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ASSESSMENT OF THE NUTRITIONAL STATUS IN TYPE II DIABETES MELLITUS PATIENTS IN THI-QAR

Dr. Zainab Mohammed Ali Hasan[1], Dr. Ali Abdulridha AbuTiheen[1], Ali Abid Saadoon[2]

[1] Family and Community Medicine department, College of Medicine, University of Kerbala, Iraq.

[2] Family and Community Medicine department, College of Medicine, University of Thi Qar, Iraq.

Abstract

Background : Diabetes mellitus (DM) is a global leading killer and cases number of DM had increases dramatically over last decades and expected to continue. Type 2 DM represent more than 95% of DM cases and it affect adults mainly. Recent estimates give that one in each 10 adults got DM. East Mediterranean region including Iraq is the region that have the highest prevalence of DM in world of 14%. Diabetic patients suffer from wide range of nutritional problems, which could negatively affect the control, prognosis, complication of the disease and their quality of life.

Objective: to assess of the nutritional status of type 2 DM patients and factors associated with it.

Patient and methods : An analytical cross-sectional study. A random sample of 300 patients with type 2 DM. were selected from those attending the diabetes and endocrine center in Thi-Qar province/ Iraq from 1/4/2022-15/9/2022. For each patient, demographic, nutritional and history related to the disease was taken. Anthropometric measures were checked, RBS, HbA1c, lipid profile and body component was examined by human body element analyzer (impedance electrochemistry). A p value of less than 0.05 was considered significant.

Results: More than 50% of the sample were obese and 89% were overweight. A significant positive correlation identified between body mass index (BMI) and the central obesity parameters including the pelvis circumference and waist circumference, also breakfast intake and with fat, protein and water content. The protective factor from obesity were in the normal weight group are male sex(p=0.007), address(p=0.006), Type of therapy the patient received(p=0.004) or DM family history (p= 0.003), absence of chronic diseases(p=0.023), smoking (p= 0.0001), chronic constipation (p= 0.062)and when the patient rarely eat rice(p= 0.018).

Conclusion In T2DM, highly significant and and positive correlation between BMI and the central obesity and between BMI and body component including fat, protein and water content

Key word: Diabetes, type 2 diabetes, obesity, nutritional assessment, Thi-Qar, anthropometric

Introduction

Type 2 diabetes is a metabolic disease characterized by insulin resistance and/or abnormal insulin secretion which is caused by many factors including genetics, nutrition, and physical activity. Insulin signaling dysregulation during glucose metabolism is the major mechanism contributing to T2D, understanding this pathway beneficial for understanding prevention and intervention of T2D.(**Manual of Harrison's textbook of medicine,2021)**

According to the ninth addition of the IDF Diabetes Atlas in 2019, 488 million adults aged 20–99 years live with diabetes in the world, and the number will reach 578 million by 2030 and 700 million by 2045.(**IDF Diabetes Atlas 2021**).

Type 2 diabetes develops slowly. Two symptoms that occur in many people with the disease are increased thirst (polydipsia) and frequent urination (polyuria) due to excess glucose in the body draws water from the tissues. (Essential of Kumar textbook of clinical medicine ,2011). Other warning symptoms of diabetes mellitus are fatigue, irritability, blurred vision, slow-healing sores, frequent infections etc.

Prevention, based on body mass index (BMI) about 65% of Americans peoples are overweight (BMI ≥25) or obese(BMI ≥30), 16 million adults in this country were diagnosed with DM2. 16 million of Americans were prediabetes and subsequently at risk for developing overt DM2 within 10 years. (**Jennifer, 2021**). Good relationship was found between T2DM and obesity mostly due to hormonal factors, pro inflammatory substances, leptin secretion. (**Manson 2001**)

Obesity it is defined as excessive accumulation of adipose tissue in the body, that impair the normal daily activity. It leads to several dangerous complications on the health including cardiovascular or strokes. It is due to imbalance between the dietary intake and the consumption of energy.(**Salvador, 2017**).

