pleasure of eating, thus developing a custom-made diet.

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INTRODUCTION:

Diabetes mellitus (DM) is identified by chronic hyperglycemia and damaged carbohydrates, lipids, as well as proteins metabolic process triggered by total or partial insufficiency of insulin excretion and/or insulin activity. There are two key types of diabetes, insulin-dependent diabetes mellitus (type 1 diabetes mellitus, T1DM) and non-insulin-dependent diabetes mellitus (type 2 diabetes mellitus, T2DM). T2DM is the most typical form of DM, which makes up 90% to 95% of all diabetic patients and also is expected to raise to 439 million by 2030^[1]. T2DM mainly results from the interaction amongst hereditary, external and also other threat factors.

For that reason, execution of effective T2D avoidance approaches, in addition to early discovery programs is of major importance to minimize the health stress of the condition ^[2]. To avoid onset of T2D at a very early age and to lower life-long danger of getting T2D, ideal option of food and also nutritional factors have been identified to perform a vital role. Former metaanalyses of possible researches showed that whole grains were related to lower T2D danger, whereas red meat, processed meat, and also sugar sweetened drinks (SSB) were associated with enhanced danger ^{[2],[3]}.

Among dietary recommendations for DM, the complying with dietary structure is suggested: 45 to 60% of everyday calories from total carbohydrates, 15 to 20% of daily calories from protein, and 25 to 35% of day-to-day total calories from lipids. The last are stratified as follows: <7% of everyday calories from saturated fatty acids (SFA), approximately 10% of day-to-day calories from polyunsaturated fatty acids (PUFAs), 5 to 15% of daily calories from monounsaturated fatty acids (MUFAs), as well as everyday cholesterol consumption less than 300 mg ^[4]. The minimum nutritional fiber referral is 14 g per 1000 kcal, with top priority offered to whole grains, vegetables, and also fruits [4]. Under Brazilian guidelines, the advised intake of vitamins and minerals is for individuals without diabetes, while sodium intake should not surpass 2000 mg each day, which is equivalent to 5 g of food preparation salt ^{[4],[5]}.

T2DM is a chronic metabolic condition in which frequency has actually been enhancing gradually throughout the globe. And stays a significant reason for morbidity and death worldwide. Nutritional factors are of vital significance in the management as well as prevention of type 2 diabetes. In this review, we will discuss about indexes and questionnaires which can be a valuable device for dietary evaluation and management of diabetics in medical application.

METHODOLOGY:

We performed comprehensive search using biomedical databases; Medline, and Embase, for studies concerned with type 2 Diabetes mellitus (T2DM) disease published with English language up to, December, 2019. keywords used in our search through the databases were as; "Diabetes mellitus", "dietary management", "assessment". More relevant articles were recruited from references lists scanning of each included study.

DISCUSSION:

• ETIOLOGY

Type 2 DM is as a result of mostly to life-style elements and genes ^[4]. A number of lifestyle factors are known to be vital to the advancement of type 2 DM. These are physical lack of exercise, inactive lifestyle, cigarette smoking as well as generous consumption of alcohol. Obesity has been discovered to add to roughly 55% of cases of type 2 DM^[6]. The enhanced percentage of childhood obesity between the 1960s and also 2000s is thought to have actually resulted in the increase in type 2 DM in youngsters as well as adolescents [7]. Environmental toxins may contribute to the current boosts in the rate of type 2 DM. A weak positive correlation has been found in between the concentration in the urine of bisphenol A, a component of some plastics, as well as the occurrence of type 2 DM^[8]. There is a solid inheritable hereditary link in type 2 DM, having family members (specifically first degree) with type 2 DM raises the dangers of establishing type 2 DM considerably. Concordance among monozygotic twins is close to 100%, as well as concerning 25% of those with the condition have a family history of DM^[9].



Figure 1. Pathway to acquire T2DM^[5].

Table 1. Etiology of T2DM [4-9].

