Dietary patterns among Sample of Metabolic Syndrome Adults in Egypt

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Abstract

The Metabolic Syndrome (MetS) is composed of cardiovascular and metabolic hazard agents who highly prevalent in adult populations and have a significant financial impact on public health systems globally. Understanding the correlation between eating habits and Metabolic Syndrome is crucial for effective prevention and management. The purpose of the current research was to examine the correlation among nutritional patterns among a sample of Egyptian adults suffering from risk factors for metabolic syndrome (at least 3 risk factors). One hundred adults were included in a cross-sectional study aged from twenty to sixty years attending the National Nutrition Institute (NNI) outpatient clinics. The study involved standardized anthropometric assessments, dietary evaluations, and laboratory assessments. About 73% of the sample was females at 42.9 ± 9.4 years old on average. The majority (85%) of the sample had a secondary school or university degree, and 63% had sufficient income. Nearly 86% of the samples were physically inactive. Most of the studied sample was morbidly obese with a mean BMI of (42.4 ± 11.2), high fasting blood sugar (FBG), low-density lipoprotein (LDL), and Triglycerides (TG). ***In conclusion,*** *the findings reveal that specific dietary habits are linked to an increased risk of Mets development.*

Keywords: *Metabolic Syndrome, Dietary Patterns, Adults.*

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INTRODUCTION

The (MetS) is a group of cardiac and metabolic hazard agents which highly prevalent in adult populations and have a significant financial impact on public health systems globally. Although the definition and diagnosis criteria of the syndrome are not widely agreed upon, it is defined by the co-occurrence of hazard agents that are unquestionably correlated with an elevated risk of chronic illnesses like cardiovascular disease (CVD) and type 2 diabetes (T2D), such include hypertension, atherogenic dyslipidemia, and central obesity, a pro-thrombotic and an inflammatory, impaired insulin sensitivity, and high blood sugar levels. Although it has been strongly suggested that imbalanced eating habits and sedentary lifestyles may have contributed to the syndrome's origin, this is unknown. (**Bovolini *et al.*, 2021**).

Depending on the criterion used, the MetS was present in 12.5% to 31.4% of people globally. The Eastern countries Mediterr-anean and America had significantly higher prevalence rates and a rise in the income level of the nation **(Noubiap *et al.*, 2022).**

The pathophysiology of Syndrome X involves many complex processes that are yet poorly understood. The question of whether the various components of MetS constitute unique illnesses unto themselves or are part of a larger, shared pathogenic process is still up for dispute. Apart from genetic and epigenetic variables **(Dizaji, 2018).**

Overeating and inactivity are two examples of lifestyle and environmental factors that are significant causes of the development of MetS. High-calorie intake and increased visceral adiposity are significant triggers that activate the majority of the MetS pathways, and they can be considered causal factors **(Pekgor *and others*., 2019).**

Aim of the study

The research aimed to investigate dietary patterns among a sample of the Egyptian

population suffering from risk factors for metabolic syndrome.

METHODOLOGY

- This cross-sectional research was carried out on one hundred adults with dysmetabolic syndrome risk factors, ages 20 to 60.

Subjects exposed to:

1- ***Anthropometric assessment:*** (height, hip, weight, BMI, and waist measurements). Quetelet Index was calculated is calculated by taking a person's weight, in kilograms, divided by their height, in meters squared **(Jelliffe, 1966).** BMI was used according to **(WHO, 2000).** Hip and Waist circumferences **(Dalton *et al.*, 2003).**

2- ***Biochemical analysis:***
Serum lipid profile (TG, total cholesterol, HDL-c, LDL-c), and fasting blood sugar were made according to the method described by **(Raba and Mottola 1995; Kumari and Kanwar 2012; Lopes-Virella *et al.*, 1977; Martin *et al.*, 2013; Fossati and Prencipe 1982).**

3- Routine Medical examination*:*
Including full history, and general examination including a family history of related chronic diseases like obesity, DM, CVD, dyslipidemia, and HTN. Blood pressure was measured at baseline. **Blood pressure:** Systolic and diastolic blood pressure was measured in a sitting position from the right hand, with the arm supported at heart level and feet flat on the floor **(Owusu *et al.*, 2015).**

