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Original Article

Mediterranean Diet Adherence and Eating Disorders Screening in Adults with Celiac Disease in Morocco

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Abstract

Background: Celiac disease is a chronic autoimmune disease of the small intestine, related to gluten intolerance occurring in genetically predisposed patients. This study aimed to evaluate Mediterranean diet adherence, screen eating disorders and establish the relationship between Mediterranean diet and eating disorders.

Methods: This study included 81 adults with celiac disease, and 85 without celiac disease from Rabat-Sale-Kenitra hospitals between May 2022 and Nov 2022. The Mediterranean Diet Serving Score (MDSS) questionnaire was used to determine adherence to the Mediterranean diet and SCOFF questionnaire was used to screen eating disorders.

Results: The results showed a significant difference between the two groups in age (P=0.000), weight (P=0.041), height (P=0.000) and non-adherence to Mediterranean diet (P=0.032). Participants without celiac disease reported a significantly (P=0.032) lower adherence score to the Mediterranean diet (62.35%) than participants with celiac disease (29.62%). Additionally, the results of the Khi² test which revealed a significant association between MDSS and SCOFF (P=0.024). In addition, based on logistic regression the Mediterranean diet Serving Score was significantly associated with eating disorders (P=0.025) in adults with celiac disease, on the other hand, weight, height, BMI and MDSS were significantly associated with eating disorders in adults without celiac disease.

Conclusion: Our study showed good adherence to the Mediterranean diet by celiac adults so it can be assumed that the Mediterranean diet could have a protective effect against eating disorders in celiac patients

Keywords: Celiac disease; Mediterranean diet; Eating disorders; Adults; Morocco

Introduction

Celiac disease (CD) is an autoimmune enteropathy observed in genetically predisposed individuals who develop an immune reaction to gluten (1). It is now recognized as a global disease that affects approximately 1%-2% of the world's population (2). The presentations are numerous ranging from asymptomatic patients to severe malnutrition. Late diagnosis of celiac disease depends on the development of nutritional (growth retardation in children, undernutrition and vitamin deficiencies), digestive, hematological (anemia), neurological (peripheral neuropathy), cardiovascular (coronary heart disease and venous thrombosis), endocrine and autoimmune compli-

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cations. At present, the only effective treatment for celiac disease is a strict gluten free diet for life (3).

In fact, the Mediterranean diet (MD) is considered one of the healthiest dietary models in the world, and a reference for a balanced diet (4). The MD is characterized by a high consumption of fruits, vegetables, grains, legumes, fish, nuts, and olive oil; moderate consumption of eggs, poultry, and dairy products and a limited consumption of red meat (5). The MD is associated with a decrease in mortality and morbidity and a lower incidence of chronic diseases: cardiovascular diseases, hypertension, obesity, metabolic syndrome, type 2 diabetes, certain cancers and osteoporosis (6-9). Moreover, eating disorders (EDs) are considered as a psychiatric disorder characterized by abnormal eating or weight control behaviors, with diagnostic criteria based on psychological, behavioral and physiological characteristics (10,11). EDs can often develop in adolescents and young adults, but they can appear at other ages. Early detection of EDs could improve their diagnosis, reduce mortality and morbidity and prevent somatic, psychiatric and psychological complications (12). Today, CD may contribute to the development of EDs in adolescents and adults for the following reasons: chronic dietary restriction, gluten-free diet, interference with growth, pubertal delay and weight gain during treatment (13).

No study in Morocco has evaluated the relationship between celiac disease and adherence to Mediterranean diet in adults with celiac disease. Thus, the objectives of our study were to evaluate Mediterranean diet adherence, to screen eating disorders and to establish the relationship between Mediterranean diet and eating disorders.

Materials and Methods

Study Design and Population

This study was conducted in 81 adults (19-62 yr) with celiac disease participated voluntarily, in the Rabat-Sale-Kenitra hospitals between May 2022 and November 2022 and 85 adults without CD. The subjects recruited were individuals already diagnosed with celiac disease and following the gluten-free diet, who came to hospital for a simple control.

