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Effectiveness of and Adherence to Dietary and Lifestyle Counselling

Effect on metabolic control in type 2 diabetic Omani patients

*Mohammed Al-Sinani,[1] Yoeju Min,[2] Kebreab Ghebremeskel,[2] Hussain S Qazaq[3]

فعالية الإرشاد للتغذية ونمط الحياة والتمسك به

تأثيره على السيطرة الأيضية عند المرضى العُمانيين

المصابين بداء السكر من النوع الثاني

محمد السناني، يوجو مين، كيبرب غيبريميسكل، حسين قزق

الملخص: الهدف: تم تطبيق نظام الإرشاد الغذائي الذي وضعته وزارة الصحة للسيطرة على مرض السكري في الرعاية الصحية الأولية في جميع أنحاء سلطنة عمان منذ عام 2003. هذه الدراسة تهدف إلى تقييم فعالية الإرشاد لتبني النظام الغذائي ونمط الحياة وتحديد مفاهيم ومواقف مرضى السكري من النوع الثاني في عمان حول علاج داء السكر. **الطريقة:** هذه دراسة مسحية مقطعية وبائية أجريت على 98 مريضا مصابا بداء السكري من النوع الثاني في محافظة البريمي بسلطنة عمان. تم تقييم المتغيرات الأيضية، مقدار كمية الأغذية المأخوذة ومستويات النشاط البدني في عام 2005، وتم إعادة تقييم نفس المتغيرات في عام 2008. **النتائج:** ما مجموعه 43٪ من المرضى (الذكور = 16 ، والإناث = 27) لم يتلقوا أي تثقيف رسمي. تم تحقيق خفض كبير في مستوى سكر الدم على الريق وتحسين مستوى كولسترول البروتين الشحمي عالي الكثافة في كل المرضى ذكورا وإناثا. ومع ذلك لم تلاحظ في الرجال أي تغييرات في القياسات الجسمية أو في المتغيرات الأيضية او مستوى تناول عناصر الأغذية الأساسية. على العكس من ذلك، فقد انخفض بشكل كبير استهلاك الإناث للمغذيات الأساسية والذي أدى إلى تحسن ملحوظ في وزن الجسم ومنسب كتلة الجسم ومستوى الجلوكوز بالدم ومستويات الكولسترول الكلي. اعترف أحدَ عشرَ مريضا (11.6%) بأنّهم لَم يُلتزموا بالنظام الغذائي المعد لهم من قبل أخصائي التغذية، بينما اتبع 63.2% من المرضى (62 مريضا) نظامهم الغذائي في بعض الأحيان وأخيرا التزم 25.2%َ من المرضىَ (25 مريضا) بالنظام الغذائي بطريقة حازمة. **الخلاصة:** إرشاد المرضى الأميين المصابين بداء السكر بشأن تأثير الغذاء والتغذية وممارسة التمارين الرياضية على داء السكري نقل المرضى من معدل "ضعيف" إلى "جيد" من حيث السيطرة على المؤشرات الأيضية مثل مستوى الهيموغلوبين السكري ومستوى السكر على الريق والكولسترول الكلي. هذا التحول البسيط من الممكن تعزيزه بزيادة التثقيف الصحي.

مفتاح الكلمات: داء السكري، النوع الثاني، الالتزام، التغذية العلاجية، عُمان.

ABSTRACT: ***Objectives:*** The Nutritional Advice Protocol, established by the Department of Health to combat diabetes, has been implemented in primary health care throughout Oman since 2003. This study aimed to assess the effectiveness of dietary and lifestyle advice and determine the perception and attitudes of Omani adults with type 2 diabetes to diabetes management. ***Methods:*** A cross-sectional epidemiological survey was conducted on 98 patients diagnosed with type 2 diabetes in Al-Buraimi Governorate, Oman. Metabolic parameters, dietary intake and exercise levels were evaluated in 2005 and re-evaluated in 2008. ***Results:*** A total of 43% of the patients (male = 16, female = 27) had received no formal education. A significant reduction in fasting glucose and enhanced high density lipoprotein cholesterol were achieved in both male and female patients. However, in men, no changes were noted, other than in anthropometric and metabolic measurements and macronutrient intake. Conversely, women's macronutrient intakes reduced significantly leading to considerable improvement in body weight, body mass index, blood glucose and total cholesterol levels. Eleven patients (11.6%) admitted that they did not adhere at all to the diet advised by the dietician; 63.2% (n = 62) reported they followed their diet sometimes, and 25.2% (n = 25) stated they strictly followed the diet. ***Conclusion:*** Counselling largely illiterate diabetic patients about the impact of food, nutrition and exercise on diabetes shifted the patients from "Poor" to "Good" control in terms of metabolic outcome (glycosylated haemoglobin, fasting glucose and total cholesterol). This minor improvement could be further enhanced by more health education.

