Effect of a health education program on the lifestyle of adults with a high diabetes risk score in the Abo-Hammad city, Sharkia Governorate

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Received 1 January 2012
Accepted 19 March 2012

Journal of the Arab Society for Medical Research
2012, 7:14–20

Background/aim
Diabetes has emerged as a global health problem. The diabetes risk score is used to identify how high a risk an individual has of developing diabetes. The diabetes risk score will help individuals to rapidly and easily determine their chance of developing diabetes and, accordingly, action can be taken. The present study aimed to determine the diabetes risk score among adults in the Abo-Hammad city, Sharkia Governorate, as well as to implement and determine the outcome of a health education program on the lifestyle of adults with a high diabetes risk score.

Participants and methods
A cross-sectional study was carried out on 282 adults of both sexes, 40–64 years of age, in the Abo-Hammad city, Sharkia Governorate. The questionnaire administered included some sociodemographic items, a diabetes type II risk assessment form, and measurements such as BMI, waist circumference, blood pressure, and random blood sugar. A health education program was implemented and evaluated after 3 months.

Results
It was found that 40.4% of adults aged 40–64 years had a high diabetic risk score. Men had a high diabetes risk score (32.2%) compared with women (46.1%), with a high significant difference ($P=0.019$). The lifestyle health education program had a significant effect on individuals with high diabetes risk scores in terms of a reduction in the consumption of animal fat, shift to the use of vegetable oil, and also a decrease in the consumption of salt.

Conclusion
A lifestyle health education program can be effective for adults with a high diabetic risk score. Further researcher is needed.

Keywords:
diabetes risk score, diabetes type II, health education, lifestyle, sedentary life

J Arab Soc Med Res 7:14–20

1687-4293

Introduction

Diabetes has emerged as a global health problem. The prevalence and incidence of diabetes are increasing worldwide [1].

Egypt ranks in the top ten in terms of the highest number of individuals with diabetes. The number of individuals with diabetes in 2003 was 3.9 million. The expected number of individuals with diabetes in 2025 is 7.8 million [2].

The incidence of type II diabetes depends on an interplay between genetics and lifestyle factors. A positive family history strongly predisposes toward the development of type II diabetes. A sedentary lifestyle and obesity have also been documented as risk factors of diabetes [3]. Also, a central pattern of body fat distribution is an independent risk factor of diabetes and it has been associated with insulin resistance [4]. Increased waist circumference and high blood pressure have been considered as risk factors of diabetes among men. Obesity and lack of physical activity are risk factors of diabetes among women [5,6].

In developed countries, most individuals with diabetes are past the age of retirement, whereas in developing countries, the most affected individuals are between 35 and 64 years of age [7]. Type II diabetes often remains undetected for many years; when diagnosed with diabetes, 25% of the individuals have established retinopathy and have clinical evidence of tissue damage because of diabetes [8].

The diabetes risk score may be a useful tool to determine the risk of developing diabetes in a population, and it is acceptable to individuals compared with biochemical tests [8]. The diabetes risk score can increase individuals' awareness, leading to lifestyle modifications also in the general population, and will help individuals to quickly and easily determine their chances of developing diabetes and participate in a lifestyle intervention program at an early stage to prevent or delay the onset of type II diabetes [1,9].

The benefits of lifestyle intervention have been observed in both sexes and for all ages; interventions have been effective in reducing the risk of diabetes by 58% [10]. An intervention health education program on a healthy diet, regular physical activity, and body weight reduction should be available in the primary healthcare setting. This may help delay the onset of diabetes and its complications [11,12]. The current work aimed to study the future burden of diabetes through the following objectives: to determine the diabetes risk score among adults in the Abo-Hammad city, Sharkia Governorate, to identify sex differences in the diabetes risk score, and implement an intervention education program on a healthy lifestyle and assess its outcomes.

Research question

Can a lifestyle intervention program help change health-related behavior among adults with a high diabetes risk score?