4- Dietary assessment:
Dietary assessment, (24-hour (24 h) recall, diet history, and food frequency questionnaire). 24 h recalls were. The recalls were used to calculate the intake of food types as well as energy and nutrients. A culturally appropriate food frequency questionnaire was used to assess the diet (with portion sizes). Additionally, questions about the kind and amount of oil used in the home per time unit were used to track the use of cooking oils. The Egyptian food composition tables were used to calculate the consumption of

energy and nutrients. **National Nutrition Institute, 2006)**. By comparing the calorie and nutrient intake with **Raymond and, Morrow's (2022)** recommended dietary allowances (RDA) the adequacy of the diet was evaluated.

The criteria for exclusion:

• Gravid or nursing mothers
• Whom is on a restrictive diet
• People who suffer from serious diseases such as cancer, liver or heart problems, or are unable to engage in physical activity

Statistical Analysis:

Version 21 of the Statistical Package for the Social Sciences (SPSS) was used to analyze the data. Percentages and mean ±SD of the results were reported. Compare means (paired-samples T-test) was used to assess the results. Significant statistically were taken into consideration at $P < 0.05$. (**Snidecor and Cokhran 1967)**

OUTCOMES

Figure (1) shows that the studied sample (100 patients), (27 %) males and (73 %) females.

Figure (2) shows that the majority of the sample (85%) were secondary school education, and university degrees but only (3%) read and write.

Figure (3) shows that the majority (63%) of them had enough income however, (34%) didn't have enough income.

Figure (4) shows that (86%) of the studied sample were physically inactive.

Figures (6&7) show that (70 %) of the studied sample have a chronic disease of which 62.8 % were hypertensive, (45.7 %) had fatty liver, and (27.14 %) with type 2 diabetes.

Figure (8) shows that (50%) of the Studied sample had 4 factors for metabolic risk factors

Table (1) shows that the studied samples were morbidly obese with BMI (42.4 ± 11.2 kg/m2) with central obesity (waist was 116.1 ± 11.9 cm) and high W: H and W: ht ratios. BP data shows that DBP was higher than SBP (88.2 ± 9.9 mm Hg).

Table (2) shows that the studied sample had a high FBG of 110 ± 47 (mg/dl) with a high TG of 179 ± 67(mg/dl).

Table (3) illustrates that the consumption of fructose by the examined group was 161.34 ±28.1 grams/week.

Figure (9,10) shows that (100%) of the study sample preferred the Mesabk method for vegetables and fried meat.

Fig (11) shows that most of the sample (91 %) took (< 50 %) from RDA from fibers which are (14 g / 1000 Kcal)

Table (4) showed that sodium intake was (3153.8± 1418.7 (mg) and from calcium, 581.9 ± 269.6 (mg).

DISCUSSION

Table (1) shows that the studied sample was morbidly obese with BMI (42.4 ± 11.2 kg/m^2) with central obesity (waist was 116.1 ± 11.9 cm) and high W: H and W: ht ratios. BP data shows that DBP was higher than SBP (88.2 ± 9.9 mm Hg).

As regards to frequency of fructose consumption of the studied sample was 161.34 ± 28.1 grams/week (table 2). The finding of **Taskinen, (2019)** demonstrated that fructose has been consumed at a significantly higher rate over the past 40 years and makes up a significant amount of the modern diet, especially in adults. There are correlation between metabolic syndrome criteria and sugar-sweetened beverages (SSBs) and fructose intake

Additionally, SSBs consumption and hypertension were found to be positively correlated in a study carried out by **Zahao et al., (2023).** Ameta-analysis, by **Neelakantan *et al.*, (2022)** on high (SSB) consumption and disease risk in Asian populations showed significant associations with weight gain and risk of CVD outcomes after adjustment for BMI.

On the other hand, randomized controlled trials by **Jalilvand *et al.*, (2020)** demonstrated a considerable reduction in the patient's lipid profile, systemic inflammation, and glucose management. moreover, the most significant decrease was in diastolic blood pressure when comparing a low-fructose diet with a diabetic diet in Type 2 diabetes.