Keywords: Diabetes Mellitus, Type 2; Compliance; Diet therapy; Oman.

[1]Department of Nutrition, Al-Buraimi Hospital, Al-Buraimi Governorate, Oman; [2]Institute of Brain Chemistry & Human Nutrition, London Metropolitan University, UK; [3]Nutrition Department, Eastern Medical Region, SEHA (Health Services Company), Abu Dhabi, United Arab Emirates

**Corresponding Author email: mjsa@live.co.uk*

Advances in Knowledge

1. *This is the first study in Oman to assess the effectiveness of dietary and lifestyle advice and determine the attitudes of Omani patients with type 2 diabetes.*
2. *Patients' knowledge of nutrition was poor, as more than 65% of the participants in this study were illiterate.*
3. *Fasting blood glucose levels and high density lipoprotein cholesterol showed a marked reduction in all subjects in the study.*
4. *Compliance with dietary advice was better in female patients.*
5. *Low levels of education have been associated with poorer compliance to diet and exercise advice.*
6. *Improving dietary awareness in type 2 diabetes patients is the key to successful diabetes management.*

Application to Patient Care

1. *Nutritional advice for patients with type 2 diabetes needs to be reworded to take into account the patients' needs.*
2. *Exercise is an important component of diabetes care management.*
3. *Dietary compliance for type 2 diabetes should be improved by focusing on increasing the number of follow-up visits to the nutrition clinic.*

Type 2 diabetes has become one of the leading causes of disability and death in most developed countries as well as in developing countries undergoing rapid economic transition.[1,2] Oman is not an exception to this trend. It has progressed rapidly from an agrarian subsistence economy, emphasising animal husbandry and date production, to a diverse economy producing oil and oil-based products and with growing commerce and tourism sectors. This rapid change has had a huge impact on the lifestyle of the Omani population in the last three decades. The first national diabetes survey, conducted by the Ministry of Health in collaboration with the WHO in 1991, estimated that 10% of the Omani population aged 20 years or above had diabetes.[3] The latest study by Al-Moosa *et al.* in 2006 found that the prevalence of diabetes in the capital region of Muscat was 17.7%.[4]

Type 2 diabetes presents as a complex spectrum of hypertension, hyperglycemia, insulin resistance, and dyslipidemia.[5,6] It is well known that obesity plays a central role in the development of insulin resistance and type 2 diabetes.[7,8] Diet and exercise modification are considered important components of the treatment strategy for adults with type 2 diabetes.[6] Suitable use of diet and exercise can improve glycemic control and insulin sensitivity and reduce the need for insulin or oral medications.[5] The Finnish Diabetes Prevention Study demonstrated that the risk of type 2 diabetes can be reduced significantly through a personalised intensive lifestyle intervention (i.e., individualised dietary advice and physical activity regime).[9,10,11] Similarly, Knowles *et al.* found that therapeutic lifestyle changes were more effective in reducing the incidence of type 2 diabetes than metformin treatment in patients with hyperglycemia.[12] These studies showed that type 2 diabetes can be prevented through non-pharmacological means. However, non-adherence to diet and exercise in the long-term was found to be the most frequently reported barrier in diabetes self management.[13,14]

The Fifth Health Development Plan in Oman (1996-2000) identified diabetes as a major cause of concern and set specific goals to prevent further progression of the disease. This led to a nationwide "Diabetes Control Programme" which established the Nutritional Advice Protocol;[15] however, the effectiveness of the Nutritional Advice Protocol for type 2 diabetic patients has not been tested. In this study, we aimed to assess the effectiveness of dietary and lifestyle advice and determine how patients with type 2, who attended the Diabetic Clinic at Al-Buraimi Hospital in Al-Buraimi Governorate, Oman, perceived their diabetes and their attitude toward diabetes management.