Participants and methods

This study was carried out in two phases from January 2011 to September 2011.

Phase 1

Technical design

Study design and sampling technique: A cross-sectional study was carried out on a sample of adults of both sexes, 40–64 years of age, living in the Abo-Hammad city, Sharkia Governorate. The sample was selected using the multi-stage random sampling technique.

Sample size: Using Epi-Info (epidemiological information package) software version 6.04 (Atlanta, Georgia, USA), the calculated sample was 286 individuals according to the estimated urban population in Abo-Hammad city whose age between 40-64 years were 32363. The expected frequency of high-risk individuals of developing diabetes was 25%, the power of the test was 80%, and the confidence level was 95%.

Administrative design: Ethical considerations were followed. The participants were informed about the aim of the study; ethical approval for this study was provided by the Ethical Committee of the Faculty of Medicine, Zagazig University. An informed consent was obtained from all the participants in this study, the right to refuse participation was emphasized, and permission was obtained from the local health authority.

Data collection tools: Data for this study were collected using the following questionnaires

(1) A structured questionnaire was administered that aimed to determine sociodemographic items such as age, sex, working status, educational level, and marital status.
(2) Type II diabetes risk assessment form [13]. The diabetes risk score is a simple, fast, inexpensive, valid, reliable, and practical noninvasive tool to identify individuals at a high risk of developing type II diabetes [14].

The risk assessment form includes eight items: age, BMI, waist circumference, frequency of intake of vegetables and fruits, family history of diabetes, antihypertensive treatment, past history of gestational diabetes, and physical activity.

For physical activity, the following definitions were used: an individual was considered to be physically active if he or she had regular physical activity for 30 min or more a day, three times per week and as inactive if he or she had a sedentary lifestyle or had irregular physical activity [15].

The total risk score of developing type II diabetes within 10 years was estimated by Tuomilehto and Linsdtrom [13] as follows:

Less than 7: low risk; one in 100 may develop the disease.

7–11: slightly elevated risk; one in 25 may develop the disease.

12–14: moderate risk; one in six may develop the disease.

15–20: high risk; one in three may develop the disease.

Higher than 20: an estimated one in two may develop the disease.

The lowest score was 0 and the maximum score was 26.

Score equal or above 15 indicated that an individual was at high risk of developing diabetes [16].

(3) Height was measured without shoes to the nearest 1.0 cm.
(4) Weight was measured on a calibrated balance scale to the nearest 1.0 kg.
(5) BMI was calculated according to the following formula: weight (kg)/height (m^2).
(6) Waist circumference was measured at the midpoint between the highest point of the iliac crest and the lowest point of the costal margin at the mid axillary line [17].
(7) Blood pressure was measured in the sitting position after 5 min of rest using a recently calibrated mercury blood pressure device.
(8) Random blood glucose was determined using an Accu-Check Blood Glucometer (Ireland).

Operational design

This study had two stages: a pilot study and a field work stage.

Pilot study: The pilot study included 30 adults to determine the clarity and feasibility of the questionnaire and test the response of individuals. At the field work stage of the study, it was difficult to obtain fasting and postprandial blood sugar samples. Therefore, the random blood sugar was determined instead.

Work: All study participants were interviewed by the researcher; then the designed questionnaires were filled in by the researcher and other measurements and investigations were carried out. Four patients with undiagnosed diabetes were identified during the study

and they were advised to contact with their physicians for treatment and follow-up.

