Scientific Foundation SPIROSKI, Skopje, Republic of Macedonia
Open Access Macedonian Journal of Medical Sciences. 2022 Mar 10; 10(B):576-583.
https://doi.org/10.3889/oamjms.2022.7177
eISSN: 1857-9655
Category: *B - Clinical Sciences*
Section: *Endocrinology*

OPEN ACCESS

Association between Quality of Diets and the Risk of Obesity Complication among a Sample of Egyptian Obese Women

Nayera E. Hassan[1], Salwa Elshebini[2], Nihad Hassan[2], Mohamed S. El hussieny[1], Mohamed Selim[3], Darine Helmy Amin[1], Ayat Nageeb[1], Mohammed Ibrahim[4], Aya Khalil[1]*

[1]*Department of Biological Anthropology, Medical Research Division, National Research Center, Cairo, Egypt;* [2]*Department of Nutrition and Food Science, Division of Nutrition Science and Food Industries, National Research Center, Cairo, Egypt;* [3]*Department of Complementary Medicine, Division of Medical Research, National Research Center, Cairo, Egypt;* [5]*Department of Clinical Pathology, Medical Research Division, National Research Center, Cairo, Egypt*

Edited by: Ksenija Bogoeva-Kostovska
Citation: Hassan ME, Elshebini S, Hassan N, El Hussieny MS, Selim M, Amin DH, Nageeb A, Ibrahim M, Khalil A. Association between Quality of Diets and the Risk of Obesity Complication among a Sample of Egyptian Obese Women. Open-Access Maced J Med Sci. 2022 Mar 10; 10(B):576-583. https://doi.org/10.3889/oamjms.2022.7177
Keywords: Healthy diet; DASH diet; Obesity; Anthropometry; Lipid profile; Social factors
***Correspondence:** Aya Khalil, Department of Biological Anthropology, Division of Medical Research, National Research Center, Cairo, Egypt Cairo, Egypt. E-mail: ayakh2010@yahoo.com
Received: 30-Aug-2021
Revised: 18-Jan-2022
Accepted: 28-Feb-2022

Funding: This research did not receive any financial support.
Competing Interest: The authors have declared that no competing interests exist.

Abstract

BACKGROUND: The fundamental cause of obesity and overweight is an energy imbalance between calories consumed and calories expended.

AIM: The aim of this study was to identify the awareness of a sample of Egyptian women about eating healthy diet, using Dietary Approaches to Stop Hypertension (DASH) diet as an example.

METHODS: This study is a cross-sectional study included 109 Egyptian women random chosen, with age range 25–60 years. Full clinical examinations, anthropometric parameters, dietary recalls, and socioeconomic parameters were recorded. Biochemical analysis was done including serum lipid profile.

RESULTS: Data showed that a large percentage of the participants (56.9%) were consuming a poor quality diet, while 20.0% were consuming intermediate quality diet. Only 16.5% and 9.2% of them were aware of eating a good and high-quality healthy diet. Data show that the calories, macronutrients, saturated fatty acids, cholesterol, and sodium intake among both poor and the intermediate groups were higher, while their intake of the monounsaturated fatty acids, polyunsaturated fatty acids, fiber, important vitamins, and the minerals was significantly low. The mean values of the body mass index, body fat %, fat-free mass, waist circumference, visceral fat, and low-density lipoprotein cholesterol values showed significant differences between the groups at p ≤ 0.05–0.001, in favor of the good and high groups.

CONCLUSION: Data of this study revealed that poor quality diet was widespread among studied Egyptian women sample; right food choice was associated with the educational level. Hence, helping individuals to make the right food choices will help in improve diet quality and health.

LEVEL OF EVIDENCE: Cross-sectional study, level V.

Introduction

The Egyptian national survey carried out in 2012 revealed the high predominance of different risk factors for cardiovascular disease (CVD) than the world and territorial figures, particularly increased body weight, physical inertia, and low intake of fruit, vegetable, and whole grains intake. The predominance of hypertension and tobacco used was extremely high, 39.7% and 24.4%, respectively [1].

Metabolic syndrome (MetS) could be a cluster of metabolic risk components, includes visceral obesity, hypertension, dyslipidemia, low concentration of high-density lipoprotein cholesterol (HDL-c), and insulin resistance. Lifestyle alterations, particularly dietary habits, are the most therapeutic strategy for the treatment of MetS, but the foremost viable dietary design for its management has not been established [2].

Obesity is one of the basic criteria of the MetS. Body mass index (BMI) and waist circumference (WC) are essential obesity criteria. BMI is more closely associated with common obesity, and WC is more closely related to abdominal obesity and metabolic-related disorders [3]. The crucial cause of overweight and obesity is an imbalance between caloric intake and used calories. Globally, there has been increased consumption of energy-dense foods that are rich in sugars and fat; and a decrease in physical activity due to the progressively inactive nature of numerous shapes of work, changing modes of transportation, and increasing urbanization [4].