With the help of nurses, we explained the purpose of the study, and then they volunteered and signed the consent form. We took responsibility for filling in the questionnaires and sociodemographic information ourselves, based on their own responses.

Data collection

We collected the following data on a data sheet: age, sex, duration of the disease, anthropometric measurement, and the responses related to the 2 questionnaires: SCOFF and MDSS.

Anthropometric measurement

Anthropometric measurements consisted of measuring weight, height in adults. The Body Mass Index (BMI) is calculated according to the mathematical formula:

$$BMI = \frac{\text{weight Kg}}{\text{height m}^2}$$

With, BMI in kg/m2, weight (kg) and height (m).

In adults, MBI was used to classify subjects according to their nutritional status using World Health Organization (WHO) standards. Underweight = <18.5, Normal weight = 18.5–25

Overweight = 25–30, Obesity = BMI of 30 or greater.

Mediterranean diet serving score (MDSS)

The Mediterranean Diet Serving Score (MDSS) questionnaire was used to determine adherence to the MD by considering the consumption of different foods and foods groups in time intervals per meal, day or week (14). According to the original study, MDSS is a valid instrument with sensitivity=74% and specificity=48% (14).

Food are divided into fourteen food groups and points are awarded according to the new Mediterranean food pyramid as follows: three points for fruits, vegetables, olive oil, and cereals if consumed at every meal; two points for dairy products and nuts if consumed daily; one point for

the recommended number of servings per week is consumed for potatoes (≤3), legumes (≥2), eggs (2-4), fish (≥2), white meat (2), red meat (<2), and sweets (≤2) (15). A score of 0 is given when the consumption per meal (week or day) is above or below the recommendation (Table 1).

Table 1: Components and scoring system of the MDSS

Variable	*Recommendation**	*Score*
Fruit	1-2 servings/main meal **	3
Vegetables	≥ 2 servings/main meal**	3
Cereals	1-2 servings/ main meal**	3
Potatoes	≤ 3 servings/ week	1
Olive oil	1 serving /main meal	3
Nuts	1-2 servings /day	2
Dairy products	2 servings/ day	2
Legumes	≥ 2 servings/ week	1
Eggs	2-4 servings /week	1
Fish	≥ 2 servings/ week	1
White meat	2 servings/ week	1
Red meat	< 2 servings /week	1
Sweets	≤ 2 servings /week	1
Total score		23

*According with the new Mediterranean Diet Pyramid
**Main meals: breakfast, lunch and dinner

It boils down to a maximum MDSS score of twenty-three {23}, and the larger score implies greater Mediterranean diet adherence. The optimal cutoff point ≥ 14 was set to determine adherence or non-adherence to MD (14).

SCOFF Questionnaire

The SCOFF was developed in 1999 by Morgan et al, in England to assess the presence of eating disorders (16). The SCOFF questionnaire was tested and validated in a group of subjects with EDs and a control group. This study showed a sensitivity of 100% and a specificity of 87.5%. These results were subsequently confirmed in general and school medicine (17,18). Additionally, the Arabic version of the SCOFF questionnaire has been validated with a sensitivity of 80% and a specificity of 72.2% (19). It adopted an acronym to refer to the five main items covered by the test (Sick, Control, One, Fat, Food). The goal of the authors was to establish a reliable, simple and rapid tool to identify subjects at risk of or affected by EDs.

It consists of 5 dichotomous questions, with one point awarded for each answer that includes «yes». Two positive responses are highly predictive of an eating disorder (Table 2).

Table 2: SCOFF Questionnaire

SCOFF Questionnaire
1. Do you make yourself **Sick** because you feel uncomfortably full?
2. Do you worry you have lost **Control** over how much you eat?
3. Have you recently lost **One** stone in a 3-month period?
4. Do you believe yourself to be **Fat** when others say you are too thin?
5. Would you say that **Food** dominates your life?

