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Original article

Comparing dietary guidelines indices between women with chronic diseases and healthy women: a cross-sectional study

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Abstract. *Background and aim:* There is widespread recognition that many chronic diseases seen today are related to physical inactivity and poor dietary choices. Most dietary guidelines were based on safe eating habits to safeguard against malnutrition and the emergence of poor diet-linked illnesses. The present study aimed to compare the dietary guidelines index (DGI) scores in women with chronic diseases and healthy women. *Methods:* The information in this study was collected through a questionnaire distributed to the Saudi community from January 2020 to February 2021. The inclusion criteria include all women with and without chronic diseases. The DGI data obtained from a tool developed based on the valid short semi food-frequency questionnaire (FFQ), valid food-based New Zealand diet quality index (NZDQI), Saudi dietary guidelines (SDG), and American dietary recommendation (ADR*). Results:* 879 women filled out this questionnaire; 12.8% of them are women with chronic diseases, whereas healthy women constitute 87.2%. The results revealed that women with chronic diseases had a significantly higher fruit score ($p < 0.05$) and vegetable score ($p < 0.01$) compared to the healthy women. The findings also indicated that women with chronic diseases who are overweight or obese and not engaged in physical activity showed significantly ($p < 0.05$) higher total DGI scores compared to women without chronic diseases who are overweight or obese and not engaged in physical activity. In contrast, there is no significant difference in DGI score between the women with chronic diseases with normal BMI and engaged in physical exercise and their healthy counterparts. *Conclusions* By excluding the physical activity factor and the healthy BMI, women with chronic diseases adopt healthy dietary systems compared to healthy women.

Key words: dietary guidelines, women, chronic diseases, physical activity, body mass index.

Introduction

Nowadays, chronic diseases as cardiovascular diseases (CVDs) and diabetes are the leading causes of morbidity and mortality (1). They represent a diverse cluster of illnesses that predominantly last a year or more with necessitate ongoing clinical attention and/or restrict certain food or activities (2). Chronic disease considers a major public health problem which speedily increasing with a growing and aging population due to pandemics of inactivity and an unhealthy diet (3). World health organization (WHO) estimated that chronic diseases kill 40 million/ year 4). In Saudi Arabia, the prevalence of type 2 diabetes amounted 23.1% and CVDs 32.6 % (5,6). In 2020, Saudi Arabia began transformation and investment programs in the health care sector as a part of the 2030 vision. The Ministry of Health in Saudi Arabia announced this transformation, including promoting prevention against disease risk factors, easing access to health care services, and improving its efficiency and quality (6,7).

Body mass index (BMI) is extensively used in health promotion program and medical practices as a measure of health, behavioural and lifestyle. It is also

used as an indicator of chronic diseases risk. Normal BMI can prevent progression toward diabetes and reduce risk factors for cardiovascular disease (8,9). Physical activity independently influences health. Physical inactivity is a major risk factor for progression of chronic diseases, research increasingly points to measures of fitness as an indicator of health and well-being over fatness (10,11). Saudi women identified as a high-risk group for overweight, obesity and physical inactivity. Obesity estimated to be 35.4% and 74.9 % of Saudi women reported as being insufficiently active (12,13).

Eating patterns have been associated with a reduced risk of chronic diseases. Diet acquaint to a large extent the peoples' health (14). Healthy dietary patterns have been associated with a lower risk of chronic diseases (15,16). It is defined as "diets high in vegetables, fruits, whole grains, low and non-fat dairy, and lean protein, as well as low in saturated fat, trans fat, sodium, and added sugars" (17). Poor diet quality is thought to be a leading risk factor for chronic diseases, disability, and lives lost. In addition to smoking and physical inactivity, diet is believed to play a major role in developing chronic diseases. Several organizations have issued dietary recommendations aimed at chronic disease prevention (2,18).