As regards cooking methods, all results showed that

100 % of the studied sample preferred mesbak and fried foods (Fig. 9, 10). Which are known as a source of Trans fatty acids (TFAs). These results went in parallel with a study by **Tripathi *et al.*, (2022)** who disclosed that TFAs are produced by various thermal processing techniques and that the number of processing cycles, temperature, and time impact how they form. Therefore, we must exercise caution when choosing the type of cooking oil we use to maintain a safe amount of TFAs in our diet.

Also, current results agreed with **Verneque *et al.*, (2022)** who demonstrated that sources of TFAs can increase cardiometabolic risk parameters, especially lipid profile. However, the dose of TFAs and the whole composition of the food must be considered.

A study by **Islam *et al.*, (2019)** revealed a 23% increase in cardiovascular risk was linked to a 2% absolute increase in energy consumption from trans-fat. They raise LDL-C levels, which are harmful to health.

By analyzing the 24-hour recall of the studied sample and referral to their RDA study noticed most of the sample (91 %) took less than 50 % from RDA from fibers, which are (14 g / 1000 Kcal) (Fig. 11). This may be lead to rising the presents of metabolic syndrome risk factors among them based on data from numerous cohort studies , both healthy and affected by metabolic illnesses, it was found that consuming more dietary fiber can improve metabolic health via changing the gut microbiome. **(Cronin *et al.*, 2021).**

As regards to micronutrient intake of the studied group, results showed an imbalance between sodium and potassium intake with a mean of (3153.8 ± 1418.7) and (2418.7 ± 1052.1) mg respectively as well as low calcium and magnesium with a mean of (581.9 ± 269.6)and (138.9 ± 62.6) mg respectively (table 4).

This imbalance was associated with hypertension as a component of Mets. This was in agreement with **Newberry *et Cetra,* (2018),**

the **NASEM, (2019) Jayedi, *etc.*, (2019), Wang *and the rest,* (2020)** who found a linear association above 800mg sodium (2g salt) and dose-dependent association for each 1 g rise in sodium consumption and developed in CVD by 6%. We also found that low potassium intake among our participants which was proposed as a mechanism that can lead to high blood pressure through an imbalance between sodium and potassium this was clarified by a systematic review by **Newberry *and so forth,* (2018) and Jayedi *and so on,* (2019)** who demonstrated that blood pressure can be dramatically lowered, especially in people with hypertension, by consuming less sodium, more potassium, and potassium-containing salt alternatives in the diet.

Every 50 mmol lowering sodium excretion in 24-hour urine was linked to 1.10 mm Hg and 0.33 mmole Hg in SBP and DBP, respectively, according to Systematic review and meta-analysis of randomized trials on the effects of dosage and duration of dietary sodium reduction on blood pressure levels. Furthermore, there was no linkage between the trial period and reducing of SBP **(Huang *et al.*, 2020).**

Results of low calcium intake illustrated the presence of hypertension in matching with **Jayedi and Zargar, (2019)** who found low calcium intake in a meta-analysis of eight Cohort prospective surveys whereas the number of participants reached 248,398, and the study included 30,838 people suffering from high blood pressure. The data suggests that there is an 11% reduction in the risk of developing hypertension for the highest category of dietary calcium intake compared to the lowest group, and for every 500 milligrams per day (mg/d) increase in calcium consumption, the risk of incidence of hypertension decreased by 7%.

Another meta-synthesis by **Han *and the rest.*, 2019** demonstrated a dose-response impact of calcium consumption from dietary sources, whereby the risk of developing metabolic

syndrome in females decreased by 7% with every 300 mg/day increase in intake of calcium from food**.**

Research by **Das and Choudhuri 2021** observed that some of the physiological proceedings play a major role against the risk of metabolic conditions such as changes in intracellular calcium level, inflammation, oxidative stress, fat metabolism, fecal fat excretion, intestinal absorption of lipid; metabolism of carbs and renin-angiotensin system are all regulated by the increase in ingestion of Calcium through the diet.