At the same time, one of the markers of MetS is high blood pressure (BP). Raised BP emerges from an interaction of genetic and environmental factors. A considerable prove from animal studies meta-analyses, randomized controlled trials, and epidemiologic study has illustrated that certain personal dietary components and dietary patterns play an important role in hypertension development. Changes in diet can prevent development, improve hypertension, and decrease the chance of hypertension-related complications. Diminishing sodium consumption, increasing potassium intake, constraining alcohol consumption, and following a generally dietary design such as the Dietary Approaches to Stop Hypertension (DASH Diet), is a dietary strategy for the prevention of hypertension [5].

Obesity and poor diet are worldwide epidemics that display a noteworthy challenge for public health and to the avoidance of chronic disease [6]. A high-quality diet is imperative for the anticipation and treatment of chronic diseases, as diabetes CVDs, cancer, and obesity [7]. Consumption of different nutrients is not in separation within the everyday diet. Hence, dietary patterns analysis offers an important approach to prevent and treat diseases by explaining the collective health benefits of the healthy diet and improving the education of the public and clinical application [8].

The previous dietary studies [9], [10] and systematic reviews [11], [12] have demonstrated that high adherence with health-improving dietary patterns, characterized and utilizing similar healthy quality diet ingredients such as the DASH score and the Alternate Healthy Eating-2010 Index. They were related to decreasing in obesity prevalence, diabetes mellitus, cardiovascular malady, cancer, and all-cause mortality, basically in common in the Western nations. The DASH dietary design is based on specified food groups, which were to a great extent included in the meta-analysis study and contain higher amounts of vegetables, fruits, whole grains, nuts, low-fat dairy products, and lower amount of sugar-sweetened beverages (SSBs), fats, oils, and red and processed meat [13].

This study aimed to identify the habitual dietary pattern of a sample of Egyptian women, their awareness about eating a high-good quality diet and compare it to a healthy diet (DASH diet); and to clarify its relationship to their body weight and composition.

Methods

Study design and participants

This cross-sectional study included 109 Egyptian women (with age range 25–60 years) and BMI range 18.78–56.67 km/m^2. They were recruited and randomly chosen, from all employees and workers of all categories; of the "National Research Centre (NRC), Egypt, and from those hesitating to Management of visceral obesity and growth disturbance clinic in Medical Center of Excellency." Written informed consent was obtained from all participants after being informed about the purpose of the study. This research paper was derived during a cross-sectional survey of a project funded by NRC, Egypt, 2020–2023 entitled "Gut Microbiota in Obesity and MetS among obese women: Interactions of the Microbiome, Epigenetic, Nutrition, and Probiotic intervention" (12th Research Plan of the NRC), with approval obtained from the Ethical Committee of NRC (Registration Number is 19/236).

All studied participants were subjected to full history taking and physical examination including the measurement of BP, anthropometric assessment, and laboratory investigation.

BP

BP was measured by cuff sphygmomanometer while the subjects sat quietly on a chair, and the mean of three readings was taken.

Anthropometric measurements

Bodyweight (Wt) and height were measured, following the recommendations of the "International Biological Program [14]." Wt was determined to the nearest 0.01 kg using a seca scale balance, with the participant wearing minimal clothes and with no shoes. Body height was measured to the nearest 0.1 cm using a Holtain portable stadiometer. Body mass index (BMI: Weight [in kilograms] divided by height [in meters squared]) was calculated. Then, according to body mass index (Weight [kg]/Height^2 [mm]), the sample will be classified as normal (BMI = 18–<25), overweight (BMI ≥ 25–<30), and obese (BMI ≥ 30). WC was measured using a non-stretchable tape measure at the narrowest level without any pressure to the nude body. Waist-to-hip ratio was calculated (WC/hip circumference in cm).

Body composition was assessed using Tanita Segmental Body Composition Analyzer (bioelectrical impedance apparatus) to measure fat-free mass, fat mass, (FM) fat%, lean%, and visceral fat according to age, weight, and height approximated to the nearest unit as specified by the manufacturer, the unit was calibrated before testing. The participant stood on the footboard of the device, while she was holding the two handles carefully; each by one hand at the same time. Using her sex, age, weight, and height approximated to the nearest unit, the percentage body fat (Fat%: An estimate of the fraction of the total body mass that is adipose tissue), FM (an estimate of the fraction of the total body weight that is adipose tissue), and fat-free mass (FFM: An estimate of the fraction of the total body weight that is not adipose tissue), total body water, and basal metabolic rate were derived and visceral fat was derived. Cutoff point of visceral fat is >13.

Laboratory investigations

The following parameters were done in the laboratory of "Medical Excellence Research Center MERC," which is part of "National Research Centre, NRC," Egypt. Venous blood samples were obtained to measure serum lipid profile (triglycerides [TG], total cholesterol, and HDL) in the morning by venipuncture after 12 h of overnight fasting by enzyme-linked immunoassay technique. Professional staff performed venipuncture. The blood samples were left to clot; sera were separated by centrifugation for 10 min at 5000 rpm then stored at –80°C until assays. Plasma concentrations of total cholesterol [15], TG [16], and HDL-C [17] were measured using commercially available kits provided by STANBIO Laboratory Inc. (1261 North Main Street, Boerne, Texas 78006, USA). Then, total cholesterol/HDL-C ratio was calculated. LDL-C was calculated according to an equation developed by Friedewald *et al*., 1972 [18], as follows:

$$LDL-C = \frac{Total\ cholesterol - Triglycerides}{5 + HDL - C}$$

Dietary intake

Detailed data about nutritional habits and intake through 24 recalls were reported for 3 successive days by trained nutritionist. Analysis of food items intake was done using the World Food Dietary Assessment System, USA, and the University of California. The association between the dietary pattern and the prevalence of certain clinical chronic disease risk factors was investigated. For comparison, we have taken the DASH diet as a model for a healthy dietary pattern. We calculated the DASH score to check participants adherence to the DASH diet based on foods and nutrients that were emphasized or summarized in the pillars of the DASH diet: Vegetables, fruits, whole grains and seeds, legumes and nuts, low-fat dairy products, red processed meat, oil, sweets, SSBs, and salty foods. A score was given to participants with the highest intake of low-fat dairy products, vegetables, fruits, nuts, whole grains, and legumes. A score was given to participants within the lowest intake of red and processed meats, SSBs, sweets, and high sodium consumption. The DASH score was calculated for each participant by the summation of scores from all components for a total DASH score [19].

Socioeconomic status (SES)

Education level was evaluated by a questionnaire commonly divided into four stages: Illiteracy, primary school, secondary school, and university level. Occupation types are also divided into four groups: Not working, workers, employees, and professional and owner of private business.

Statistical analysis

All values were expressed as mean value ± SE. A two-tailed Student's t-test was used to compare between data of the groups. $p < 0.05$ was considered statistically significant. SPSS window software version 17.0 (SPSS Inc. Chicago, IL, USA, 2008) was used [20].

Results

Table 1 shows the components of the DASH diet score and the serving number per day for each. The table showed the components of the diet sore that is rich in vegetables, fruits, and whole grain. It includes low-fat milk and dairy products, legumes, and nuts. It limits foods that are high in saturated fat, salts, and sugar such as red or processed meat, lamb, beef, organ meats hot dog, sugary beverage, candy, carbonate, and non-carbonate beverages, in addition to salty foods, soda, and the sum of sodium content of all foods

Table 1: Components of the DASH diet score

Types of foods	Dixon's dash index (women)	Score
Vegetables: All vegetables except potatoes	≥3 servings/day	+
Fruits: All fruits and fruit juices	≥4 servings/day	+
Whole grains: Brown bread, brown rice, other wholegrain cereals, bran	≥4 servings/day	+
Legumes and nuts	≥3 servings/day	+
Low-fat dairy products: Skim milk, yoghurt, cottage cheese	≥2 servings/day	+
Red or processed meat: Lamb, beef, organ meats, hot dog		-
High monounsaturated/saturated fat (oil)		+
Sugary beverage and candy: Carbonate and non-carbonate beverages		-
Salty foods and soda: Sum of sodium content of all foods		-
Total diet score		

Scoring of "+" indicates food groups that are positively scored; "−" indicates food groups that are negatively scored. Participants receive 1 point for meeting a target, 0.5 points for meeting an intermediate target, and 0 points for meeting neither target.

Table 2 shows the distribution of studied participants comparing their dietary intake with the DASH diet. Data show that a large percentage of the participants (56.9%) were consuming a poor quality diet, while 17.4% were consuming intermediate quality diet. Only 16.5% of them were aware of eating a good diet. High-quality healthy diets which contain more than the recommended serving were consumed by 9.2% of the participants.

Table 2: Distribution of the participants comparing their dietary intake with the DASH diet

Score	No.	%
Poor	62	56.9
Intermediate	19	17.4
Good	18	16.5
High	10	9.2
Total	109	100

Table 3 shows mean ± SE of the nutrient's intake among the studied sample and their % of the RDA according to the awareness groups. Data show that the calories, macronutrients (protein, total fat, and carbohydrate), saturated fatty acids (SFAs),

Table 3: Mean ± SE of the nutrient's intake among studied sample and their % of the RDAs according to the scores of the groups' awareness