Malnutrition is a broad meaning issue globally distributed. Malnutrition is defined by the WHO as a state of imbalance that occur between supplies of the nutrients and energy consumption in respect to the body demand to ensure normal growth of the body, maintenance of normal life and normal functions, therefore; both- undernourishment and obesity are found at both sides of the line.(**WHO, 2019**)

Malnutrition can present as a problem in many adults with DM. Malnutrition may occur due to therapeutic treatment, insufficient availability of food, insufficient intake, non-nutritive food and other poor appetite and inadequate nutrient absorption immoderate nutrient losses or may be due to over eating of food(**John, 2010,**)&(**Azétsop & Joy, 2013**).

The other side of malnutrition is obesity, which is a great problem especially in diabetic patients(**Hana, 2021**). Obesity is defined as accumulation of fatty tissue to a state that impare the physical and /or psychosocial health and leads to decrease the wellbeing(**Naser ,2006).** Obesity is considered a health problem in developing and developed countries(**Gallagher, 2000**).

In the USA, approximately two thirds of the adult population are either overweight or obese, the same are seen worldwide.(**Tsai AG, 2011**). Obesity is associated with many psychological, medical and social conditions, the most important one may be type 2 diabetes.

lifestyle differences like increase carbohydrate intake and decrease the physical activity, are associated with defect in insulin receptor sensitivity (**Kasuga , 2006**). Fatty tissue affects metabolism by secretion of several hormones, cytokine, glycerol, leptin, adiponectin, and proinflammatory substances, and by releasing NEFAs (non-esterified fatty acids). In obese and overweight people, there is increase in the secretion of these substances(**Karpe . et al., 2011**).

Individuals with high-normal HbA1c levels have a greater risk of developing type 2 DM. (**Bonora, Kiechl & Mayr , et al., 2011** Moreover, obesity in women was noted to be an

independent risk predictor for type 2 DM. Studies have demonstrated that the risk of developing type 2 DM is significantly higher in individuals with BMI ≥30 kg/m^2 compared with those with normal BMI.(**Ganz, et al., 2011**).

Diabetes may be diagnosed based on plasma glucose criteria, either the fasting plasma glucose (FPG) value or the 2-h plasma glucose (2-h PG) value during a 75-g oral glucose tolerance test (OGTT), or Hb A1C criteria . Generally, FPG, 2-h PG during 75-g OGTT, and HbA1C are equally appropriate for diagnostic screening. It should be noted that the screening tests do not necessarily detect diabetes in the same individuals.

The same tests may be used to screen for and diagnose diabetes and to detect as was mentioned in Mayo Foundation for Medical Education and Research, 2016)(**Mayo foundation for medical education and research, 2016**). An abnormal **screening** test result should prompt clinician to repeat the same test or perform another test to confirm the diagnosis.(**Natisha, 2020**)

The prevalence of moderate and high nutritional morbidity was 34.8% and 29.4%, respectively. Malnutrition state has association with marital status (unmarried), increased BMI, male gender, educational state(low), cognitive performance(low), and less adherance to the Mediterranean diet. the prevalence of malnutrition in urbans is little bit high with a ranging between 10.9% and 14.2% and prevalence in rurals around 3.0-7.8% in population around 20 years and above with more prevalence in people aged over 50 years as was found in Indian study(**Medeiros & Morais , 2021**).

It was estimated that diabetes caused 4.2 million deaths in adults aged 20–79 years during 2019, which is 11.3% of global mortality. In addition, nearly half of these deaths (46.2%, 1.9 million) are estimated to occur in working-age adults, younger than 60 years (**Roglic & Unwin. 2010**)

Advanced age, high BMI, abdominal obesity, a family history of diabetes, hyperlipidemia, and smoking increased the risk of T2DM and prediabetes.The higher incidence of type 2 DM among older women may be attributable to the high prevalence of overweight and obesity, sedentary lifestyle, nutritional habits and early menopause witnessed in our population(**Rizk , Bener, Ezimokhai, et al., 1998**).

Additionally, due to frequent infection, susceptible children become engaged in a negative cycle whereby infections lead to growth delays and their learning abilities are hindered, and infections in malnourished children may lead to childhood mortality (**Mengistu, 2013**).