The current study group has a magnesium intake of (138.9 ± 62.6) mg this low intake of dietary magnesium (mg) is associated with metabolic its single component and this is going in parallel with a study by **Jiao *et cetra,* (2022),** Which found that when magnesium consumed from the diet was lower than 280 mg/day there was a significant none linear correlation between insulin resistance syndrome and its criteria and the consumption of dietary magnesium.

However, analyzed data from 29 randomized control trials of 1724 participants who administered variable forms of magnesium (Mg) supplementation for a duration extended from 4 to 24 weeks reported that there was no effect of ingestion supplementation of Mg (**Găman *et al.*, 2021**).

CONCLUSION:

In conclusion, **t**his cross-sectional study suggests that consumption of fructose, low consumption of fiber, the imbalance between sodium and potassium consumption, as well as low calcium and magnesium consumption and fried foods consumption may be related to the prevalence of the syndrome X and its criteria. These findings suggest that there is a relation between nutritional habits and the presence of MetS criteria

among a sample of adults experiencing syndrome X.

RECOMMENDATIONS:

- Reduce weight gradually and slowly by following a balanced diet is very important
- Eating whole fruits and vegetables gives a feeling of fullness because they contain fiber, which is also important for intestinal health
- Eat full cream milk and other dairy products to get a sufficient amount of calcium and fat-soluble vitamins, which play a key role in maintaining bone health and a healthy weight.
- Drink a sufficient amount of water and fresh, unsweetened juices to keep the body hydrated at all times, in addition to the role of water in maintaining body weight.
- Exercising regularly and keeping the body active continuously prevents the occurrence of obesity and its complications

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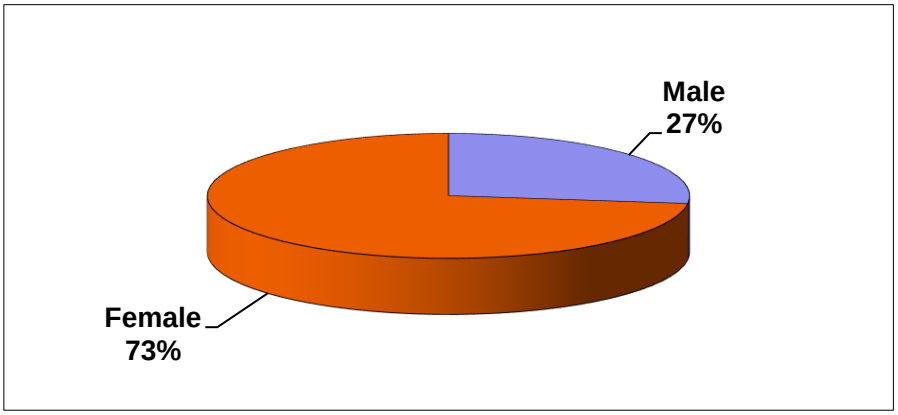

Fig. (1): Distribution of the studied sample according to their sex.

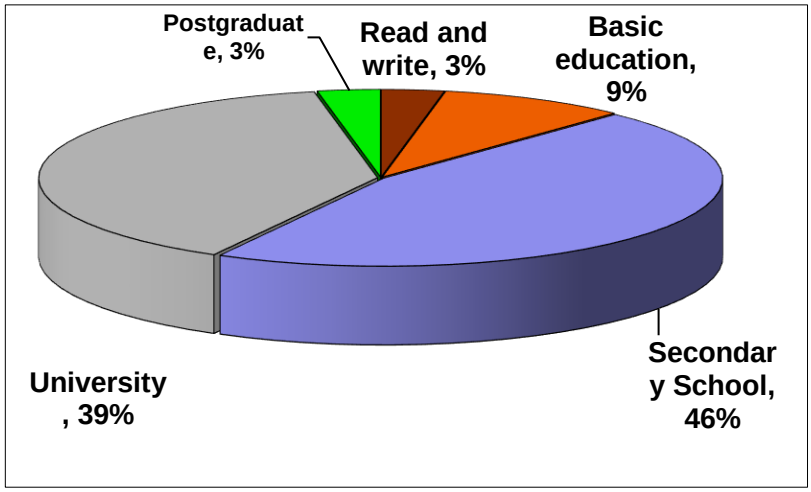

Fig. (2): Distribution of the Studied sample According to their Educational level