Genetic factors of DM2
Genetic defects in insulin secretion
Genetic defects of insulin resistance
Environmental factors of DM2
Obesity
Aging
Psychological stress
Diet and nutrients
Glucotoxicity and lipotoxicity
Endoplasmic reticulum stress and endothelial dysfunction
Deficit in insulin secretion
Insulin resistance (IR)
IR in the liver
IR in adipose tissue
IR in the muscle

Food frequency questionnaires are created to determine standard long-lasting diet plan instead of to supply a specific estimate of temporary intake ^[10]. The affordable and ease of self-administration of a food frequency questionnaire facilitates use in large populations. Because 1979, there has been creating a semiquantitative food frequency questionnaire; a very early 61-item variation was revealed to supply a practical step of dietary consumption amongst women nurses when compared to 4 one-week diet regimen records ^{[11],[10]}. A later variation with 116 items was found to produce a comparable degree of validity for examining diet regimen 3-4 years in the past ^[12].

The questionnaire was developed to classify people according to degrees of average daily consumption of picked nutrients over the past year. Dietary variables approximated by the survey included calories, total fat, different types of fats and also sugars, vitamins, protein, alcohol and also caffeine.

Nutrient consumptions are computed from the questionnaire by multiplying a weight designated to the frequency of use (where when each day is equal to one) by the nutrient composition for the part size defined for every food or vitamin supplement. Nutrients are summation throughout all foods as well as vitamins to acquire an overall nutrient intake for every individual.

DASH Score

The Dietary Approaches to Stop Hypertension (DASH) diet plan, which is high in vegetables and fruits, modest in low-fat dairy products, and reduced in animal protein yet with considerable quantity of plant protein from beans and also nuts, significantly minimizes both systolic and also diastolic blood pressure among hypertensive and normotensive individuals ^[13].

While initially developed to assist people in the avoidance and also management of hypertension, DASH is now advised for the nutritional administration of T2D ^[13]. Adherence to DASH favorably effects on glycemic control, weight, and hypertension, which are crucial indicators of risk for diabetes-related difficulties ^[13]. A randomized controlled trial (RCT) performed in people with T2D showed that adherence to DASH boosted glycated hemoglobin (HbA1c) (-1.2%), fasting blood glucose (-0.92 mmol/L), weight (-3 kg) and also waist circumference (-4.8 centimeters) over 8 weeks when compared to a control diet plan^[14].

A systematic review and also meta-analysis of 20 RCTs discovered DASH substantially decreased systolic ($-5 \cdot 2 \text{ mmHg}$) and diastolic blood pressure ($-2 \cdot 6 \text{ mmHg}$) in adults with and without diabetes ^[15]. One more systematic review as well as meta-analysis

of 13 RCTs exposed that adults without T2D who stuck to DASH accomplished higher fat burning (-1.42 kg), lowered Body Mass Index (BMI) (-0.42 kg/m2) and also lowered waist circumference (-1.05 cm) compared to controls ^[16].

DASH scores are computed utilizing the common scoring tool developed by Fung et alia^[17]. The basic racking up tool determines a score in between 8 and 40 points, with 40 points representing optimal accordance with the DASH nutritional pattern^[17]. The DASH score is computed by summing the variety of daily portions of 7 dietary parts; fruits, veggies, nuts and legumes, whole-grains, low-fat dairy products, red and also processed meats, added sugar, as well as sodium intake. For each and every of the parts, individuals are identified depending on to their intake position. Greater intakes of fruits, veggies, low-fat dairy products, whole-grains, and nuts and also legumes get higher scores. Consumption of sodium, red and processed meats as well as sugarcoated are racked up in reverse as these are much less preferable foods ^[17]. The most affordable quintile is offered a score of 5 points and also the greatest quintile is provided a score of 1 factor. The parts scores are after that summed to give a total DASH score ^[17]. The scoring requirements for the DASH-style diet plan is detailed in Table 2.