Nutrients can be classified in two ways; Classification based on their synthesis: based on this classification, they are divided into essential and non- essential nutrients. The essentials are those that cannot be synthesized in the body (either at all, or in sufficient quantities), and so must be consumed by an organism from its environment. For humans, these include essential fatty acids, essential amino acids, vitamins, and certain dietary minerals.

The nonessential nutrients are those nutrients that can be synthesized in the body; they may often also be absorbed from consumed food. (**Yongqing , 2015).**

Macronutrients are defined as a class of chemical compounds which humans consume in the largest quantities and which provide humans with the bulk of energy. The macronutrients are carbohydrates, fiber, fats, protein, and water.(**Taşğın, 2017**). Individuals with diabetes typically

consume 45% of their daily calories from carbohydrate, 16–18% from protein, and 36–40% from fat.(**Sharon, 2019**)
Micronutrients that include the mineral, vitamins, and electrolytes.
This study aims to assess the nutritional status of type 2 diabetic patients and factors associated with the nutritional status. .

Patients and methods

Un evaluative study that randomly selecting patients, three days weekly as cross-sectional comparative study, this study was performed from the first day of April 2022- the fifteenth day of September 2022. The study was performed in diabetes and endocrine center in Thi-Qar province/ Iraq.
About 300 and more patients were participated in the study we discussed with the patients our action by direct question and by questionnaire, All participants were informed about the nature and the purpose of the study.
Inclusion criteria: All diabetic patients type 2 who are more than 30 years old attend the center of diabetes were eligible for the study
Exclusion criteria: we exclude patients with severe renal, cardiac or liver dysfunction, malignancy, requirement of intensive care unit, diabetic decompensation and confused patients. and pregnant patient as it doesn't give a real calculation of the anthropometric measures including the waist ails
We visited the diabetic center three days weekly from 8 am to 1 pm , history taking, proper examination, answering of the questionnaire and we checked the files of the patient and we check the required investigations. The sample size was calculated using Dobson's equation
Anthropometric measure:
Height, weight, BMI are calculated by= human body element analyzer
Aimylin GS6.6/ China- 2018/test
Test method by multifrequency
Bioelectrical impedance analysis
while the pelvic, waist,, wrist and mid-arm circumferences had been calculated by the tape measure.
According to the World Health Organization (WHO)(**WHO Expert Consultation Geneva, 2008**) , a moderate WHR is:

- 0.9 or less in men
- 0.85 or less for women

In both men and women, a WHR of 1.0 or higher increases the risk of heart disease and other conditions that are linked to having overweight.
RBS, S.cholestrol, S.triglyceride and HbA1c were checked, all of them measured using COBAS E311 (Electrochemiluminescence (ECL) technology, Germany.

We use windows 10 program in our computer and SPSS-26 as mentioned above, numbers expressed inform of frequency and percentages by using the Excel sheets for drawing graphs and figures and by using the statistical package of social sciences to analyze the quantitative data where t-test and /or Z test and ANOVA were used to check correlation between the parameters. Probability (P) value was taken less than 0.05 considered as statistically significant. Figures, tables and bar chat were drawn by using axil 10

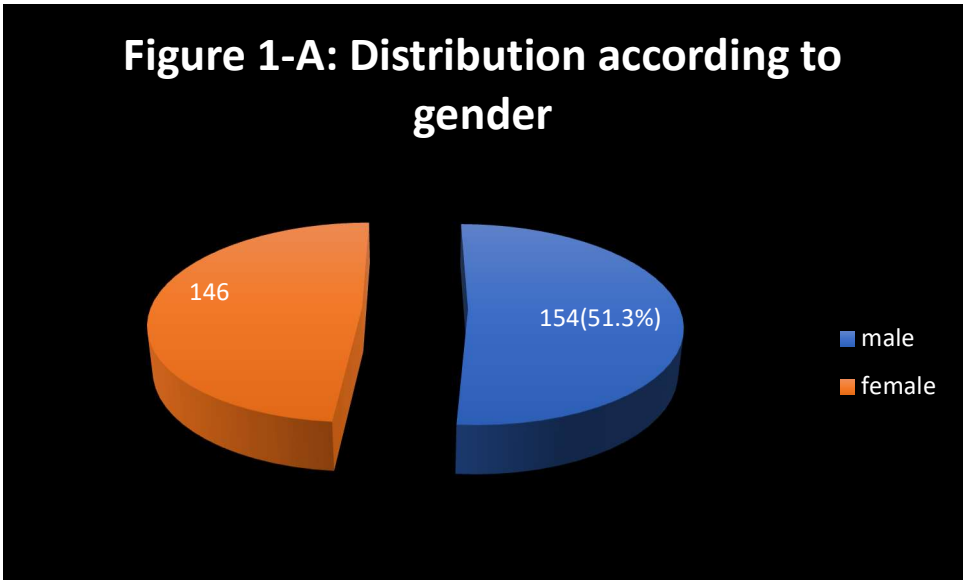
Ethical consideration: official endorsement had been taken from general directorate of the health in the province especially from the development and the research unit within the directorate and full agreement from the management unit of indoor clean and the endocrine and diabetes mellitus centre full form 4 the written acceptance had been copied on the questionnaire of the patients with diabetes.