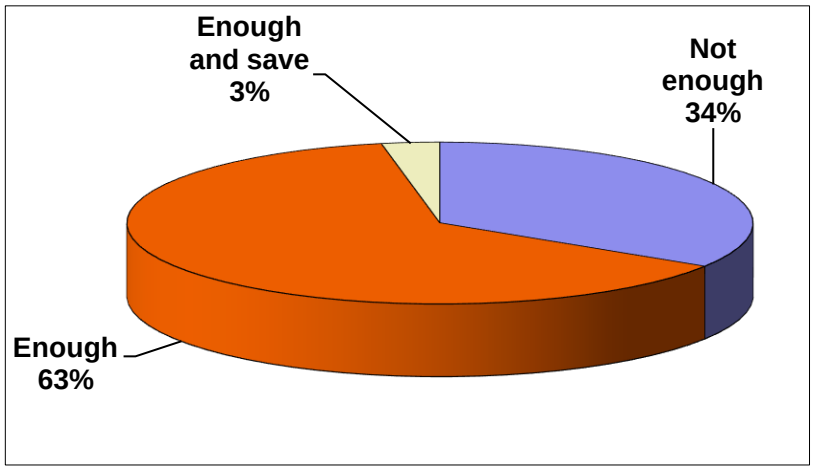

Fig. (3): Distribution of the Studied sample According to their Income Level.

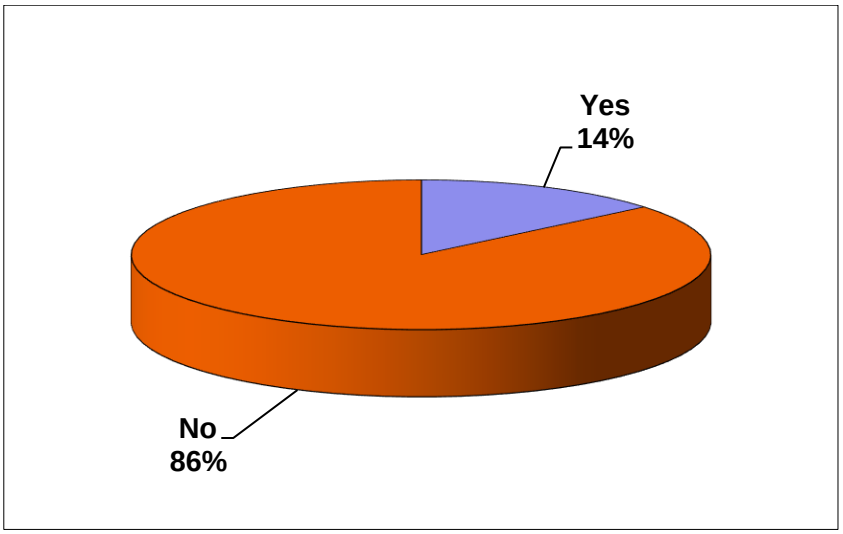

Fig. (4): Distribution of the Studied sample According to their physical activity