Component	Foods	Scoring Quintiles (Q) *
Fruits	All fruits and fruit juices	Q1 = 1 point
Vegetables	All vegetables except potatoes and legumes	Q2 = 2 points
Nuts and legumes	Nuts and peanut butter, dried beans, peas, tofu	Q3 = 3 points
Whole-grains	Brown rice, dark breads, cooked cereal, whole- grain cereal, other grains, popcorn, wheat germ, bran	Q4 = 4 points
Low-fat dairy	Skim milk, yogurt, cottage cheese	Q5 = 5 points
Sodium	Sum of sodium content of all foods	Q1 = 5 points
		Q2 = 4 points
Red and processed meats	Beef, pork, lamb, deli meats, organ meats, hot dogs, bacon	Q3 = 3 points
		Q4 = 2 points
Added sugar	Foods and beverages with added sugars (i.e., sugar sweetened beverages)	Q5 = 1 point

Table 2. Dietary Approaches to Stop Hypertension (DASH) dietary pattern scoring criteria ^[17].

* Q1 represents low consumption and Q5 represents high consumption.

Healthy Eating Index (HEI)

The latest version of the HEI, made use of in that research study, contains 12 elements: 9 food groups and 3 items referring to elements to be consumed in moderation ("refined grains", "sodium", and also "empty calories", i.e., calories from solid fats, alcohols, and sugarcoated) ^[18]. The HEI is explained in detail in Table 3. Individual ratings range from 0 to 20 factors, and also the amount of the scores of each component produces a percent worldwide score.

Whether assessing diet regimens or some facet of the food environment, the fundamental steps for acquiring HEI-2010 scores are the same: (1) recognize the set of foods under consideration; (2) figure out the amount of each pertinent food group, subgroup, and nutrient in the collection of foods; (3) obtain the pertinent ratios; and also (4) score each component using the suitable typical ^[19].

Components	Maximum Score	Maximum score criteria	Criteria for zero score
1. Total fruit (includes fruit juice)	5	\geq 0.8 cup per 1000 kcal	No fruit or juice
2. Whole fruit (includes all forms except juice)	5	\geq 0.4 cup per1000 kcal	No whole fruit
3. Total vegetables	5	\geq 1.1 cup per 1000 kcal	No vegetables
4. Greens and beans	5	\geq 0.2 cup per 1000 kcal	No dark green vegetables or legumes
5. Whole grains	10	\geq 40 g per 1000 kcal	No whole grains
6. Dairy	10	\geq 1.3 cup per1000 kcal	No dairy
7. Total protein foods	5	\geq 70 g per 1000 kcal	No protein foods
8. Seafood and plant proteins	5	\geq 20 g per 1000 kcal	No seafood or plant protein
9. Fatty acids	10	(PUFAs + MUFAs) / SFAs≥2.5	(PUFAs + MUFAs) / SFAs≤1.2
10. Refined grains	10	\leq 50 g per 1000 kcal	\geq 120 g per 1000 kcal
11. Sodium	10	\leq 1.1 g per 1000 kcal	\geq 2 g per 1000 kcal
12. Empty calories	20	\leq 19% of energy	\geq 50% of energy

Table 3. Healthy Eating Inde	(HEI) con	nponents and criteria used for maximum score and zero score ^[18] .
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Diabetes Healthy Eating Index (DHEI)

The DHEI consists of 10 elements: 6 food categories, three elements describing "percent day-to-day calorie intake from lipids", "dietary cholesterol", and also "trans fats"; as well as a "diet selection" component ^[20]. For the last component, each food was counted just when consumption was > 50% the advised intake in the matching food group. A score had been developed for each and every element, the worth of which is classified depending on adherence to current national

nutritional suggestions for DM, namely: "inadequate" (no points), "fair" (one-half point), and also "good" (one point) ^[20]. The sum of the scores of each element yields a general score of diet high quality, which it transformed on a range of zero to 100. The DHEI is explained carefully in Table 4. In both indexes, the overall diet plan high quality is identified as low (<51%), needing improvement (51–80%), or sufficient (> 80 factors) [21]

