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Health-Promoting Lifestyles and Awareness of Diabetes in Adults with Type 2 Diabetes in Jordan

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Abstract

Aim: This study evaluates the association between health-promoting lifestyles and diabetes knowledge with glycemic control in adults with type 2 diabetes.

Methods: This cross-sectional study employed convenience sampling and a structured interview questionnaire consisting of the following measures: demographic and clinical characteristics, Health Promotion Lifestyle Profile II, diabetes knowledge questionnaire, and laboratory measurements. Descriptive and inferential statistics were used to analyze the data.

Results: The study included 248 participants recruited from four public hospitals. The results indicated a deficit in several aspects of diabetes knowledge and a suboptimal adoption of health-promoting lifestyles. The findings showed that 81.5% of the sample had non-optimal glycemic control as measured by glycosylated hemoglobin (HbA1c) level. Health-promoting lifestyles predicted optimal glycemic control, while insulin use was a statistically significant predictor for non-optimal glycemic control.

Conclusion: Most participants did not have their diabetes controlled and their diabetes knowledge and health-promoting lifestyles were suboptimal. Health promotion education and strategies to enhance health-promoting lifestyles and diabetes management are essential to patients so that they become confident about managing their diabetes.

Keywords: Awareness, diabetes knowledge, health-promoting lifestyle, glycemic control, type 2 diabetes

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1. INTRODUCTION

Diabetes is a global health issue because of its high rates of prevalence, complications, and mortality, as well as huge associated healthcare costs [1]. The prevalence of diabetes is rising at an alarming rate particularly in developing countries. The 2019 Diabetes Atlas of the International Diabetes Federation (IDF) estimated the global diabetes prevalence in the age group 20–79 years was 9.3%, which translates into 463 million adults suffering from diabetes. It is estimated that 79.4% of these adults live in middle- and low-income countries. By 2030, the number of people aged 20–79 years living with diabetes will likely have reached 578.4 million and, by 2045, 700.2 million [2]. Globally, total healthcare expenditure in 2019 on diabetes

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for those aged 20–79 was USD 760.3 billion, and the economic burden of diabetes is expected to continue to grow. It is projected that healthcare expenditure on diabetes for those aged 20–79 years will reach USD 824.7 billion by 2030 and USD 845.0 billion by 2045 [2].

Currently, unhealthy lifestyles, such as inadequate physical activity, obesity or being overweight, and unhealthy dietary patterns, raise the prevalence of type 2 diabetes and related complications, as well as other non-communicable diseases [3]. Therefore, diabetes control is a crucial component of diabetes management because of the high prevalence of diabetes and its complications [4]. Self-management of type 2 diabetes is challenging and often requires adherence to a treatment regimen that requires skillful integration of a long-term healthy lifestyle incorporating diet, regular exercise, optimum weight control, self-monitoring of blood glucose (BG), and medication adjustment as part of daily routine [5]. Diabetes self-management is of immense importance because the adoption of a healthy lifestyle produces optimum glycemic control for diabetes. This, in turn, helps minimize or prevent subsequent acute and chronic complications of the disease [4]. Poor awareness of diabetes and its management are some of the key variables influencing the progression of diabetes and its preventable complications. Since different behaviors may relate to different influential factors, exploring health-promoting lifestyles and diabetes knowledge among diabetics can provide a useful reference for the development of an effective diabetes prevention program.

In the health-promotion model [6], Pender pointed out that incorporating health-promoting behavior within a person's lifestyle will lead to better physical and psychological health, increase fitness, and improve quality of life. However, studies from Jordan have highlighted alarming findings that reflect the inadequate adoption of healthy lifestyle behaviors [7–8]. The international literature also indicates that the percentage of people who adopt healthy lifestyles is disappointing [9]. To date, little is known about diabetes knowledge and health-promoting lifestyles in developing countries like Jordan. Although previous studies [10–12] have examined diabetes knowledge among Jordanians, to the best of our knowledge, there are no published studies of the health-promoting lifestyles among people with type 2 diabetes in a Jordanian population context. Therefore, in this context, the aims of the present study focused on: (1) examining the levels of diabetes knowledge and health-promoting lifestyles; (2) determining the factors associated with diabetes knowledge and health-promoting lifestyles; and, (3) identifying significant predictors of glycemic control in patients with type 2 diabetes.

