Impacts of nutritional education before Ramadan fasting on dietary intake, weight and body composition in diabetic patients

Impacts de l'éducation nutritionnelle avant le jeûne du Ramadan sur l'apport alimentaire, le poids et la composition corporelle chez les patients diabétiques

Houda Ben jemaa, Faten Mahjoub, Olfa Berriche, Amel Gammoudi, Salma Chaabouni, Henda Jamoussi

Research Unit "Obesity: etiopathology and treatment, UR18ES01", National Institute of Nutrition and Food Technology, Tunisia - Higher School of Health Sciences and Technics, University of Tunis El Manar, Tunisia

RÉSUMÉ

Introduction : La période de jeûne du Ramadan (JR) requiert une attention particulière surtout chez les patients diabétiques**.**

Objectif : Déterminer les impacts d'un programme d'éducation nutritionnelle avant le JR sur l'apport alimentaire, l'anthropométrie et la composition corporelle**.**

Méthodes: Il s'agissait d'une étude interventionnelle et comparative. Elle a été réalisée auprès de 54 diabétiques de type 2, recrutés à l'Institut National de Nutrition. Les patients ont été répartis en deux groupes : un groupe éduqué qui a bénéficié d'une séance d'éducation nutritionnelle avant le JR (n=26), et un groupe témoin, qui n'a pas eu d'éducation (n=28). Une enquête alimentaire, des mesures anthropométriques et une étude de la composition corporelle ont été réalisées avant et après le JR.

Résultats: Au cours du JR, une diminution significative de l'apport en glucides a été observée chez tous les patients (Δ=-4,1±7,0 contre Δ=-6,25±6,3). L'apport lipidique a été augmenté de manière significative pendant le JR chez tous les patients. Cette augmentation était plus faible chez les patients ayant reçu une éducation par rapport à l'autre groupe (3,4±7,43 contre 5,25±5,7). Une augmentation significative de la consommation de protéines, d'acides gras saturés et monoinsaturés a été observée pendant la période du jeûne dans le groupe non éduqué par rapport au groupe éduqué (respectivement, Δ=1,19±2,30 contre Δ=1,06±7,10, Δ=3,40±7,43 contre Δ=5,25±5,70 et Δ=2,23±5,60 contre Δ=2,31±5,10). La perte pondérale a été similaire entre les deux groupes éduqué (-1,05 kg) et non éduqué (-0,58 kg). La composition corporelle n'a pas subi de modifications significatives dans les deux groupes de diabétiques.

Conclusion: Des programmes d'éducation nutritionnelle ont des impacts positifs sur les diabétiques qui insistent pour jeûner. Ces programmes doivent être dispensés aux diabétiques avant le JR.

Mots-clés

Religion, Métabolisme, Education, Régime alimentaire, Indice de masse corporelle

SUMMARY

Background: The fasting period of Ramadan requires special attention for diabetic patients in particular.

Aim: To determine the impacts of a nutritional education program before Ramadan fasting (RF) on dietary intake, anthropometry and body composition.

Methods: This was an interventional and comparative study including 54 type 2 diabetic patients, recruited at the National Institute of Nutrition. The patients were divided into two groups: an educated group who received a nutritional education session before Ramadan (n=26), and an uneducated group who did not receive any education (n=28). Food survey, anthropometry and body composition measurements were conducted before and after the month of Ramadan

Results: During RF, a significantly decrease in carbohydrate intake was observed in both educated and uneducated patients (Δ=-4.1 vs. Δ=-6.25). Lipid intake was increased significantly during RF for all patients. This increase was lower in patients receiving education compared to the other group (3.4±7.43 vs. 5.25±5.7). During RF, a significant increase in protein, saturated and monounsaturated fatty acids intake was shown in the uneducated group compared to educated group (respectively, Δ=1.19±2.30 vs. Δ =1.06±7.10, Δ=3.40±7.43 vs. Δ=5.25±5.70 and Δ=2.23±5.60 vs. Δ=2.31±5.10). The weight loss was similar between the two groups of educated (-1.05 kg) and uneducated (-0.58 kg) patients. There was no significant change in body composition during Ramadan in both groups of diabetics.