Quality diet indices are progressively being used in epidemiologic studies (19). Exploring overall diet quality consider a growing research interest *via* diet complexity and potentially antagonistic or synergistic effects of dietary components (20). However, measuring diet quality indices and analyzing its correlation with chronic diseases vary across studies, which hampered high-quality dietary pattern health recommendations related to health outcomes, especially with chronic diseases patients (19). High score quality diet indices are associated with an 18 to 26 % decline risk of mortality from most common diet-related chronic diseases as diabetes and CVDs (21).

Quality diet indices, normal BMI, and physical activity are modifiable risk factors for preventing chronic diseases. Therefore, this research is based on the hypothesis that "in order to avoid chronic diseases and their complications, patients with chronic diseases must consume a high-quality diet, maintain a healthy weight, and engage in physical activity". Hence, this study aimed to assess whether Saudi women with chronic diseases as type 2 diabetes, hypertension, and heart diseases have better diet quality than women free of chronic diseases.

Subjects and methods

Study design

A cross-sectional study was conducted from February 2021 to September 2021. The participants had been selected based on the inclusion and exclusion criteria set for the research. This study was conducted on 879 Saudi women. The participants were classified into two groups based on health status; group one, healthy women (not previously diagnosed with any chronic diseases), and group two women who previously diagnosed with any of these chronic diseases (type 2 diabetes, hypertension, or heart disease) during last year or before.

Inclusion criteria

Females ages more than 18 years reside in Saudi Arabia, not currently pregnant or lactating. They are either healthy (not suffering from any chronic diseases) or diagnosed with type 2 diabetes, hypertension, or heart disease during the last year or before.

Exclusion criteria

Females less than 18 years and more than 60 years, currently pregnant or lactating, not resided in Saudi Arabia and were previously diagnosed with any other chronic diseases than the selected illnesses.

Data collection

Participants provided information including their age, having or not chronic diseases, marital status, occupational status, educational level, economic status, anthropometric measurements (height and weight to calculate body mass index (BMI)), physical activity, and smoking.

Assessment of Dietary Guidelines Index (DGI)

The DGI data obtained from a tool developed based on the valid short semi food-frequency questionnaire (FFQ) and valid food-based New Zealand Diet Quality Index (NZDQI) with adaption (22,23). It is a tool that translates the nutrients' requirements and dietary guidelines into food components. The DGI reflects the Saudi Dietary Guidelines' main recommendations (SDG) and American dietary recommendations (ADR). The main SDG recommendation including 1) Enjoy a variety of food from the major group; 2) Choose whole grains; 3) Consume a variety of fruits and vegetables; 4) Limit intake of foods with high salt and sugars, 5) Achieve and maintain healthy body weight and 6) Be physically active.

The NZDQI has 5 components, while the DGI questionnaire contains 8 components, and their scores as follow: 1) fruits 7 scores; 2) vegetables 7 scores; 3) grains and cereals 3 scores; 4) dairy 2 scores; 5) meat and meat alternative 5 scores, and 3 additional components to be in allied with SDG including 6) sugar 2 scores; 7) BMI 1 score; and 8) physical activity 1 score.

Briefly, the DGI total score 28 including the following: 7 scores for fruits [1) dates; 2) watermelon or melon; 3) apple or pears; 4) orange or mandarin; 5) banana; 6) peaches/ plums; and 1 for consume a variety of fruits/week]; 7 scores for vegetables [1) tomato; 2) egg plant or zucchini; 3) carrot or sweat potatoes; 4) lettuces or leafy vegetables; 5) mix vegetables; 6) broccoli or cauliflower; and 1 for consume a variety of vegetables/week]; 3 scores for grains and cereals [1) for whole grains or mix grains bread (a question asked about the type of bread consume); 2) for specific quantity of rice and pasta; and 3) for consumed whole meal cereals (breakfast cereals)]; 2 scores for milk and dairy products [1) for milk and 2) for any diary-products as cheese, yogurt..etc]; 5 scores for meat and meat alternative [1) red meat and/or processed meat; 2) chicken and poultry with no skin; 3) eggs; 4) seafoods and 5) legumes]; 2 scores for sugars [1) not consume unhealthy food such as sweets, cakes, candy, pie, beverages contain sugar, soft drinks, ….etc and 2) not consume fast foods]; 1 score for healthy body weight [1) normal healthy weight BMI=18.5-24.9 kg/m^2 (24)]; and 1 score for physical activity [1) doing walking or any activity for 15 min./ daily (25)].