2. MATERIALS AND METHODS

2.1 Study design, setting, and sample

A cross-sectional study design was used to gather data. In an ambulatory clinic setting, we recruited subjects following a diabetes clinic in four public hospitals in Jordan. Adult patients who were 18 years or more of age and had confirmed diabetes mellitus for at least one year before enrollment in the study, and who agreed to participate, were recruited. Pregnant women and patients with severe mental or physical deterioration and those unable to answer the questionnaire independently were excluded. The number of participants needed to answer the study questions was determined using a sample size calculation.

2.2 Measures

The measures covered in the structured interview questionnaire are described next.

2.2.1 Demographic and clinical data

This part contained questions about age, gender, level of formal education, current employment status, marital status, and household monthly income. Diabetes clinical data include the duration of diabetes since diagnosis, previous diabetes education, presence of a family history of diabetes, and current type of treatment (diet, insulin, oral hypoglycemic agents).

2.2.2 Health Promotion Lifestyle Profile-II (HPLP-II)

The HPLP-II is a self-reported questionnaire that aims to measure health-promoting lifestyles [13]. The measure includes 52 items divided into six subscales: physical activity, stress management, spiritual growth, nutrition, interpersonal relations, and health responsibility. The measure asks respondents to indicate how often they adopt specific health-promoting lifestyles and is reported to have satisfactory reliability and validity for use in different societies and populations [14]. The HPLP-II has previously been used in the Jordanian community [15–16]. In this study, a translated Arabic version was used to collect the data. For the English version of the HPLP-II, a Cronbach's alpha of 0.94 for the overall scale and an alpha ranging from 0.79–0.87 for the six subscales were reported [17]. In this study, the subscales of physical activity and nutrition were investigated on a 4-point Likert scale, with options of 'never' (1), 'sometimes' (2), 'often' (3), or 'routinely' (4). The subscale scores are used as an indicator of a health-promoting lifestyle, with a higher score representing a higher level. The HPLP-II has been used in health-promotion and health responsibility research. In our sample, Cronbach's alphas were 0.95, 0.84, and 0.84 for health responsibility, physical activity, and nutrition, respectively.

2.2.3 Diabetes Knowledge Questionnaire (DKQ)

The Diabetes Knowledge Questionnaire (DKQ) was developed by researchers based on a literature review assessing aspects of diabetes knowledge [18–20]. Content validity of DKQ was checked by a panel of four experts in the fields of health education and diabetes. Content validity index (CVI) was 0.92, and Cronbach's alpha of 0.78 was achieved. The DKQ consists of 24 items with one correct answer from multiple choices for each question. The knowledge score is determined by giving one point for each correct answer and zero for a wrong or 'Don't know' response. The total score ranged from 0–24, with higher scores indicating a higher level of diabetes knowledge. The aspects to be evaluated in the DKQ assessment tool include: general knowledge about diabetes (nine items), physical activity (two items), medications (four items), nutrition (three items), complications (two items), foot care (two items), sick day management (one item) and BG monitoring (one item).

2.2.4 Laboratory and anthropometric measurements

The last readings of glycosylated hemoglobin level (HbA1c) measured 1 day to 3 months before the date of data collection were collected from the medical records. Glycemic control status was classified as non-optimal if HbA1c $\geq$ 7%, and optimal if HbA1c < 7% [21]. To classify the participants according to their body mass index (BMI), a classification system for obesity was used: underweight (<18.5), normal weight (18.5–24.9), overweight (25–29.9), and obese (> 30) [22].

2.3 Ethical considerations and data collection procedures

Ethical approval was obtained from the ethics committees of the healthcare settings from which the participants were recruited and from the Institutional Review Board at Mutah University. Informed consent was obtained from every participant. The participants were reassured of the confidentiality of the collected information, and that involvement in the study was voluntary. Participants who met the inclusion criteria were interviewed by trained, qualified research assistants at the diabetes clinics where patients

came for a follow-up visit. The interviews were conducted after a briefing about the study's aims and participants' queries had been managed. For the data collection, validated and standardized interview questionnaires were used. The tools were initially designed in English and translated into Arabic (local language), and again back translated into English by experts who had similar experiences. The questionnaires were pretested with a similar group of people with diabetes.

