Effect of Dietary pattern and lifestyle choices among Egyptian Patients with Type 2 Diabetes Mellitus

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ABSTRACT

Diabetes is one of many diseases in which prevention and treatment are essentially based on proper nutrition. The cross-sectional study's objective was to determine how dietary patterns affected anthropometric measurements, hemoglobin A1C test (HbA1c), Fasting Blood Sugar level (FBS), and Lipid profile among Egyptian patients with type 2 Diabetes Mellitus (T_2DM). One hundred and two patients (48 female and 54 male) who participated in this study were chosen from the National Diabetes Institute's outpatient clinic. The participant's subjective nutritional assessment using anthropometric and dietary parameters and laboratory data on their lipid profile, HbA1c, and FBS levels. According to the results, there was a positive correlation between inappropriate nutritional habits, anthropometric measurements and blood lipids, and glucose levels, for all participants with higher obesity levels, uncontrollable blood glucose levels, lower-than-normal levels of high-density lipoprotein (HDL) were observed in the female group, so nutritional education and physical activity should be a constant, integral and indispensable part of the therapeutic procedure in type 2 diabetes to improve nutritional habits which will simultaneously reflect in an improvement of the anthropometric measurements (BMI), blood lipids and glucose level.

Keywords: *Diabetes, dietary habits, anthropometric measurements, blood glucose, lipid.*

INTRODUCTION

Non-communicable diseases (NCDs) are major global health threats, causing 15 million premature deaths annually **(WHO, 2018)**. Trends in diabetes-related mortality showed a 3% increase in age-standardized rates between 2000 and 2019 **(World health statistics, 2021).** Currently, the prevalence of type 2 diabetes Mellitus in Egypt is around 15.6% of all adults aged 20 to 79 **(Hegazi et al., 2015)**. T_2DM is a chronic condition characterized by persistent hyperglycemia and glucose intolerance. It develops when the body is unable to adequately respond to insulin **(WHO, 2021)**. Aging, economic expansion, fast urbanization, and nutritional patterns in different income level countries have all contributed to the rise of diabetes mellitus globally **(Liu, 2020)**. T2DM accounts for almost 90% of all diabetes cases **(Ma et al., 2022)**. Due to the serious complications associated with type 2 diabetes, including the risk of blindness, renal failure, and cardiovascular disease (CVD) **(Susan-van 2010; Danaei 2011; American Diabetes Association 2013).** Since 1952, the American Diabetes Association (ADA) has supported diabetes research, funding studies, disseminating best practices, and leading patient education campaigns to improve diabetes outcomes **(ADA, 2021)**. **WHO, (2016**)report urges governments to promote healthy decision-making and healthcare systems for people with diabetes. It encourages eating, exercise, and weight management, enhancing lives and slowing diabetes spread.

Diet changes significantly impact diabetes, cardiovascular disease, and cancer. However, many developing nations' food policies focus on under-nourishment, neglecting chronic disease prevention **(Seals et al., 2016)**. Research on the connections between diet and health has repeatedly shown links between poor health outcomes, low intakes of plant-based meals, and large intakes of animal products and ultra-processed foods **(Ferrari, 2022)**. Dietary habits are routine decisions a person or society makes on the foods they eat and how they should be consumed **(Dietary Habits, 2021)**. Dietary practices and decisions greatly impact people's health **(Preedy, 2010)**. Therefore, we classified dietary habits in this study as actual food intake and dietary behavior.

This study aimed to examine the relationship between dietary habits and patterns with other unhealthy practices (smoking, low water intake, and sedentary lifestyle) affected anthropometric measurements and blood glucose levels among Egyptian outpatient clinics with Type 2 Diabetes Mellitus Visitors to the National Diabetes Institute.

SUBJECTS AND METHODS

Design:

Observational cross-section study conducted during the academic year (2023)

Inclusion criteria: the study was undertaken on 102 type 2 diabetic patients (48 females & 54 males) non-complicated diabetic patients with renal, liver, and heart diseases, aged between 42-71years were chosen from the outpatient clinics of the National Institute of Diabetes and Endocrinology, Cairo, Egypt. The National Hepatology and Tropical Medicine Research Institute (NHTM-RI) issued an ethical permit for the study, which allowed it to proceed (Protocol NO: E00305-2023).

Methods:

Data on sociodemographics (gender, age, level of education, marital, status social and economic level), smoking, physical activity, and medical drugs were compiled. A complete nutritional assessment was performed on each individual to obtain their:

1-Anthropometric Measurements:

Measurements of anthropometry were made by **Jelliffe, (1966)**; Measurements of height and weight were taken, and the BMI was computed using the formula below:

BMI = weight (kg)/height (m^2).

• Weight: Using a beam balance, a participant was weighed to the nearest 0.1 kg while wearing light clothing and no shoes.

• Height: measured to the closest 0.1 cm when the subject's head was in the Frankfort plane and had no shoes.

2- Clinical Assessment:

A checklist of common clinical indicators of severe dietary deficiencies included clinical assessment. A thorough medical history of the patients was acquired to look for any indications of dietary deficiency.