Results

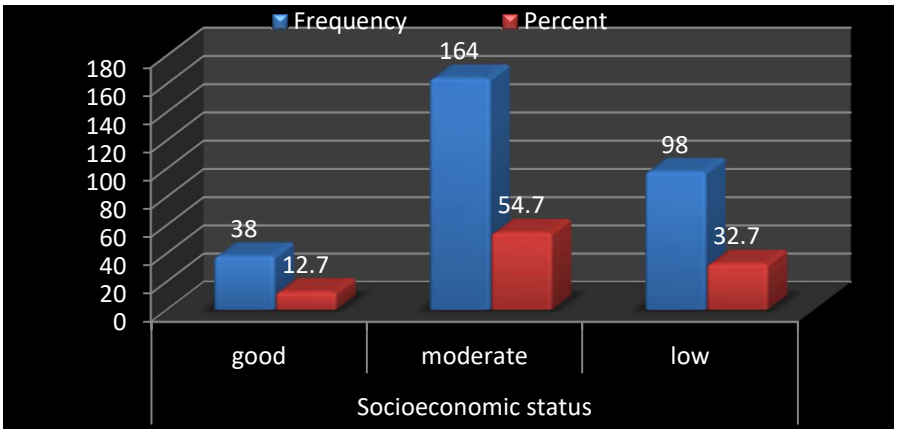
A three hundred Patients were included in this study. All of them were diagnosed as DM.

Socio-demography of the studied population

The males were slightly higher in their number than female 154(51.3%) for male versus 146(48.7%)female figure (1-A). Regarding socioeconomic state 164 (54.7%) were in moderate state while 98 (32 0.7%) patients were in low state and about 38(12.7%) was in good state. (figure1-B). The majority of the current study patients were either overweight 112 (37.3%)patients, obese154 (51.3%), the others was a normal weight 31 (10.3%) and underweight just a 3(1%). (As shown in fig 1-C).



A



B

Figure 1. :Socio-demography of studied population (A,B)