Conclusions: Nutritional education programs positively impact diabetic patients who prefer RF or insist to fast during Ramadan. These programs must be provided to diabetics before Ramadan.

Key-words

Religion, Metabolism, Education, Diet, Body mass index

INTRODUCTION

Ramadan takes place on the 9th lunar month of the Islamic calendar. Fasting during the holy month of Ramadan is an important spiritual practice. Muslims who fast during Ramadan must abstain from eating, drinking, use of oral medications, and smoking from pre-dawn to after sunset; however, there are no restrictions on food or fluid intake between sunset and dawn [1].

Ramadan fasting (RF) is associated with certain variations of the eating habits mainly the composition and the meal schedule. Most people consume two meals per day during this month [2]. The decrease in the frequency of meals may be associated with an intensification of the feeling of hunger. However, people who are hungry throughout the day cannot consume an iso-caloric meal and abdominal fullness is often reported after the break-up [3]. RF could also disturb the homeostasis of the body [4].

RF is not meant to create excessive hardship on the Muslim individual according to religious tenets. Nevertheless, many patients with diabetes insist to fast during Ramadan, thereby creating a medical challenge for themselves and their health care providers. Patients with poorly controlled diabetes and who fast during Ramadan may be at risk for certain adverse events, which may increase with longer fasting periods [5,6]. Daytime hypoglycaemia remains the most prominent event during RF feared by both patients and physicians [7].It is increasingly important that medical professionals be aware of potential risks associated with RF and with approaches to mitigate those risks [8,9].

Pre-Ramadan diabetes education enables the patients to make informed decisions and effectively manage themselves during the RF. A structured educational programme should be devised for the patients and their families, which gives information on risk quantification, physical activity, glucose monitoring, diet, hypoglycemia, dosage and timing of medications, and identification of the symptoms of complications [10,11]. The objective of this interventional and comparative study was to determine the effects of a nutritional education program before Ramadan on dietary intake, anthropometry and body composition of two groups of diabetic patients: educated and uneducated (control) groups. The null hypothesis was that RF alleviates dietary intake in the educated group compared to the uneducated one.

METHODS

Populations: Fifty-four type 2 diabetic patients were recruited in this study. Patients were assigned randomly into two groups: an educated diabetics group (n=26) and an uneducated diabetics one (n=28). The patients were recruited at the service ‘‘A’’ of the Tunisian National Institute of Nutrition, which have been authorized by their doctors to fast Ramadan. All diabetics were treated with oral antidiabetics. Patients who have experienced severe hypoglycemia in the three months preceding the month of Ramadan or with macrovascular complications including ischemic heart disease, renal impairment, and pregnant and lactating women were not included in the study.

Study design

This was an interventional and comparative study conducted in Ramadan 2013, this month took place from July 9 to August 7 in summer season. The study protocol was approved by the ethics committee on human research of the Tunisian National Institute of Nutrition. A nutritional education session of 90 minutes, one or two weeks before Ramadan was given to the educated group. The session was a collective education of 10 patients provided by a multidisciplinary team formed by a physician, a nutritionist and a dietician. The objective of this education was to enable patients to acquire knowledge and self-care skills to better manage their disease during RF, namely:

– Ensure a balanced food intake in both qualitative and quantitative terms (limiting fatty and fried foods and products with high glycemic index).

– Prevent dehydration by ensuring adequate fluid intake after periods of non-fasting.

– Recognize the clinical manifestations of hypoglycemia, hyperglycemia and learn what to do when they occurred.

Collected data

Data collection was performed using a questionnaire administered by the attending physician during the visits with a face to-face interview. The following variables were obtained: age, sex, socio-economic level, education level, physical activity level, as well as the duration of diabetes.