Phase II

An intervention study was carried out on 97 (85%) participants at a high risk of developing diabetes; the other 17 (15%) participants dropped out during follow-up. The lifestyle health education program included the following:

(1) Self-reported, pretest questionnaires for assessment of lifestyle practices were completed by participants at a high risk of developing diabetes.
(2) The Health Education Program was adapted from the National Diabetes Information Clearing house (NDIC) [18] aimed at encouraging individuals at a high risk of developing diabetes to follow a healthy lifestyle.
   (a) The health education program included the following:
   (b) An individual session to emphasize the importance of a healthy lifestyle to minimize the risk of developing diabetes.
   (c) Written and verbal health education messages, which included the following:
   (d) Dietary advice for weight loss involving the following:
   (e) The importance of a low-calorie diet with a high intake of vegetables, reduced consumption of animal fat, use of low-fat dairy products and meat products, avoidance or decreased consumption of fried food, and shift to the use of vegetable oil, decreased consumption of sugar, sweet drinks, and sweet food.
   (f) Increase the consumption of vegetables and fruits, and whole grains.
   (g) Moderate physical activity such as walking for 30 min or more three times a week.
   (h) Control of blood pressure through decreased salt intake, regular intake of antihypertensive drugs, and regular monitoring of blood pressure.
(3) Evaluation of the outcome of the program was carried out after 3 months using the same pretest questionnaire.

Data processing: The data collected were coded, entered, and statistically analyzed using the SPSS program (version 19 for the statistical calculation; SPSS Inc., Chicago, Illinois, USA). Quantitative data were expressed as mean and SD and qualitative data were expressed as frequency; the *P* value was computed using the McNemar χ^2-test and *P* value 0.05 or less was considered significant.

Results

This study was carried on 282 adults living in the Abo-Hammad city, Sharkia Governorate to assess the diabetes risk score.

In terms of the sociodemographic characteristics of the studied group Table 1 shows that 115 participants (40.8%) were men and 167 (59.2%) were women. The mean age of the men was 50.47 ± 6.32 years, whereas the mean age of the women was 49.6 ± 5.9 years. A total of 256 participants (90.8%) were married, whereas 26 (9.2%) were unmarried (single, divorced, or widowed). In terms of the education level of the studied group, 18.8% were illiterate, 29.4% had basic and secondary education, and 51.8% had university education and above. Of the participants, 89.7% had a job and 10.3% stated that they did not work.

Table 1 Sociodemographic characteristics of the studied group

Variable	*N* (%)
Sex	
Males	115 (40.8)
Females	167 (59.2)
Social status	
Married	256 (90.8)
Others	26 (9.2)
Education	
Illiterate	53 (18.8)
Basic and secondary education	83 (29.4)
University	146 (51.8)
Work	
Work	253 (89.7)
No work	29 (10.3)

Table 2 shows that men had a mean BMI of 30.98 ± 6.3 kg/m^2. The women had a mean BMI of 32.87 ± 5.5 kg/m^2.

The mean blood pressure of the men was 128 ± 15.65/82.3 ± 10 mmHg, whereas the mean blood pressure of the women was 125 ± 14.9/81.9 ± 9.8 mmHg. Random blood sugar was 114.5 ± 25.4 mg/dl among men whereas it was 116.8 ± 24.8 mg/dl among women.

Table 3 shows that a family history of diabetes in first-degree relatives (brother, sister, parent, or own child) was found among 59.9% of women compared with 41.7% of men. A family history of diabetes in second-degree relatives (grandparent, aunt, uncle, or first cousin) was found among 15.6% of women and 37.4% of men. Only 24.5% of women and 20.9% of men had no family history of diabetes.

On the basis of the BMI of the studied group, 71.2% of the women were obese compared with 51.3% of men.

In terms of waist circumference, which indicates visceral and subcutaneous fat, it was found that 61.6% of women had a waist circumference of more than 88 cm and 33.9% of men had a waist circumference of more than 102 cm.

Table 2 Anthropometric and biological measurements of the studied group

	Mean ± SD			
Variables	Males	Females	*t*	*P*
Age	50.47 ± 6.3	49.6 ± 5.9	1.4	0.2
BMI	30.98 ± 6.3	32.87 ± 5.5	2.6	0.008*
Systolic blood pressure	128 ± 15.62	125 ± 14.9	1.6	0.1
Diastolic blood pressure	82.3 ± 10	81.9 ± 9.8	0.2	0.7
Random blood glucose	114.5 ± 25.4	116.8 ± 24.8	0.7	0.4

*Statistically significant.