3- Dietary Assessment (dietary questionnaire):

There were two main categories for the techniques employed to gauge the patients' dietary intake:

a. **Quantitative daily consumption (Twenty-four-hour recall) method:** each patient was asked to recall the particular foods and beverages they had ingested over the previous 24 hours. Food and beverage consumption were given in typical household measurements and converted to grams. **The National Nutrition Institute's (2006)** food composition tables were utilized to determine each patient's daily calorie and nutrient intake. The sufficiency of the diet that was taken was assessed by comparing the patient's calorie and nutrient intake with the recommended daily allowances (RDA) for his age category. Analysis was based on the percentage of nutrients and energy that should be consumed each day **(FAO/WHO/UNU, 2004)**.

b. **Qualitative Method for Assessment of Dietary pattern "Food Frequency Questionnaire" and Diet History Questionnaire:** The purpose of this approach was to gather qualitative descriptive data regarding some dietary practices as well as the typical food and beverage consumption patterns per day, week, month, and year (less than three times, equal to three times, more than three times, or non-usage).

***4- Biochemical Assessment*:**

Blood Samples: Venous blood was drawn from each patient to determine:

Glycated hemoglobin (HbA1c) was used to indicate the average plasma glucose over the previous 8 to 12 weeks, to track glycemic management. It was decided by **Weykamp, (2013)**. Fasting Blood Sugar **(FBS)** values are used to determine treatment and evaluate glycemic control. It was determined according to **Jeon et al., (2013)** after overnight fasting. Total cholesterol was determined as stated by **Allain et al., (1974).** High-density lipoprotein (HDL) was determined as claimed by **Friedewald et al., (1972)**. Low-Density Lipoprotein (LDL) was calculated on the report of **Friedewald et al., (1972)**. Triglycerides (T.G) were evaluated in the opinion of **Fossati and Prancipel, (1982)**.

5-Statistical analysis:

The mean and standard deviation (SD), or frequencies and percentages, as applicable, were used to statistically describe the data. Based on statistical analysis SPSS, PC statistical software (version 15 SPSS Inc., Chicago, USA). **The tests used were as follows:** To examine whether there are any differences between the male and female groups, frequency percentage distributions, means with standard deviation (S.D.), and T-tests were utilized at a p-value of 5% ($p<0.05$), and correlations between some variants was computed using Pearson rank correlation **(Steel and Torri, 1980)**.

RESULTS AND DISCUSSION

Table (1) represented the average values of age, height, weight, and BMI for all participants (n=102), the majority of the participants were overweight and obese. The female group was more obese than the male group. About 50% of females have excessive obesity and obesity class 2 obesity range according to the **CDC, (2022).** Only 22.3% of males have excessive obesity. Women are typically believed to have a somewhat higher risk of obesity than men **(Chang et al., 2018)**. The ways that men and women store fat, utilize fat, and are affected by both vary. Women experience fewer obesity-related issues than men do, according to **Kanter & Caballero (2012)**, Type 2 diabetes may be attributed to all environmental and lifestyle factors that cause excessive weight gain, although there is conflicting information regarding whether specific dietary items have an impact separate from their influence on developing obesity **(WHO, 2003)**. **Hossain et al., (2007) & Leitner et al., (2017)** showed that a close relationship also led to the connotation of ‘diabesity', highlighting the fact that the majority of individuals with diabetes are overweight or obese. **Piaggi et al., (2018)** demonstrated that there is a positive energy balance and energy is stored, primarily as body fat. Concerning current results an imbalance between energy intake and energy expenditure is one of the reasons that caused the presence of obesity in the present research sample, and a greater worse in the female group, as they are less active than males. These results in agreement with **Gao et**

al.,(2021) confirmed that the mean BMI (kg/m2) in the female group (33.61 ± 6.07kg/m2) more than the BMI (kg/m2) in the male group (32.13± 5.27kg/m2) and both have type2 diabetes with (10.8y of duration) and obesity, present of slightly glucose control in male more than female In addition, As obesity severity worse, there was a higher correlation between it and worsening renal function or neuropathy. **Cooper et al, (2013)** reported that gender differences in metabolic rates are attributable primarily to differences in body size and composition. Women, who generally have more fat in proportion to muscle than men, have metabolic rates that are approximately 5% to 10% lower than men of the same weight and height. However, with aging, this difference becomes less pronounced.

Table (2) observes the percent values of education in five levels, marital four status, social-economic three levels, smoking, and physical activity for males and females, The majority of participants were at the middle socioeconomic level, and more than half percent (56.3%) of the female group were illiterate vs (33.3%) illiterate in a male group while more than half male group were learner with different level of education. A study was conducted by **Al-Rubeaan et al., (2015)** Supportive evidence as e was found in a Saudi Arabian study as it showed that the rise in affluence, which hides a rise in diabetes propensity in genetic or ethnic groups, along with alterations in dietary practices and physical inactivity have all been linked to an increase in the incidence of diabetes. The information we provide is consistent with **Zhou et al., (2016)** who did Compared to high-income countries, the burden of diabetes has risen more quickly in low- and middle-income nations in terms of prevalence and the number of persons affected. **Popkin, (2001)** showed significant changes in income and shopping habits over the past decade, impacting affluent and poor individuals differently. Additional income boosts the poor's fat intake more than the rich. Regarding marital status, 50% of females were married vs 88.9% of the male group the rest is in between widow, unmarried, and divorced which reflects a more stable marital status and healthy life for the male group than the female group. This information fits with the research of **Ueno et al., (2021)** demonstrated that sharing meals leads to behavioral adjustments for healthy lifestyles. Regarding lifestyle, no female was smoking vs more than half of (55.6%) males were smoking and physical activity half of the female group had low physical activity and the other had middle physical activity but more than half male group had middle physical activity, and (11.1%) of male group were high physical activity. According to **Losier (1993),** the most significant predictor of health appears to be an individual's perception of their surroundings, together with their ability to influence the direction and setting of their own lives.