Nutrient intake	Poor No. 62 Mean ± SE %RDA	Intermediate No. 19 Mean ± SE %RDA	Good No. 18 Mean ± SE %RDA	High No. 10 Mean ± SE %RDA	RDAs	P-value
Energy (Cal)	2669.71 ± 8.07 121.35%	2293.76 ± 1.70 104.26%	1666.38 ± 3.78 75.74%	1516.37 ± 1.69 68.92%	2200	0.000**
Protein (g)	94.42 ± 3.64 188.84%	80.81 ± 7.70 161.62%	68.82 ± 8.59 137.64%	51.80 ± 7.14 103.60%	50	0.000**
Fat (g)	136.39 ± 8.38 177.13%	107.48 ± 1.04 139.58%	70.06 ± 1.86 90.99	76.89 ± 1.65 99.86%	77	0.006**
Carbohydrate (g)	266.13 ± 1.50 88.71%	250.80 ± 1.62 83.60%	190.14 ± 4.59 63.38%	154.29 ± 2.52 51.43%	300	0.021*
Dietary fiber (g)	12.26 ± 2.17 49.04%	14.90 ± 1.99 59.60%	23.21 ± 3.73 92.84%	24.55 ± 2.95 98.20%	25	0.023*
Vit. A (μg)	629.62 ± 9.74 78.70%	662.21 ± 1.36 82.78%	803.56 ± 2.09 100.45%	809.12 ± 1.91 101.14%	800	0.028*
Vit. D (μg)	2.49 ± 0.39 49.80%	2.56 ± 0.33 51.20%	3.48 ± 0.31 69.60%	3.96 ± 0.83 79.20%	5	0.047*
Sodium (mg)	2289.49 ± 16.79 152.63%	2055.18 ± 15.42 137.01%	1427.19 ± 12.34 95.15%	1384.17.38 92.28%	1500	0.019*
Potassium (mg)	2829.73 ± 17.74 141.49%	2684.83 ± 14.57 134.24%	2085.25 ± 16.31 104.26%	2077.42 ± 17.12 103.87%	2000	0.030*
Calcium (mg)	681.67 ± 6.71 85.21%	702.10 ± 7.32 87.76%	761.43 ± 5.17 95.18%	788.92 ± 5.43 98.62%	800	0.041*
Iron (mg)	5.47 ± 1.42 68.38%	5.80 ± 1.27 72.50%	6.34 ± 1.63 79.25%	6.78 ± 1.29 84.75%	8	0.033*
Zinc (mg)	6.17 ± 2.41 51.42%	6.56 ± 1.51 54.67%	9.95 ± 2.71 82.92%	11.99 ± 4.01 99.92%	12	0.044*
SFAs (g)	35.54 ± 2.36 11.99%	30.07 ± 3.56 11.79%	19.56 ± 6.40 10.56%	15.31 ± 4.62 9.08%	No more than 7% total calories intake	0.026*
MUFAs (g)	13.87 ± 3.58 4.67%	26.04 ± 8.47 10.21%	30.40 ± 2.21 16.41%	30.34 ± 3.65 15.16%	12–14% total calories intake	0.022*
PUFAs (g)	14.03 ± 7.09 4.72%	14.50 ± 4.74 5.08%	21.94 ± 1.81 11.84%	19.42 ± 2.21 11.52%	6–8% total calories intake	0.056
Cholesterol (mg)	384.53 ± 23.72 128.17%	380.58 ± 15.71 126.58%	254.33 ± 16.34 84.77%	218.45 ± 19.48 72.81%	300	0.023*

SFAs: Saturated fatty acids, MUFAs: Monounsaturated fatty acids, PUFAs: Polyunsaturated fatty acids, SE: Standard error. **Highly significant at P≤0.01. *Significant at P≤0.05. Recommended Dietary Allowance (RDA) 10th Education (ADR) (1989). National Academy of Science, Washington, DC.

cholesterol, and sodium intake among both poor and the intermediate groups were higher when compared to the good and the high groups with significant differences at p ≤ 0.5–0.001. While their intake of monounsaturated fatty acids (MUFAs), polyunsaturated fatty acids (PUFAs), fiber, Vitamins A and D, and the minerals calcium, iron, and zinc were significantly low.

Table 4 shows the mean ± SE of the anthropometric, BP, and biochemical parameters of studied participants according to their awareness about a healthy diet (DASH diet). The mean values of the BMI, body fat %, FFM, WC, and visceral fat values showed significant differences between the groups at p ≤ 0.001, LDL-C showed significant difference at p ≤ 0.034 in favor of the good and high groups. The values of the recorded BP both systolic and diastolic BP (SBP and DBP) were around normal values as the patients, yet the lower level for the SBP was found in the good quality diet group and for the DBP in the high-quality diet group.

Distribution of the studied sample according to their visceral fat, blood pressure and biochemical parameters according to their awareness about healthy diet (DASH Diet) and their health hazards is presented in Table 5. The percentage of the participants who had visceral fat >13.0 kg was 27.5%, most of them 90.0% were found among the group consumed an unhealthy diet. The percentages among the whole sample for the high BP, SBP > 130 mmHg and the DBP>85 mmHg, were 34.9 and 28.4%, 65.9 and 61.3% of them found among poor diet groups. Biochemical parameters showed that participants who had serum cholesterol concentration >200 mg/dl were 44.0% and who had LDL-C mg/dl >100 mg/dl were 71.6%, while 20.2% of them had high TG > 150 mg/dl 20.2%, 68.7, 69.2, and 77.3% were also found among poor diet group. Significant differences at p ≤ 0.05–≤0.01 were found between groups as regards visceral fat, serum concentration of cholesterol, LDL-C, and TG.

Table 6 shows the distribution of the studied sample according to their education level and type of job and adherence to a healthy diet. The illiterate, primary, and secondary education participants were the groups who consumed the poor quality diet in a high percentage, 90.0, 100.0, and 69.4%. The percent of those with a university education consumed poor quality diet was 0.0%, while 43.8, 37.5, and 18.7% consumed an intermediate, good, and high-quality diet. Significant difference at p≤0.05 was detected between dietary groups who work as workers, employee, and professional; the high percentage was found among groups consumed poor quality diets.