Ethical Approval

The study protocol was previously approved by the ethics committee of regional direction of health and social protection rabat sale kenitra (N 2973/2022). All participants signed an informed consent before asking to questions.

Statistical Analysis

The description of the central parameters (mean, standard deviation SD and percentage) of the total sample has been made. The Mann-Whitney test was used to compare participants with CD and participants without CD. The Khi^2 test was used to evaluate the relationship between MDSS and SCOFF. A logistic regression was used to reveal the dependence between several variables (age, weight, height, BMI, MDSS) and eating disorders. The data analysis was entered and performed using the SPSS (software ver. 22.0 (IBM Corp., Armonk, NY, USA)) and Excel 2013. Significance level was set at *P*-value<0.05.

Results

We determined Mediterranean diet adherence, screening eating disorders as well as the relationship between Mediterranean diet and eating disorders of 81 adults (61 women, 20 men) aged 19 to 62 yr and 85 adults without celiac disease (49 women, 36 men) aged 18 to 69 yr.

Description of the study population

The sociodemographic characteristics of the study population are shown in Table 3. The mean age of study participants without CD was 30.75±14.295; 57.64% were women. About 12.94% of the subjects was overweight. The average age of participants with CD was 35.79 ±12.045.

Table 3: Sociodemographic characteristics of the study population

Variable	*Adults with celiac disease (n=81)*	*Adults without celiac disease (n=85)*	*p-value*
Age (yr)	35.79 ±12.045	30.75±14.295	0.000[a]
Gender, n (%women)	61 (75.30)	49 (57.64)	
Weight (kg)	59.51±10.976	63.522±12.3803	0.041[a]
Height (m)	163.68±5.062	168.65±8.605	0.000[a]
BMI (Kg/m^2)	22.158±3.6258	22.293±3.7914	0.75
BMI classification			
< 18.5, n (%)	9 (11.11)	13 (15.29)	0.60
18.5 – 25, n (%)	54 (66.66)	57 (67.05)	0.069
25-30, n (%)	15 (18.51)	11 (12.94)	0.11
≥30 , n (%)	3 (3.70)	4 (4.70)	0.99
MDSS			
< 14, n(%)	24 (29.62)	53 (62.35)	0.032[a]
≥ 14, n(%)	57 (70.73)	32 (37.64)	0.93

The Mann- Whitney test was used. BMI: Body Mass Index. Data are reported as mean ± standard deviation (SD), or number and percentage n(%), as appropriate. [a]significant difference at 5%

The significant differences between the two groups were observed in age (*P*=0.000), weight (*P*=0.041), height (*P*=0.000) and non-adherence to MD (*P*=0.032).

Adherence to the Mediterranean diet

Participants without CD reported a significantly (*P*=0.032) lower adherence score to the MD (62.35%) than participants with CD (29.62%). Figs. 1-2 show the results obtained for the different food groups considered in the MDSS questionnaire according to whether the optimal rec-

ommendations of the MD were met. Participants with CD had an optimal consumption of olive oil (92.59% vs 51.77%), fruits (90.12% vs 71.76%), potatoes (79.01% vs 63.52%), cereals (77.78% vs 57.64%) and legumes (70.38% vs 41.18%) compared to the participants without CD.