2.4 Data analysis

Descriptive statistics were used for participant characteristics and measured variables. An independent sample *t*-test, ANOVA test and Tukey post hoc test were used to examine significant differences in diabetes knowledge and health-promoting lifestyles scores among groups of participants. Multivariate logistic regression analysis was used to estimate relationships between the subsets of participants' characteristics, diabetes knowledge, health-promoting lifestyles and glycemic control (HbA1c levels), as the dependent variable. Significant predictors from each subset were included in the final regression model to estimate variables that predicted glycemic control. All statistical analyses were performed using SPSS version 21 at a significance level of $p< 0.05$.

3. RESULTS

3.1 Characteristics of study participants

The sample consisted of 248 participants: 53.2% were female, mean age 57.4 years (SD±12.3, range=18–84 years). Of all the participants, 36.8% (n= 47) had university-level education, 73% were unemployed, and the majority were married (82.7%). The results revealed that 53.6 % and 35.5% were obese and overweight, receptively. Of the sample, 81.5% had non-optimal glycemic control and 62.5% reported they had received diabetes education. The demographic and clinical characteristics of participants are presented in Table 1.

Table 1: Participants' characteristics and mean scores for diabetes knowledge (n=248)

Variable	Sub-group	n	%	Mean /24	±SD	Test statistic	*p*-value[a]
Age (years)	Less than 40	15	6	17.66	3.43	4.09	0.018[a]
	40–60	126	50.8	14.52	4.40		
	>60	107	43.1	14.27	4.33		
Gender	Male	116	46.8	14.78	3.68	.605	0.546
	Female	132	53.2	14.44	4.91		
Education level	No school	23	9.3	8.65	5.18	31.04	0.000[a]
	Primary	69	27.8	13.56	4.26		
	High school	66	26.6	14.83	3.36		
	University	90	36.3	16.75	3.11		
Income	Low	140	56.5	13.52	4.76	10.94	0.000[a]
	Moderate	90	36.3	16.16	3.37		
	High	18	7.3	15.27	3.28		
Marital status	Married	205	82.7	14.35	4.43	-1.96	0.051
	Unmarried	43	17.3	15.79	3.94		
Employment status	Employed	67	27	16.02	3.41	-3.17	0.002
	Unemployed	181	73	14.07	4.58		
Diabetes duration (years)	<5	70	28.2	13.68	4.83	5.09	0.007
	5–10	94	37.9	14.23	4.22		
	>10	84	33.9	15.78	3.92		
Diet therapy	Yes	118	47.6	15.62	3.37	3.58	0.000[a]
	No	130	52.4	13.67	4.95		
Insulin therapy	Yes	131	52.8	16.02	3.89	5.73	0.000[a]

Variable	Sub-group	n	%	Mean /24	±SD	Test statistic	*p*-value[a]
	No	117	47.2	13.01	4.36		
Oral hypoglycemic agents	Yes	211	85.1	14.62	4,24	.178	0.859
	No	37	14.9	14.48	5,12		
Diabetes education	Yes	155	62.5	15.56	3.58	4.65	0.000[a]
	No	93	37.5	13.00	5.08		
BMI (kg/m2)	18.5–24.9	27	10.9	15.29	4.92	.449	0.639
	25–29.9	88	35.5	14.65	4.43		
	More than 30	133	53.6	14.42	4.24		

Values are presented as mean ± standard deviation (*t*-test, one-way analysis of variance, and Tukey post hoc test).
[a] Significant at $\alpha < 0.05$ (2 tailed) using independent samples *t*-test or ANOVA tests.

