

Eating Habits of People with Type 2 Diabetes Mellitus in Portugal: A Cross-Sectional Study

Hábitos Alimentares das Pessoas com Diabetes Mellitus Tipo 2 em Portugal: Um Estudo Transversal

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ABSTRACT

Introduction: Nutrition is a cornerstone of diabetes mellitus prevention and management; therefore, it is essential to enable patients to adopt healthy eating habits. Previous studies have not yet documented the main errors in the eating habits of Portuguese people with type 2 diabetes mellitus. This study aims to identify the main errors in the eating habits of people living with type 2 diabetes mellitus in Portugal and to evaluate its associations with sociodemographic variables.

Methods: Cross-sectional multicentric study in a convenience sample of people with type 2 diabetes mellitus in Primary Health Care Units. The UK Diabetes and Diet Questionnaire (UKDDQ) – translated and adapted, was applied from July to October 2022. Descriptive and inferential statistical analyses were conducted.

Results: Of the 550 participants, 52.2% were female, 68.3% were 65 years or over, 55.8 % had an education level up to the fourth grade, 24.7% had economic deprivation, and the mean time since diagnosis was 10.60 ± 8.13 years. Only 36.2% of the sample had a healthy UKDDQ score. Less than 50% of the sample had healthy scores for the items “high-fiber rice or pasta”, “high-fiber bread”, “butter, margarine and vegetable oils” and “vegetables and pulses”. Only 8.9% of the sample had a healthy consumption of fiber. About 70.4% reported healthy scores for the consumption of “high-added-sugar foods” and 54.7% for “high-saturated fat”. A statistically significant weak positive correlation was found between the UKDDQ score and age ($p = 0.201$, $p < 0.001$) with a more frequent choice of healthy foods with increasing age. Female respondents reported healthier habits, particularly in the consumption of “high-saturated fat” and “high-fiber foods”.

Conclusion: The majority of our sample did not take advantage of the potential benefits of healthy eating habits. The main food groups whose consumption should be emphasized or discouraged were individualized, particularly the need to encourage the consumption of high-fiber foods. Targeted educational actions must focus especially on younger and/or male patients.

Keywords: Diabetes Mellitus, Type 2; Eating; Feeding Behavior

RESUMO

Introdução: A nutrição é uma área de intervenção na prevenção e gestão da diabetes *mellitus*; por isso, é fulcral promover a capacitação da população para a adoção de hábitos alimentares saudáveis. Ainda que existam alguns estudos nesta área, não se conhecem os principais erros nos hábitos alimentares das pessoas com diabetes *mellitus* tipo 2 em Portugal e avaliar a sua relação com variáveis sociodemográficas.

Métodos: Estudo transversal multicêntrico, em amostra de conveniência de pessoas com diabetes *mellitus* tipo 2 seguidas em Unidades de Cuidados de Saúde Primários. Aplicação do *UK Diabetes and Diet Questionnaire* (UKDDQ) – traduzido e adaptado, de julho a outubro de 2022. Análise estatística descritiva e inferencial.

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Resultados: Amostra de 550 participantes, 52,2% do sexo feminino, 68,3% com 65 anos ou mais, 55,8% com nível de escolaridade igual ou inferior ao 1.º ciclo do ensino básico, 24,7% com insuficiência económica e tempo desde o diagnóstico médio de 10,60 ± 8,13 anos. Apenas 36,2% da amostra obteve um score UKDDQ considerado saudável. Menos de 50% obteve scores saudáveis para os itens “arroz ou massa ricos em fibras”, “pão integral”, “manteiga, margarina e óleos vegetais” e “vegetais e leguminosas”. Somente 8,9% da amostra obteve score saudável para o consumo de fibras. Cerca de 70,4% obteve score saudável para o consumo de açúcares livres e 54,7% para o consumo de ácidos gordos saturados. Verificou-se a existência de uma correlação com significado estatístico positiva fraca entre o score UKDDQ e a idade ($p = 0,201$, $p < 0,001$), com escolha mais frequente de alimentos saudáveis com o aumentar da idade. As pessoas do sexo feminino reportaram hábitos alimentares mais saudáveis, particularmente no consumo de fibras e ácidos gordos saturados.