Methods

A cross-sectional survey study was designed for Omani citizens with type 2 diabetes living in Al-Buraimi Governorate in the north of Oman. In Oman, every new case of diabetes is registered on the National Diabetes Register which is a part of "Diabetes Control Programme" initiated by the Ministry of Health in 2000. The registry, which is regularly updated, contains patients' demographic data, medical history, clinical assessment, laboratory investigation results, initial treatment plan, referrals, and follow-up plans. This registry was used to identify the patients for the study. There were a

Table 1: Recommended targets for nutrition and life style advice on metabolic control

Indicator	Good	Borderline	Poor
BMI	18–24.9	25–29.9	>30
Plasma glucose (mmol/l)			
Fasting	4.4–6.1	6.2–7	>7
HbA1c (%)	<7	7–8	>8
Total cholesterol (mmol/l)	<5.2	5.2–6.5	>6.5
Blood pressure (mmHg)			
Systolic	<130	>130 & <140	>140
Diastolic	<80	>80 & <90	>90
Smoking status	non-smoker	smoker	smoker

Legend: BMI = body mass index; HbA1c = haemoglobin A1c

total of 195 cases of new type 2 diabetics in 2005 at the Diabetic Clinic at Al-Buraimi Hospital. Of these patients, 187 had complete diagnostic clinical and biochemical data which were obtained at the time of diagnosis. Out of these 187 patients, 63 cases were excluded from the study as they had not been attending the Diabetes Clinic for the last 6 months or the relevant data were missing. A further 3 patients were excluded as they did not receive any dietary advice during their treatment. Out of 121 patients who were invited to participate in the study, 23 declined. In the end, 98 patients were enrolled for the study. Thirty-three were treated with diet only and 65 patients were either on hypoglycemic agents and/or insulin to control blood glucose.

Upon enrolment, all patients received nutrition and lifestyle counselling based around four key themes: education about diabetes; diet and nutrition; weight management, and exercise. Particular emphasis was given to education, i.e., what diabetes is, why it is important to control blood glucose, possible complications, why regular exercise is important etc. In Oman, although the dietary guidelines for diabetic patients are the same as for the general populations, individualised diet plans are prescribed to the patients.

The initial assessment of patients' diabetic management and their perception of the importance of diet and exercise took place in 2005. Following the assessment, all patients received dietary and lifestyle advice and were re-invited in 2008 in order to assess: 1) if this advice had encouraged the patients to make any changes, and 2) if it did, how it affected diabetic control, taking into account each subject's primary method of diabetes management (diet control, hypoglycemic agents and insulin).

Dietary assessment and anthropometric and biochemical measurements were carried out in 2005 and in 2008. The recommended targets for nutrition and lifestyle advice on metabolic control described in Table 1 were used to assess patients' compliance.[15]

Ethical approval was granted by the Ministry of Health, Oman. The nature and aim of study was explained to all participants (in both verbal form and via a written information sheet) and written consent was obtained from each participant. This investigation was conducted in accordance with the principles of the Declaration of Helsinki II.

All patients were asked to complete (with or without assistance from the dietician) a food frequency questionnaire, which contains more than 60 questions covering five food sections: meat, milk, fruits and vegetables, breads, and other food and some Omani-style beverages. Food composition tables for Arab Gulf countries were used to analyse the nutrient composition.[16]

Height, weight and blood pressure were measured by one of the investigators according to WHO recommendations.[17] A digital scale was used to measure weight; subjects were weighed dressed in their own clothing hence a 1kg subtraction was set onto the device to account for the weight of the attire. Readings were recorded to the nearest kilogramme. The height of subjects was measured using a stadiometer and recorded to the nearest centimetre. Blood pressure was measured using an electronic measuring device. All subjects rested for ten minutes before recording their blood pressure. A digital sphygmomanometer made three consecutive blood pressure readings for each

Table 2: Demographic description of patients

		Frequency (n)	Percentage (%)
Sex (Male/Female)		49/49	50/50
Age group [a]	<20	2	2.0
	≥20 & <30	7	7.1
	≥30 & <40	22	22.4
	≥40 & <50	23	23.5
	≥50 & <60	24	24.5
	≥60	20	20.4
Marital status	Married	85	86.7
	Single	13	13.3
Educational status	No formal Schooling	43	43.9
	Elementary school completed	22	22.5
	Secondary school or higher	21	21.4
	University or higher	12	12.2
Diabetic management	Diet only	33	33.7
	Hypoglycaemic agents	41	41.8
	Insulin	9	9.2
	Insulin & hypoglycaemic agents	15	15.3
Diabetes related complication [b]		66	67.4
Use of traditional herbal medicine [c]		28	28.6
Smoker		31	31.6

[a]Age in year 2005; [b]Hypertension, hyperlipidemia; [c]Drinks mixed with honey, thyme or wheat or blackseed (Nigella sativa), germander, bitter frankincense, fenugreek, stinkweed and aloe.

subject. The average reading was taken from these three readings.