3.2 Knowledge of aspects of diabetes

The mean score of diabetes knowledge was 14.6 out of 24 (SD±4.3, range=0–23). The interpretation of diabetes knowledge scores was based on the Jordanian education system, as agreed by the panel of experts, and was defined as: less than 50 failed, 50–59 weak, 60–69 satisfactory, 70–79 good, 80–89 very good, and 90–100 excellent. Based on these grading criteria, 19.8%, 23.4%, 21.8%, 25.4%, 6%, and 3.6% of the participants were classed as failing, weak, satisfactory, good, very good, and excellent regarding their diabetes knowledge, respectively. Table 2 provides details of the performance of the participants on diabetes knowledge.

Table 2: Performance of participants on diabetes knowledge (n=248)

	Question	M (±SD)	Correct Answer (n) %
	General knowledge	5.67 (2.26)	
1.	Hba1c is a blood test that measures average BG level ….for the past		185 (74.6)
2.	Normal range for fasting blood sugar is….		160 (64.5)
3.	What HbAC1 results indicate the lowest risk of developing…		206 (83.1)
4.	Best method for testing BG …		149 (60.1)
5.	Which of the following statements is true about diabetes…		111 (44.8
6.	Signs of hyperglycemia include…		133 (53.6)
7.	Signs of hypoglycemia include…		105 (42.3)
8.	Low BG may be caused by…		133 (53.6)
9.	Which of the following is used in hypoglycemia?		226 (91.1)
	Medications	2.86 (1.11)	
10.	What effect do oral hypoglycemic agents have on BG?		219 (88.3)
11.	Best site for insulin injection is…		169 (68.1)
12.	Opened insulin bottle stored in…		123 (49.6)
13.	Which of the following is true about oral hypoglycemic agents?		200 (80.6)
	Sick day management	0.74 (0.43)	
14.	If you sick with flue, which of the following changes …		184 (74.2)
	Physical activity	1.36 (0.69)	
15.	What effect does exercise have on BG?		213 (85.9)
16.	How often should people with DM exercise?		126 (50.8)
	Diet	1.76 (0.77)	

	Question	M (±SD)	Correct Answer (n) %
17.	What effect does unsweetened fruit juice have on BG?		91 (36.7)
18.	Which of the following is used to treat hypoglycemia?		203 (81.9)
19.	Which of the following statements about DM and diet is true?		144 (58.1)
	Blood monitoring	0.42 (0.49)	
20.	Why are people with diabetes advised to test their own BG?		105 (42.3)
	Complications	0.69 (0.83)	
21.	Which of the following is usually not associated with diabetes		99 (39.9)
22.	Which of the following is not a long-term complication of diabetes?		76 (30.6)
	Footcare	1.09 (0.69)	
23.	Which foot problems are people with diabetes most likely at risk of?		80 (32.3)
24.	The best way to take care of feet is…		193 (77.8)

3.3 Factors associated with diabetes knowledge

As shown in Table 1, there were statistically significant differences in diabetes knowledge associated with age, educational level, income level, employment status, duration of diabetes, diet therapy, insulin therapy, and receipt of diabetes education. Those with the highest diabetes knowledge were employed participants aged under 40 with a university-level education and moderate-income. They had had diabetes for more than ten years, followed dietary therapy, used insulin, and received diabetes education.

3.4 Health-promoting lifestyles of the participants

For health-promoting lifestyles, the highest mean score was for health responsibility (M=2.40, SD±0.67), followed by nutrition (M= 2.16, SD±0.51), and the lowest mean score was for physical activity (M=1.31, SD±0.46). Mean scores for the HPLP-II sub-scales were classified into three levels: high (scores over 3), moderate (between 2.5 and 3), and low (scores less than 2.5). According to these grading criteria, participants scored poorly on health responsibility, physical activity, and nutrition health-promoting lifestyles.

3.5 Factors associated with health-promoting lifestyles

As shown in Table 3, there were significant differences in the participants' nutritional lifestyle related to education level, diet therapy, and diabetes education. The analysis revealed that those participants with high school certificates, who followed diet therapy and received diabetes education, had high scores in the nutrition lifestyle. There were also significant differences in the physical activity lifestyle scores associated with employment status, diet therapy, and insulin therapy. Those participants who were employed, followed diet therapy, and used insulin had high scores in the physical activity lifestyle. In addition, significant differences were found in the participants' health responsibility lifestyle scores associated with the level of education, income level, duration of diabetes, diet therapy, and insulin therapy. The analysis revealed that participants with a university-level education and moderate income, who followed diet therapy, used insulin, and had had diabetes for more than ten years, had high scores in health responsibility lifestyle.