Conclusão: A maior parte da nossa amostra não usufruiu do potencial efeito positivo de uma alimentação saudável. Individualizam-se grupos de alimentos cujos consumos devem ser enfatizados ou desencorajados, particularmente, a necessidade de incentivar o consumo de alimentos ricos em fibra. Ações educacionais dirigidas devem ter especial foco em pessoas mais jovens e/ou do sexo masculino.

Palavras-chave: Comportamento Alimentar; Diabetes Mellitus Tipo 2; Ingestão de Alimentos

INTRODUCTION

Diabetes mellitus (DM) is a global public health issue with an increasing incidence. Globally, it was estimated that 537 million people were affected in 2021 and 643 million could be affected by 2030.¹ In Portugal, more than one million people were living with this condition in 2018, corresponding to an estimated 13.6% prevalence.²

Characterised by persistent hyperglycaemia, DM can lead to macrovascular and microvascular complications, as well as acute decompensations, namely ketoacidosis, hyperglycaemic hyperosmolar syndrome and severe hypoglycaemia.^{3,4} A total of 32.292 hospital admissions were recorded in 2018 by the Portuguese National Health System (*Sistema Nacional de Saúde* - SNS), due to decompensation/complications of DM, and it was considered as the underlying cause of 3.8% of deaths in Portugal.²

The adoption of healthy eating habits, regular physical activity, smoking cessation, maintaining adequate body weight and psychosocial care are considered crucial in type 2 DM, the most prevalent,³ in association with a pharmacological treatment. A reduction in glycated haemoglobin levels is achieved by these lifestyle changes, in addition to prevention, delay and treatment of related comorbidities including hypertension, dyslipidaemia or obesity. The importance of patient empowerment towards the active involvement in therapeutic decisions and self-management of the disease is also emphasized.³⁻⁵

As regards diet, the adoption of eating patterns that simultaneously promote the privilege of healthy foods and minimise the consumption of unhealthy foods is also recommended. Individual preferences should always be taken into account in order to create healthy and sustainable eating habits.^{4,5} Unhealthy diets include all with high energy density and low nutritional value, with a high content of free sugars, saturated or trans fatty acids and/or salt, which are unnecessary to meet nutritional needs for maintaining health.⁶ In patients where weight reduction is required, a deficit in calorie intake may be recommended.^{4,5}

The effectiveness of nutritional therapy significantly reducing glycated haemoglobin has already been shown

in Portugal in patients presenting with type 1 and type 2 DM,⁷ leading to outcomes that were in line with studies from abroad.^{8,9}

In Portugal, unhealthy diet, overweight, obesity and malnutrition are included as the main risk factor for the burden of disease. In 2019, poor eating habits were among the risk factors for chronic non-communicable diseases that most led to the loss of healthy life years and mortality, reaching 7.3% of disability-adjusted life years (DALYs) and 11.4% of mortality. It is estimated that 13.84% of total expected deaths will be attributable to dietary errors in 2030.^{6,10}

There are different reports on the eating habits of the Portuguese population^{8,11,12} in addition to a study carried out in 2007, characterising some of the knowledge and eating habits of patients with type 2 DM.¹³ However, the major dietary errors of Portuguese patients affected by type 2 DM are unknown.

This study was aimed at assessing the main errors in the eating habits of patients presenting with type 2 DM in Portugal, in addition to the assessment of the relationship with sociodemographic variables. The knowledge obtained could be used to personalise nutritional counselling for the Portuguese population with type 2 DM, contributing to their empowerment and better self-management.

METHODS

Study design

This was a cross-sectional study using the version 3 of the UK Diabetes and Diet Questionnaire (UKDDQ) in addition to the collection of social and demographic data.