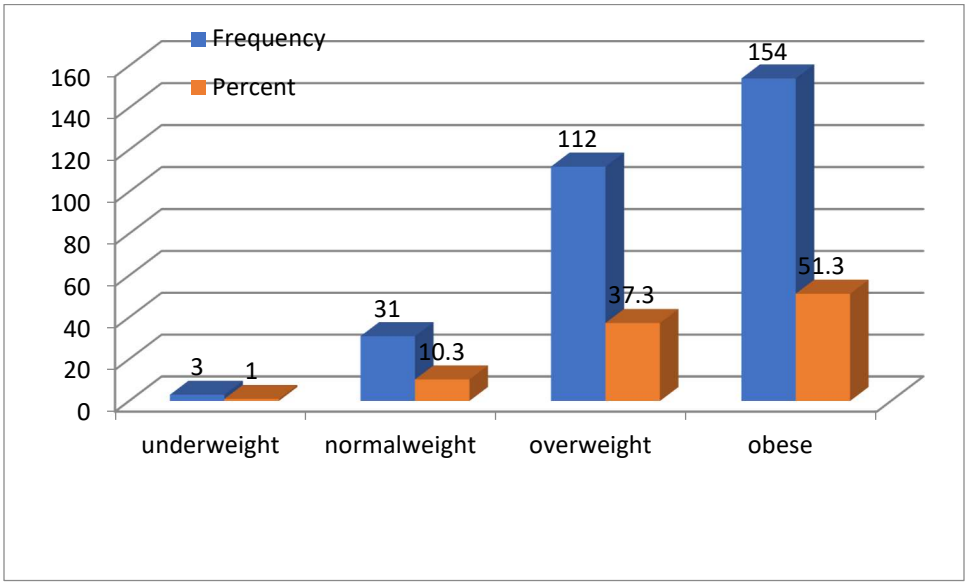


Figure 2: Distribution according to BMI categories.

Drug modalities for the patients

The majority of the current study patients199 (66.3%) took several types of modalities of oral antidiabetic therapy and we have 42(14%) patient they changed oral therapy to insulin, while The Others 18 (6%) they received both tablet and insulin, the remaining 41(13.7%) they were on diet therapy alone.(table 1)

Table 1. Type of therapy for the studied population

Type of therapy	No.	percent
Diet	41	13.7%
Oral hypoglycemic therapy	199	66.3%
Insulin	42	14%
Tablet and insulin	18	6%

The criteria of the study population:- was divided into 3 groups the first one that we study the distribution of those 300 patients according to nutritional intake and dietary habits and we took all the compartments of the nutrition including carbohydrates, fats, proteins and their constituents in our diet in Iraq and we asked the same person for details of the diet and these include sweaty diet, soft drink, bread, meet, fatty diet, fish ,rice, vegetables, fruits and number of meals that usually taken daily in addition to appetite and we found that the patient that rarely consume sweaty diet were 130(43.3%) and only 57(19%) were sometime used so. and only 35(11.7%) were did so and took it always.

Most of the current study patients were either not or rarely drink a soft drink 145(48.3%) and 105(35%) respectively and only 45(15%) of the patients were sometimes drink soft drinks, the remaining 5(1.7%) do so always.

In the current study society we use one kind of the bread either brown 79(26.3%) from barley or white type from wheat 221(73.7%). Regarding meat about 22(7.3%) of the current study population did not consume meat while 120(40%) and 106(35.3%) either rarely or sometimes eat meat respectively the remaining 52(17.3%) were always eat meat .

Less than half 126(42%) of the current study patients rarely eat fatty diet while 73(24.3%) patient eat fatty diet and 37(12.4%)of the current study patients were always do so, the remaining 64(21.3%) use it sometimes .

Two third of the current study studied patients 200(66.7%) prefer to eat both grilled and fried fish while 91(30.3%) eat grilled one and the other 9(3%) prefer to eat fried only.

Half of the current study patient eat rice either sometimes 97(32.3%) or always 59(19.7%) and 125(41.7%) rarely eat rice the remaining 19(6.3%) no prefer to do so.

All of the current study patients eat vegetable whether only once 64(21.3%) or twice 199(66.3%) or trice 29(9.7%)or more than that 8(2.7%). And the same in fruits 99(33%)they use it once , 144(48%) twice, or trice 55(18.3%) or more than that 2(0.7%).

Most of the current study patients eat three meals 248(82.7%) or two times 25(8.3%)or once 1(0.3%) while only 26(8.7%) eat more than that.

232(77.3%) had a good appetite and 43(14.3%) had fair appetite and only 25(8.3%) had a poor appetite as (shown in table2)

Table 2. :distribution of patients (300) according to nutritional intake and dietary habits:

Type of Diet	Frequency of intake	Frequency	Percent
	No	78	26
Sweet diet	Rarely	130	43.3
	Sometime	57	19.0
	Always	35	11.7
Soft Drink	No	145	48.3
	Rarely	105	35.0
	Sometime	45	15.0
	Always	5	1.7
Bread	Brown bread	79	26.3
	White bread	221	73.7
Meat	No	22	7.3
	Rarely	120	40.0
	Sometime	106	35.3
	Always	52	17.3
Fatty diet	No	73	24.3
	Rarely	126	42
	Sometime	64	21.3
	Always	37	12.4
Fish	Fried	9	3.0
	Grilled	91	30.3
	Both	200	66.7
Rice	No	19	6.3
	Rarely	125	41.7
	Sometime	97	32.3
	Always	59	19.7
Vegetables	One	64	21.3
	Two	199	66.3
	Three	29	9.7
	More	8	2.7
Fruits	One	99	33.0
	Two	144	48.0
	Three	55	18.3
	More	2	0.7
Meals no.	One meal	1	0.3