Table (3): shows that more than half (56.25%) of the female group used insulin as diabetes medication with or without blood pressure medication (25% of the female group used insulin alone but 31.25% of them used insulin with blood pressure medication) whereas the lowest percentage was 43.7%for females who used tablets with or without blood pressure medication, while more than half (66.70%) males group had taken tablet diabetes medications alone without blood pressure medication whereas our result showed that male group hadn't taken tablets with blood pressure medication but (12.5%)of the female group had taken tablets with blood pressure medication. **Chaplin, (2014)** stated that many persons with type 2 diabetes eventually need insulin therapy to keep their blood sugar levels under control. Insulin therapy frequently results in weight gain, with average increases in body weight between 2kg and 4kg. which explains one of the causes of overweight and obesity in our participants' especially the female group than the male group. Regarding blood pressure (43.75%) of the female group had taken blood pressure medication vs. only (22.20%) from the male group however, the mean value of blood pressure for females was higher than male group this result indicates that females had higher blood pressure than males.

Table (4): showed that the male group had more water than the female. **Madjd, et al., (2017)** illustrated that drinking water instead of diet beverages considerably reduced the group's calorie and carbohydrate intake, which at least partially accounts for the group's improved glycemic control.

Table (5) illustrates percent values of keeping breakfast and neglected meals for females (n=48) and males (n=54), the result showed that only 50% of the female group didn't keep breakfast but 88.90% of the male group kept breakfast and 55.6% of the male group keep three main meals without neglected meal vs only 37.4% of the female group which indicates that the group of men practice better eating habits than women. **Hashimoto et al., (2020)** reported that the HbA1c levels were higher among patients who skipped breakfast than among those who did not.

The daily energy and nutrient consumption for all patients is shown in **Table (6**). According to the data, men consumed more macronutrients and minerals overall than women, with copper being the exception. Except for thiamine, which was given in higher amounts relative to the other vitamins, men received less of them overall. All participants consumed more carb, fat, and sodium than the RDA but took less than 50% from RDA of fiber, calcium, magnesium, and vitamin A.

Table (7): showed that 94.1% of participants consumed balady bread, while 64.7% of participants consumed rice daily. Macaroni was consumed every week by 73.5% of participants. It can be concluded that the cereal group was a stable food for the participants, and that balady bread was consumed daily with very low consumption of whole grains and tubers.

Table (8) displayed that Beans, broad (Foul Medames) were consumed daily by (32.4%) of participants. lentils, peeled (yellow) consumed by (44.1%) every week. It can be concluded that the legumes group was an important plant food as a source of protein for the participants. The male group was consuming this type of food with more variety of legumes than the female group which indicated the male group had a higher intake of protein.

Table (9) shows that sugar was consumed by 64.7% of participants daily which is consistent with **Chiavaroli et al., (2023)** who suggested that too much sugar-derived energy increases obesity whereas too little of it reduces it. The current results agree with **Sami et al., (2020)** who demonstrated diabetes patients had inadequate information about consuming carbohydrates and making healthy food choices. On the contrary to present results, free sugar consumption exceeded recommendations, and daily dietary fiber consumption (9 grams) was substantially lower. **Thewjitcharoen et al., (2018)** demonstrated that there are no links between diet and glycemic management.

Table (10) demonstrates that the majority of participants consumed cooked vegetables every week (76.5%). No intake of celery for all participants except (11.1%) of the male group consumed celery once monthly. This indicated that the majority of participants do not take the vegetable group as an important part of their meals daily, which reflects the low intake of dietary fiber, it was a completely unhealthy procedure for a diabetic patient.

Table (11) shows that all participants were low consumption of milk group (35.3%) of participants unconsumed milk and (44.1%) of unconsumed yoghurt at all, and only (26.5% &8.8%) consumed milk and yoghurt daily respectively. which indicated low calcium for all participants.

Table (12) shows that 58.8% of all participants consumed red meat every week. Tuna, mackerel, salmon, and sardine fish were consumed by (8.8%), (26.5%) and (5.9%) of participants on weekly, monthly, and yearly respectively, with (58.8%) of unconsumed Tuna, mackerel, salmon, and sardine fish at all. The egg was consumed by 35.3%, 61.8%, and 2.9% of participants on weekly, monthly, and yearly respectively. Which indicates a low intake of animal protein, iron, calcium, omega-3, and vitamin D.

Table (13) showed that the majority of participants 70.6% unconsumed butter and ghee at all. Margarine was consumed by 47.1% of participants daily.

Table (14): indicated that 50% of samples consumed carbonated soft drinks 2 or ≥3/week. Chicken stock was consumed by 55.9% every week with only a year (35.3%) of participants.