Table 3 Distribution of the number and percent of the risk factors of type II diabetes by sex

	N (%)		
Variables	Total (*N*=282)	Males (*N*=115, 40.8%)	Females (*N*=167, 59.2%)
Age group			
Younger than 45	65 (23.05)	19 (16.5)	46 (27.5)
45–	155 (54.96)	58 (50.4)	97 (58.1)
55–64	62 (21.99)	38 (33.1)	24 (14.4)
BMI			
Normal	24 (8.5)	13 (11.3)	11 (6.6)
Overweight	80 (28.4)	43 (37.4)	37 (22.2)
Obese	178 (63.1)	59 (51.3)	119 (71.2)
Waist circumference			
No risk	49 (17.4)	26 (22.6)	23 (13.8)
Moderate risk	91 (32.3)	50 (43.5)	41 (24.6)
High risk	142 (50.3)	39 (33.9)	103 (61.6)
Physical activity			
Present	105 (37.2)	59 (51.3)	46 (27.5)
Absent	177 (62.8)	56 (48.7)	121 (72.5)
Intake of vegetable and fruits			
Every day	167 (9.2)	58 (50.4)	109 (65.3)
Not every day	115 (40.8)	57 (49.6)	58 (34.7)
Hypertension treatment			
Have no hypertension	199 (70.6)	82 (71.3)	117 (70)
Take treatment for hypertension	83 (29.4)	33 (28.7)	50 (30)
Previous increase blood glucose			
No	255 (90.4)	109 (94.8)	146 (87.4)
Yes	27 (9.6)	6 (5.2)	21 (12.6)
Family history of diabetes			
No family history	65 (23)	24 (20.9)	41 (24.5)
Second-degree relative	69 (24.4)	43 (37.4)	26 (15.6)
First-degree relative	148 (52.2)	48 (41.7)	100 (59.9)

In total, 72.5% of women had a sedentary lifestyle compared with 48.7% of men. A total of 34.7% women and 49.6% men reported daily intake of vegetables and fruits; and 30% of women and 28.7% of men were found to have hypertension.

In terms of the association between sociodemographic characteristics and the estimated risk of diabetes Table 4 shows that 46.1% of women had a high diabetes risk score compared with 32.2% of men, with a statistically significant difference ($P = 0.019$). A total of 36.98% of university-educated adults, 39.8% with basic and secondary education, and 51% of the illiterate group had a high diabetes risk score; the difference was statistically insignificant ($P = 0.096$). The diabetes risk score showed an insignificant association with working social status and marriage.

Figure 1 shows that there was a positive significant correlation between BMI and random blood glucose level ($r = 0.3$, $P = 0.01$).

Figure 2 shows that 40.4% of adults aged 40–64 years had a high diabetic risk score.

Figure 3 shows the distribution of the diabetes risk score in terms of sex; 11.4, 34.7, 21.7, and 32.2% of the men had a low diabetic risk score, a slightly elevated risk of developing diabetic, a moderate risk of developing diabetes, and a high diabetic risk score, respectively, compared with 10.7, 21.6, 21.6, and 46.1% of women.

The modification in lifestyle after the health education program among the high diabetic risk group was reduced consumption of animal fat. Shift to the use of vegetable oil and decreased salt consumption were statistically significant ($P<0.05$), whereas sugar consumption, increased intake of vegetables and fruits, regular exercise, and proper control of blood pressure showed a statistically insignificant difference ($P>0.05$, Table 5).

Discussion

The development of type II diabetes involves an interplay between genetic and environmental risk factors. It is known that there is a strong genetic predisposition for development of type II diabetes mellitus.

This study showed that 59.9% of women and 41.7% of men had a family history of diabetes among first-degree relatives, which is in agreement with Dutt *et al.* [19], who found that a family history of diabetes was a very important risk factor for developing diabetes. Hariri *et al.* [20], in their study, found that 73% of diabetic patients had a family history of diabetes.