Discussion

Due to the high prevalence and substantial morbidity and mortality of obesity, it becomes a growing

Table 4: The mean ± SE of the anthropometric, blood pressure, and biochemical parameters of studied participants according to groups' awareness

Parameters	Scores of adherence				
	Poor	Intermediate	Good	High	p
	No. 62	No. 19	No. 18	No. 10	
	Mean ± SE				
Age (year)	44.73 ± 1.65	40.63 ± 2.94	37.66 ± 3.24	46.20 ± 7.44	0.153
Weight (K)	96.94 ± 2.12	85.57 ± 5.13	63.96 ± 4.52	89.76 ± 2.15	0.613
Height (cm)	158.56 ± 0.78	158.22 ± 1.57	160.89 ± 1.88	156.60 ± 2.82	0.000**
BMI (Kg/m^2)	40.07 ± 0.86	34.52 ± 1.93	25.50 ± 1.54	36.77 ± 0.89	0.000**
Body fat (%)	44.48 ± 0.84	42.67 ± 2.09	33.04 ± 2.87	32.92 ± 6.49	0.000**
FFM (kg)	41.87 ± 1.29	43.34 ± 1.59	45.73 ± 1.19	50.12 ± 1.61	0.035*
Waist circum. (cm)	107.15 ± 2.11	98.74 ± 4.48	84.00 ± 3.54	90.80 ± 7.87	0.001**
WHR (cm/cm)	0.67 ± 0.16	0.62 ± 0.03	0.51 ± 0.02	0.58 ± 0.05	0.010*
Visceral fat (Kg)	11.58 ± 0.43	7.50 ± 1.16	5.87 ± 1.12	7.40 ± 2.24	0.000**
SBP (mmHg)	120.80 ± 2.40	121.76 ± 5.83	105.00 ± 7.07	121.25 ± 4.26	0.161
DBP (mmHg)	77.49 ± 2.27	75.01 ± 3.09	76.25 ± 6.52	72.50 ± 4.79	0.977
TG (mg/dl)	116.54 ± 8.33	98.50 ± 1.48	79.38 ± 1.36	70.80 ± 1.45	0.160
TC (mg/dl)	203.025 ± 5.45	188.61 ± 1.15	166.89 ± 1.09	162.24 ± 2.61	0.072
HDL-C (mg/dl)	58.03 ± 1.49	55.72 ± 2.92	57.75 ± 4.79	57.01 ± 6.26	0.911
LDL-C (mg/dl)	124.18 ± 3.80	113.22 ± 8.68	93.38 ± 8.20	101.20 ± 2.09	0.034*

BMI: Body mass index, FFM: Fat-free mass, WHR: Waist–hip ratio, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, TG: Triglyceride, TC: Total cholesterol, HDL-C: High-density lipoprotein-cholesterol, LDL-C: Low-density lipoprotein-cholesterol, SE: Standard error. **Highly significant at p ≤ 0.01, *significant at p ≤ 0.05.

worldwide public health problem. Multiple chronic diseases are associated with obesity and visceral obesity as hypercholesterolemia, CVD, diabetes, asthma, and cancer [21]. Bonneau *et al*. (2014) [22] reported that visceral obesity is associated with cardiometabolic disorders such as MetS, hypertension, dyslipidemia, insulin resistance, and diabetes and can be more pro-oncogenic more than total body fat.

Table 5: Distribution of the studied sample according to visceral obesity, blood pressure, lipid profile, and groups' awareness

Items	Total (109), no. %	Poor, no. %	Intermediate, no. %	Good, no. %	High, no. %	P
Visceral>13	3027.5	27	3	0	0	0.000
		90.0	10.0	0.0	0.0	
SBP>130	38	25	7	2	4	0.097
	34.9	65.9	18.4	5.3	10.5	
DBP>85	31	19	6	4	2	0.390
	28.4	61.3	19.4	12.9	6.5	
SBP>120	41	26	7	2	6	0.046*
	37.6	63.4	17.1	4.9	14.6	
DBP>80	33	22	5	4	2	0.173
	30.3	66.7	15.1	12.1	6.1	
Cholesterol>200	48	33	9	2	4	0.016*
	44.0	68.7	18.8	4.2	8.3	
LDL>100	78	54	12	6	6	0.003**
	71.6	69.2	15.4	7.7	7.7	

**Highly significant at p ≤ 0.01, *significant at p ≤ 0.05. SBP: Systolic blood pressure, DBP: Diastolic blood pressure, LDL: Low-density lipoprotein.

The objective of this study was to identify the habitual dietary pattern of a sample of Egyptian women and compare it to a healthy diet (Dash diet), and clarify its relationship to their body weight, body composition, serum lipid profile, and BP.

Widespread obesity and overweight were detected among most of the participants shared in this study. The percentage of the participants who had visceral fat >13.0 kg was 27.5%, most of them 90.0% were found among the group consumed an unhealthy diet. The work of the WHO in the Eastern Mediterranean Region reported that obesity as metabolic disorders is dramatically increasing among adults in the Eastern Mediterranean Region. Data for adults aged 15 years and older from 16 countries in the region show the highest levels of overweight and obesity in Egypt, Bahrain, Jordan, Kuwait, Saudi Arabia, and the United Arab Emirates. The prevalence of overweight and obesity in these countries ranges from 74% to 86% in women and 69% to 77% in men [23].

Analysis of the food intake of the participants showed that the dietary pattern of a large proportion of them (56.9%) was considered poor and unhealthy when compared to the DASH diet, while participants who consumed a good and high-quality diet represented only 16.5% and 9.2% of the sample.