Study population

Our target population included patients with type 2 DM attending primary healthcare (PHC) in Portugal.

Considering that 862,197 patients with DM were registered in NHS network in mainland Portugal in 2018,² a minimum sample size of 384 patients was estimated using the sample size calculator by Raosoft®, for a 95% confidence level and 5% margin of error.¹⁴

A convenience sample of patients followed up in PHC units was used, for which the inclusion criteria included coding of the diagnosis of type 2 DM and age 18+. The presence of ongoing pregnancy was considered an exclusion criterion.

Data collection

The study was approved by the Ethics Committee of the *Administração Regional de Saúde* (ARS) on February 24, 2022, and authorisations from the heads of department of the *Unidades de Cuidados de Saúde Primários* (UCSP) and *Unidades de Saúde Familiar* (USF) were obtained before data collection.

The questionnaire was administered by healthcare professionals, on paper, to patients who attended a planned diabetes medical or nursing appointment and who agreed to take part in the study, from July to October 2022. A code was assigned to each questionnaire allowing the allocation of responses to the place where they were completed.

Before answering the questionnaire, information about the study was provided, followed by an informed consent was signed by the patients or in the case of illiterate patients or those unable to sign, by their legal representative or two impartial witnesses. Participation was voluntary, anonymous, and confidential.

Instruments

The UKDDQ is aimed at characterising the eating habits of adult patients affected by type 2 DM or at risk of developing it and was validated by comparing it with four-day food diaries. Response options were provided for each question, contributing to the score and characterising the frequency of retrospective intake of a food item, from A (healthiest choice) to E (least healthy choice).¹⁵ Each response was coded into a numerical value - A = 5, B = 4, C = 3, D = 2, E = 1, F = 0 - with the average score ranging between 0 and 5. The questionnaire was translated and the information about response coding was removed; the number of questions was adjusted to the objectives of the study (three questions regarding the patients' concern about their weight, their motivation to change their eating habits and their confidence in this change were excluded), with the authorisation of the team that developed it. A 24-item final version was used, including 21 items that contributed to the average overall score. The following sociodemographic data were collected: age, gender, level of education, time since type 2 DM was diagnosed and the presence of an income insufficiency record in the patient's clinical file.

Data analysis

The IBM® SPSS® Statistics software (version 28.0.1.0) was used.

Scores were obtained for each item and for each participant according to their performance overall (UKDDQ score) and within the specific sets of items, assessing saturated fatty acid (butter and vegetable oils, high-fat cheese, processed meat, high-fat pastries and milk), fibre (vegetables, fruit and bread, cereals, high-fibre rice or pasta) and free sugar intake (cakes and cookies, sweets and chocolates, sugar-sweetened beverages and sweet desserts). The higher the score, the greater the number of healthy choices made by the participant within the past month. A 'healthy' score was defined as a score ≥ 4 .

A descriptive statistical analysis was carried out on the sample's sociodemographic variables and the scores for each item and each participant. Since the statistical evidence of the sample did not suggest normality (Kolmogorov-Smirnov test), a non-parametric test (Mann-Whitney u-test) and Spearman's correlation coefficient were used for statistical inference.

Considering the absolute value of the estimates for Spearman's correlation coefficient (ρ), the correlation was considered as weak ($\rho < 0.30$), moderate ($\rho \geq 0.30$ and < 0.60) or strong ($\rho \geq 0.60$).¹⁶ The p -value < 0.05 was set to conclude on the statistical significance of the estimate or test. A multivariate analysis was carried out using linear regression with the variables that showed a significant association with the total score.

RESULTS

Characteristics of the study sample

A sample of 550 participants was used, 500 of which (90.9%) were patients attending 16 collaborating units from the *ARS Centro*. The remaining 50 participants included patients attending the *ARS Lisboa e Vale do Tejo* and *ARS Alentejo*.