Three day registration food recalls were used to assess the dietary intakes before (one or two weeks before Ramadan) and during Ramadan (the second or the third week of Ramadan) to estimate energy intake and macronutrient composition of the diet. Patients were asked to record all they ate and drank on three consecutive days (2 weekdays

and 1 weekend day). Participants were given written and verbal instructions to complete the diary and were asked to record the time, type, brand, portion size of all food and drink. Usual measures (bowl, cup, glass, tablespoon, teaspoon ...) were used to estimate food portions and to quantify intakes. The nutritional assessment includes spontaneous calorie intake total, the distribution of energy nutrients (proteins, carbohydrates and lipids) in the day, the distribution of the fat intake of saturated fatty acids, monounsaturated and polyunsaturated and the contribution of other nutrients (cholesterol and dietary fiber). From these dietary data, the mean daily energy intakes were calculated and expressed as a percentage of their Total Energy Intake (TEI).

For physical activity, the journal method was proposed to the subjects. The purpose of this method is to estimate the level of physical activity that is calculated according to the formula presented by Martin et al. [12]. There are three levels of intensity of physical activity: sedentary, moderate and intense.

All patients underwent anthropometric measures including the calculation of body mass index (BMI) (calculated as weight (kg)/height $(m)^2$). The World Health Organization (WHO) criteria was used for BMI categorization ([18.5 kg/m^2 ≤BMI <25.0 kg/m^2]= normal weight; [25.0 kg/m^2 ≤ BMI < 29.9 kg/m^2 = overweight; [BMI ≥30.0 kg/m^2]= obesity) [13]. Bioelectrical impedance (TANITA, TBF-401A, Tokyo, Japan) was used to assess body composition. It is presented as a pedestal analyzer and measuring is done in minutes. Information on fat mass (FM), fat free mass (FFM) and total body water (TBW) were provided.

Glycemic control was assessed using glycosylated hemoglobin (HbA1c) dating from a month before the first visit. Glycemic control was considered good when HbA1c value was ≤ 7% [14].

All measurements were performed fifteen days to a month before RF and were done one or two weeks after the end of the holy month.

Statistical Analysis

The data were analyzed using the SPSS statistics 23.0 program (SPSS Inc., Chicago, IL). Results were expressed as means±SD for quantitative variables and frequencies and percentages for qualitative variables. The nonparametric test of Mann-Whitney U was used to compare the means of two independent groups. Wilcoxon test was used for the comparison of dependent variables before and after Ramadan. Delta (∆) express the difference between data collected in during Ramadan and before Ramadan. The delta was compared between educated and uneducated group by the test of Mann-Whitney.

RESULTS

Characteristics of the Study Population

Table 1 presents the general characteristics of the sample. The two groups were matched for age, BMI and included similar frequencies of patients divided according to sex, education, socioeconomic and physical activity levels, BMI classes, diabetes duration and HbA1C values.

Impacts of nutritional education before Ramadan on nutritional profile during Ramadan

According to Table 2, during RF, the observed decreases in total daily caloric intake for both groups weren't statistically significant. Carbohydrate intake decreased significantly during RF in all diabetic patients. In the uneducated group, protein intake (expressed as percentage of TEI or in g/kg/day) increased significantly between the two periods. However, in the educated group, no significant change was observed.

The distribution of the protein ration before RF showed an excess of animal proteins consumption for the uneducated and the educated groups with ratios between animal and vegetal proteins (AP/VP) of 1.11 and 1.05, respectively. During RF, non-significant increase in the AP/VP ratio was observed in both groups.

Lipid intake increased significantly during RF for all patients. However, this increase seems to be lower in the educated group compared to the uneducated one, but without a statistically significant difference. During RF, significantly raises in saturated and monounsaturated fatty acids were observed in the uneducated group. However, no significant difference was noticed in the educated group.

The consumption of high cholesterol foods increased significantly during RF in both groups.

During RF, an increase in fiber intake was seen in diabetic receiving education (1.15 g /day) than the uneducated group (0.14 g /day).