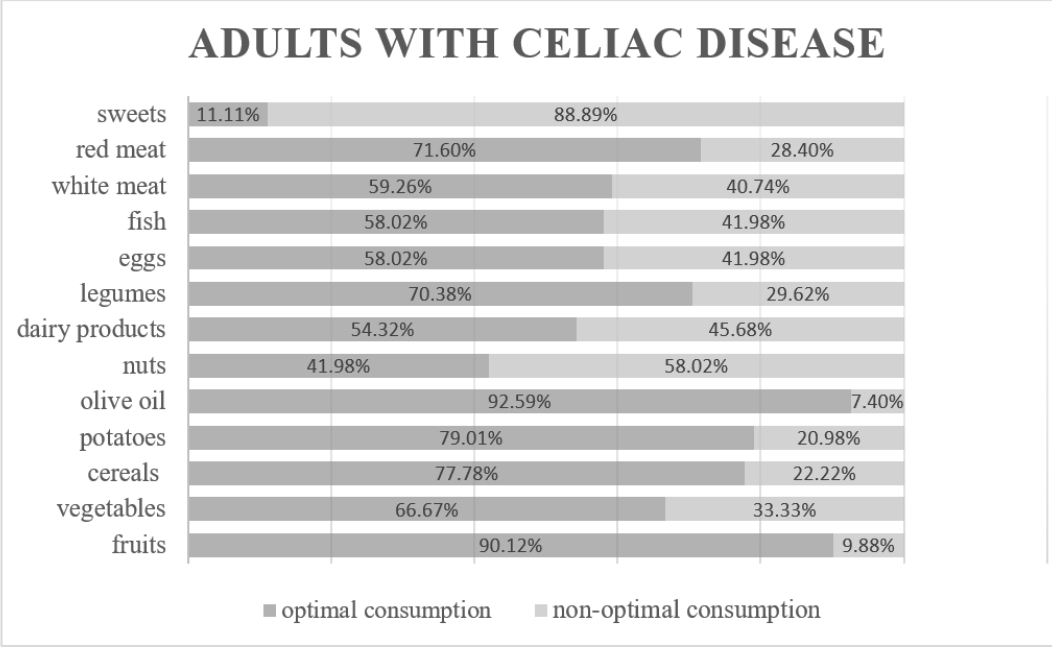

Fig. 1: percentage of adults with celiac disease who reported an optimal and non- optimal intake of the single food groups of the MDSS

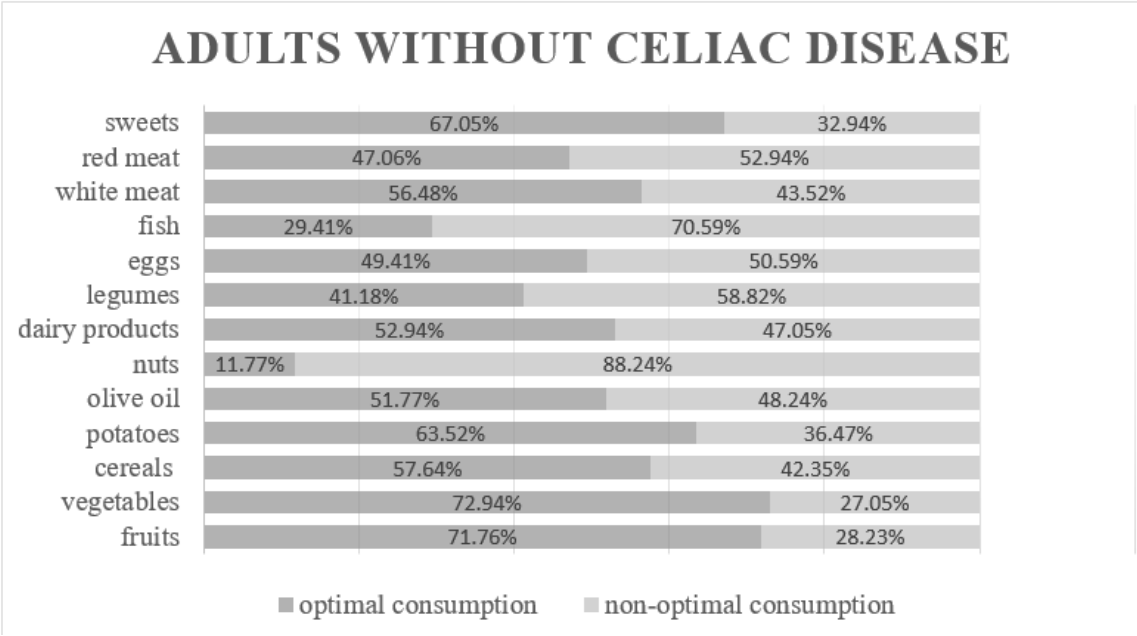

Fig. 2: percentage of adults without celiac disease who reported an optimal and non- optimal intake of the single food groups of the MDSS