	Two meal	25	8.3
	Three meals	248	82.7
	More	26	8.7
Appetite	Poor	25	8.3
	Fair	43	14.3
	Good	232	77.3
	Total	300	100.0

Dietary intake

Effect of the diet intake on the studied parameters

There is only mild effect of the fatty diet on midarm circumference although not significant statistically (p=0.07) (as shown in the table 3.A).

Table 3. Effect of food types on other parameters(table A-J)

A. fatty diet

Fatty diet(No.)	Mid-arm (Mean)(cm)	S.D.
No (73)	29.8	4.5
Rarely (126)	29.5	3.7
Sometime (64)	32.7	16.5
Always (37)	31.5	4.7
Total(300)	30.5	8.5
ANOVA	2.3	
P	0.07	

There is an effect of the sweet diet on BMI, fat component and RBS(p=0.02, 0.01 and p=0.04) respectively (table 3. B)

B. effect of sweet diet on BMI, fat component & RBS.

Sweet diet		BMI mean(Std)	Fat component (kg)	RBS (mg/dl)
No(78)	Mean	30.0	26.7	178.0
	Std. Deviation	5.2	9.8	79.8
Rarely (130)	Mean	30.2	28.5	181.8
	Std. Deviation	5.2	10.2	82.3
Sometime	Mean	31.7	31.9	171.2

(57)	Std. Deviation	5.5	16.1	81.4
Always (35)	Mean	32.8	32.6	220.5
	Std. Deviation	5.3	10.2	103.9
Total(300)	Mean	30.7	29.2	183.3
	Std. Deviation	5.3	11.6	85.0
ANOVA		3.2	3.5	2.7
P		.023	0.01	0.04

There is an effect of soft drink intake on BMI, wrist circumference, protein component and RBS (p= 0.004 , p= 0.02, p=0.01 and P=0.02) respectively(table 3.C)

C. Effect of soft drink

Soft Drink		BMI kg/m^2	Wrist (cm)	Protein kg	RBS mg/dl
No(145)	Mean	30.4	18.7	12.9	178.7
	Std. Deviation	4.9	2.6	1.9	78.1
Rarely (105)	Mean	30.1	19	13.5	174.6
	Std. Deviation	5.5	2.4	1.8	78.0
Sometime (45)	Mean	33	19	13.6	213.4
	Std. Deviation	5.3	2.3	1.7	113.7
Always (5)	Mean	35.2	22.4	14.6	227.8
	Std. Deviation	8.1	8.0	2.1	72
Total (300)	Mean	30.7	18.9	13.2	183.3
	Std. Deviation	5.3	2.6	1.9	85
ANOVA		4.6	3.09	3.8	2.9
P		0.004	0.02	0.01	0.02

D. Effect of meat on HbA1c & RBS

Report

meat		HbA1C	RBS(mg/dl)
No(22)	Mean	8.1	158
	Std. Deviation	1.3	57
Rarely(120)	Mean	8.5	181
	Std. Deviation	2	78
Sometime (105)	Mean	8.4	175
	Std. Deviation	1.8	78
Always (53)	Mean	9	213
	Std. Deviation	2.1	111
Total(300)	Mean	8.5	183
	Std. Deviation	1.9	85
ANOVA		1.8	3
P		.01	.02

E. HbA1C & RBS with vegetables & No. of meals

Report

		Vegetable		Meals	
		HbA1C	RBS(mg/dl)	HbA1C	RBS(mg/dl)
One (64)	Mean	9.2	205	10	155
	Std. Deviation	1.9	87	8	150
Two (198)	Mean	8.3	174	7	164
	Std. Deviation	1.8	80.9	1.6	64
Three (29)	Mean	8.7	189	8	180
	Std. Deviation	2.2	104	1.9	84
More (9)	Mean	8.5	198	10	232
	Std. Deviation	1.6	71	1.7	92
Total (300)	Mean	8.5	183	8.5	183
	Std. Deviation	1.9	85	1.9	85
	ANOVA	3.8	2.3	6.9	.0001
	P	.01	.07	3.5	.01