Blood samples, after 12 hours fasting, were obtained twice from the patients: on the same day on which they enrolled and had nutrition counselling, and then once during follow-up counselling. The samples were used to determine glucose, glycosylated haemoglobin (HbA1c) and lipid profile (total cholesterol, low density lipoproteins (LDL), high density lipoproteins (HDL), and triglyceride).

The paired-sample t-test was used to determine the changes in parameters between 2005 and 2008. The difference in macronutrient intake and the type of primary diabetes management was compared between the subjects by gender and was assessed with an independent t-test. The Statistical Package for the Social Sciences (SPSS), Version 16.0 for Windows, (SPSS Inc., Chicago, IL, USA) was used in data analysis. Results are given as mean values with corresponding standard deviations (SD). *P* values below 0.5% were considered significant.

Results

The demographic description of the patients is summarised in Table 2. Of the 98 patients, 90.8% were over 30 years old and 43.9% (male = 16; female = 27) had received no formal education. The most common form of diabetes management used by the subjects was hypoglycemic agents (male = 19, female = 22). A total of 33 subjects followed a controlled diet only, 15 subjects used both insulin and hypoglycemic agents, and 9 subjects used insulin to control their blood sugar level.

A total of 28 patients (28.6%) also used traditional herbal medicine. 75% of male (n = 37) and 51% of female (n = 25) patients also presented with hypertension and/or hyperlipidemia at the time of diagnosis in 2005.

Table 3: Changes in body weight and metabolic parameters

	Men					Women				
	2005		2008		*P* value	2005		2008		*P* value
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Weight (cm)	72.2	14.5	74.9	10.4	0.623	71.8	13.5	67.7	9.8	<0.0001
BMI (kg/m2)	26.8	4.6	27.1	3.3	0.555	30.8	5.4	29.1	4.0	<0.0001
Fasting glucose (mmol/l)	12.9	5.7	9.1	3.4	<0.0001	11.9	4.4	9.5	2.7	0.002
HbA1c (%)[a]	9.6	2.1	9.0	2.0	0.081	9.0	2.4	8.9	1.9	0.729
Systolic BP (mmHg)	131.9	10.7	135.1	15.7	0.211	130.0	11.4	131.1	17.2	0.667
Diastolic BP (mmHg)	83.5	5.9	82.6	7.8	0.575	82.1	10.6	79.8	11.2	0.32
Total cholesterol (mmol/l)	6.4	6.8	6.5	9.9	0.991	5.5	1.7	4.9	0.8	0.023
LDL-cholesterol (mmol/l)[b]	3.9	4.4	3.0	1.1	0.254	2.9	1.0	2.7	0.9	0.427
HDL-cholesterol (mmol/l)[c]	1.4	0.6	1.3	0.5	0.426	1.8	1.6	1.6	1.4	0.578
Triglycerides (mmol/l)[d]	2.8	2.9	2.2	1.6	0.06	2.1	0.9	1.9	0.9	0.106

Notes: All values are expressed as mean ± SD

[a, b, c, d] The values are based on the following numbers: HbA1c (n = 97); LDL-cholesterol (n = 71); HDL-cholesterol (n = 69); triglycerides (n = 96).

Legend: BMI = body mass index; HbA1c = glycosylated haemoglobin; BP = blood pressure; LDL = low-density lipoprotein; HDL = high-density lipoprotein

As far as changes in body weight and metabolic measurements are concerned [Table 3], a significant reduction in fasting glucose were achieved in both male and female patients. In men, no changes were noted in weight, body mass index (BMI), HbA1c, blood pressure, LDL-cholesterol and triglycerides over the three years of the study. In contrast, women made considerable improvement in terms of body weight, BMI, blood glucose, and total cholesterol levels. There was no significant difference in the metabolic measurements between different diabetes management groups, as it has no obvious effect on the rate of blood glucose level in the subjects.