Diets evolve, being influenced by many factors and complex interactions. Income, prices, individual preferences and beliefs, cultural traditions, as well as geographical, environmental, social, and economic factors all interact in a complex manner to shape dietary consumption patterns **(WHO, 2003)**. Finally, in addition to total caloric intake and adiposity, dietary composition and physical activity might affect diabetes risk and contribute to differences in regional trends **(Ley et al., 2014)**. Reducing risk factors and implementing health-promoting practices like exercise and a nutritious diet will help aging people and populations. **WHO, (2003)**; **Yang et al., (2020)** demonstrated that early adulthood is when the human capital that develops through educational attainment is most crucial for health. Nutritionists suggest a dietary correction to reduce diabetes risk by reducing caloric content, optimizing (the quality and quantity) of protein, fat, and carbohydrates, fortifying with vitamins, and minerals, and using hypoglycemic substances **(Kochetkova et al., 2018; Mazo et al., 2018; Sharafetdinov et al., 2019).**

Table (15): shows that the females' group had higher levels of blood glucose levels, LDL-c, and TG than other groups and the normal range. While the male group had lower concentrations of HbA1c, LDL-c, and T.G. Untreated diabetes complications can compromise health and life quality, leading to life-threatening outcomes like diabetic ketoacidosis and hyperosmolar coma **(WHO, 2016)**. Type 2 diabetes with obesity increases the individuals' mortality risk 7-fold (**Oldridge et al., 2001)**. **Zanchim et al., (2018)** agreed with the present finding, which revealed that a high percentage of the respondents were overweight and/or obese and showed inadequate glycemic control. **Dyson, (2010)** demonstrated that type 2 diabetes is most strongly associated with obesity. **American Diabetes Association (2019)** recommends an (HbA1c) level below 7%, the higher HbA1C level reflects poorer blood sugar control and a higher risk of diabetes complications, which reflected that our female group was exposed to diabetes complications more than the male group because all participants had a mean value of HbA1c higher than 7%. Looser A1C targets above 8.5% (69 mmol/mol) are not recommended as they may expose patients to more frequent higher glucose values and the acute risks from glycosuria, dehydration, hyperglycemic hyperosmolar syndrome, and poor wound healing. **Sherwani et al., (2016)** revealed that lower HbA1c levels and a lower mortality % are directly correlated. The risk of cardiovascular illnesses is greatly reduced in diabetics when HbA1c levels are kept at healthy levels. Poor glycemic control and having diabetes for a longer period are associated with cognitive decline **(Yaffe et al., 2012).** Contrary to current results **Kjøllesdal et al., (2016)** demonstrated that individuals with lower levels of total cholesterol in women while our results showed that females have higher TG than males. Hypertriglyceridemia is a common lipid disorder caused by obesity and uncontrolled diabetes **(Simha, 2020)**, which explains why the blood lipid profile was higher in the female group than the male group where there was more obesity and uncontrolled diabetes. **Al-Okbi et al., (2022)** demonstrated that hypertension and dyslipidemia in diabetic patients are thought to be significant risk factors for atherosclerotic disease. According to a study, on the risk of coronary heart disease, the results showed that the female group has higher FBS and HbA1c than the male group with statistically significant differences. **Kautzky-Willer et al., (2016)** demonstrated that T2DM is more frequently diagnosed at low body mass index in men; however, the most prominent risk factor, which is obesity, is more common in women in agrees with the present result. **Mauvais-Jarvis, (2018)** was not consistent with these results and represented that contrary to males, however, women are protected from several metabolic abnormalities and their consequences that are associated with the emergence of obesity-related disease. The connection between fat and disease is significantly regulated by sex hormones **(Mauvais-Jarvis, 2017; Yassin et al., 2019)**. Women are more likely than males to have impaired glucose tolerance, a sign of postprandial insulin resistance, whereas men are more likely to have impaired fasting blood glucose, a sign of fasting insulin resistance **(Navarro et al.,2015; Varlamov et al., 2015). Inzucchi et al., (2015)** agree present results that confirm that there is a positive relationship between FBS, BMI, and blood pressure. Importantly, **Maric-Bilkan,(2017)** showed that sex hormones and sex-biased risk variables play a significant role in the association between diabetes and a higher risk of vascular complications in women than in males. **Schlesinger et al., (2019)** have demonstrated that obese T2DM patients had a higher incidence of microalbuminuria, macroalbuminuria, renal function impairment, and neuropathy, Whereas an HbA1c level < 6.0% or > 8%, and even > 10%, may increase the risk of incident heart failure (HF) or HF-related hospitalization **(Dunlay et al., 2019)**, Which represents a risk factor for our research sample as most of participants were suffer from obesity with high blood pressure and poor glycemic control.

Table (16) shows that there were significant correlations between weight and number of snacks, number of meals, fiber and carb intake the greater the weight, the greater all of the above. A significant correlation between BMI with number of snacks and the number of meals. HbA1C and FBS have a positive correlation and statistically significant value with several snacks and several meals. There was a significant positive relationship between the number of snacks and with number of meals, carb., and fiber intake that is, the greater number of snacks led to high carb and fiber intake. There was a significant positive relationship between carbs. and Na intake. There was a negative correlation statistically significant value with protein that is, the greater protein intake the lower HbA1C. **De van der Schueren et al., (2016)** demonstrated that in older people whose energy intake is limited, the absolute amount of protein consumed may be more significant than the proportion of protein consumed, which was indicated by our results in Table (16) which was found a negative correlation between age with energy and amount of protein intake. Similarly, there was a significant variation in the mean protein intake of females (61.74g) and male group (83.82g), In agreement with this study results **Miki et al., (2017)** discovered that in older patients with type 2 diabetes, total protein consumption, particularly protein from vegetables, was favorably correlated with skeletal muscle mass, which may explain that the increase in male weight may be due to their increase of muscle mass than female.

