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ORIGINAL STUDY

Assessing the Impact of Dietary Supplements on Diabetic Quality of Life: Insights From the EQ-5D Model

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Abstract

The use of dietary supplements (DS) has been observed to be increasing among patients with diabetes. However, the effect of DS on health-related quality of life (HRQoL) is still an understudied area. This study aims to evaluate the prevalence of DS use among diabetic patients, their attitudes toward these supplements, and their effect on HRQoL. A cross-sectional study was conducted among diabetic patients attending an outpatient facility in Baghdad, Iraq. A validated survey instrument was used to collect data on DS use, attitudes, and HRQoL using EQ-5D measures. The study found that 73.8% of patients used DS, including omega-3 fatty acids, vitamin D, and probiotics. Users reported a positive attitude towards DS ($P = 0.002$). HRQoL measures showed issues in walking, personal care, daily activities, pain, and moderate depression. Thirty-six health statuses were reported, and the highest rated was health status 12,222. A significant difference was noted between users and non-users of DS on the EQ-5D measure, where a positive effect of DS use was seen on diabetic patient health status ($P < 0.001$). It is necessary to implement complex interventions to improve patients' health based on broad approaches to treatment.

Keywords: Diabetes management, Dietary supplements, Health-related quality of life, EQ-5D measure, Patient attitudes

Diabetes is a chronic metabolic disease that affects many people around the world. It is a metabolic disease characterized by persistent blood glucose elevation, causing significant problems affecting patients' physical, mental, and social well-being [1]. The management of it has progressed beyond the standard treatment and now involves pharmacological and integrative approaches. For instance, dietary supplements have become, in recent years, a popular strategy among diabetic patients to control their disease. Meanwhile, diabetic management requires constant monitoring of blood glucose, disease consequences, and its influence on daily activities. Previous studies found that diabetic patients often use supplements to improve their health and reduce the burden of diabetes [2,3]. These supplements encompass a variety of vitamins and minerals, herbs, and bioactive substances. The reason for using supplements is often generated

from the belief that supplements can enhance the body's metabolism, compensate for nutritional deficits, and support overall health [4,5]. Patients' beliefs about their illness play a crucial role in managing diabetes. Therefore, addressing this may reveal the answer to the question of why patients seek modalities other than their standard prescribed treatment.

It is agreed that individual health status is a combination of physical, mental, and social well-being that forms the concept of Health-Related Quality of life (HRQoL). This is defined as [A person's perceived quality of life representing satisfaction in those areas affected by health status] [6]. In line with this, the EuroQoL Group has developed a standardized measure for assessing HRQoL. Their well-established tool evaluates an individual's health in five dimensions: mobility, self-care, daily activities, pain, depression, and anxiety [7]. In

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addition, the tool evaluates health status in quantitative and qualitative ways. Also, it reflects further information about the disease status and outcomes of treatment and intervention, which would be helpful for future strategies. In this regard, evaluating the effect of DS use on HRQoL and diabetic patients' health status is essential. Several studies have been undertaken to analyze the advantages and disadvantages of DS in diabetes management, but little is known regarding their impact on patients' quality of life. Some observational studies have linked the effect of DS on the HRQoL scale among diabetic patients. For instance, it was found that the use of vitamin D supplements by diabetic patients improved the patient's mobility [8]. The use of omega-3 fatty acids supplementation by diabetic patients improved diabetic neuropathy [9]. In addition, vitamin E has been reported to be effective in relieving the pain associated with diabetic neuropathy [10]. Most of these studies have concentrated on clinical benefits without much being known about patient's HRQoL. Many diabetic patients pursue DS as a way of enhancing their lives. In this regard, this study was done to assess the use of DS among diabetic patients, evaluate their attitudes toward its use, and determine how DS can affect their HRQoL.

1. Materials and methods

1.1. Study design

A cross-sectional study was conducted among diabetic patients attending the Al-Karama Teaching Hospital's outpatient clinic in Baghdad, Iraq. The study's duration is extended from September to December 2023. This public hospital is affiliated with the Iraqi Ministry of Health. A convenience sampling method was used to select diabetic patients. A validated questionnaire was employed to collect data. Approval of the study was obtained from the College of Pharmacy, Uruk University (number 120).