Table 3: Participant characteristics and mean scores for health-promoting lifestyles (n=248)

Variable	Sub-group	n	%	Nutrition mean	*p*-value[a]	Exercise mean	*p*-value	Health re[b] mean	*p*-value
Age (years)	<40	15	6	2.29	0.605	1.45	0.429	2.39	0.267
	40–60	126	50.8	2.14		1.32		2.34	
	>60	107	43.1	2.16		1.28		2.48	
Gender	Male	116	46.8	2.20	0.271	1.36	0.141	2.39	0.736
	Female	132	53.2	2.13		1.27		2.41	
Education level	No school	23	9.3	1.96	0.023[a]	1.17	0.119	1.76	0.000[a]
	Primary	69	27.8	2.06		1.27		2.26	
	High school	66	26.6	2.26		1.41		2.52	
	University	90	36.3	2.21		1.30		2.58	
Income	Low	140	56.5	2.15	0.904	1.34	0.326	2.29	0.002[a]
	Moderate	90	36.3	2.18		1.28		2.60	
	High	18	7.3	2.16		1.20		2.27	
Marital status	Married	205	82.7	2.16	0.896	1.30	0.422	2.39	0.677
	Unmarried	43	17.3	2.17		1.36		2.44	
Employment status	Employed	67	27	2.19	0.520	1.47	0.001[a]	2.43	0.674
	Unemployed	181	73	2.15		1.25		2.39	
Duration (years)	<5	70	28.2	2.16	0.290	1.37	0.421	2.25	0.004[a]
	5–10	94	37.9	2.10		1.29		2.34	
	>10	84	33.9	2.23		1.29		2.59	
Diet therapy	Yes	118	47.6	2.38	0.000[a]	1.40)	0.003[a]	2.62	0.000[a]
	No	130	52.4	1.96		1.23)		2.21	
Insulin therapy	Yes	131	52.8	2.20	0.247	1.25	0.027[a]	2.53	0.001[a]
	No	117	47.2	2.12		1.39		2.27	
Oral hypoglycemic agents	Yes	211	85.1	2.14	0.077	1.32	0.558	2.38	0.216
	No	37	14.9	2.30		1.27		2.53	
Diabetes education	Yes	155	62.5	2.21	0.043[a]	1.32	0.565	2.46	0.077
	No	93	37.5	2.07		1.29		2.30	

[a] Significant at <0.05 (2 tailed) using independent samples *t*-test or one-way analysis of variance (ANOVA) test.
[b] Health re: health responsibility

3.6 Predictors of glycemic control

To estimate significant predictors of glycemic control among participants' variables, three separate logistic regression analyses were conducted to estimate their independent effects on glycemic control. In the first and second logistic regression analyses, the clinical and sociodemographic variables were entered into the regression model. Table 4 shows that insulin therapy had a statistically significant independent effect on glycemic control (non-optimal) (OR=10.7, 95% CI: 3.8–29.7) and diet therapy had a statistically significant independent effect on glycemic control (optimal) (OR=0.3, 95% CI: 0.1–0.6). In the third regression model, the significant predictors of glycemic control from the first and second logistic regression analyses were included with health-promoting lifestyle (total) and diabetes knowledge (total) to estimate their independent effects on glycemic control. The final model shows that two out of the four variables tested simultaneously, health-promoting lifestyles (OR=0.3, 95% CI: 0.1–0.7), and insulin therapy (OR=9.0, 95% CI: 3.7–21.9), were statistically significant independent predictors of glycemic control. Specifically, participants who more frequently reported health-promoting lifestyles were more likely to have a lower value of HbA1c (optimal) and participants who were using insulin were more likely to have high HbA1c values (non-

optimal) (Table 5).