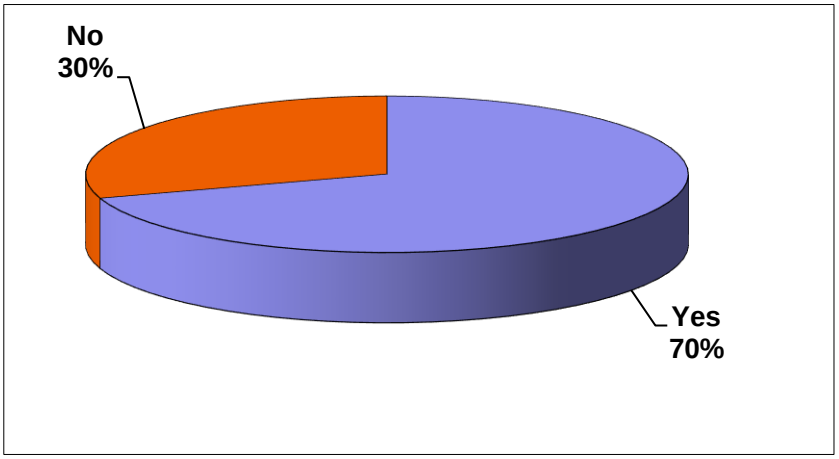

Fig. (6): Distribution of the Studied sample According to their Chronic Diseases

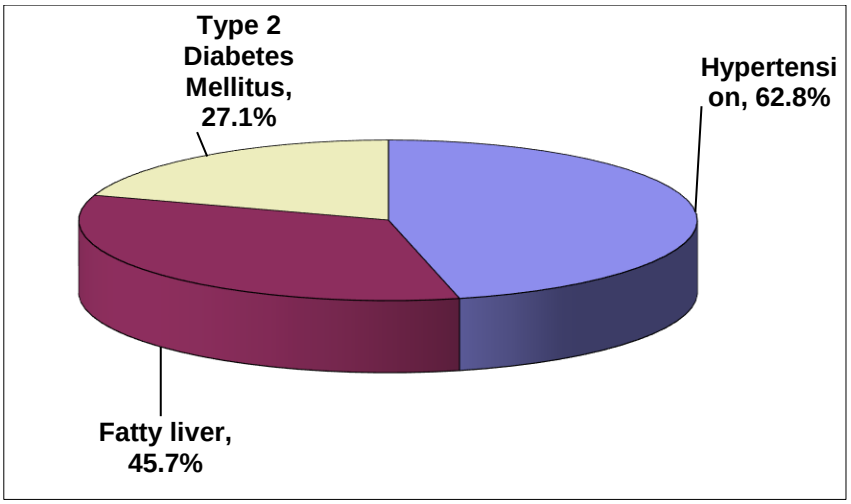

Fig. (7): Distribution of those who have chronic disease (N = 70)

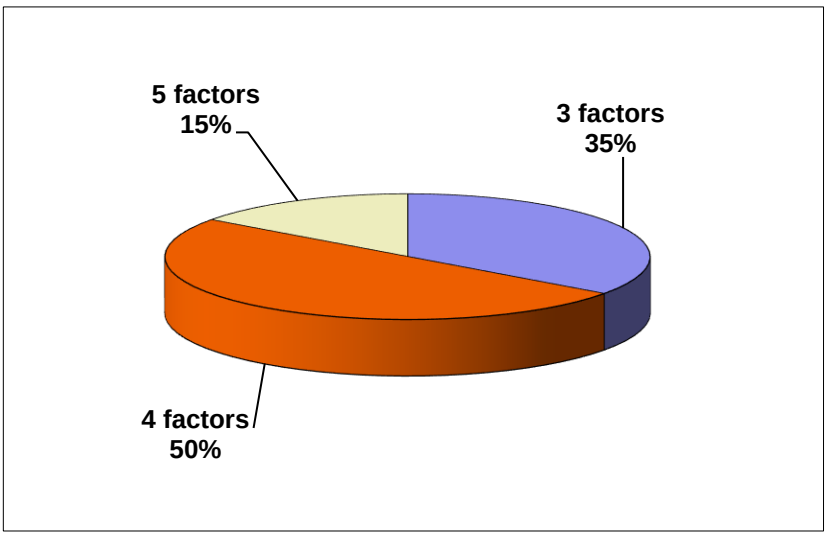

Fig. (8): Distribution of the Studied sample According to the presence of metabolic risk factors

Table (1): anthropometric and clinical data

Anthropometric and clinical data		N= 100
		Mean ± SD
Anthropometric data	Age (yrs.)	42.9 ± 9.4
	Weight (Kg)	105.2 ± 19.4
	Height (Cm)	160.0 ± 10.8
	BMI (kg/m^2)	42.4 ± 11.2
	Waist (Cm)	116.1 ± 11.9
	Hip (Cm)	120.6 ± 13.4
	Waist to Hip ratio (Cm)	0.97 ± 0.1
	Waist to Height ratio (Cm)	0.73 ± 0.1
Clinical data	Systolic BP (mm Hg)	134.5 ± 17.0
	Diastolic BP (mm Hg)	88.2 ± 9.9