In our group of patients, 52.5% of the respondents were female and 68.3% were aged 65+. Most respondents had basic education (55.8%). The average time since diagnosis was 10.60 ± 8.13 years. Around 24.7% of the participants had income insufficiency recorded in their patient file.

Responses to the questionnaire

"Whole grain rice or pasta", "wholemeal bread", "butter, margarine and vegetable oil" and "vegetable and legume" intake were the items for which more than 50% of the participants did not achieve a healthy score, corresponding to the most frequent errors in eating habits. From the individual analysis of these items, it is worth mentioning that 80.4% of the respondents never selected "whole grain rice or pasta" over other versions of these foods; 38.7% never opted for "wholemeal bread"; 28.7% consumed "butter, margarine and vegetable oils" daily; only 7.8% consumed "vegetables and legumes" once a week or less and 3.5% never or rarely.

Table 1 – Characteristics of our group of patients (n = 550)

Variable		n	%
Gender	Male	263	47.8
	Female	287	52.2
Age (years)	Mean \pm SD	69.19 \pm 10.40	
	Minimum	37	
	Maximum	92	
Level of education Mean \pm SD: 6.65 \pm 4.21 years	Illiterate	20	3.6
	Literate	21	3.8
	Basic (1 st cycle) - Primary	266	48.4
	Basic (2 nd cycle) - Primary	68	12.4
	Basic (3 rd cycle) - Lower secondary	60	10.9
	Secondary	66	12.0
	High school	49	8.9
Time since diagnosis (years)	Mean \pm SD	10.60 \pm 8.14	
	Minimum	0	
	Maximum	50	
Income insufficiency (record in patient's clinical file)	No	414	75.3
	Yes	136	24.7

SD: standard deviation

Around 78.2% of the respondents consumed “bread” every day and 33.1% “rice or pasta”. There was a low intake of “breakfast cereals, oats or muesli”, with around 76.4% of the respondents selecting the “never or very rarely” option.

A healthy UKDDQ score was obtained by only 36.2% of the respondents, while a healthy score regarding the limitation on free sugar intake was obtained by around 70.4% of the respondents, in contrast to fibre intake, with only 8.9% achieving a healthy score.

Correlations between responses and sociodemographic variables

A statistically significant weak positive correlation was found between the UKDDQ score and the patients' age ($p = 0.201$; $p < 0.001$), showing that the older the patients, the more often they choose healthy foods. Statistically significant weak positive correlations were also found between age and the scores for the saturated fatty acid ($p = 0.169$; $p < 0.001$), free sugar ($p = 0.181$; $p < 0.001$) and vegetable and legume intake ($p = 0.156$; $p < 0.001$).

Statistically significant weak negative correlations were found between the participants' level of education and (i) the UKDDQ scores ($p = -0.121$; $p = 0.005$), (ii) the scores regarding saturated fatty acid ($p = -0.113$; $p = 0.008$), free sugar ($p = -0.143$; $p < 0.001$) and vegetable and legume intake ($p = -0.092$; $p = 0.030$), as well as statistically significant weak positive correlations with the scores regarding wholemeal bread intake ($p = 0.140$; $p = 0.001$) and whole

grain rice and pasta ($p = 0.085$; $p = 0.046$). Statistically significant weak negative correlations were also found between the level of education and bread intake frequency ($p = -0.090$; $p = 0.036$) and rice and pasta intake ($p = -0.092$; $p = 0.031$).

The time since diagnosis had a statistically significant weak positive correlation with the UKDDQ scores ($p = 0.137$; $p = 0.001$) and with free sugar intake ($p = 0.152$; $p < 0.001$), suggesting that the longer the time since diagnosis, the greater the care taken by patients regarding their diet, particularly regarding free sugar intake.

No statistically significant correlations were found with fibre intake.