Statistical analysis

The statistical analysis was conducted using SPSS (Statistical Package for Social Sciences software, version 25). The descriptive data were presented as frequencies and percent, while the quantitative data were presented as (min, max, and mean ± SD). One-Way ANOVA, independent t-test, Mann-Whitney, Chi-square, and Fisher exact tests were used for statistical analysis. All tests were considered statistically significant at a p-value ≤ 0.05.

Results

The demographic characteristics of women who participated in the study

The participants ranged in age from 18 to less than 60 years old. The majority of them (33.5%) were between the ages of 21 and 29, followed by 19.1% (168 women) between the ages of 40 and 49, and just 13.4% (118 women) were between the ages of 50 and 59. There were 423 married women (48.1%), 399 single women (45.4%), and 57 divorced women (6.5%). In terms of occupation, 361 (41.1%) of the participants were students, 199 (22.6%) were employees, and 67 (7.6%) of the participants were retired. The majority of the participants (594, 67.6%) had a university degree, while the fewest had a postgraduate education (95, 10.8%). In terms of financial status, 441 (50.1%) of the participants have a monthly income of less than 3000 SR, while 180 (20.4%) have a monthly income of more than 10000 SR (Table 1).

The health-related factors of women who participated in the study

The distribution of participants according to whether they had or did not have chronic diseases was 112 women (12.8%) having chronic diseases and 767 women (87.2%) not having chronic diseases. In terms of BMI values, 325 (37%) of participants have a normal BMI, while 248 (28%) have BMI values of obesity, 235 (27%) have BMI values of overweight, and

Table 1. The demographic characteristics of women who participated in the study (n=879).

Demographic characteristics		Frequency (%)
Age (Year)	18 – 20	137 (15.6)
	21 – 29	312 (35.5)
	30 – 39	144 (16.4)
	40 – 49	168 (19.1)
	50 – 59	118 (13.4)
Marital status	Single	399 (45.4)
	Married	423 (48.1)
	Divorced	57 (6.5)
Occupational status	Employee	199 (22.6)
	Unemployed	58 (6.6)
	Student	361 (41.1)
	Housewives	194 (22.1)
	Retired	67 (7.6)
Educational level	Basic education	190 (21.6)
	University	594 (67.6)
	Postgraduate	95 (10.8)
Economic status	Less than 3000 SR	441 (50.1)
	3000 – 5000 SR	104 (11.8)
	5000 – 10000 SR	154 (17.5)
	Above 10000 SR	180 (20.4)

Data presented as frequency and percentage (%).

Table 2. The health-related factors of women who participated in the study (n=879)

Health related variables		Frequency (%)
Chronic diseases	Yes	112 (12.8)
	No	767 (87.2)
BMI	Underweight	71 (8)
	Normal	325 (37)
	Overweight	235 (27)
	Obese	248 (28)
Physical activity	Yes	413 (47)
	No	466 (53)
Smoking	Yes	28 (3.2)
	No	851 (96.8)

BMI: Body mass index. Data presented as frequency and percentage (%).

Table 3. The dietary guidelines index (DGI) scores of women who participated in the study.

DGI components	Score		
	Min	Max	Mean ± SD
Fruits	0	7	2.90 ± 1.88
Vegetables	0	7	3.41 ± 1.90
Grains and cereals	0	3	1.12 ± 0.90
Dairy products	0	2	0.52 ± 0.78
Meat	0	5	2.21 ± 0.82
Diet low in sugar and salt	0	2	0.63 ± 0.69
Total DGI with BMI and physical activity	2	26	11.86 ± 4.06
Total DGI without BMI and physical activity	2	23	10.79 ± 3.94

71 (8%) have BMI values of underweight. 413 (47%) of the participants engage in physical exercise, compared to 466 (53%) who do not engage in any physical activity. The vast majority of participants, 851 (96.8%), are nonsmokers, with just 28 (3.2%) being smokers (Table 2).