Table (2): Descriptive Statistics for and laboratory parameters

	Cutoff points	N= 100
		Mean ± SD
FBG (mg/dl)	< 100	110 ± 37
TC (mg/dl)	< 200	208 ± 53
TG (mg/dl)	< 150	179 ± 67
HDL (mg/dl)	> 40	43 ± 15
LDL (mg/dl)	< 100	124 ± 53

Table (3): fructose consumption/week for the studied sample

Food Items	Fructose content in grams/week Mean ± SD
Soft drinks	**46.74±10.28**
Sugar	**104 ±12.85**
Canned juices	**10.60 ±4.97**
Total	**161.34 ±28.1**

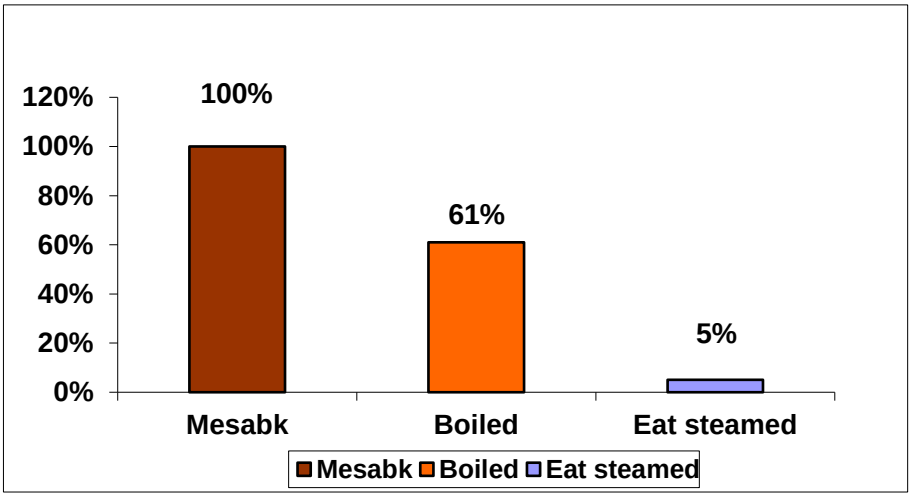

Fig. (9): Dietary practices concerning method of cooking vegetables

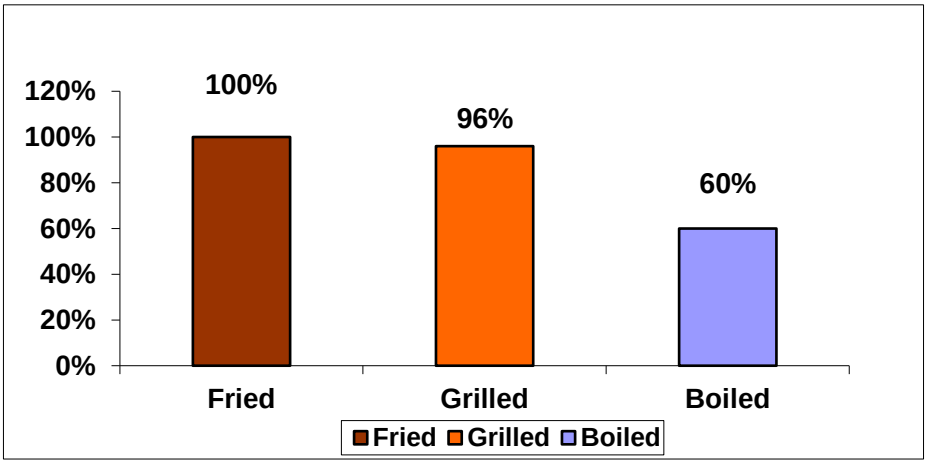

Fig. (10): Dietary practices according to the method of cooking meat

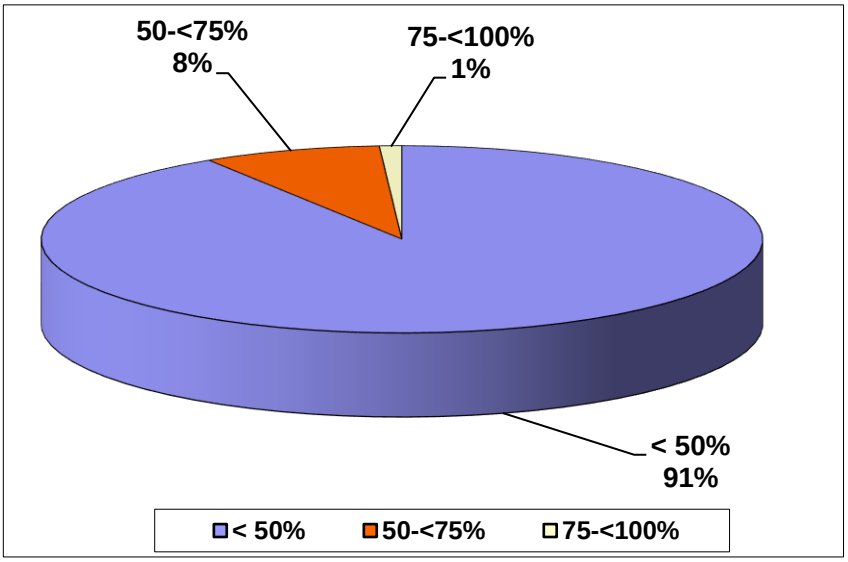

Fig. (11): Distribution of the Studied sample According to Their Dietary Intake from Fibers According to RDA

Table (4): Dietary intake from selected micronutrients for the studied sample

Micronutrients	RDA range	Mean ± SD
Sodium (mg)	1300 - 1500	3153.8 ± 1418.7
Potassium (mg)	4700 – 4700	2418.7 ± 1052.1
Calcium (mg)	1000 – 1200	581.9 ± 269.6
Magnesium	310 – 420	138.9 ± 62.6

النمط الغذائى لدى عينة من البالغين المصابين بمتلازمة التمثيل الغذائى فى مصر

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الملخص العربي