WHO and FAO recommendations for a healthy diet emphasize increasing plant-based foods, limiting sugars and fats, consuming unsaturated fats, limiting salt intake to prevent undernutrition and reduce non-communicable disease (NCD) risk**,** limiting saturated fatty acid intake to less than 10% of total energy(for high-risk groups, less than 7%), achieving 20 g daily dietary fiber through wholegrain cereals, legumes, fruits, and vegetables, reducing the intake of free sugars to less than 10% of total energy intake and suggests that further reduction to 5% could have additional health benefits **(WHO, 2016)**. Low intake of whole grains was the leading dietary risk factor in all WHO regions other than the Western Pacific Region, where high intake of sodium was the leading risk factor for Disability Adjusted Life Years (DALYs) (**Dong et al., 2022).**

The present results showed that the dietary habits of patients were the exact opposite of these aforementioned recommendations, low intakes of several plant foods (fruits, vegetables, legumes, nuts, and whole grains) couldn't achieve adequate intakes of dietary fiber (mean daily intake was 8.35 g); Regarding several food habits, the findings indicated that all participants had worse and unhealthy dietary habits although the results were slightly better in terms water intake, variety sours of protein intake (quantity and quality) against male than female.

Feskens et al., (1995); Bo et al., (2001); Salmeron et al., (2001); Meyer et al., (2001) reported that higher levels of polyunsaturated fatty acids and unsaturated fatty acids from vegetable sources have been linked to lower fasting and 2-hour glucose levels as well as a decreased risk of type 2 diabetes. In research including human intervention, switching from saturated to unsaturated fatty acids improves insulin sensitivity and glucose tolerance **(Vessby et al., 2001; Uusitupa et al., 1994)**. However, compared to mono-unsaturated fatty acids, long-chain polyunsaturated fatty acids do not seem to offer any significant benefits in intervention studies **(Vessby et al.,2001)**. **Feskens et al., (1995); Marshall et al., (1994)** agree with this search results demonstrated that a high intake of total fat has also been shown to predict the development of impaired glucose tolerance and the progression of impaired glucose tolerance to type 2 diabetes in observational studies. However, when total fat intake is high (greater than 37% of total energy), changing the quality of dietary fat appears to have little impact **(Vessby et al., 2001)**. In contrast to this finding, according to **Mayer et al. (1993)**; **Lovejoy and DiGirolamo (1992),** eating a lot of total fat has also been linked to higher fasting insulin concentrations and a poorer insulin sensitivity index. In agreement with the present results **Frost et al., (1994); Fontvieille et al., (1992); Wolever et al., (1992)** reported that low glycemic index foods, such as legumes, are linked to improved glycemic control in diabetics and decreased glycemic response compared to higher glycemic index foods, which were evident in the results of the male's group. **Zanchim et al., (2018)** harmony with the current results, demonstrated that unhealthy dietary habits raised an average of HbA1c and fasting blood glucose levels were 8.38± 2.17% and 154.28 ±67.93mg/dL, respectively, indicating unsatisfactory glycemic control based on these markers in 50% and 68% of the diabetic patients, respectively.

Food frequency for participants showed that the female group more consumed canned fruit juices, carbonated beverages, and artificial sweeteners than the male group in agreed with **Mathur et al., (2020)** who showed that the ones who used artificial sweeteners had a higher insulin resistance. The study also showed that the duration of use of artificial sweeteners had a direct impact on insulin resistance. Regarding the relation between the number of snacks or meals with HbA1c and FBS level results reflected an appositive correlation between them so increasing the number of snacks or meals increases HbA1c and FBS levels and vice versa. Decreased food intake is a well-known risk factor for hypoglycemia among patients with diabetes **(Ahmad et al.,2012)**. Caloric restriction (CR) has also been shown to prevent several chronic degenerative and inflammatory diseases **(Michalsen and Li, (2013)**. Low-calorie intake has indirect positive effects on human longevity, as seen in the Okinawan population **Willcox and Willcox, (2014)**. **Jenkins et al.,(2022)** demonstrated that low-carb vegetarian and vegan diets decreased body weight, improved blood pressure and glycemic management, but the more plant-based diet had a larger potential to cut greenhouse gas emissions.

CONCLUSION

Diabetes is linked to obesity, uncontrolled blood glucose, and high blood pressure. Unhealthy dietary habits, low education, and low physical activity contribute to these issues. Females are more affected, and maintaining a balanced lifestyle with medical nutrition therapy and exercise is recommended. Further research is needed to understand the effects, and plan of action, and provide education on adjusting food intake and physical activity for type 2 diabetes patients.