Female patients had reached a median UKDDQ score corresponding to better statistically significant eating habits ($p < 0.001$) when compared to male patients (Mann-Whitney U-test, Table 6). Statistically significant differences were found in saturated fatty acid ($p = 0.003$) and fibre ($p = 0.0005$) intake, and female patients showed better scores. This trend was also found in free sugar intake, although with no statistical significance.

No statistically significant differences were found between the median of any of the scores and the presence of income insufficiency (Mann-Whitney U test). However, as regards the most frequent errors in eating habits, a statistically significant higher median consumption of butter, margarine, and vegetable oils ($p = 0.042$) was found in patients with income insufficiency recorded in their clinical file, with

Table 2 – Most frequent unhealthy dietary choices described by the participants

Item [§]	Mean score ± SD	95% CI	Median score (IQR)	Equivalent score	Healthy score*
Whole-grain rice or pasta	1.57 ± 1.26	1.46 a 1.67	1 (0)	Never	73 (13.3) [¶]
Wholemeal bread	2.67 ± 1.60	2.54 a 2.81	2 (3)	Less than half the time	214 (38.9) [¶]
Butter, margarine, and vegetable oil	2.96 ± 1.56	2.83 a 3.09	3 (4)	2 - 4 times a week	219 (39.8)
Vegetables and legumes	3.02 ± 1.22	2.92 a 3.12	3 (2)	5 - 6 times a week	271 (49.3)
Fatty fish	2.80 ± 1.92	2.64 a 2.96	4 (4)	Once a week	298 (54.2)
Fatty cheese	3.77 ± 1.31	3.66 a 3.88	4 (2)	Once a week or less	341 (62.0)
Processed meat	3.82 ± 1.25	3.71 a 3.92	4 (2)	Once a week or less	342 (62.2)
Alcohol	3.71 ± 1.78	3.56 a 3.86	5 (4)	Never or very rarely // once a week or less	379 (68.9)
Sugar-sweetened beverages	3.89 ± 1.55	3.76 a 4.02	5 (2)	Never or very rarely	391 (71.1)
Breakfast	3.82 ± 2.02	3.65 a 3.99	5 (2)	Every day	405 (73.6)
High fibre breakfast cereals	3.97 ± 1.63	3.83 a 4.11	5 (2)	Always // did not have any cereals	409 (74.4) [¶]

SD: standard deviation; CI: confidence interval; IQR: interquartile range

*: Healthy score was defined as ≥ 4.

¶: The consumption of high fibre option of these foods and non-consumption of any option of these were both considered healthy options.

§: Those items in which less than 75% of the participants have achieved healthy scores were included in this table; data regarding all the items of the questionnaire are available in Appendix 1 (Appendix 1: <https://www.actamedicaportuguesa.com/revista/index.php/amp/article/view/19738/15279>).

Table 3 – Responses (%) to items of the questionnaire not included in the scores

Item	Never or hardly ever	Once a week or less	2 - 6 times a week	1 - 2 times a day	3 - 4 times a day	> 4 times a day
Bread	20 (3.6%)	23 (4.2%)	77 (14.0%)	364 (66.2%)	58 (10.5%)	8 (1.5%)
Breakfast cereals, oat, or muesli	420 (76.4%)	48 (8.7%)	52 (9.5%)	30 (5.5%)	0	0
Rice or pasta	19 (3.5%)	84 (15.3%)	265 (48.2%)	168 (30.5%)	14 (2.4%)	1 (0.2%)

a higher median score regarding the consumption of vegetables and legumes ($p = 0.031$).

The multivariate analysis has shown an independent and statistically significant relationship with the UKDDQ score, with an adjusted R² of 0.089 as regards 'age' ($B = 0.004 - 0.011$; $p < 0.001$) and 'gender' ($B = 0.115 - 0.248$; $p < 0.001$).