Table 6: Distribution of the studied sample according to their education level and type of job and their awareness about healthy diet (DASH diet)

Awareness items	Total (109)	Poor	Intermediate	Good	High	p
Education levels						
Illiteracy	No: 21	18	1	2	0	0.00**
	%: 19.3	85.7	4.8	9.5	0	
Primary	No: 10	10	0	0	0	0.00**
	%: 9.2	100	0	0	0	
Secondary	No: 53	34	11	4	4	0.031*
	%: 48.6	64.2	20.8	7.5	7.5	
University	No: 25	0	7	12	6	0.046*
	%: 22.9	0	28.0	48.0	24.0	
Type of occupations						
Not working	No: 22	13	3	6	0	0.234
	%: 20.2	59.1	13.6	27.3	0	
Workers	No: 14	6	2	4	2	0.431
	%: 12.8	42.9	14.3	28.5	14.3	
Employee and professional	No: 71	42	13	8	8	0.032*
	%: 65.1	59.1	18.3	11.3	11.3	
Owner of private business	No: 2	1	1	0	0	0.059
	%: 1.8	50	50	0	0	

**Highly significant at p ≤ 0.01, *significant at p≤0.05.

The results showed that the poor and the intermediate quality diet groups consumed a diet high in calories, total fat including SFAs, carbohydrates, cholesterol, and sodium when compared to the other groups. Their intake of the monounsaturated fatty acids (MUFAs), poly unsaturated fatty acids (PUFAs), fiber, vitamin A, D and the minerals calcium, iron and zinc was significantly low. In this context, the condition of malnutrition among these participants was recognized as excessive consumption of high-density calorie foods and deficiencies of essential vitamins and minerals. Dietary hazard components for obesity and chronic disease incorporate a low consumption of whole grains, seeds, vegetables, fruits, low-fat dairy products, nuts, and fiber and an increased intake of red and processed meat, sodium, and sugar [24].

This deviation from adequate nutrition reported among the poor and intermediate diet groups had an obvious effect on their studied nutritional parameters. Significant differences were detected between the different groups as regards their anthropometric and biochemical parameters while no significant differences were reported in the values of the SBP and the DBP.

Data show that the groups who consumed poor and intermediate diet had a BMI of more than 40 k/m^2 and 34.52 ± 1.93 and their percentage of body fat was 44.48 ± 0.84% and 42.67 ± 2.09% which including the dangerous visceral fat. As for the other two groups who consumed healthy meals, the anthropological measurements were around standard, especially the WC and the visceral fat. However, the increase in the

BMI value in the high-quality diet group is evident by increasing the volume FFM. In this context, it was found that comparing the percent of each of the macronutrients to the RDAs, in this group, it was found that the protein intake was the highest among them, which may be the reason for the recorded increase in the volume of the FFM.

The same results and the differences between the groups were detected for the biochemical parameters including the total cholesterol, LDL-C, and the triglyceride, where the good and high groups showed the normal healthy values of these parameters. The results are in agreement with the previous systematic reviews which have shown that better compliance with healthy diets as the DASH dietary pattern could reduce total cholesterol, LDL, SBP, and DBP [25], [26], body weight, and fat [27]; and also improve glycemic control [28] and serum inflammatory markers [29]. According to the WHO reports, universally, the predominance of raised total cholesterol is assessed to be 39%, and a third of ischemic heart disease is associated with this high-risk figure [30].

SES has been identified as one of the factors related to obesity, but later updates illustrated conflicting associations across populations. A few confirmations from developed nations demonstrated that low SES populations were at high risk of obesity than their high SES partners [31]. Whereas in low- or middle-income nations, the association got to be mixed, showing a variety from none or inverse to the positive relationship [32]. Data of our study showed important relation of the level of education with the different dietary patterns. A high percentage of the illiterate and those who had primary education participants were consumed poor quality diet (90.0% and 100%, respectively) despite their high BMI. Participants who had university degree were consuming intermediate, good and high quality diets in different percentages, which indicates their good choice of their diets. When using the type of work as an indicator, data show that dietary pattern was not severely affected by the types of the job of the participants. It was found that most of the participants ate poor meals with the percentage range from 50% to 68.4%, the higher was found among not working for the group and the lowest percentage was found among the owner of private business. However, significant differences were observed in the group of workers and the group of employees and those with professional jobs as regards their distribution according to the types of dietary patterns. The socioeconomic difference in nutrition is well proved [33], [34] that helps to clarify a few of the watched social inequalities in health. Individuals with high financial status (SES) are more likely to have healthier food habits, while individuals with low SES have dietary patterns less consistent with the recommended intake or dietary guidelines, subsequently contributing to their poorer health status [34].

Conclusion

Data of this study revealed that poor quality diet was widespread among the studied Egyptian women included in this sample (56.8%). The poor quality diet itself could be a risk factor for chronic disease including obesity, visceral obesity, high BP, and high serum lipid profile which are accompanied by metabolic-related diseases. In addition, data show that there was an association between the right food choice and the educational level. Hence, helping individuals to make the right food choices will help improve nutrient intakes and diet quality.