1.2. Inclusion criteria

The study included patients who had had diabetes for over a year at the time of data collection, adults who were eighteen or older, both sexes, and those who were capable of reading and writing but not extensively ill. Before enrolling the patients, they were briefed on the study objectives and the protocols that would be used. Moreover, they were promised that answers would remain confidential and only be used for academic purposes.

The sample size was calculated using the prevalence-based sampling technique [11]. The prevalence of diabetes is 36%, and the required sample size is 419 patients. The confidence level is 95%, the precision is 5%, and the drop rate is 20%.

1.3. Study tool

A developed and validated questionnaire consisting of three sections was used for data collection. Section one contains the demographic characteristics of respondents like gender, age, educational level, monthly income, duration of diabetes, and presence of comorbidity. On the other hand, section two involved DS and patients' attitudes towards their use. Patients' attitudes towards DS were assessed by six questions: effectiveness, protection, safety, naturalist, personal responsibility, and philosophy of health [12,13]. These questions were answered either "Yes," "No," or "Do not Know". To assess the level of attitude on each question, scores ranging from 2 (for yes) to zero (for do not know) were used. The sum of all this gives the total score for the six items showing levels of attitude towards using DS. A higher total score indicated more positive attitudes [14]. Part three consists of HRQoL questions with the European Quality of Life scale [15]. This scale uses several dimensions to describe health status and yields a single value index. It comprises two components; the first (descriptive measure) has five dimensions: mobility, self-care, daily activity, pain/discomfort, and anxiety/depression. Responses to these dimensions were classified as "no problem," "some problems," or "confined to bed." These responses were given scores from 1 to 3, respectively. Theoretically, there could have been 243 generated health statuses according to the EuroQoL system from these five different descriptive measures of the scale. Each generated health status was assigned a value using the tariff for estimated health status. The tariff is provided and published by the United Kingdom general population survey for EuroQoL [16]. The second part of EQ-5D is the visual analog scale (VAS). In this part, patients indicated their health status on the VAS scale ranging between zero (the worst possible health state) and one hundred (the best imaginable).

The panel of clinical and social pharmacy experts was consulted to determine the face and content validity of sequences and the appropriateness and reasonableness of items. Cronbach's alpha test has been employed to measure reliability. Attitudes toward the DS domain had good internal consistency (0.69). In addition, good internal consistency values

were obtained for the EQ-5D descriptive measure (0.74) and EQ-5D VAS (0.70). Moreover, a pilot study was conducted to evaluate the tool among 30 diabetic patients, and data obtained from them was not included in the significant research. The respondents approved the questions as clear enough to understand without any problem or confusion.

1.4. Statistical analysis

Data was analyzed using a statistical package for social sciences (SPSS) version 22. Descriptive variables were expressed as frequencies and percentages for categorical data, while continuous data were presented using mean (\pm SD), median (IQR), and range. Respondents were categorized into DS users or non-users depending on their responses for further analysis. The Mann-Whitney U test was used to determine whether there is a significant difference between patients' attitudes towards using DS or not, while the level of significance was accepted at $P < 0.05$.

2. Results

Demographic characteristics of respondents: The total number of valid responses was 390, recording a response rate of 93.1%. Males constituted slightly more than half (56.4%) of respondents; those above 65 years old remained the dominant age group (53.6%), whereas the intermediate level of education was the highest (42.3%) among other levels. Respondents with income levels between \$500 - \$1000 US dollars were the highest (40.8%) among different income levels. More than half (55.9%) of respondents have been diagnosed with diabetes for five years or more. Most of them had comorbid diseases such as hypertension (35.3%, $n = 145$), lipid disorders (32.0%, $n = 128$), chronic kidney infections (31.3%, $n = 125$), osteoporosis (6.3%, $n = 25$), Parkinson's disease (6.0%, $n = 24$), heart failure (5%, $n = 20$), and peripheral vascular diseases (5%, $n = 20$). The demographic data is shown in [Table 1](#).