DISCUSSION

Main findings and comparison with literature

A healthy UKDDQ score was only obtained by 36.2% of the respondents. In 2007, in a similar Portuguese study aimed at the population with type 2 DM, 31.2% of the study group had healthy habits, so these seem in line, even

though a different method of measuring eating habits had been used.¹³

Our data showed a high percentage of "rice or pasta" and "bread" in dietary habits, and a preference for low-fibre versions of these foods. In contrast, "breakfast cereals, oatmeal or muesli" are rarely consumed. High intake of bread and toast, especially among the elderly, and infrequent intake of breakfast cereals among the elderly and adults have been described by the *Inquérito Alimentar Nacional e de Atividade Física* (National Food and Physical Activity Survey - IAN-AF) characterising the eating habits of the whole Portuguese population.¹²

It was expected that few participants would reach a healthy score of fibre intake, which was around 8.9%, due

Table 4 – UKDDQ scores regarding saturated fatty acid, fibre, and free sugar intake

Score	Mean score \pm SD	95% CI	Median score (IQR)	No. (%) of participants reaching a healthy score*	
UKDDQ	3.81 \pm 0.41	3.78 a 3.84	3.86 (0.53)	199	(36.2)
Saturated fatty acid intake	3.93 \pm 0.62	3.88 a 3.98	4 (0.8)	301	(54.7)
Fibre intake	3.05 \pm 0.69	2.99 a 3.11	3 (1.0)	49	(8.9)
Free sugar intake	4.17 \pm 0.69	4.12 a 4.23	4.25 (1.0)	387	(70.4)

SD: standard deviation; CI: confidence interval; IQR: interquartile range

*: Healthy score was defined as ≥ 4 .

to the low “vegetable and legume” intake that was found in this study. In 2017, a study analysing the Portuguese population’s knowledge of dietary fibre reached the conclusion that a lower than desired awareness of the benefits for DM existed,¹⁷ reinforcing the need for educational interventions at this level.

A lower than desired vegetable, fruit and legume intake has been found in the IAN-AF.^{6,12} Most participants have described an unhealthy “vegetable and legume” intake, even though with an adequate “fruit” intake. This disagreement could be explained by the fact that, according to the results of the IAN-AF, more fresh fruit are consumed by the elderly,¹² the most prevalent age group in our sample.

An adequate saturated fatty acid intake has been found in 54.7% of the participants. However, it is worth mentioning that “butter, margarine and vegetable oil” intake was inadequate in 60.2% of the participants. This behaviour is slightly different from that of the Portuguese population, in which an adequate fat and oil intake has globally been found.^{6,12}

Data from the IAN-AF have shown that processed meat consumption is generally inadequate among the Portuguese.^{6,12} Around 62.2% of our participants have described a healthy consumption of processed meat, with frequencies ranging from ‘never’ to ‘once a week or less’. These results may be partly due to the predominant age group, as the elderly consume processed meat less frequently.¹²

An adequate free sugar intake was described by 70.4% of the participants. In a 2007 Portuguese study, with similar endpoints and target population, 32.1% of the participants consumed these foods every week,¹³ in line with our study, even though considering the use of different assessment instruments. Given that type 2 DM is often described as in-

ducing “excess blood sugar”, we should bear in mind that, if on the one hand the scores are biased by social desirability, on the other hand, there may be lower intake of this type of food by patients, leading to a relationship between these and “blood sugar”. A higher than recommended free sugar intake has been found in around 24.4% of the Portuguese population,^{6,12} a lower rate than what was found in our group of patients.

Even though 29% of the total food intake of the Portuguese patients include foods not included in the food wheel, including cakes, sweets, cookies, snacks, salty snacks, pizzas, soft drinks, nectars and alcoholic beverages,¹² healthy scores regarding these items were achieved by most participants, with the exception of “sugar-sweetened beverages” (the only item that makes up free sugar intake score with less than 75% of the sample achieving a healthy score) and “alcohol”. However, the results of the analysis of the frequency of alcohol intake should be interpreted with caution as it was only considered healthy by the UKDDQ when intake occurred once a week or less.