The dietary guidelines index (DGI) scores of women who participated in the study.

The results revealed that the mean DGI score for food components were as follow; fruits 2.90 ± 1.88, vegetables 3.41 ± 1.90, grains and cereals 1.12 ± 0.90, dairy products 0.52 ± 0.78 and meat 2.21 ± 0.82. Although, the diet low in sugar and salt score was 0.63 ± 0.69. Total DGI with BMI and physical activity score was 11.86 ± 4.06, while without BMI and physical activity score was 10.79 ± 3.94 (Table 3).

The correlation between the DGI score and the demographic characteristics of women who participated in the study

The total DGI with BMI and physical activity scores increase with increasing age; the high DGI score was 13.75 ± 3.83 in participants' age 50-59 year, while the low score was 10.65 ± 3.84 in participants' age 18-20 year. There was a significant correlation ($p < 0.001$) in total DGI with BMI and physical activity

scores and age group. The same trend was found in the total DGI without BMI and physical activity scores; the high total DGI score was 12.99 ± 3.57 in participants' age 50-59 year, while the low score was 9.40 ± 3.69 in participants' age 18-20 year. There was a significant correlation ($p < 0.001$) in total DGI without BMI and physical activity scores and age group. This mean that the total DGI score either with or without BMI and physical activity scores increased with increasing participants' age, and the age has significantly positive effect in the total DGI score (Table 4).

Concerning the correlation between total DGI either with or without BMI and physical activity scores and the marital status; the high total DGI with BMI and physical activity scores was 12.60 ± 3.97 found in married women, while the low score was 11.07 ± 3.97 found in single women. There was a significant correlation ($p < 0.001$) in total DGI with BMI and physical activity scores and marital status. The same trend in the total DGI without BMI and physical activity scores; the high total score of DGI was 11.69 ± 3.80 in married women, while the low score was 9.81 ± 3.81 in single women. There was a significant correlation ($p < 0.001$) between total DGI without BMI and physical activity scores and marital status. This mean that the total DGI either with or without BMI and physical activity scores increased in married women compared with single or divorced women (Table 4).

Regarding the correlation between total DGI either with or without BMI and physical activity scores and the occupational status; the high total DGI with

Table 4. The correlation between DGI with or without BMI, and physical activity scores and demographic characteristics of the participants.

		DGI with BMI and physical activity scores		DGI without BMI and physical activity scores	
Demographic characteristics		**Mean ± SD**	**P-value [a]**	**Mean ± SD**	**P-value [a]**
Age (Year)	18 – 20	10.65 ± 3.84	0.000	9.40 ± 3.69	0.000
	21 – 29	11.25 ± 3.87		9.99 ± 3.71	
	30 – 39	11.53 ± 4.17		10.63 ± 4.00	
	40 – 49	12.92 ± 3.97		11.98 ± 3.79	
	50 – 59	13.75 ± 3.83		12.99 ± 3.57	
Marital status	Single	11.07 ± 3.97	0.000	9.81 ± 3.81	0.000
	Married	12.60 ± 3.97		11.69 ± 3.80	
	Divorced	11.89 ± 4.32		10.91 ± 4.18	
Occupational status	Employee	12.11 ± 3.91	0.000	11.09 ± 3.75	0.000
	Unemployed	11.78 ± 4.27		10.59 ± 4.12	
	Student	10.91 ± 3.84		9.66 ± 3.68	
	Housewives	12.58 ± 4.08		11.73 ± 3.91	
	Retired	14.19 ± 3.99		13.40 ± 3.71	
Educational level	Basic education	11.81 ± 4.14	0.005	10.94 ± 4.03	0.002
	University	11.65 ± 3.96		10.53 ± 3.83	
	Postgraduate	13.11 ± 4.26		12.02 ± 4.12	
Economic status	Less than 3000 SR	11.21 ± 4.11	0.000	10.03 ± 3.98	0.000
	3000 – 5000 SR	11.90 ± 3.93		10.92 ± 3.79	
	5000 – 10000 SR	12.39 ± 3.77		11.37 ± 3.66	
	Above 10000 SR	12.89 ± 3.86		11.97 ± 3.67	

[a]One-way ANOVA. DGI: Dietary guideline index; BMI: Body mass index.