Authors' Contributions

Nayera E. Hassan and Salwa M. El Shebini were responsible for the conception and the design of the study; Mohamed S. El Hussieny, Mohamed Selim Mostafa, Daren Helmy Amin, and Ayat N. Kamal conducted the study; Nihad H. Ahmed and Mohammed I Mostafa designed the analytical approach, processed, and analyzed the data; Nayera E. Hassan, Salwa M. El Shebini, Nihad H. Ahmed, and Aya Khalil reviewed data and wrote the paper; Nayera E. Hassan and Salwa M. El Shebini had primary responsibility for final content. All authors read and approved the final manuscript.

Availability of Data and Materials

The datasets used during the current study are available from corresponding author.

Declarations

Ethical approval and informed consent

All participants provided informed consent.

References

1. WHO STEPS Chronic Disease Risk Factor Surveillance? Egypt STEPS Survey 2011-2012, Fact Sheet 6-3C-1; 2018. Available from: https://www.who.int/chp/steps/2011-2012_egypt_factsheet.pdf [Last accessed on 2018 Jan 30].
2. Castro-Barquero S, Ruiz-León AM, Sierra-Pérez M, Estruch R, Casas R. Dietary strategies for metabolic syndrome:

A comprehensive review. Nutrients. 2020;12(10):2983. https://doi.org/10.3390/nu12102983

PMid:33003472

3. Liao Q, Zheng Z, Xiu S, Chan P. Waist circumference is a better predictor of risk for frailty than BMI in the community-dwelling elderly in Beijing. Aging Clin Exp Res. 2018;30(11):1319-25. https://doi.org/10.1007/s40520-018-0933-x

PMid:29589287

4. WHO. Obesity and Overweight, Fact Sheet. Geneva: WHO; 2016. Available from: https://www.who.int/mediacentre/factsheets/fs311/en [Last accessed on 2016 Jul 16].

5. Bazzano LA, Green T, Harrison TN, Reynolds K. Dietary approaches to prevent hypertension. Curr Hypertens Rep. 2013;15(6):694-702. https://doi.org/10.1007/s11906-013-0390-z

PMid:24091874

6. Amine E, Baba N, Belhadj M. Diet, Nutrition and the Prevention of Chronic Diseases: Report of a Joint WHO/FAO Expert Consultation; 2012. Available from: https://www.who.int/dietphysicalactivity/publications/trs916/en [Last accessed 0n 2016 Jul 16].

7. Mandalazi E, Drake I, Wirfalt E, Orho-Melander M, Sonestedt E.A high diet quality based on dietary recommendations is not associated with lower incidence of Type 2 diabetes in the Malmö diet and cancer cohort. Int J Mol Sci. 2016;17(6):901. https://doi.org/10.3390/ijms17060901

PMid:27338354

8. Jacobs DR Jr., Steffen LM. Nutrients, foods, and dietary patterns as exposures in research: A framework for food synergy. Am J Clin Nutr. 2003;78 Suppl 3:508S-13S. https://doi.org/10.1093/ajcn/78.3.508S

PMid:12936941

9. Schwingshackl L, Hoffmann G. Diet quality as assessed by the healthy eating index, the alternate healthy eating index, the dietary approaches to stop hypertension score, and health outcomes: A systematic review and meta-analysis of cohort studies. J Acad Nutr Diet. 2015;115(5):780-800. https://doi.org/10.1016/j.jand.2014.12.009

PMid:25680825

10. Asghari G, Mirmiran P, Yuzbashian E, Azizi F. Systematic review of diet quality indices in relation to obesity. Br J Nutr. 2017;117(8):1055-65. https://doi.org/10.1017/S0007114517000915

PMid:28478768

11. Livingstone KM, McNaughton SA. Diet quality is associated with obesity and hypertension in Australian adults: A cross sectional study. BMC Public Health. 2016;16(1):1037. https://doi.org/10.1186/s12889-016-3714-5

PMid:27716133

12. Sundararajan K, Campbell MK, Choi YH, Sarma S. The relationship between diet quality and adult obesity: Evidence from Canada. J Am Coll Nutr. 2014;33:1-17. https://doi.org/10.1080/07315724.2013.848157

PMid:24533603

13. Appel LJ, Moore TJ, Obarzanek E, Vollmer WM, Svetkey LP, Sacks FM, *et al*. A clinical trial of the effects of dietary patterns on blood pressure. N Engl J Med. 1997;336(16):1117-24. https://doi.org/10.1056/NEJM199704173361601

PMid:9099655

14. Hiernaux J, Tanner JM. Growth and physical studies. In: Weiner JS, Lourie SA, editors. Human Biology: Guide to Field Methods. London: Blackwell Scientific Publications; 1969.

15. Allain CC, Poon LS, Chen CS, Richmond W, Fu PC. Enzymatic determination of total serum cholesterol. Clin Chem. 1974;20(4):470-5. https://doi.org/10.1093/clinchem/20.4.470

PMid:4818200

16. Fossati P, Prencipe L. Serum triglycerides determination colorimetrically with an enzyme that produces hydrogen peroxide. Clin Chem. 1982;28(10):2077-88. https://doi.org/10.1093/clinchem/28.10.2077

PMid:6812986

17. Burstein M, Scholnick HR, Morfin R. Rapid method for the isolation of lipoproteins from human serum by precipitation with polyanions. J Lipid Res. 1970;11(6):583-95. https://doi.org/10.1016/S0022-2275(20)42943-8

PMid:4100998

18. Friedewald WI, Levy RI, Fredrickson DS. Estimation of the concentration of low density lipoprotein cholesterol in plasma without use of preparative ultracentrifuge. Clin Chem. 1972;18(6):499-502.