Examination of changes in macronutrient intakes revealed that in 2005 women had a greater total calorie intake (P <0.01) compared to men. However, the macronutrient intake did not differ between the two sexes in 2005. In men, no changes were found in macronutrient intake between 2005 and 2008 [Table 4]. On the contrary, women had a significant reduction in the amount of macronutrients over the three years. In 2008, the average total energy intake (kcal/day) in women was reduced by 18% compared to that of 2005. Moreover, women ate less fat, carbohydrate and protein (21%, 14% and 14% respectively) per day (g/day) in 2008 than they did in 2005.

Dietary compliance was divided into three categories: always, sometimes and none. Only 11 patients (11.6%) admitted that they never adhered to the diet advised by the dietician, while 63.2% (n = 62) reported they followed their diet sometimes and 25.2% (n = 25) stated they strictly followed diet. Patients were grouped into three clusters according to physical activity: sedentary, moderate and active. A total of 47% of the patients (n = 46) reported they were "active", 24% "moderate" and 28% "sedentary". The most common form of physical activity reported was walking.

Finally, patients were asked about their perceptions and beliefs and attitudes toward diet and exercise and their effect on metabolic control. Their responses are presented in Table 5. A total of 21.2% of the patients reported that they strongly believed "drinking 0.5 cup fruit juice improves hypoglycemia" and 9.6% strongly believed that "diet only is sufficient for improving blood sugar".

Table 4: Changes in macronutrient intakes per day

	Men					Women				
	2005		2008		*P* value	2005		2008		*P* value
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
Total energy (kcal)	2818.7	754.3	2809.3	671.5	0.954	3128.1	575.7	2577.1	586.2	<0.0001
Energy intake from carbohydrate (kcal)	1294.1	395.4	1275.7	279.6	0.79	1438.0	345.6	1232.9	275.7	<0.0001
Energy intake from fat (kcal)	1096.2	323.7	1059.1	339.3	0.619	1204.7	281.3	953.4	308.0	<0.0001
Carbohydrate (g)	323.5	98.9	318.9	69.9	0.790	359.5	86.4	308.2	68.9	<0.0001
Fat (g)	121.8	36.0	117.7	37.7	0.619	133.9	31.3	105.9	24.2	<0.0001
Protein (g)	101.8	23.9	98.9	19.3	0.516	110.1	17.9	95.6	19.6	<0.0001

Legend: SD = standard deviation

Regarding exercise, 55.8% of the patients strongly believed that "exercise improves blood sugar". Moreover, 15.4% of the patients also strongly believed that "taking traditional herbs improves blood sugar levels". Furthermore, more than 10% of the patients did not follow the advice, as they did not believe diabetes or diabetes related complications would affect their quality of life.

Discussion

This epidemiological survey was designed to assess the impact of nutritional and lifestyle advice given to patients by dietitians and to determine the perception of and attitudes to diabetes management of type 2 diabetic patients attending the Diabetic Clinic at Al-Buraimi Hospital.

In this study, nutrition and lifestyle counselling made a small improvement in metabolic control in diabetic patients living in Al-Buraimi Governorate. At the time of this study, there were no specific dietary recommendations for people with diabetes in Oman. The guidelines used for diabetic patients at the Al-Buraimi Hospital were similar to the ones recommended for the general population, i.e. total calorie intake should constitute 50–55% carbohydrates, ≤30% fat (<10% saturated, 10% polyunsaturated, 10% monounsaturated) and 10–15% protein with 300 mg/day or less cholesterol. In addition, diabetic patients were advised to eat frequent small meals in order to maintain a steady blood sugar level.[18] The subjects' fasting blood glucose level showed a very slight change among the subjects in the study, while the fasting blood glucose and HDL-cholesterol levels showed a marked improvement, though this did not reach the target value in all subjects in the study. This could be due to the decrease in nutritional intake, especially from fat and carbohydrate among the subjects in the study. On the other hand, HbA1c did not change, which is an important result.

Unexpectedly, despite a higher illiteracy rate in women, the compliance for dietary advice was better in female patients; overweight and obese women achieved an average of 3.0 kg and 7.1 kg weight loss respectively over three years. This could be explained by the substantial reduction of total energy and nutritional intake in women which was associated with a decrease in blood pressure and lipids profile. On the contrary, there was no enhancement noted in HbA1c, blood pressure or lipids profile levels in men and, in addition to this, 16.4 % of men whose BMI was within ideal body weight in 2005 became overweight (30< BMI ≥25) by year 2008. This could be explained by the substantial reduction of total energy and nutritional intake in women in 2008 (when compared with 2005) and the lack of change in the nutritional intake levels in men from the collection of baseline figures until the end of the study.