Impacts of education on the anthropometric profile and body composition

As shown in **Table 3**, a statistically significant weight

Table 1. Characteristics of the study population

		All Diabetic patients(n=54)	Diabetics educated(n=26)	Diabetics uneducated (n=28)	P value
Age *(years)*		54.8±7.2	53.0±5.3	55.0±8.6	NS
Sex[Nbre(%)]	**Man**	28(51.8)	11 (42.3)	17 (60.7)	NS
Education level[Nbre(%)]	**Illiterate**	6(11.1)	6 (23.0)	0 (0.0)	NS
	Primary	15(27.8)	4 (15.3)	11 (39.3)	
	Secondary	19(35.2)	8 (30.7)	11 (39.3)	
	High	14(25.9)	8 (31.0)	6 (21.4)	
Socioeconomic level[Nbre(%)]	**Low**	8(14.8)	2 (7.7)	6 (21.4)	NS
	Medium	23(42.6)	9 (34.6)	14 (50)	
	High	23(42.6)	15 (57.7)	8 (28.6)	
Physical activity[Nbre(%)]	**Sedentary**	31(57.4)	15 (57.7)	16 (57.1)	NS
	Moderate	18(33.3)	8 (30.8)	10 (35.7)	
	Intensive	5(9.3)	3 (11.5)	2 (7.2)	
BMI (kg / m²)		30.5 ± 4.6	31.0 ± 5.0	30.0 ± 4.0	NS
BMI class[Nbre(%)]	**BMI<25.0 kg/m²**	4(7.4)	2 (7.7)	2 (7.1)	NS
	25.0<BMI<29.9 kg/m²	26(48.2)	10 (38.5)	16 (57.1)	
	BMI≥30.0 kg/m²	24(44.4)	14(53.8)	10(35.7)	
Duration of diabetes (years)		5.2±4.0	4.3±4.0	6.0±3.7	NS
HbA1c[Nbre(%)]	**(≥7%)**	39(72.2)	18 (69)	21 (75)	NS

BMI: Body Mass Index ; **HbA1c:** glycosylated hemoglobin **NS:** not significant; Age and BMI was expressed as mean ± SD. The Mann-Whitney U test was used for the comparaison between educated and uneducated diabetic groups.

loss was observed in the two groups. A significant weight loss was observed in educated patients with overweight compared to uneducated group. The comparison between the educated and the uneducated groups did not give any significant difference

There was a statistically significant improvement in BMI from before to after RF for patients receiving education and who did not receive.

RF did not bring any significant changes in the body composition of the two groups. Education program did not report a statistically significant difference in body composition after Ramadan.

DISCUSSION

To the best of the authors' knowledge, this is the first study conducted in Tunisia, aiming to evaluate the impacts of a structured therapeutic education protocol evaluating dietary, nutritional and anthropometric profiles in patients with type 2 diabetes. The results reflected the positive impacts of nutritional education protocol that must be provided to diabetic patients before RF as during this month there is a major change in dietary patterns.

Table 2. Impacts of education before Ramadan on nutritional profile during Ramadan

	Educated diabetic group(n=26)			Uneducated diabetic group(n=28)			P value
	Before Ramadan	During Ramadan	Δ	Before Ramadan	During Ramadan	Δ	
Daily calorie intake (Kcal/day)	2140.3±275.1	2087.2±297.0	-57.0±417.4	2233.3±320.1	2175.0±345.2	-65.0±380.2	NS
Total carbohydrates (% TEI)	51.03±4.8	46.44±5.6	-4.10±7.0	52.9±4.2	46.6±5.2	-6.25±6.3*	NS
Total protein(% TEI)g/kg/ dayAP/VP	11.72±1.81.08±0.181.05±0.4	12.91±2.51.12±0.21.2±0.3	1.19±2.3	11.85±1.91.10±0.21.11±0.4	12.91±1.91.13±0.21.15±0.4	1.06±7.1*	NS
Total lipids (% TEI)	37.23±4.6	40.64±5.9	3.40±7.4*	35.26±3.7	40.5±4.4	5.25±5.70*	NS
Saturated fatty acids (% TEI)	8.96±2.28	9.48±1.37	0.52±2.6	8.43±1.8	9.65±1.64	1.21±2.6*	NS
Monounsaturated Fatty acids (%TEI)	19.12±3.5	21.4±5.1	2.23±5.6	18.07±4.2	20.4±4	2.31±5.1*	NS
Polyunsaturated fatty acids (%TEI)	9.07±4.5	9.54±4.1	0.4±5.6	8.7±3.5	10.45±3.7	1.7±4.9	NS
Food cholesterol (mg / day)	154.09±132.3	261.87±127	107.8±174.8*	172.77±178.6	256.23±131	83.56±251.3*	NS
Fibers (g /day)	18.75±7.9	19.9±7.1	1.15±7.1	20±9.5	20.8±7	0.14±9.5	NS