Components (daily intake)	Portion (kcal)	Criteria for adherence with diabetes recommendations			
		Poor	Fair	Good	
1. Diet variety: number of items	_	< 6	6–16	≥16	
2. Fresh fruit (portions per 1000 kcal)	70	< 1.0	1.0–1.5	≥1 ¹ / ₂	
3. Vegetables (portions per 1000 kcal)	15	< 1.0	1.0–1.5	≥1 ½	
4. Carbohydrates and fiber sources (portions per 1000 kcal)	150	< 3	< 3 BUT at least 50% from fiber sources	\geq 3 AND at least 50% from fiber sources	
5. Meat and eggs (portions per 1000 kcal)	190	>1.0	0.5–1.0	≤0.5	
6. Dairy products (portions per 1000 kcal) AND saturated fatty acids (% of energy)	120	<0.75 portion/day of dairy OR saturated fatty acids intake > 10.5% of energy	 > 0.5 portion of dairy AND Saturated Fatty Acids < 7.0% of energy OR > 0.75 portion of dairy AND saturated fatty acids between 7.0 and 10.5% of energy 	1.0–2.0 portions/day of dairy AND saturated fatty acids < 7% of energy	
7. Oils, fats, and nuts (portions per 1000 kcal)	73	>1.0	0.5–1.0	≤0.5	
8. Total lipids (% of energy)	_	≥45%	30–45%	≤30%	
9. Dietary cholesterol (mg/day)	_	≥450	300-450	≤300	
10. <i>Trans</i> -unsaturated fatty acids (% of energy)	-	≥1.5%	1.0–1.5%	≤1.0%	

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✤ The alternate healthy eating index

This DQI is an adaptation by McCullough as well as colleagues (2002) of the former Healthy Eating Index. The 9 parts are racked up on a variety of 0- 10. The score for each element is symmetrical to the degree which the nutritional standard is fulfilled ^[22].

✤ The healthy diet indicator

The Healthy Diet Indicator was developed based on the World Health Organization (WHO) guidelines for diet regimen and also nutrition in the avoidance of chronic disease. These standards were ultimately upgraded in 2003, nonetheless nutritional referrals remain the same. This index uses a dichotomous scoring technique, with a total rating series of 0-9. A score of +1 is given to those who meet the referral for a recommended dietary element and also a score of 0 is offered to those that do not satisfy the provided guidelines ^[25].

* Mediterranean diet

The typical Mediterranean diet routine is defined by a high ingestion of monounsaturated fat, plant proteins, whole grains, fish, modest intake of alcohol, and low usage of red meat, refined grains, and sweet products ^[32]. An intervention investigation has actually just recently revealed that the Mediterranean diet is much more reliable in guiding weight decline and reducing total: HDL cholesterol proportion in overweight individuals than a low-fat diet^[32]. Formerly, the Lyon Heart Study revealed that the Mediterranean diet regimen was a lot more efficient than a low-fat diet in secondary elimination of heart events. Ever since, the Mediterranean diet plan pattern has been displayed in several research studies from all over the world to be vice versa related to total and cardiovascular (CVD) death [33],[34].

The Mediterranean diet score

Established by Trichopoulou et al., this diet quality assessment tool is based on the traditional dietary pattern of the Mediterranean region. The index has an overall score varying in between of 0-9. The sexspecific typical intake is computed for every nutritional component and also is utilized as a mean value to help application of scores. Ingestion of greater than the median value is granted a score of +1, with the exceptions for meat and dairy, where consumption of higher than the typical amount is gained a score of 0 $^{[23]}$.

The alternate Mediterranean diet score

Fung as well as co-workers (2005) adapted the conventional Mediterranean Diet Score. Whilst similar to the initial Mediterranean Diet Score, modifications were made to the original Mediterranean Diet Score based upon nutritional patterns and practices that were continuously obtained to be related to diminished risks of chronic illneses ^[24].