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Table (1): average values of weight, height, age, Body mass index (BMI), and Duration of diabetes for all participant

Variants	Total sample (n= 102)	Female group (n=48)	Male group (n=54)	*P*-value
Weight (Kg)	91.8±19.5	89.13±20.86	94.17± 18.08	0.20
Height (Cm)	163.7±7.5	159.31±5.61	167.56± 6.86	0.00*
Age by years(y)	53.5±7. 9	51.31±6.52	55.44± 8.53	0.08*
BMI (kg/m2)	34.4±7.8	35.5±9.5	33.4± 5.8	0.01*
Duration of diabetes(y)	10.2±9.1	8.8±7.4	11.3± 10.2	0.18
Normal Weight (18.5–24.9)	18.8	18.8%	0%	-
Over Weight (25.0 – 29.9)	52.1	18.8%	33.3%	-
Obesity class1(30.0 < 35.0)	56.9	12.5%	44.4%	-
Obesity class2(35.0 < 40.0)	18.8	18.8%	0%	-
Excessive obesity (BMI≥40)	53.6	31.3%	22.3%	-

**Confidence Interval of the Difference 95%*

Table (2): Percent values of education level, marital status, social economic level, smoking, and physical activity for males (N=54) and females (N=48).

Variants	education level					marital status				smoking		social economic level			physical activity		
	illiterate	primary	preparatory	secondary	collegiate	widow	Married	unmarried	divorced	smoker	Nonsmoker	low	middle	high	low	middle	high
Females (%)	56.3	25	6.3	6.3	6.3	6.3	50	6.3	37.5	0	100	37.5	56.3	6.3	50	50	0
Males (%)	33.3	44.4	11.1	11.1	0	0	88.9	0	11.1	55.6	44.4	33.3	55.6	11.1	33.3	55.5	11.1

Table (3) Percent values of diabetes medications (insulin or tablets) with or without blood pressure medication for females and males

Variants	Percent values of females (n=48)	Percent values of males (n=54)
Insulin	25%	11.10%
Tablets	31.25%	66.70%
Insulin with blood pressure medication	31.25%	22.20%
Tablets with blood pressure medication	12.5%	0%

Table (4) Mean values of all participants and differences between mean daily intakes from water, number of Snacks, and number of meals for males and females

Variants	Total samples group (n=102)	Female group (n=48)	Male group (n=54)	***P*-value**
Water intake (L)	1.74	1.64± 0.97	1.83± 1.01	0.32
Number of Snacks	0.74	0.81± 0.89	0.67± 1.06	0.34
Number of meals	2.47	2.38± 0.49	2.56± 0.50	0.35

Table (5) Percent values of keep breakfast, and neglected meals for males and females.

Variants	Females group (n=48)	Males group (n=54)
Keep breakfast	50%	88.9%
Doesn't keep breakfast	50%	11.1%
neglected lunch meal	6.3%	22.2%
neglected dinner meal	6.3%	11.1%
no neglected meal	37.4%	55.6%

Table (6) Mean daily intakes of energy and nutrients (mean ± SD) compared with RDA

Variants	**RDA		Total samples (n=102)	Female group (n=48)	Male group (n=54)
	For Female	For male			
Energy (kcal)*	**1867.6**	**2192.8**	2015.3±836.2	1809.5± 669.1	2198.3± 929
% of RDA			**99.3**	**96.9**	**100**
Protein (g)	**116.7**	**137**	73.4 ±36.0	61.7 ± 26.1	83.8 ± 40.5
% of RDA			**57.9**	**52.9**	**61.2**
Fat (g)	**51.9**	**60.9**	61.2±30.9	54.9 ± 26.8	66.7 ± 33.4
% of RDA			**108**	**105.8**	**109.5**
Carb.	**233.4**	**274.1**	290.1±129.5	266.6 ± 105.5	311.0± 145.4
% of RDA			**114.3**	**114.2**	**113.5**
Fiber(g)	**28**		8.4 ± 4.7	8.2 ± 3.6	8.5 ± 5.5
% of RDA			**30**	**29**	**30**
Na (mg)	**2300**		3067.0±2462.1	2414.9± 815.0	3646.6±3199.3
% of RDA			**133**	**105**	**159**
K (mg)	**4700**		2526.5±1135.0	2407.5± 822.6	2632.2±1353.1
% of RDA			**54**	**51**	**56**
Ca (mg)	**1300**		527.5 ±394.2	524.4± 280.5	530.3± 475.7
% of RDA			**41**	**40**	**41**
Phosphorus(mg)	**1250**		939.4±576.1	790.4± 339.3	1071.8± 701.8
% of RDA			**75.2**	**63**	**86**
Mg(mg)	**420**		122.5 ±78.5	112.0 ± 65.5	131.9 ± 88.0
% of RDA			**29**	**27**	**31**
Iron(mg)	**18**		15.2 ±7.3	14.6 ± 4.3	15.7 ± 9.1
% of RDA			**84**	**81**	**87**
Zinc(mg)	**11**		10.6 ±6.1	8.9 ± 3.2	12.0 ± 7.5
% of RDA			**96**	**81**	**109**
Copper(µg)	**0.9**		0.75 ± 0.43	0.77± 0.24	0.74± 0.6
% of RDA			**83**	**86**	**82**
Vit A (µg)	**900**		223.9 ±194.9	250.6± 163.6	200.2± 217.8
% of RDA			**25**	**28**	**22**
Vit C (mg)	**90**		83.1 ±121.9	109.4± 117.2	59.7± 122.2
% of RDA			**92**	**122**	**66**
Thiamine (mg)	**1.2**		0.94 ±0.7	0.91± 0.5	0.96 ± 0.8
% of RDA			**78**	**76**	**80**
Riboflavin (mg)	**1.3**		0.84±0.62	0.90 ± 0.6	0.79 ± 0.7
% of RDA			**65**	**69**	**61**