% TEI : Total Energy Intake ; AP/VP: ratio: animal proteins/vegetal proteins
Data presented as Mean ± SD, Δ =Before Ramadan - During Ramadan; *: P-value < 0.05(comparison between Before and During Ramadan (Wilcoxon test)); P value: comparison between educated and uneducated diabetic groups (Mann-Whitney U test).; NS: Not significant.

Table 3. Impacts of education before Ramadan on anthropometric profile and body composition during Ramadan

	Educated diabetic group (n=26)			Uneducated diabetic group (n=28)			P value
	Before Ramadan	During Ramadan	Δ	Before Ramadan	During Ramadan	Δ	
Weight (kg) Total population	83.5±12.1	82.4±13.3	-1.05 *	82.0±14.2	81.1±14.1	-0.58 *	NS
Man	81.4±10.0	80.7±11	-0.6	85.2±15.1	84.8±15.3	-0.47	NS
Woman	82.7±11.3	81.4±11	-1.38	77.9±12.0	77.1±12.4	-0.77	NS
BMI (kg/m²)	31.0±5.0	30.8±4.8	-0.2 *	30±4	29.6±4	-0.4 *	NS
BMI class							
<25.0 kg/m²	67.7±5.4	68.3±8.4	+0.55	54.0	53.4	-0.6	NS
[25.0 - 29.9] kg/m²	77.5±9.5	76.0±10.0	-1.24*	73.99±6.4	73.8±6.6	-0.2	NS
≥30.0 kg/m²	85.88±9.9	84.82±10.2	-1.05	90.39±13.4	89.25±13.3	-0.95	NS
Body composition							
FM (%)	32.5±11.0	32.2±11.0	-0.386	29.0±8.0	28.6±8.0	-0.5	NS
FFM (%)	67.44±11.0	67.75±11.0	+0.31	70.9±8.5	71.43±8.2	+0.53	NS
TBW (%)	49±8	49.5±8.4	+0.5	52±6	52.3±6	+0.3	NS

Data presented as Mean ± SD, BMI: Body mass index; FM: Fat Mass FFM: Fat Free Mass; TBW: Total body water; Δ =Before Ramadan - During Ramadan, *: P-value < 0.05 (comparison between Before and During Ramadan (Wilcoxon test)); P value: comparison between educated and uneducated groups (Mann-Whitney U test).; NS: Not significant.

Impacts of nutritional education before Ramadan on nutritional profile during Ramadan

Impacts of education before Ramadan on total daily caloric intake

In the present study, during RF, a non significant decrease in total daily caloric intake in the uneducated and the educated groups was revealed. Sebbani et al. [15] compared the daily dietary intake of tow groups of type 2 diabetes patients (fasting and not fasting during RF). They reported that, the mean total daily caloric intake was significantly lower in the fasting than non-fasting group [1447.5±756.3 vs. 1919.0±823.4 kcal/day] [15]. Bouguerra et al. [16] demonstrated, in type 2 diabetic Tunisian patients, that daily calorie intake decreased from 2084 kcal / day before Ramadan to 1981 kcal / day during Ramadan [16].