The use of dietary supplements by diabetic patients: More than two-thirds of respondents, equal to 73.8%, used nutritional supplements when they completed the questionnaires. Among these, omega-three fatty acids accounted for the highest number of them (62.1%, $n = 242$), followed by Vitamin D (31.0%, $n = 121$); probiotics (31.5%, $n = 123$); cinnamon (27.4%, $n = 107$); green tea (23.8%, $n = 93$), magnesium (17.9%, $n = 70$); and chromium (8.2%, $n = 32$). Moreover, most DS users (69.4%, $n = 200$) used these supplements without physician consultation.

Table 1. Demographic characteristics of patients.

Characteristics	n (%)	{N = 390}
Gender	Female	170 (43.6)
	Male	220 (56.4)
Age groups in years	≤ 65	181 (46.4)
	> 65	209 (53.6)
Educational levels	Elementary	133 (34.1)
	Intermediate	165 (42.3)
	High	92 (23.6)
Income in US \$ ^a	< 500	125 (32.1)
	500–1000	159 (40.8)
	> 1000	106 (27.2)
Duration of diabetes in years	< 5	172 (44.1)
	≥ 5	218 (55.9)
Comorbidity	Yes	280 (71.8)
	No	110 (28.2)

^a Each 1 US Dollar = 1320 Iraqi Dinar.

Attitudes towards using dietary supplements: Analysis of attitudes towards DS showed an overall picture of what respondents think about nutritional supplements in managing diabetes. It was noted that a belief in the effectiveness of DS was among more than half of users (59%). A belief in the ability of DS to protect from the complications of diabetes was noted among all users of DS. A belief in the safety of these supplements was pointed out by most of the users (93.7%). More than two-thirds (69.4%) of users feel these supplements do not interact with the prescribed treatment. However, fewer precise cuts among users were noted (39.2%) when asked whether the DS allowed them to participate actively in care decisions. Lastly, around half of users (49.3%) have a holistic view of DS in keeping good health. Contrary results were noted among the non-users of DS, where most revealed exceptionally low percentages on attitude items. The mean total score for DS users was higher than that of non-users, indicating a positive attitude towards supplement use (6.0 ± 1.3) compared to non-users (4.1 ± 0.72), as well as the median. A Mann-Whitney U test detected a statistically significant difference where the P value was 0.002, thus showing that users have more positive attitudes about DS than non-users. The response towards attitudes items is seen in [Table 2](#).

Health-related quality of life between users and non-users of DS: Evaluation of the EQ-5D descriptive scale revealed how respondents answered questions regarding living with diabetes. More than half of them had difficulty with walking (58.6%). Around three-quarters (72.4%) had problems doing personal tasks such as washing themselves or dressing up. Further, more than two-thirds (64.8%) had some problem performing usual daily activities. Many of them (74.1%) had severe pain from time to

Table 2. Diabetic patient attitudes towards the use of dietary supplements.

Items	Users (73.8%, n = 288) % (n)			Non-users (26.1%, n = 102) % (n)		
	Yes	No	Don't know	Yes	No	Don't know
1. They are effective in the management of diabetes	59.0 (170)	28.8 (83)	12.1 (35)	14.7 (15)	85.2 (87)	–
2. They protect the patients from diabetic complications.	100 (288)	–	–	11.7 (12)	88.2 (90)	–
3. They are safe	93.7 (270)	3.8 (11)	2.4 (7)	14.7 (15)	85.2 (87)	–
4. They do not interact with my prescribed treatment	69.4 (200)	11.1 (32)	19.4 (56)	12.7 (13)	87.2 (89)	–
5. They enable me to take a more active part in keeping good health	39.2 (113)	37.8 (109)	22.9 (66)	1.96 (2)	98.0 (100)	14.7 (15)
6. Health is about harmonizing the body with the mind and spirit	49.3 (142)	13.8 (40)	36.8 (106)	8.8 (9)	58.8 (60)	32.3 (33)
Total score	Mean (\pm Sd)	6.0 (\pm 1.3)		4.1 (\pm 0.72)		
	Median (IQR)	5.1* (0–8)		3.9 (0–8)		

*P = 0.002 (by Mann-Whitney U test).

time, and most of them (54.1%) suffered from depression. Responses on the EQ-5D descriptive scale are shown in Table 3.