It is not clear why women were more amenable to changing their diet than men. Food is exclusively prepared by women in Oman and female diabetics may find it easier to change their diet since they

Table 5: Patients' attitude toward diabetes management

	Strongly agree (%)	Agree (%)	Don't know (%)	Disagree (%)	Strongly disagree (%)
Drinking 0.5 cup fruit juice improves hypoglycaemia	21.2	46.2	25.0	3.8	3.8
Taking herbs improves blood sugar levels	15.4	34.6	28.8	19.2	1.9
Diet only is sufficient for improving blood sugar	9.6	32.7	28.8	26.9	1.9
People with diabetes need enough information to take care of their blood sugar level	51.9	36.5	5.8	5.8	0
Exercise improves blood sugar	55.8	32.7	5.8	5.8	0

do the cooking compared to male diabetics who would have to explain the needed changes to their wives. It is uncommon to cook separate meals for different members of family; whole families tend to share food from the same plates and meals are often high in calories and fat.[4] In Oman, men tend to lead a sedentary lifestyle and are more likely to attend social functions which invariably include meals which are high in calories, fat and sugar. Women, on the other hand, tend to lead a more active lifestyle than men. Moreover, Omani women are becoming increasingly conscious about their body image, and being overweight or obese is considered undesirable. Therefore, it is probable that women simply cut down their food intake and did more exercise in order to lose weight.

Low dietary compliance among the subjects in the study (75%) was largely due to lack of awareness of the condition and its implications on the quality of their life. Alternatively, it is possible that participants simply could not follow the diabetic diet plan as it did not fit in with the traditional Omani high calorie and high fat diet.[4] It should also be noted that poor compliance to dietary advice by diabetic patients is not unique to the Omani population.[13,14]

It was clear from the interviews that patients' knowledge of nutrition was poor, as more than 65% of the participants in this study were illiterate. For instance, 98.1% of patients replied that unsweetened fruit juice would not increase their blood sugar level. Although all patients were seen by a dietician and a health educator, an overwhelmingly large proportion of patients did not recognise the importance that diet or losing weight could have on diabetic management.

According to the National Health Survey 2000,[19] the prevalence of diabetes amongst men (4.3%) and women (17.1%) with secondary education is 25% less than the rate found amongst the illiterate sector of the population. A study of the prevalence of diabetes in the Omani population found that highly educated individuals may be better aware of coronary risk factors and therefore use more effective preventive measures.[4] A similar finding was reported in Bahraini population.[20] Low levels of education have been associated with poorer compliance to diet and exercise and greater diabetes-related morbidity.[21] In addition, it has also been demonstrated that education does make a difference in long-term diabetes management. In a group of older type 2 diabetic patients, higher diabetic knowledge scores were linked with better glycemic control when randomly assigned to diabetic education programmes compared with those randomly assigned to normal care.[22] Similarly, Rubin *et al.* found that subjects who received outpatient diabetes education for more than one week showed a significant increase in their knowledge score, which was associated with a significant fall in HbA1c at 6 months.[23]

More than 70% of the subjects in the study were active which is considered to be an important factor in managing obesity (BMI) and achieving a low glycemic index in diabetic patients,[18] However, obesity in these type 2 diabetic patients was also more likely, due to poor dietary habits rather than through lack of exercise.[24]

Traditional herbal medicine is also sometimes

included in the diet plan. Germander (*Teucrium polium*) or fenugreek is favoured by some patients, either boiled in water and then drunk as tea, or ground into powder and mixed with wheat and then boiled and drunk. Incidentally, these herbs are known to have blood sugar lowering effects.[25,26,27]

Conclusion

The nutritional and lifestyle advice for the Omani type 2 diabetic patients in the study brought about a slight improvement in fasting glucose level in both male and female patients. Female patients made a significant improvement in body mass index, total cholesterol levels and macronutrients intake over three years. This minor improvement in the overall metabolic control could be further enhanced by increasing health education. More than 70% of the subjects in the study were active which is considered to be an important factor in managing obesity (BMI) and lowering the glycemic index in diabetic patients;[18] however, obesity in these type 2 diabetic patients was also more likely due to poor dietary habits rather than to lack of exercise.[24]

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CONFLICT OF INTEREST

The authors reported no conflict of interest.

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