Table 4: Logistic regression between sociodemographic and clinical characteristics, and glycemic control (n=248)

Variable	OR	95% CI	*p*-value
Sociodemographic variables			
Gender	1.133	0.569–2.258	.772
Age	.7740	.377–1.5900	.486
Income	.8160	.329–2.0200	.660
Education	1.615	.782–3.3340	.195
Marital status	.5160	.189–1.4100	.197
Employment	.7740	.322–1.8580	.566
Clinical variables			
Duration of diabetes	0.996	.380–2.6070	.993
Diet therapy	.3270	.156–0.6870	.003
Insulin use	10.749	3.885–29.743	.000
Use of oral hypoglycemic agents	2.148	.648–7.1160	.211
Diabetes education	.9920	.467–2.1090	.984
Family history	.6140	0.295–1.276	.191
BMI	.7960	.288–2.2000	.660

Reference group: female; age >58; income >500; education >12; unmarried; employed; duration of diabetes >10 years; no oral hypoglycemic agents; no insulin therapy; no diabetes education; BMI >25 kg/m2; not following diet therapy; yes family history. Outcome measure: glycemic control <7

Table 5: Multivariate logistic regression of four variables and glycemic control (n=248)

Variable	OR	95% CI	*p*-value
Health-promoting lifestyles (total)	0.318	0.139–0.728	.007
Diabetes knowledge (total)	1.052	0.486–2.278	.898
Diet therapy	0.499	0.226–1.098	.084
Insulin therapy	9.087	3.755–21.990	.000

Reference group: health-promoting lifestyles (total) ≤1.98; diabetes knowledge (total) ≤14; no insulin use; not following diet therapy. Outcome measure: glycemic control <7

4. DISCUSSION

The primary aim of this study was to examine the relationship between diabetes knowledge, health-promoting lifestyle, and glycemic control in patients with type 2 diabetes. We found that participants demonstrated a deficit in several aspects of diabetes knowledge and health-promoting lifestyles. Diabetes knowledge is essential in developing healthy lifestyles that will enhance the skills of self-care of patients [23]. Moreover, the role of diabetes knowledge is to improve the clinical outcomes of diabetes management and prevent acute and chronic complications of diabetes [24]. The current study reports inadequate diabetes knowledge among the participants, which may result in poor adherence to treatment plan and ultimately may lead to non-optimal glycemic control, as shown in the results. This finding is congruent with those of other studies conducted in diabetes patients [25–26]. In contrast, other studies have also reported satisfactory diabetes knowledge [27–28]. Moreover, the findings show that knowledge deficits were related to all aspects of diabetes knowledge (knowledge regarding medications, physical activity, diet, foot care, complications, and BG monitoring). In the present study, a significant difference in diabetes knowledge was associated with age, educational level, income level, employment status, diet therapy, duration of diabetes, marital status, and insulin therapy. Previous literature evaluating the relationship between age and knowledge of diabetes reported different findings. In our study, patients aged

under 40 had significantly higher diabetes knowledge than older patients. This finding is similar to results reported by several studies that found a higher level of diabetes knowledge in younger people [29–30]. Nevertheless, other studies reported a positive relationship between age and diabetes knowledge [31–32], and several studies revealed no association between age and diabetes knowledge [5, 33]. In the present study, a difference in knowledge score was associated with educational level. Patients with a higher educational level had better diabetes knowledge. The association between diabetes knowledge and education level was also reported in previous studies [25, 30–31]. Furthermore, a relationship between knowledge and duration of diabetes since diagnosis in this study was found. This finding is consistent with other studies that have found higher diabetes knowledge with an increasing number of years of the disease [34]. However, this was inconsistent with the findings of [25] and [29]. It is noteworthy that, in the present study, a significant difference in diabetes knowledge was found to be related to diabetes education. Participants who reported receiving diabetes education had higher scores in diabetes knowledge. This finding is consistent with other studies' findings [35–37] and suggests the importance of integrating diabetes education as an essential component of routine care in diabetes clinics. Our results also showed that the participants did not score well in the lifestyles of health responsibility, nutrition and physical activity. These results suggest that the adoption of health-promoting lifestyles by participants is sub-optimal and that they are not consistently engaged in them. This finding aligns with results published in previous studies [31–32, 38–40] and supports the widespread argument of unsatisfactory levels of healthy lifestyles and self-care practices for diabetes, as well as indicating the high risk of developing chronic complications of diabetes. Physical activity lifestyle, which evaluated the participants' ability to follow a regular physical activity pattern, was graded as the last health-promoting lifestyle in this study. This finding is consistent with previous studies that reported unsatisfactory levels of physical activity among people with diabetes [11, 40–42].