There is an effect of bread with HbA1c and RBS(p= 0.04 & p=0.04)

F. Effect of bread:

Report

Bread		HbA1C	RBS
brown bread (78)	Mean	8.1	177
	Std. Deviation	1.6	84.1
white bread (222)	Mean	8.6	185.3
	Std. Deviation	2.0	85.4
Total (300)	Mean	8.5	183.3
	Std. Deviation	1.9	85
	ANOVA	4.0	1.3
	P	0.04	0.04

The consumption of meat affect only fat composition(p=0.02) and RBS (p=0.02)(table G)

G. Effect of meat

meat		fat	RBS
No (22)	Mean	33.5	158
	Std. Deviation	21.8	57
Rarely (120)	Mean	29.3	181
	Std. Deviation	9.5	78.8
Sometime (106)	Mean	26.7	175.7
	Std. Deviation	10.4	78.3
Always (52)	Mean	32	213
	Std. Deviation	11	111
Total (300)	Mean	29	183
	Std. Deviation	11.6	85
	ANOVA	3.7	3.2
	P	0.02	0.02

Vegetable intake affect only RBS(0.07) and HbA1c(p= 0.006)(table H)

H. Effect of vegetables

vegetables		RBS	HbA1C
One (64)	Mean	205.6	9.2
	Std. Deviation	87	1.9
Two (199)	Mean	174.7	8.3
	Std. Deviation	80.9	1.8
Three (29)	Mean	189	8.7
	Std. Deviation	104	2.2
More (8)	Mean	198	8.2
	Std. Deviation	71.5	1.7
Total (300)	Mean	183.3	8.5
	Std. Deviation	85	1.9
	ANOVA	2.3	4.2
	P	0.07	0.006

Meal numbers can affect RBS(p=0.01), HbA1c(p=0.0001) and wakeup time at the morning(p=0.02)(table I)

I. Effect of meal numbers

meals		RBS (mg/dl)	HbA1C	Wakeup (hrs.)
one meal (1)	Mean	155	10.4	6
	Std. Deviation			
two meal (25)	Mean	164.5	7.8	7.8
	Std. Deviation	64.4	1.6	1.6
three meals (248)	Mean	180.2	8.4	7.5
	Std. Deviation	84.7	1.9	1.2
More (26)	Mean	232	10	6.9
	Std. Deviation	92	1.7	0.8
Total (300)	Mean	183	8.5	7.5
	Std. Deviation	85	1.9	1.2
	ANOVA	3.5	6.5	2.9
	P	0.01	0.0001	0.03

Correlation

The results had been divided into two groups

The correlation between the BMI and lipid profile and body component the current study found a strong and positive correlation between BMI and fat, protein and water content where (p

=0.0001) and (r=0.586**),(p=0.0001) and (r=0.228)and the last (p=0.0001) and (r=0.447) respectively. (table 4)

Table 4.: correlation between BMI with lipids and body component

		BMI	Cholesterol	TG	Fat	Protein	Inorganic	Water content
Cholesterol	Pearson Correlation	-0.04-	1					
	Sig. (2-tailed)	0.4						
TG	Pearson Correlation	0.06	.38**	1				
	Sig. (2-tailed)	0.4	.0001					
Fat	Pearson Correlation	.5**	-.05-	.02	1			
	Sig. (2-tailed)	0.0001	0.31	0.7				
Protein	Pearson Correlation	.2**	-.002-	.04	.1*	1		
	Sig. (2-tailed)	0.0001	0.9	0.4	0.04			
Inorganic	Pearson Correlation	0.1	0.01	0.1	-0.03-	-.2-*	1	
	Sig. (2-tailed)	0.05	0.8	0.06	0.5	0.04		
Water content	Pearson Correlation	0.4**	0.002	0.04	-0.1-	0.6**	0.2**	1
	Sig. (2-tailed)	0.0001	0.9	0.4	0.07	0.0001	0.0001	
	N	300	300	300	300	300	300	300

Discussion

Consumption of the fatty diet:-Consumption of the fatty diet (rarely taken) was similar to sweety diet and soft drink consumption., This kind of diet takes on various forms in different countries especially because of cultural factors that affect the dissemination of the model. Other study agree with the current result like **(Pierre, et al 2015).**

Most of our population depend on the vegetable intake, they take it twice Daily.