As the age of the participants increased, there was a higher frequency of healthy food choices, with a reduction in saturated fatty acid and free sugar intake and an increase in vegetable and legume intake. Without statistical significance, there was also a tendency to increase fibre intake. Age-related behaviours in our group of patients are consistent with those of the Portuguese population.¹² However, despite better performance in questionnaires such as the UKDDQ, excessively limiting the variety of the diet in the elderly increases the risk of malnutrition, something that should not be overlooked.^{18,19}

The behaviour of female participants when compared to

Table 5 – Spearman correlation between demographic variables and scores

	UKDDQ score	Saturated fatty acid intake (score)	Fibre intake (score)	Free sugar intake (score)
Age	0.201 ($p < 0.001$)	0.169 ($p < 0.001$)	0.072 ($p = 0.091$)	0.181 ($p < 0.001$)
Education	- 0.121 ($p = 0.005$)	- 0.113 ($p = 0.008$)	0.083 ($p = 0.053$)	- 0.143 ($p < 0.001$)
Time since diagnosis	0.137 ($p = 0.001$)	0.082 ($p = 0.055$)	- 0.011 ($p = 0.792$)	0.152 ($p < 0.001$)

SD: standard deviation; p = statistical significance

male participants - lower saturated fatty acid intake and a preference for high-fibre foods - is consistent with the findings of the International Health and Behaviour Survey in Portugal. However, only a limited age range (17-30) was covered by this study.²⁰ However, these findings are not in line with those of the IAN-AF, in which inadequate saturated fatty acid intake was more prevalent in female patients and daily fibre intake was higher in male.¹² In our sample, even though with no statistical significance, female patients also seemed to reduce their free sugar intake, in contrast to what was described by the IAN-AF.¹²

A higher fibre intake has been found in the Portuguese population, in patients with higher education,¹² in line with our study, even though with no statistical significance. It is worth mentioning that this trend was mainly due to the preference for high-fibre options of bread, rice, and pasta - even though the food frequency (high or low-fibre options) was lower, when compared to patients with lower education. The intake of vegetables and legumes did not contribute to this trend since, in our sample, it seems to decrease with increasing levels of education.

In our study, higher education was associated with higher consumption of saturated fatty acids and free sugars. In the IAN-AF, higher education was associated with lower total saturated fatty acid and free sugar intake,¹² even though there was also a higher intake of foods including sweets, cakes, cookies, snacks, salty snacks and pizzas.^{6,12} It should be noted that the UKDDQ assesses food frequencies and not the contribution to total food intake of each item; for this reason, the greater food diversification associated with higher education may be reflected in worse scores. The fact that education could represent a poor predictor of therapeutic adherence should be kept in mind,²¹ as well as the use of different measurement methods between the studies.

Strengths and limitations

The UKDDQ has not been formally validated for the Portuguese population and there may be biases related to the application of the questionnaire, namely memory bias and social desirability bias. Like any measuring instrument, the UKDDQ has its own strengths and limitations, namely the use of frequencies for different items instead of portions.¹⁵ In addition, a sample with limited dispersion across the country has been used (selection bias).

On the other hand, the sample size is representative of the target population and coordination with the study collaborators ensured that the same participant could not have responded more than once. Information about the coding process was removed from the questionnaire given to the participants (which was included in the questionnaire itself in the original version) to contradict the participants' tendency to underestimate high intakes and overestimate low intakes showing healthier eating habits.