Of concern is the finding in this study that participants reported non-compliance with the physical activity recommendations. For example, in this study, only 3% of participants reported that they exercised at least three times a week for 30 minutes and the majority (82%) reported that they were not following a planned exercise program. Low physical activity can be attributed to the Jordanians' perception of physical activity, whereby they do not consider physical activity as part of their daily routine. Moreover, the lack of exercise and sports facilities might contribute to the problem of physical inactivity [43]. Also, physical activity is an area that could be affected by culture. Cultural constraints further limit the use of outside facilities for certain types of physical activities. This finding should alert healthcare providers to the need to incorporate physical activity as part of the education in diabetes clinics to enhance patients' adherence to recommended plans. Therefore, efforts to promote patients' physical activity must consider increasing places for exercise, such as sidewalks and fitness centers. It seems that it might be beneficial to advise the patient about a home exercise program to overcome many exercise barriers [44]. Concerning nutritional lifestyle, the results of this study indicate that the participants did not demonstrate compliance with the recommended nutritional plan. For example, in this study, only 8% of participants reported that they limited the use of sugar and food containing sugar (sweets) each day and only 5% of the participants chose a daily diet low in fat and cholesterol. Therefore, nutritional results are alarming and significant interventions are required to improve the nutritional lifestyle of adults with type 2 diabetes. These findings support the results of previous studies [11, 38, 40]. The study findings revealed that health-responsibility lifestyle was the highest among the health-promoting lifestyles but still low according to the grading criteria. The health responsibility lifestyle is concerned with being educated about health, paying attention to, and accepting responsibility for, one's health, and seeking professional assistance when needed [45].

Previous studies reported similar findings in the general population [46–47]. The present study's findings indicated that the majority of the participants had less than optimal glycemic control and did not follow the recommendation of the American Diabetes Association, in which a level of less than 7% was considered the target for diabetes therapy [4]. This result is higher than the results reported by many previous studies [28, 38]. The low levels of health-promoting lifestyles and inadequate diabetes knowledge demonstrated by this sample may have contributed to their higher levels of HbA1c. The study findings indicated that the most statistically significant predictors of glycemic control were health-promoting lifestyles and insulin use. Furthermore, the analysis suggested that subjects with greater health-promoting lifestyles had lower HbA1c levels, whereas being on insulin was associated with higher HbA1c levels. These findings are consistent with some previous literature, in which adequate diabetes self-care practices [35, 38] and health-promoting behavior [48] were associated with optimal glycemic control. However, in our study, insulin use was a significant predictor of non-optimal glycemic control; a possible explanation for this might be that insulin is added to the treatment therapy in patients with type 2 diabetes as a result of worsening glycemic control. A previous study reported similar findings [38] and this may imply that prescribed insulin regimen or insulin injection technique, or both, were insufficient to achieve optimal glycemic control. Moreover, the finding that insulin users have non-optimal glycemic control may be an indication that the participants did not have sufficient knowledge or skills to manage their insulin optimally, suggesting a need for further counseling and education.

While this study provides important information about diabetes knowledge and health-promoting lifestyles and their correlation with glycemic control in patients with type 2 diabetes, the following limitations should be taken into account when interpreting the study findings. The cross-sectional design prohibited the ability to conclude causal relationships between the statistically significant factors and self-reported health-promoting lifestyles and diabetes knowledge. The use of a convenience sampling technique is likely subject to selection bias. Moreover, using self-report questionnaires for measuring health-promoting lifestyles and diabetes knowledge is another limitation, as participants may report more favorable behaviors than they actually practice. Nevertheless, it is recommended to repeat this study with a wider and more representative sample using a random sampling method from various health sectors. Although a great deal of research has been carried out in this field, diabetes self-management and diabetes education continue to be an area of interest to clinical researchers and healthcare providers.