It is obvious that most of the sport habits seen in the youth group than the elderly one so they lies in small group.

Effect of Dietary intake on other parameters.

There was good relationship between fatty diet and midarm circumference which indicate obesity and insulin resistance as was mentioned in Chinese study which indicated that among Chinese subjects with type 2 diabetes, MUAC is a simple and effective tool for the determination of central obesity and insulin resistance.(**Yanhua, et al, 2020**

It is clear in the study there is influence of sweety diet on BMI, fat body composition and obesity and RBS, several study agree with the current study**.(Meike et al., 2022**)

As most of Soft drinks has a big quantity of carbohydrate they give a large amount of energy and subsequently increases the BMI and obesity, this is also seen in other studies when they study the beverages and soft drinks **(Leticia, et al., 2020)**

Bread and other carbohydrate also has an effect on increase blood sugar and HbA1c . several studies suggested low carbohydrate diet as part of the therapy of DM. **(Kumar et al., 2022)**

Meat consumption can increase the BMI and RBS in patients with T2DM. Meta-analyses have shown that the risk of developing diabetes mellitus is associated with the consumption of red meat and processed meat, (**Pan et al, 2011**)

As far as the patient wakeup at early morning with good appetite it is correlated with the number of meals the patient taken per day and eventually with the RBS.

Vegetable intake can affect the blood sugar and the HbA1c, Large amounts of vegetable proteins are present in nuts, soybeans and cereals. In the USA and Canada showed an inverse correlation between the intake of nuts and the prevalence of obesity which is corresponding to the current study.(**Jaceldo, 2014**).

Correlation between BMI and lipids and body components

No correlation was found between S. cholesterol and S. triglyceride with BMI, this also found in other studies like (**Arshad, et al, 2019**) after studying 305 diabetic patient they saw that the only one which affect the BMI in Diabetic is the HDL and no effect of the other S. cholesterol and S. triglyceride on BMI.

Therefore, assessment and management for altered blood lipids should not be based on a patient's body weight or BMI.

During studying the body component composition with the BMI there were a great correlation between them indicating great effect of the body component on the BMI and getting obesity in DMT2 and the body component give idea about BMI. A study done by (**Ana Et al study, 2019**) found that Body composition assessment is an important tool to evaluate the nutritional status of diabetic

Measurement of body composition can be included as a primary care strategy to motivate lifestyle modifications while managing metabolic derangements of type 2 diabetes(**J Solanki, Makwana& Shah, 2015**).

Also the same finding was observed in (**Xiongfei, et al Study, 2018**) when they found Significant trends were observed for body fat, body fat percentages and visceral fat area for both sexes with age and both sexes with BMI. Focusing on obesity-related lifestyle and prevent weight gain. Xiongfei Liang, et al assessing these patients based only on BMI or WHR may hinder the development of individualized treatment strategies.(**Renato, 2022**)

BMI strongly correlate with body fat percentage estimated by bioelectrical impedance, which is similar to sub population in South Asian adults. In the current study the relationship was curvilinear in nature and was significantly influenced by age and sex. This was mentioned in other study done by(**Chathuranga, Et al, 2013**)

Aerobic exercise is associated with loss of both fat and lean mass in adults with diabetes; however, adding resistance training appears to preserve, and may increase, the lean mass.

Conclusion:

The patients with type 2 DM prefer to eat a lot of white bread, meat, fish whether grilled or fried, rice, vegetable twice daily, fruits twice daily, three and more times of meal daily and most of them they had good appetite. Dietary intake has a great influence on the BMI and obesity including fatty diet, sweet diet, soft drink, bread, meat, vegetables, grilled fish, rice and number of meals per day that the patients take. Larger multicentric studies are in need to get better control of malnutrition.

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