Given that a convenience sample has been analysed, the demographics of this sample do not reflect the prevalence of DM in Portugal in terms of gender,² but rather the fact that female patients attend primary care more frequently.²²

The average age of this population reflects the age group with the highest prevalence of the disease (60 - 79 years)² and education, and therefore academic training, expected for this age group.²³ The fact that a varied sample in terms of age and time since diagnosis was analysed is a strong point of this study. It is not possible to estimate the representativeness of the sample in terms of the patient's economic background. However, the inclusion of this variable is also a strength of the study, given its influence on diet quality^{24,25} and the relationship with DM.^{6,26}

Table 6 – Relationship between 'gender' variable and scores – Mann-Whitney's test

Gender	Male	Female
UKDDQ score (mean ± SD)	3.71 ± 0.44	3.90 ± 0.36
p	< 0.001	
Saturated fatty acid intake (score) (mean ± SD)	3.84 ± 0.66	4.02 ± 0.58
p	0.003	
Fibre intake (score) (mean ± SD)	2.97 ± 0.71	3.13 ± 0.66
p	0.005	
Free sugar intake (score) (mean ± SD)	4.15 ± 0.70	4.19 ± 0.68
p	0.54	

SD: standard deviation; p = statistical significance

Implications

The conclusions of the study, despite its limitations, when disclosed and integrated into nutritional counselling in primary care, may allow for a more personalised approach to patients with type 2 DM in Portugal, increasing the number of patients who benefit from a healthy diet.

Future research

We suggest a formal validity of this instrument to the Portuguese population, as well as subsequent adaptations including items such as the consumption of potatoes and other tuber vegetables for better comparison with Portuguese studies.

Although the limitations of the UKDDQ remain,¹⁵ the application of this study to other regions in Portugal would be relevant to understand the impact of geography on the eating habits of patients with type 2 DM, since differences have been documented in the general population with other assessment instruments.¹²

Since the UKDDQ has been shown to be sensitive to changes,²³ its serial application to patients with type 2 DM could show the temporal evolution of dietary habits²⁷ and preferential times for targeted educational actions. The effectiveness of these actions could also be assessed by the subsequent application of the UKDDQ.

On the other hand, the simultaneous assessment of other parameters that could be predictors of eating habits - including the presence of other comorbidities, body mass index, usual medication, household, number of meals with/without company, physical activity and source/making of main meals - could define risk subgroups that would benefit from a more specific type of guidance, such as extending nutritional counselling to family members or planning weekly meals.

CONCLUSION

The potentially positive effect of a healthy diet on the management of diabetes is not achieved by most of the patients in this study, based on the assessment of their eating habits.

It was possible to individualize the main food groups whose intake should be emphasized - "high-fibre rice or pasta", "wholemeal bread", "vegetables and legumes" - or discouraged - "butter, margarine and vegetable oils", and the low intake of high-fibre foods is particularly concerning.

Further educational actions with the inclusion of this new knowledge should focus particularly on younger and/or male patients, in addition to the analysis of the best ap-

proach to changing habits in this subpopulation of patients with diabetes.

PREVIOUS PRESENTATIONS

This study was presented as a poster to the IN4MED (students), the AIMS Meeting (students), the *XXVIII Curso Pós-Graduado de Endocrinologia, Diabetes e Metabolismo* (9.º Congresso Português de Diabetes and 40.º Encontro Nacional de MGF).

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AUTHOR CONTRIBUTION

BCR: Study conception, data collection, analysis, and interpretation, writing and final version approval of the manuscript.

IR: Study conception, data analysis and interpretation, critical revision, and approval of the final version of the manuscript.

TISC: Data interpretation, critical review, and approval of the final version of the manuscript.

PDM, GSR, AFF, ASCM, TB, FGF, AFC, CL, IMF, JAG, IVO, TDCG, ARP, ASAG, CFM, SPS, AC, PVC, BAR: Data collection, critical review, and approval of the final version of the manuscript.

HUMAN AND ANIMAL PROTECTION

The authors declare that this project complied with the regulations that were established by the Ethics and Clinical Research Committee, according to the 2013 update of the Helsinki Declaration of the World Medical Association.

CONFLICTS OF INTEREST

The authors declare that there were no conflicts of interest in writing this manuscript.

DATA CONFIDENTIALITY

The authors declare that they have followed the protocols of their work centre on the publication of patient data.

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