المتلازمة الأيضية هي مجموعة من عوامل الخطر القلبية الوعائية والتمثيل الغذائي التي تنتشر بشكل كبير بين السكان البالغين ولها تأثير مالي كبير على أنظمة الصحة العامة على مستوى العالم. إن فهم العلاقة بين الأنماط الغذائية ومتلازمة التمثيل الغذائي أمر بالغ الأهمية للوقاية والإدارة الفعالة. هدفت هذه الدراسة إلى معرفة العلاقة بين الأنماط الغذائية لدى عينة من البالغين المصريين الذين يعانون من عوامل خطر الإصابة بالمتلازمة الأيضية (3 عوامل خطر على الأقل). أجريت دراسة مقطعية على 100 شخص بالغ، تتراوح أعمارهم بين 20 إلى 60 عامًا، يرتادون العيادات الخارجية التابعة للمعهد الوطني للتغذية . وشملت الدراسة تقييمات القياسات البشرية الموحدة، والتقييمات الغذائية والتقييمات المختبرية. حوالي 73% من العينة كانوا من الإناث بمتوسط عمر 42.9 ± 9.4 سنة. غالبية أفراد العينة (85%) حاصلون على شهادة ثانوية أو جامعية، و63% لديهم دخل كاف. وكان ما يقرب من 86% من العينات غير نشطين بدنيًا. كان معظم العينة المدروسة يعانون من السمنة المفرطة مع متوسط مؤشر كتلة الجسم (42.4 ± 11.2)، وارتفاع نسبة الجلوكوز في الدم أثناء الصيام ، والبروتين الدهني منخفض الكثافة ، والدهون الثلاثية. في الختام، تكشف النتائج أن عادات غذائية محددة ترتبط بزيادة خطر الإصابة بمتلازمة التمثيل الغذائي.

الكلمات المفتاحية: المتلازمة الأيضية، الأنماط الغذائية، البالغون.

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