Estimated by Harris-Benedict equation **(Roza and Shizgal, 1984).**
RDA OF *(FAO/WHO/UNU, 2004)***

Table 7: % intake of cereal food frequency for all participants

Cereals	Day	Week	Month	Year	None	Total
Bread, Baladi	94.1	5.9				100
Bread, Shami		20.6	2.9	5.9	70.6	100
Bread, white		2.9	32.4	5.9	58.8	100
Bread, French	17.6	29.4	17.6	5.9	29.4	100
Bread, bran dry (sin)	11.8	11.8	5.9		70.6	100
White flour (baked products)	2.9	29.4	38.	14.7	14.7	100
wheat, grains (Belia)		11.8	20.6	11.8	55.9	100
Oat		14.7			85.3	100
Rice	64.7	26.5	5.9		2.9	100
Macaroni	2.9	73.5	23.5			100
Wheat germ		2.9			97.1	100
corn popped		20.6	26.5	11.8	41.2	100
Potato	17.6	76.5	5.9			100
Sweet potatoes		14.7	47.1	20.6	17.6	100
Colocasia		0.0	23.5	35.3	41.2	100

Table 8: % intake of legumes food frequency for all participants

Legumes	Day	Week	Month	Year	None	Total
Beans, broad (Foul Medames)	32.4	64.7			2.9	100
Beans broad (Nabet)		14.7	17.6		67.6	100
Cowpeas		11.8	14.7		73.5	100
Beans, kidney (white)			41.2	14.7	44.1	100
lentils, peeled (yellow)		44.1	20.6	8.8	26.5	100
Lentils, un-peeled			50.0	8.8	41.2	100
Chickpeas		5.9	14.7	29.4	50.0	100
Lupines (Termis)		11.8	8.8	38.2	41.2	100

Table 9: % intake of fruits food frequency for all participants

Fruits	Day	Week	Month	Year	None	Total
Fresh fruits	23.5	70.6	5.9			100
Dry fruits			8.8	17.6	73.5	100
Natural fruit juices	2.9	20.6	38.2	2.9	35.3	100
Canned fruit juices		44.1	20.6	11.8	23.5	100
Sugar	64.7	8.8			26.5	100
Honey		35.3	23.5		41.2	100
Molasses		26.5	14.7	14.7	44.1	100

Table 10: % intake of vegetable food frequency for all participants

Vegetables	Day	Week	Month	Year	None	Total
Cooked vegetables	8.8	76.5	14.7			100
Fresh leafy vegetables	5.9	44.1	50.0			100
Non-leafy salad vegetables	44.1	55.9				100
Celery			5.9		94.1	100
Cabbage		38.2	41.2	5.9	14.7	100
cauliflower		5.9	47.1	14.7	32.4	100
Broccoli			11.8	14.7	73.5	100

Table 11: % intake of milk and milk products food frequency for all participants

Milk and milk products	Day	Week	Month	Year	None	Total
Milk	26.5	17.6	20.6		35.3	100
Yoghurt	8.8	26.5	20.6		44.1	100
Fermented milk			2.9		97.1	100
Powder milk		5.9	8.8		85.3	100

Table 12: % intake of Meat and animal protein food frequency for all participants

Meat and animal protein	Day	Week	Month	Year	None	Total
Red meat	8.8	58.8	23.5	2.9	5.9	100
Poultry	5.9	79.4	14.7			100
Tuna, mackerel, salmon, and sardine fish		8.8	26.5	5.9	58.8	100
Other fish		17.6	44.1	5.9	32.4	100
Eggs	35.3	61.8	2.9			100
Cheese, kareesh	8.8	55.9	11.8		23.5	100
White cheese	20.6	47.1	14.7	5.9	11.8	100
Processed cheese	2.9	38.2	41.2		17.6	100
Processed meat		17.6	32.4	11.8	38.2	100

Table 13: % intake of fat food frequency for all participants

Fat	Day	Week	Month	Year	None	Total
Butter and ghee	14.7	11.8	2.9		70.6	100
margarine	47.1	8.8	5.9	2.9	35.3	100
Mixed butter		8.8	14.7	5.9	70.6	100
Corn oil	5.9	14.7	8.8		70.6	100
Sunflower oil	17.6	23.5	17.6		41.2	100
Olive oil		8.8	35.3	5.9	50.0	100
Flaxseed oil		17.6	2.9	17.6	61.8	100
Frying oil (mixed oil)	23.5	23.5	17.6		35.3	100
nuts			11.8	20.6	67.6	100
coconut		5.9	2.9	29.4	61.8	100

Table 14: % intake of other food frequency for all participants

Others	Day	Week	Month	Year	None	Total
Dessert		38.2	41.2	11.8	8.8	100
Tea	70.6	11.8			17.6	100
Green tea		2.9	5.9	2.9	88.2	100
Artificial sweeteners	14.7	8.8	2.9%		73.5	100
Carbonated, soft drink		50.0	32.4		17.6	100
coffee	8.8	35.3	11.8	2.9	41.2	100
Green coffee			17.6		82.4	100
Drink, coffee instant powder (black)		8.8			91.2	100
Drink, coffee instant powder (2*1) or (3*1)	2.9	14.7	14.7		67.6	100
chips		11.8	32.4	2.9	52.9	100
cake		41.2	47.1	8.8	2.9	100
biscuit	2.9	35.3	11.8		50.0	100
chocolate	2.9	11.8	17.6	8.8	58.8	100
Herring		8.8	38.2	23.5	29.4	100
Salted fish		14.7	8.8	41.2	35.3	100
Chinese salt	2.9	5.9	8.8		82.4	100
Chicken stock	5.9	55.9	2.9		35.3	100