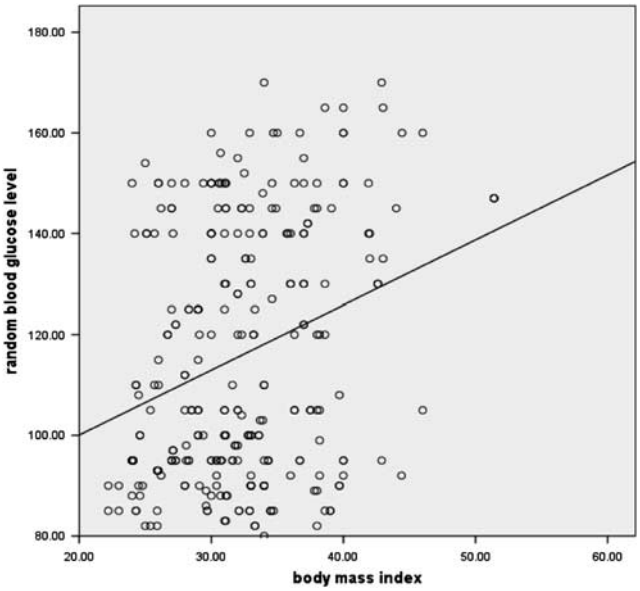
In this study, it was found that 72.5% of women and 48.7% of men had a sedentary lifestyle, which is in agreement with Thanopoulou *et al.* [21], who found that the degree of physical activity was lower in patients with recently diagnosed and undiagnosed type II diabetes mellitus compared with control participants. Dutt *et al.* [19] reported that lack of exercise is associated with development of diabetes. A study carried out by Hamilton *et al.* [22] found that sitting for long durations of time is associated with the development of type II diabetes. In addition, Veghari *et al.* [23] found that physical activity had a marked effect on the fasting blood glucose level and the prevalence of diabetes among individuals with low physical activity was two times

Table 4 Relationship between sociodemographic characteristic and the diabetes risk score

Variables	Diabetes risk score, *N* (%)		χ^2	*P*
	<15[a] (*N*=168, 59.6%)	≥15[b] (*N*=114, 40.4%)		
Age				
<45 (65)	45 (69.2)	20 (30.8)		
45– (155)	84 (54.2)	71 (45.8)	0.57	0.44
55–64 (62)	39 (62.9)	23 (37.1)		
Sex				
Males (115)	78 (67.8)	37 (32.2)	5.49	0.019
Females (167)	90 (53.9)	77 (46.1)		
Social status				
Married (256)	152 (59.4)	104 (40.6)	0.0.05	0.83
Others (26)	16 (61.5)	10 (39.5)		
Education				
Illiterate (53)	26 (49)	27 (51)	2.76	0.096
Basic and secondary (83)	50 (60.2)	33 (39.8)		
University (146)	92 (63.1)	54 (36.9)		
Work				
Work (235)	148 (58.5)	105 (41.5)	1.18	0.27
No work (29)	20 (69)	9 (31)		

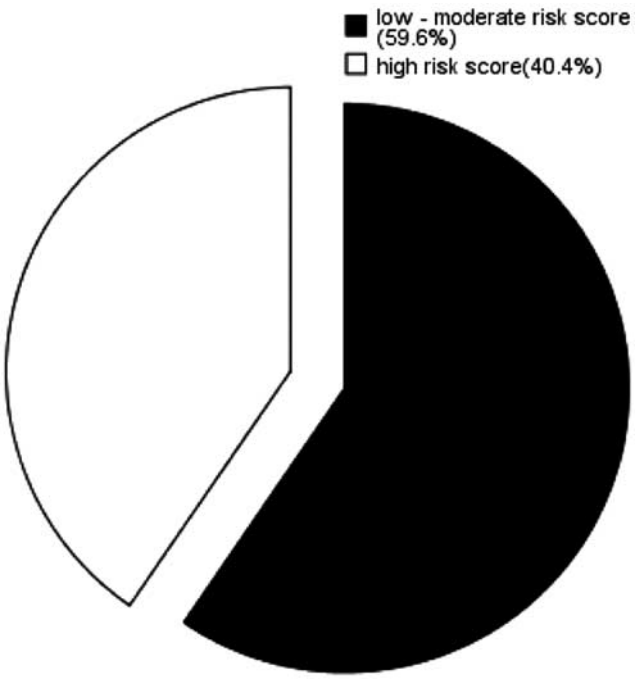
[a]Diabetes risk score is low and moderate.
[b]Diabetes risk score is high.