BMI and physical activity PA scores was 14.19 ± 3.99 found in retired participants, while the low score was 10.91 ± 3.84 found in students. There was a significant correlation ($p < 0.001$) between total DGI with BMI and physical activity scores and occupational status. The same trend was found in total DGI without BMI and physical activity scores; the high total DGI score was 13.40 ± 3.71 found in retired participants, while the low total DGI score was 9.66 ± 3.68 found in students. There was a significant correlation ($p < 0.001$) in total DGI without BMI and physical activity scores and occupational status. This mean that the total DGI either with or without BMI and physical activity scores increased in retired women compared with student women (Table 4).

Regarding the educational level, the high total DGI with BMI and physical activity scores was 13.11 ± 4.26 found in postgraduate level, while the low total DGI score was 11.81 ± 4.14 found in participants having basic education. There was a significant correlation ($p < 0.01$) in total DGI with BMI and physical activity scores and educational level. The same trend was found in total DGI without BMI and physical activity scores, the high score was 12.02 ± 4.12 found in postgraduate level, while the low score was 10.53 ± 3.83 found in university level. There was a significant correction ($p < 0.01$) in total DGI without BMI and physical activity scores and educational level. This mean that the total DGI either with or without BMI and physical activity scores increased in women with postgraduate education compared with women with basic education (Table 4).

Concerning the economic status, the high total DGI with BMI and physical activity scores was 12.89 ± 3.86 found in participants have an income above 10000 SR/ month, while the low total DGI score was 11.21 ± 4.11 found in participants have an income less than 3000 SR/month. There was a significant correlation ($p < 0.001$) between total DGI score and economic status. The same trend was found in total DGI without BMI and physical activity scores, the high scores was 11.97 ± 3.67 found in participants who have an income above 10000 SR/ month, and the low total DGI score was 10.03 ± 3.98 found in participants who have an income less than 3000 SR/month. There was a significant correlation ($p < 0.001$) between total DGI score and economic status. This mean that the total DGI either with or without BMI and physical activity scores increased in women with income above 10000 SR/month compared with women with monthly income less than 3000 SR (Table 4).

In general, it was noticed that total score of DGI with or without BMI and physical activity scores increase in high age group, married, retired, high educational level and high monthly income women. In addition, there were significant difference between the DGI scores either with or without adding BMI and physical activity scores and all demographic characteristics of the participants including, age, marital status, occupational status, educational level and economic status (Table 4).

Correlation between DGI score and health related factors of women who participated in the study

The high DGI with BMI and physical activity scores was found in participants having chronic diseases (12.43 ± 3.71), while the low DGI score was found in chronic diseases free participants (11.80 ± 4.09). There was no significant correlation ($p = 0.16$) between DGI with BMI and physical activity scores and having chronic diseases. While the high DGI without BMI and physical activity scores were in participants having chronic diseases (11.59 ± 3.53), and the low score were in chronic diseases free participants (10.69 ± 3.97). There was a significant correlation ($p < 0.05$) between DGI without BMI and physical activity scores and the presence of chronic diseases (Table 5).

Concerning the correlation between total DGI without BMI and physical activity scores and BMI, the high total DGI was 11.19 ± 4.12 and 11.12 ± 3.89, found in overweight and obese respectively, while the low DGI was 9.44 ± 3.79 found in underweight participants. There was a significant correlation between DGI and BMI ($p < 0.01$) (Table 5).

Regarding the correlation between DGI without BMI and physical activity scores and physical activity, the high DGI was 11.24 ± 3.93 found in participants who were engaged in physical activity, while the low DGI was 9.63 ± 3.72 found in participants who did not engage in physical activity. There was a significant correlation between DGI score and physical activity ($p < 0.001$) (Table 5).

Table 5. The correlation between DGI with or without BMI and physical activity scores and health related factors of the participants.