PMid:4337382

19. Dixon LB, Subar AF, Peters U, Weissfeld JL, Bresalier RS, Risch A, *et al*. Adherence to the USDA food guide, DASH eating plan, and Mediterranean dietary pattern reduces risk of colorectal adenoma. J Nutr. 2007;137(11):2443-50. https://doi.org/10.1093/jn/137.11.2443

PMid:17951483

20. WHO Regional Office for the Eastern Mediterranean. Annual Report of the Regional Director 2008. Cairo: WHO Regional Office for the Eastern Mediterranean; 2009.

21. Mokdad AH, Ford ES, Bowman BA, Dietz WH, Vinicor F, Bales VS, *et al*. Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. JAMA. 2003;289(1):76-9. https://doi.org/10.1001/jama.289.1.76

PMid:12503980

22. Bonneau GA, Pedrozo WR, Berg G. Adiponectin and waist circumference as predictors of insulin-resistance in women. Diabetes Metab Syndr. 2014;8(1):3-7. https://doi.org/10.1016/j.dsx.2013.10.005

PMid:24661750

23. Musaiger AO. Overweight and obesity in eastern mediterranean region: Prevalence and possible causes. J Obes. 2011;2011:407237. https://doi.org/10.1155/2011/407237

PMid:21941635

24. Bates B, Lennox A, Prentice A, Bates C, Page P, Nicholson S, *et al*. National Diet and Nutrition Survey Results from Years 1, 2, 3 and 4 (Combined) of the Rolling (2008/2009-2011/2012), London, England. Vol. 4; 2014. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/310995/ndns_y1_to_4_uk_report.pdf [Last accessed on 2016 Feb 21].

25. Saneei P, Salehi-Abargouei A, Esmaillzadeh A, Azadbakht L. Influence of dietary approaches to stop hypertension (DASH) diet on blood pressure: A systematic review and meta-analysis on randomized controlled trials. Nutr Metab Cardiovasc Dis. 2014;24(12):1253-61. https://doi.org/10.1016/j.numecd.2014.06.008

PMid:25149893

26. Siervo M, Lara J, Chowdhury S, Ashor A, Oggioni C, Mathers JC. Effects of the dietary approach to stop hypertension (DASH) diet on cardiovascular risk factors: A systematic review and meta-analysis. Br J Nutr. 2015;113(1):1-15 https://doi.org/10.1017/S0007114514003341

PMid:25430608

27. Soltani S, Shirani F, Chitsazi MJ, Salehi-Abargouei A. The effect of dietary approaches to stop hypertension (DASH) diet on weight and body composition in adults: A systematic review and meta-analysis of randomized controlled clinical trials. Obes Rev. 2016;17(5):442-54. https://doi.org/10.1111/obr.12391

PMid:26990451

28. Shirani F, Salehi-Abargouei A, Azadbakht L. Effects of dietary approaches to stop hypertension (DASH) diet on some risk for developing Type 2 diabetes: A systematic review and meta-analysis on controlled clinical trials. Nutrition. 2013;29(7-8):939-47. https://doi.org/10.1016/j.nut.2012.12.021

PMid:23473733

29. Soltani S, Chitsazi MJ, Salehi-Abargouei A. The effect of dietary approaches to stop hypertension (DASH) on serum inflammatory markers: A systematic review and meta-analysis of randomized trials. Clin Nutr. 2018;37(2):542-50. https://doi.org/10.1016/j.clnu.2017.02.018

PMid:28302405

30. World Health Organization. Overweight, Global Health Observatory: Deaths from NCDs. Geneva: World Health Organization; 2014.

31. Drewnowski A, Moudon AV, Jiao J, Aggarwal A, Charreire H, Chaix B. Food environment and socioeconomic status influence obesity rates in Seattle and in Paris. Int J Obes (Lond). 2014;38(2):306-14. https://doi.org/10.1038/ijo.2013.97

PMid:23736365

32. Dinsa GD, Goryakin Y, Fumagalli E, Suhrke M. Obesity and socioeconomic status in developing countries: A systematic review. Obes Rev. 2012;13(11):1067-79. https://doi.org/10.1111/j.1467-789x.2012.01017.x

PMid:22764734

33. Alkerwi A, Sauvageot N, Nau A, Lair ML, Donneau AF, Albert A, *et al*. Population compliance with national dietary recommendations and its determinants: Findings from the ORISCAV-LUX study. Br J Nutr. 2012;108(11):2083-92. http://doi.org/10.1017/S0007114512000232

PMid:22313864

34. Darmon N, Drewnowski A. Does social class predict diet quality? Am J Clin Nutr. 2008;87(5):1107-17. https://doi.org/10.1093/ajcn/87.5.1107

PMid:18469226