Several implications for practice emerge from this study. Persons with diabetes need to be encouraged to engage in healthy lifestyles. In the primary healthcare centers and diabetes clinics where the majority of people with diabetes receive their treatments, educational programs should incorporate principles of healthy lifestyles. Similarly, an environment more supportive and conducive to healthy lifestyles should be provided to people with diabetes by making resources and opportunities available for increasing physical activity and enforcing healthy diet guidelines in the community. Customized exercise educational programs are strongly recommended for overweight, older patients and those who have many comorbidities, who may consider exercise as a burden and need extra encouragement. The findings of this study demonstrate the need for primary preventive education services for healthy people at risk of diabetes and secondary prevention programs for patients with diabetes and their families. The programs should emphasize the need for the prevention and reduction of obesity through the promotion of a healthy diet and increasing physical activity. In people living with type 2 diabetes, education and awareness alone do not always translate into improved self-care practices. Therefore, it is necessary to understand the factors that lead to suboptimal healthy lifestyles fully if improved diabetes outcomes are to be achieved, particularly at the level of primary care. Therefore, innovative education and care approaches are needed to support individuals with diabetes to establish the

needed changes in their lifestyles. However, these actions require health policymakers and health organizations to incorporate healthy lifestyles in their future health plans, and interventional studies need to be supported to provide healthcare providers with evidence-based interventions about healthy lifestyles. Our findings point to the need for more research in health promotion lifestyles and qualitative research is required to examine the perception of, and barriers to, healthy lifestyles. In conclusion, our study results demonstrate that the sampled adults with type 2 diabetes had suboptimal levels of health-promoting lifestyles and a knowledge deficit in many aspects of diabetes. This study demonstrates that higher levels of health-promoting lifestyles are associated with lower HbA1c. Community-based diabetes educational programs regarding health-promoting lifestyles and diabetes management should be promoted and enhanced by health professionals. Health-policy administrators should provide appropriate facilities and resources to assist people with diabetes to develop healthy lifestyles.

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أنماط الحياة المعززة للصحة والتوعية بمرض السكري لدى البالغين المصابين بداء السكري من النوع الثاني في الأردن

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الملخص

الأهداف: تهدف هذه الدراسة إلى تقييم العلاقة بين أنماط الحياة المعززة للصحة ومعرفة مرض السكري مع التحكم في نسبة السكر التراكمي في الدم لدى البالغين المصابين بداء السكري من النوع الثاني

المنهجيه: تم استخدام دراسه مقطعيه والعينه الملائمة. تم استخدام استبيان مقابلة يتكون من المقاييس التالية: الخصائص الديموغرافية والسريرية ، استبيان أنماط الحياه لتعزيز الصحة ، استبيان معرفة مرض السكري ، والفحوصات المخبرية . تم استخدام الإحصاء الوصفي والاستنتاجي لتحليل البيانات.

النتائج: شملت الدراسة 248 مشاركًا من أربع مستشفيات عامة. أشارت النتائج إلى وجود نقص في العديد من جوانب المعرفة بمرض السكري وتبني دون المستوى الأمثل لأنماط الحياة المعززة للصحة. أظهرت النتائج أن 81.5٪ من العينة كان لديهم تحكم غير مثالي في نسبة السكرالتراكمي في الدم .(HbA1c) تنبأت أنماط الحياة المعززة للصحة بالتحكم الأمثل في نسبة السكرالتراكمي في الدم ، بينما كان استخدام الأنسولين مؤشراً ذا دلالة إحصائية للتحكم غير الأمثل في نسبة السكرالتراكمي في الدم.

الخلاصة: غالبية المشاركين لم يكونوا مسيطرين على مرض السكري. كانت معرفتهم بمرض السكري وأنماط الحياه المعززة للصحة دون المستوى الأمثل. يعد التثقيف المعزز للصحه والاستراتيجيات لتعزيز أنماط الحياة المعززة للصحة ومعالجة مرض السكري أمرًا ضروريًا للمرضى ليصبحوا واثقين و قادرين على معالجة مرض السكري لديهم.

الكلمات الدالة: السكري من النوع الثاني ،أنماط الحياة المعززه للصحة ، الوعي، المعرفه بمرض السكري، السكر التراكمي في الدم.