Impacts of education before Ramadan on total carbohydrates

This study results revealed a significantly decrease in carbohydrate intake during RF in all diabetic patients. This decrease in carbohydrate during Ramadan was also reported by Sebbani et al. [15].

Impacts of education before Ramadan on total lipids

This study results demonstrated that lipid intake was increased significantly after RF for all patients. After RF, no significant difference in saturated, monounsaturated and polyunsaturated fatty acids were noticed in the educated group but in the uneducated one a significantly raise was found. An Algerian study demonstrated that total fat and saturated fatty acids intake was significantly lower in type 2 diabetic patients receiving education compared to patients that did not receive education before Ramadan [17]. The excessive intake of lipids could be explained by eating habits change during RF, which are characterized by overconsumption of traditional dishes rich in saturated fats and carbohydrates fast assimilation (Briks, Tajine …).

Impacts of education before Ramadan on total proteins

Protein intake increased during RF in both educated and uneducated groups but without significant difference. The distribution of the protein ration before and during RF showed an excess of animal proteins consumption for both groups. So education program before Ramadan did not improve protein intake during RF. The study of Bencharif et al. [17] showed a similar result. In fact, the protein intakes were higher in both groups before and during RF without a significant difference between educated and uneducated groups [17]. This excess protein could be explained by a higher consumption of animal proteins during RF. In comparison to a normal period, during RF the traditionally cooked dishes are with eggs, red meat (sheep, beef), and/ or of white meat. The richness in animal proteins from these foods may explain this increase. The consumption of high cholesterol foods increased significantly during RF in both groups, which did not exceed the daily recommended intake (< 300 mg/day). A same finding was reported by Bencharif et al. [17].

Impacts of education before Ramadan on fibers intake

Receiving nutritional education before Ramadan improved the fiber intake by 1.15 g /day during RF in comparison with the uneducated group (0.14 g /day). A high fiber intake is recommended in type 2 diabetic patient to avoid massive carbohydrates intake. A greater consumption of foods rich on fibers is associated with the increase fat absorption capacity. Fiber also constitutes a source of antioxidants, vitamins and minerals, which play a protective role against type 2 diabetes [18].

Impacts of education before Ramadan on anthropometric profile and body composition

This study results showed a statistically significant weight loss of 1.05 kg in diabetics' educated patients compared with 0.58 kg in the uneducated group. The weight changes observed during RF in the educated group was previously reported by Bravis et al. [19]. They demonstrated a mean weight loss of 0.7 kg after RF in the group receiving education compared with a 0.6 kg mean weight gain in uneducated group ($P < 0.001$) [19]. Another study found moderate weight gain (0.2 kg) in type 2 diabetics who received several education sessions before RF and dietetic counseling compared to uneducated group [20]. In this study, education program did not report a statistically significant difference in body composition during Ramadan. This study revealed that education is important in the management of diabetes during the month of Ramadan. Indeed, although their daily energy intakes showed a non significant reduction that could be explained by the low number of subjects included in this study. These results reflect the positive impact of pre Ramadan nutritional education protocol that must be provided to diabetic patients as during this month there is a major change in dietary patterns. Because of the delay in digestion

and absorption, ingestion of foods containing complex carbohydrates may be advisable at the predawn meal, while foods with more simple carbohydrates may be more appropriate at the sunset meal. It is also suggested that intake of fluid must be increased during non fasting hours and that the predawn meal may be taken as late as possible before the start of the daily fast [5]. Several limitations were identified in this study like the sample size that was not calculated and number of nutrition education sessions. It was also interesting to include a third session (after Ramadan).

CONCLUSION

The results of this study showed that it is necessary to educate people about general principles of a diet that will prevent Ramadan-attributed complications. Also, determining the associated amounts of nutrient intake and educating the general populace would be effective steps in minimizing the number of complications related to RF. In this regard, efforts are still needed to increase the number of sessions and to improve educational programs before Ramadan.

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