Figure 1



Relation between BMI and random blood glucose (r=0.3, P=0.01).

Figure 2



Diabetes risk score among the group studied.

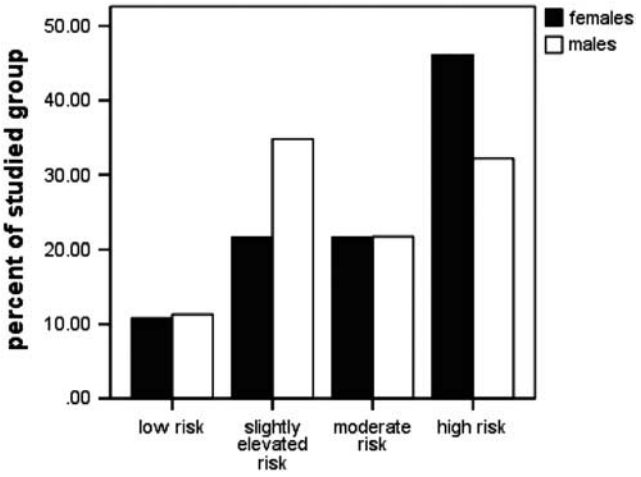
higher than that of physically active individuals. This finding can be attributed to the fact that lack of exercise increases body adiposity and weight.

In this study, 71.2% of women and 51.3% of men were obese. The same finding was obtained by Perreault *et al.* [6], who found that 73% of women and 56.5% of men were obese in their study. In a previous study, obesity was found to be the most important cause of diabetes mellitus [24]. Also, obesity was found to increase the risk of diabetes type II by 28 times compared with nonobese individuals [3]. However, Veghari *et al.* [23] found that the prevalence of diabetes mellitus among morbidly obese individuals was five times more than nonobese individuals.

In the present study, a positive correlation was found between BMI and random blood sugar ($r = 0.3$, $P = 0.01$), in agreement with Veghari *et al.* [23], who found a positive correlation between BMI and fasting blood sugar in their study.

On measuring waist circumference as an indicator for a central pattern of body fat distribution, it was found that 33.9% of men had a waist circumference above 102 cm and 61.6% of women had a waist circumference above 88 cm. Boyko *et al.* [4] and Fujimoto *et al.* [17] have reported that central body fat distribution is an independent risk factor for diabetes, which is in agreement with

Figure 3



Distribution of the diabetes risk score according to sex.

Table 5 Effect of a health education program on changes in the diet, exercise, and control of hypertension in the group with high diabetic risk scores

	N (%)		
Variables	Before the health education program (*N*=97)	After the health education program (*N*=97)	*P*
Decreased consumption of animal fat			
Yes	37 (38.1)	51 (52.5)	<0.05*
No	60 (61.9)	46 (47.5)	
Shift to the use of vegetable oil			
Yes	38 (39.1)	51 (52.5)	<0.05*
No	59 (60.9)	46 (47.5)	
Increased daily consumption of fruits and vegetables			
Yes	58 (59.8)	67 (69)	>0.05
No	39 (40.2)	30 (31)	
Decreased daily consumption of sugar			
Yes	27 (27.8)	32 (32.9)	>0.05
No	70 (72.2)	65 (67.1)	
Decreased daily consumption of salt			
Yes	37 (38.1)	50 (51.5)	<0.05*
No	60 (61.9)	47 (48.5)	
Physical activity			
Yes	36 (37.1)	41 (42.3)	>0.05
No	61 (62.9)	56 (57.7)	
Control of hypertension by medicine[a]			
Yes	29 (87.9)	31 (93.9)	>0.05
No	4 (12.1)	2 (6.1)	

*Statistically significant.
[a]Hypertensive individuals with a high diabetes risk score=33 individuals.
The *P* value was computed using the McNemar χ^2-test.