Table (15) Distribution of mean values ± SD of HbA1C, FBS, TC, HDL-c), LDL-c, TG, and blood pressure for all participants

Variants	Normal Ranges	Total samples (n=102)	Female group (n= 48)	Male group (n= 54)	P-value
HbA1C (%)	<7	9.10±1.98	9.53± 2.29	8.71± 1.57	0.04*
FBS (mg/dL)	80-130	198.76±71.91	215.63± 85.06	183.78± 54.33	0.03*
Total cholesterol(mg/dL)	125–200	192.12±54.99	190.75±48.29	193.33±60.75	0.967
HDL-c (mg/dL)	> 40	52.68±32.83	39.31±6.80	64.56±41.32	0.001*
LDL-c (mg/dL)	<100	122.00±215.47	131.50±57.42	113.58±286.91	0.01*
T.G(mg/dL)	<150	155.68±56.82	161.56±72.45	150.44±37.93	0.05*
Blood pressure (mm Hg)	120/80	128.38/83.97 ±15.06/9.81	131.56/85.31 ±17.66/10.94	125.56/82.78 ±11.76/8.61	0.04*

Table (16) Correlations between some variants with Pearson rank correlation.

var	Number of Snacks	Number of meals	Energy	protein	fat	fiber	carb	Na
weight	.522(**)	.514(**)	0.167	0.114	-0.008	.322(**)	.252(*)	0.05
height	0.077	.309(**)	0.144	0.033	0.092	.274(**)	0.164	0.187
age	0.067	-0.188	-.224(*)	-.320(**)	-.225(*)	-0.088	-0.184	-.281(**)
BMI	.435(**)	.339(**)	0.075	0.062	-0.061	0.176	0.15	-0.036
HbA1C	.219(*)	.364(**)	-0.162	-.258(**)	-0.086	0.007	-0.134	-0.108
FBS	.289(**)	.278(**)	-.324(**)	-.345(**)	-.313(**)	-0.005	-.259(**)	-.288(**)
Duration	-0.126	-0.015	-.222(*)	-.326(**)	-0.05	-0.161	-.272(**)	-0.163
Water intake	0.112	.396(**)	-0.151	0.009	-.218(*)	.309(**)	-0.107	-0.1
Number of Snacks	1	.435(**)	0.119	0.048	-0.178	.470(**)	.286(**)	-0.104
Number of meals		1	.200(*)	.253(*)	0.176	.324(**)	0.175	.306(**)
Energy			1	.829(**)	.859(**)	.512(**)	.941(**)	.786(**)
protein				1	.766(**)	.320(**)	.670(**)	.792(**)
fat					1	.206(*)	.653(**)	.782(**)
fiber						1	.653(**)	.246(*)
carb							1	.639(**)
Na								1

** *Correlation is significant at the 0.01 level (2-tailed).*

* *Correlation is significant at the 0.05 level (2-tailed).*

تأثير النمط الغذائي ونمط الحياة بين المرضى المصريين المصابين بداء السكري من النوع الثاني

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المستخلص العربي:

مرض السكري هو أحد الأمراض المزمنة و تعتمد الوقاية والعلاج فيها على التغذية السليمة.
*هدف الدراسة: الهدف من الدراسة هو تقدير تأثير النمط الغذائي على القياسات الجسمية واختبار الهيموجلوبين A1C (HbA1c) وقياس مستوى السكر الصائم في الدم (FBS) بين المرضى المصريين المصابين بداء السكري من النوع 2. **منهج البحث**: دراسة مقطعية وصفية شارك فيها 102 مريض (48 إناث و 54 ذكور) من العيادات الخارجية لمرضى السكري بالمعهد القومي للسكر ، تم جمع البيانات الذاتية والتغذوية (تاريخ غذائي على مدار 24 ساعة ، استبيان تكرار الطعام ، كمية الماء ، عدد الوجبات والوجبات الخفيفة) ، القياسات الجسمية والبيانات المتعلقة بمستوى الدهون والسكر الصائم والهيموجلوبين السكري في الدم من جميع المشاركين. أظهرت النتائج وجود العديد من العادات الغذائية غير السليمة التى لها علاقة ايجابية مع مؤشر كتلة الجسم ، HbA1c، FBS، البروتين الدهني منخفض الكثافة (LDL) ، الدهون الثلاثية في جميع المشاركين مع وجود نسبة اعلى من السمنة ،عدم ضبط مستوى السكر في الدم ومستويات أقل من المعتاد من البروتين الدهني عالي الكثافة(HDL) لدى مجموعة الايناث. الخلاصة: أظهرت الدراسة أهمية التثقيف الغذائي والنشاط البدني كجزءً ثابتًا ومتكاملاً ولا غنى عنه من الإجراء العلاجي لمرضى السكري من النوع 2 لتحسين العادات الغذائية التي ستنعكس في نفس الوقت على تحسين قياسات الجسم البشري (مؤشر كتلة الجسم) ومستوى الدهون والسكر في الدم.*

الكلمات المفتاحية: *السكري ، العادات الغذائية ، قياسات الجسم البشري*