Variable		DGI with BMI and Physical activity scores		DGI without BMI and Physical activity scores	
		Mean ± SD	P-value	Mean ± SD	P-value
Chronic diseases	Yes	12.43 ± 3.71	0.16[b]	11.59 ± 3.53	0.036[b]
	No	11.80 ± 4.09		10.69 ± 3.97	
BMI	Underweight	-	-	9.44 ± 3.79	0.007[a]
	Normal	-		10.56 ± 3.83	
	Overweight	-		11.19 ± 4.12	
	Obese	-		11.12 ± 3.89	
Physical activity	Yes	-	-	11.24 ± 3.93	0.000[b]
	No	-		9.63 ± 3.72	
Smoking	Yes	10.71 ± 3.91	0.13[b]	9.64 ± 3.56	0.118[b]
	No	11.90 ± 4.06		10.82 ± 3.94	

[a]One-Way ANOVA; [b]Independent t-test. DGI: Dietary guideline index; BMI: Body mass index.

Concerning the correlation between DGI and smoking, the high total DGI with or without BMI and physical activity scores were 11.90 ± 4.06 and 10.82 ± 3.94, respectively in not smokers, while the low DGI with or without BMI and physical activity scores was 10.71 ± 3.91 and 9.64 ± 3.56, respectively in smokers. There was no significant correlation between DGI either with or without BMI and physical activity and smoking (p= 0.130 and 0.118, respectively) (Table 5).

Correlation between DGI score and the presence or absence of chronic diseases in women who participated in the study

Women with chronic diseases have higher fruits and vegetables DGI score compared with women without chronic diseases. There was a significant correlation in the DGI score between participants with and without chronic diseases in fruits and vegetables scores (p=0.046 and p= 0.008, respectively), BMI score (p=0.004), and the total DGI without BMI and physical activity scores (p=0.032) (Table 6).

Discussion

An appropriate diet is essential for maintaining better health because it guarantees that the human body receives enough nutrients, vitamins, and minerals (26). A healthful lifestyle is the product of a well-balanced diet and regular physical activity (27). Latest adult research found that programs that incorporated methods like a healthy diet and exercise have major beneficial effects on health outcomes, including diabetes and metabolic syndrome (28-30). The WHO issued guidelines on safe eating habits to safeguard against malnutrition and the emergence of poor diet-linked illnesses (23). The present study aimed to compare the DGI score in women with chronic diseases and healthy women. The DGI system was developed based on the recommendations of NZDQI, SDG, and ADR. The present study results revealed that women with chronic diseases had a significantly higher fruit score and vegetable score compared to the healthy women.

Furthermore, women with chronic diseases who have normal BMI and engaged in physical activity showed a non-significantly higher total DGI score compared to women without chronic diseases who have normal BMI and engaged in physical activity. In contrast, women with chronic diseases who are overweight or obese and not engaged in physical activity showed significantly higher total DGI scores compared to women without chronic diseases who are overweight or obese and not engaged in physical activity. The present study's findings showed that women with chronic diseases may be the most committed to

Table 6. Correlation between DGI score and the presence or absence of chronic diseases in women who participated in the study.

Variable	Chronic diseases		P-value
	With	Without	
Fruits score	3.29 ± 1.69	2.89 ± 1.87	0.046[a]
Vegetables score	3.93 ± 1.69	3.35 ± 1.89	0.008[a]
Grains and cereals score	1.24 ± 0.91	1.10 ± 0.89	0.221[a]
Dairy products score	0.44 ± 0.71	0.53 ± 0.79	0.504[a]
Meat score	2.19 ± 0.88	2.21 ± 0.82	0.771[a]
Sugar score	0.58 ± 0.64	0.64 ± 0.70	0.661[a]
BMI score			
1	24 (2.7%)	301 (34.3%)	0.004[b]
0	67 (7.6%)	487 (55.4%)	
Physical activity score			
1	42 (4.8%)	371 (42.2%)	0.841[b]
0	49 (5.6%)	417 (47.4%)	
Total DGI with BMI and physical activity scores	12.35 ± 3.59	11.55 ± 4.10	0.095[a]
Total DGI without BMI and physical activity scores	11.68 ± 3.38	10.70 ± 3.97	0.032[a]