The analysis of estimated health status showed thirty-six different statuses; the frequencies are presented in Table 4. Notably, the highest estimate status (24%) was represented as 12,222, which signified “no problem” with walking but “some problem” concerning personal care, daily activity, pain, and depression. On the other hand, analysis of the visual analog scale (VAS) showed that respondents scores ranged between 20 and 85 with a mean of (42.30 ± 12.8) .

Further analysis was performed to find the differences in the EQ-5D model between users and non-users of DS. It was noted that the mean of EQ-5D descriptive results for users of DS was higher (Mean = 0.572 ± 0.243) than non-users (Mean = -0.0402 ± 0.173). Moreover, the mean EQ-VAS total scores for users of DS were also higher (Mean = 48.82 ± 7.8) than those who did not use supplements at all (Mean = 39.43 ± 8.4). A

Table 4. Frequencies of estimated patient health status on the EQ-5D scale.

Estimated health status	n (%)	Estimated health status	n (%)
11,112	6 (2.10)	22,223	8 (2.76)
11,121	2 (0.69)	22,232	17 (5.90)
11,123	2 (0.69)	22,333	1 (0.35)
11,222	21 (7.24)	22,233	11 (3.97)
12,222	72 (24.82)	22,322	7 (2.41)
11,233	27 (9.3)	22,323	4 (1.38)
12,133	8 (2.76)	22,332	2 (0.69)
12,223	2 (0.69)	22,333	3 (1.04)
12,232	10 (3.45)	23,133	5 (1.72)
12,233	1 (0.35)	23,223	2 (0.69)
12,333	4 (1.38)	23,232	2 (0.69)
13,332	3 (1.04)	23,233	3 (1.04)
13,333	1 (0.36)	23,323	2 (0.69)
21,123	9 (3.10)	23,332	2 (0.69)
21,133	7 (2.41)	23,333	1 (0.35)
21,222	10 (3.45)	32,332	1 (0.35)
21,223	10 (3.45)	32,333	1 (0.35)
21,233	22 (7.60)		
11,223	1 (0.35)		

Table 3. Frequencies of health-reported status on EQ-5D dimensions among diabetic patients.

Dimensions	Responses % (n)			{N = 290}
Walking	No problem	Some problem	Confined in bed	
	37.2 (108)	58.6 (170)	4.13 (12)	
Personal care	No problem	Some problem	Confined in bed	
	24.1 (70)	72.4 (210)	3.4 (10)	
Daily activity	No problem	Some problem	Confined in bed	
	17.2 (50)	64.8 (188)	17.9 (52)	
Pain	No pain	Some pain	Extreme pain	
	6.5 (19)	74.1 (215)	19.3 (56)	
Depression	Not depressed	Moderately depressed	Extreme depression	
	16.8 (49)	54.1 (157)	28.9 (84)	

Table 5. Differences in health-reported status between DS users vs. non-users on the EQ-5D Model.

HRQoL	Use of DS				P value
	Users		Non-users		
	Mean (\pm SD)	Median	Mean (\pm SD)	Median	
EQ-5D descriptive	0.572 (\pm 0.243)	0.223	-0.0402 (\pm 0.173)	0.112	0.000 *
EQ-VAS	48.82 (\pm 7.8)	60.0	39.43 (\pm 8.4)	51.0	0.000*

*Mann-Whitney U test, $P < 0.001$.

significant difference in response to EQ-5D measures was shown at $P < 0.001$ through the Mann-Whitney U test, as shown in Table 5.