Dietary quality index	Author(s)	Score	Measure	Associations
Mediterranean diet score	Trichopoulou et al., 1995	Trichopoulou et l., 1995Range: 0-9Adherence to a traditional Mediterranean	Adherence to a traditional Mediterranean	• Inverse association with total mortality ^[23] .
		dietary pattern	• Important decline in overall mortality ^[23] .	
				• Inverse association with risk of cancer illnesses ^[26] .
Alternate Mediterranean diet score	Fung <i>et</i> <i>al.</i> , 2005	Range: 0–9	Adherence to a Mediterranean dietary pattern.	• Inversely associatiated with inflammatory biomarkers ^[24] .
		Adapted score to give greater focus on within food group quality	• Lower incident of mortality from coronary heart disease and stroke ^[27] .	
				• Significant inverse association with BMI and obesity ^[28] .
Alternate healthy eating index	Iternate healthy ating indexMcCullough et al., 2002Range: 2.5- 87.5Adherence to USA dietary guidelines and the USA My Food Pyramid. Adapted score to give greater focus on within food group quality	• Significant reduction in overall chronic disease risk, with greater strength in prediction of chronic disease risk when compared to the original Healthy Eating Index ^[29] .		
			give greater focus on within food group quality	• Inverse association with inflammatory biomarkers ^[24] .
				• Reduction in overall disease risk and risk of premature mortality from coronary vascular disease ^[30] .

Table 5. Summary of dietary quality indices

Dietary quality index	Author(s)	Score	Measure	Associations
Healthy diet indicator	Huijbregts et al., 1997	Range: 0–9	Adherence to WHO 1990 dietary recommendations for the prevention of chronic disease	• Significantly inverse association with 20-year all-cause mortality in a multi-cultural population ^[25] .
				• Significantly correlated with nutritional adequacy (MAR) ^[31] .

• **PREVENTATIVE DIET MODIFICATION**

Preventative Diabetes research studies have actually shown that nutrient composition is crucial element to avoid the progression of T2DM. Epidemiological research studies have recommendations that the risks of developing diabetes mellitus can be increased or decreased due to nutritional aspects. The nutritional elements which might enhance the diabetes danger are ingestion in big amounts of refined grains, sugarsweetened beverages, red and also processed meat and alcohol, and those with the contrary results are the consumption of whole-grain cereal, vegetables, dairy, beans, nuts, separately of body weight change ^[35]. A lot of prevention research studies concerning dietary aspects have been conducted in several countries during the last numerous years. Studies from China, Japan and also India targeted at examining the effects of minimizing fat, polished carbohydrates as well as alcohol and raising fiber consumption on the development of T2DM ^{[35],[36]}. The Finnish Diabetes Prevention Study advocated decreasing total and saturated fat consumption as well as enhancing fiber density in the diet regimen [37]. In the Diabetes Prevention Program, aim of nutritional program were to reduce overall level of fat as well as energy consumption ^[38]. A Mediterranean diet program defining by a high intake of vegetables, fruit, beans, extra virgin olive oil, nuts, fish, whole grains and red wine also revealed an exceptional decrease in the incidence of diabetes mellitus in a Spanish study [39]. Although diet plan is quite variable owing to food schedule, personal choices as well as different background, a basic policy can be acquired: a high intake of vegetables, fruits and also vegetable fats; nuts, beans, dairy products and also fish must be taken as supplement for sufficient body protein; grain products unrefined and with high all-natural fiber material need to be generally chosen; red meat and also very processed foods need to be limited.

CONCLUSION:

Dietary intake contributes in both the aetiology as well as managing of type 2 diabetes mellitus (T2DM), and also is a crucial modifiable danger element. Dietary intake, characterised by a high intake of energy as well as nutrients such as fat as well as sugar together with reduced intake of fiber, has actually been revealed to boost the threat of T2DM.In people with diabetes, medical nutrition treatment need to assist an individual to attain and keep normal blood sugar levels as well as a lipid/lipoprotein profile, along with blood pressure levels in the normal variety or as near to normal as is securely feasible. A patient's personal food preferences need to be considered when creating a medical nutrition therapy, in order to keep the pleasure of eating, thus developing a custom-made diet.

Food consumption details can be acquired from a measurable food frequency questionnaire (FFQ). Reported consumption can be exchanged daily consumption, and diet quality examined utilizing different indexes. Nutritional indexes are useful devices in clinical technique since they allow the evaluation of total diet regimen quality utilizing various dietary items. Additionally, it can enhance therapy on dietary routines by concentrating on the nutritional elements that require enhancement in the compliance with nutritional requirements. Nevertheless, to the most effective of our understanding, there is no common reference for assessment of diet plan quality in people with diabetes.

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