All DGI scores are present as mean ± SD, except the BMI and physical activity scores are presented as frequency and percentage. DGI: Dietary guideline index; BMI: Body mass index; PA: Physical activity. [a]Mann-Whitney; [b]Chi square.

a healthy diet, the most conservative of their weight, and exercising compared to healthy women. The findings of this study revealed that the total DGI score for both healthy and chronically ill participants is poor. This may be demonstrated by their inability to adopt the safe lifestyle guidelines. The chronically ill participants, who are thought to be more dedicated to a healthy lifestyle, are actually higher, but only by a slight margin over the healthier participants.

Food quality and dietary patterns are prone to be impacted by income, with a noticed consumption of poor diets among limited income individuals (31). The present study showed that the total DGI, either with or without BMI and physical activity scores, increased among the higher-income women. Most cases of coronary artery disease, stroke, diabetes, and some cancers may be avoided in high-income communities by monitoring diet and lifestyle factors (32,33). The questionnaire results also revealed that nearly 50% of the women who participated in the study sample engage in physical activities. Likewise, Al-Hazzaa's study found that most Saudi women participate in medium physical activities (34). A BMI of overweight or obesity was found in 55% of the women in our sample. In Saudi society, a higher BMI was being recognized as a primary potential cause for disease risk (35). This study shows that the total DGI score either with or without BMI and physical activity scores increased with increasing participants' age. Numerous studies have linked a high-quality diet to advanced age and exercise. It has also been documented that young individuals are more likely than elderly individuals to follow unhealthy eating habits. These results are in line with the current study's observations (23, 36-38).

This research followed a DGI that was high in fruits, vegetables, moderate in meat, and low in dairy, grains, salts, and sugar intake. It also depends on a normal BMI and exercising regularly. In this study, the women with chronic diseases adopted a low-salt and sugar diet. This may be a part of their medical-dietary regimen for high blood pressure, cardiovascular disease, diabetes, and metabolic syndrome. Previous studies indicated that following a low-sugar diet helps reverse prediabetes and control diabetes and metabolic syndrome (29). Sugar-sweetened beverages are also closely linked to diabetes and heart disease (39).

Furthermore, whole grains, vegetables, and fruits have been linked to a lower risk of cardiovascular

disease, tumors, and diabetes mellitus type 2, while red meat and sugar-sweetened drinks have been linked to higher risk (40, 41). Fruits and vegetables, as well as nutritious diets in general, aid in disease prevention and reduction of complications. According to a several studies involving 469,551 participants, a higher consumption of fruits and vegetables is related to a lower risk of dying from heart disease, with a 4% decreased risk for each extra amount of fresh fruits and vegetables eaten daily (42). Physical activity and diet are essential interventions in the "war on chronic disease." Obviously, there is widespread recognition that many chronic conditions seen today are related to physical inactivity and poor dietary choices (42-45). Most doctors advise their patients with chronic diseases to follow healthy diets in conjunction with exercise to reduce the risk of illness and death (46).

Conclusion

The DGI system used in the present study was developed based on NZDQI, SDG, and ADR recommendations. This DGI score combines a healthy meal index, a normal BMI, and a physical activity index in one system. The current study's findings indicated that women with chronic diseases who are overweight or obese and not engaged in physical activity showed significantly higher total DGI scores compared to women without chronic diseases who are overweight or obese and not engaged in physical activity. Both chronically ill and healthy women who exercise and have a normal BMI showed no significant differences concerning their DGI scores; their healthy lifestyle could explain this.

Recommendations

Nutritionists must play a greater role in order for all to live a healthy life. They must raise awareness and develop strategies to improve lifestyles, especially among chronic disease patients, particularly in the areas of food and physical activity. Moreover, according to the results of this study, smokers and younger members of society should be given special consideration. Since they are more likely to consume unhealthy foods, they should develop better eating and physical activity behaviours.

Conflicts of Interest: Author declares that she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

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