3. Discussion

The study revealed the status of DS use and tendencies among Iraqi diabetic patients and their impact on HRQoL. It is important to note that many surveyed respondents used DS to manage their disease. In addition, the most frequently ingested supplements were Omega-three fatty acids, vitamin D, and probiotics. These findings reinforce earlier conclusions that Omega-3 fatty acids, vitamin D, and probiotic supplements have gained popularity due to perceived benefits in managing diabetes [17,18]. Other studies also indicated the importance of vitamin D, unsaturated fat, and vitamins in improving general health and reducing cardiovascular risk in diabetes management [19,20]. This highlights the importance of patient-focused programs for the proper use of DS. Worryingly, all users of DS in this study admitted this use without a doctor's prescription. This behavior points out flaws in communication between practitioners and patients. Hence, the urge to understand the needs regarding DS of diabetic patients should be enhanced through education programs. Further, healthcare providers must communicate with patients effectively concerning DS to facilitate safe decision-making.

Findings also showed that patients' attitudes towards DS differ greatly depending on whether they use them or not. It was noted that patients using DS generally had a positive attitude, mainly regarding how effective the products are, safety, protection, and being free of side effects. Risks of diabetic drug and DS interactions and adverse effects need to be addressed to improve healthy behavior. This complex attitude toward healthcare requires individualized means of teaching and support.

Concerning HRQoL, the analysis of estimated health status identified a diverse range of patients' health (thirty-six health status). This diversity showed the complexity of practices and perceptions of health within the study population. Notably, the

highest estimated health status was characterized by "no problem with walking," "some problem with personal care," "some problem in daily activity," "had some pain," and "moderately depressed." A previous study highlighted how complex health issues are and how they differ even within the same population [21]. The VAS scale ranged between 20 and 85 and identified many different perceptions among respondents about how healthy they are, and most of them were not healthy enough. VAS results provided valuable information to EQ-5D results, which only offer categorical evaluation. It reflected how respondents perceived their health status on a scale ranging from good to foul [22].

DS users and non-users showed significant differences in various health dimensions. Higher mean scores were seen among DS users than non-users on the EQ-VAS measure. This difference suggests that using DS could be linked with better health outcomes among diabetes patients. Nonetheless, more investigations should be done to determine if DS is causally related to improvements in health for patients with diabetes. Although both groups reported similar levels of self-care skills and depression symptoms, those using DS faced specific obstacles concerning their physical performance, such as walking difficulties, pain, and mood changes. These are multifaceted issues that underline a range of needs for broad-based care targeting diverse populations who are diabetic.

Moreover, A significant difference was seen in HRQoL between users of DS and non-users, where users demonstrated higher mean scores than their counterparts. This difference suggests a positive effect of DS use and perceived health status among diabetic patients. The positive impact of supplements products like vitamin D on HRQoL was identified previously [23,24]. This impact highlights the importance of patient education by healthcare providers regarding DS through evidence-based information and the importance of consulting medical professionals before taking supplements. In addition, policymakers must develop guidelines to ensure that DS products are safe and high-quality, encouraging patients to make proper decisions in managing their disease.

4. Limitations of the study

There are several limitations to this study. First, the cross-sectional design uses data from one point in time, hence limiting the possibilities of making conclusions on causality between supplement use and HRQoL as a health outcome. Also, the population under study consists of diabetic patients attending an outpatient clinic and may lack representation among patients from other areas or healthcare systems, making the results ungeneralizable. Furthermore, using self-reports for supplement usage and patient beliefs about supplements makes the results prone to reporting bias.

5. Conclusion

The study has provided valuable insights into the use and perceptions of DS and their effects on HRQoL. The use of DS is evident among diabetic patients in Iraq. Positive attitudes were identified among users of DS. In addition, a positive effect on HRQoL (on both descriptive and VAS scales) was seen among diabetic patients using DS. By addressing patients' needs and preferences specific to people with diabetes, healthcare providers and policymakers can help patients manage their conditions effectively and improve their quality of life. In addition, interventions aimed at enhancing HRQoL among diabetic patients should adopt an integrated approach that addresses health's physical, psychological, and social dimensions.

Ethics information

Before enrolling the patients, they were briefed on the study objectives and the protocols that would be used. Moreover, they were promised that answers would remain confidential and only be used for academic purposes. Approval of the study was obtained from the College of Pharmacy, Uruk University (number 120).

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Conflict of interest

None to declare.

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