Veghari *et al.* [23], who found that the mean blood glucose value in individuals with a central pattern of obesity was 10.1 mg/dl more than that in normal individuals. A previous study carried out by Regzedmaa *et al.* [25] reported that obesity and central body fat were two risk factors for the development of diabetes. This finding can be attributed to the central pattern of fat distribution, which has been associated with insulin resistance and an increased risk of diabetes.

The daily intake of fruits and vegetables was infrequent among 49.6% of men and 34.7% of women. Carter *et al.* [26] found a 14% reduction in the risk of type II diabetes in individuals who had a high intake of green leafy vegetables.

The current study showed that blood pressure was 128 ± 15.6/82.3 ± 10 mmHg among men and 125 ± 14.9/81.9 ± 9.8 mmHg among women. Percentage of men who received antihypertensive treatment was 28.7% compared with 30% women; similar results were obtained by Perreault *et al.* [6], who found that men had a blood pressure of 124 ± 18/80 ± 13 versus 121 ± 21/78 ± 13 mmHg in women. This result can be attributed to the fact that the risk of hypertension among menopausal women are the same as men.

In the current study, 12.6% of women had gestational diabetes in a previous pregnancy and 5.2% men had elevated blood glucose in a previous medical investigation. Saaristo *et al.* [16] reported a history of gestational diabetes in 13% of women of childbearing age. Kim *et al.* [27] found that gestational diabetes is a strong risk factor for future development of type II diabetes.

The current study found that 40.4% of all the studied participants had a high diabetes risk score, which is not in agreement with Cowie *et al.* [28] and Wojcik *et al.* [29], who found that 29.5 and 23% of adults were at a high risk of developing diabetes. This result can be attributed to the difference in age groups and also other lifestyle patterns of populations of different countries.

In terms of sex differences among the group studied, 46.1% of women and 32.2% of men had a high diabetic risk score, which is in agreement with other studies carried out by Veghari *et al.* [23] and King *et al.* [30], who reported that the prevalence of diabetes mellitus among women was higher than that among men; this can be attributed to the high prevalence of obesity, central body fat, and a sedentary lifestyle among women.

Individuals who participated in the lifestyle intervention program reported that they followed the advice in terms of the following lifestyle modifications: 37.8% of the participants reported decreased consumption of animal fat, 38% shifted to the use of vegetable oil, and 35% reduced the consumption of salt. These results were in agreement with Tuomilehto *et al.* [12], who reported that individuals included in a lifestyle intervention program made modifications in their diet and exercise patterns. This finding indicated that individuals were willing and able to participate in an intervention program if made available to them.

Conclusion

The current study indicated that a high percentage of adults in Abo-Hammad city aged (40–64 years) have a high risk of developing type II diabetes mellitus. Obesity, high waist circumference, and lack of physical activity were found among adults. Identification of individuals

with a high diabetes risk score may help individuals to follow a healthy lifestyle at an early stage to prevent or delay the onset of type II diabetes. Therefore, assessment of the diabetes risk score for all individuals and implementation of primary prevention for high-risk individuals are recommended in primary healthcare units. Also, further researches are required on this subject. The usefulness of this risk score needs to be examined across the country and more information should be obtained to develop a better diabetic risk score.

Acknowledgements

The author thanks all the participants in this study and the administration staff for their valuable assistance in the completion of this work.

Conflicts of interest

There are no conflicts of interest.

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