Relationship between adherence to the Mediterranean diet and eating disorders

Table 4 presents the results of the Khi² test which revealed a significant association between MDSS and SCOFF (*P*=0.024). The prevalence of celiac patients who adhere to the Mediterranean diet and who do not have eating disorders is 55.55%, on the other hand, 16.04% of adults with celiac disease who do not adhere to the Mediterranean diet and do not have eating disorders. While, of all celiac adults with eating disorders (n=23); 12 adhere to the Mediterranean diet and 11 do not.

Table 4: Independence test between MDSS and SCOFF in celiac patients

Variable		***MDSS***		***Total***	***Khi² (p value)***
		Adherence	Non- adherence		
SCOFF Questionnaire	SCOFF-	45 (55.55%)	13 (16.04%)	58	5.101[a] (0.024)
	SCOFF+	12 (14.81%)	11 (13.58%)	23	
Total		**57**	24	81	

The Khi2 test was used. [a]significant difference at 5%; **SCOFF+:** have eating disorders**; SCOFF-:** don't have eating disorders

Relationship between eating disorders and variables

Results of logistic regression between several variables and eating disorders are presented in Table 5. Thus, MDSS was significantly associated with eating disorders (*P*=0.025) in adults with celiac disease. On the other hand, the following variables were significantly associated with eating disorders: weight (*P*=0.027), height (*P*=0.025), BMI (*P*=0.034) and MDSS (*P*=0.025) in adults without celiac disease.

Table 5: dependent variables in eating disorders: logistic regression

	Adults with celiac disease			***Adults without celiac disease***		
Variables	Wald	Significance	Exp(B)	Wald	Significance	Exp(B)
Age	0.176	0.67	0.989	2.040	0.15	1.028
Weight	2.139	0.14	0.458	4.872	0.027[a]	1.972
Height	1.636	0.20	1.670	5.041	0.025[a]	0.572
BMI	1.952	0.16	7.254	4.497	0.034[a]	0.166
MDSS	5.014	0.025[a]	0.279	4.997	0.025[a]	0.228

[a]significant difference at 5%

Discussion

From this study, the average age of our patients was 35. 79 yr, contrary to a study conducted in India on a sample of 45 adults who reported a younger average age, estimated at 28.7 yr (20), another study conducted in Spain showed a higher average age of 41 yr (21). Adult celiac disease affects women 2 to 3 times more than men (22), in our study we also noted a clear female predominance estimated at 75.30%, which is consistent with the majority of studies (23,24). This female predominance can be explained by several factors, including the high frequency of autoimmune diseases in girls, hormonal terrain and the probable protection of the Y chromosome.

To date, few studies have evaluated the Mediterranean diet adherence and screening eating disorders among adults with celiac disease. Our results

showed that 62.35% of participants without CD did not adhere to the MD compared to 29.62% of participants with CD. Celiac adults adhering to the Mediterranean diet recommendations had a higher consumption of olive oil (92.59% vs 51.77%), fruits (90.12% vs 71.76%), potatoes (79.01% vs 63.52%), cereals (77.78% vs 57.64%) and legumes (70.38% vs 41.18%) compared to the participants without CD. In Italy, study on a sample of 103 adults with CD and 312 without CD showed a lower adherence score to the MD in participants with CD (9.4± 2.2) compared to participants without CD (10.4 ±2.5), with higher consumption of non-traditional Mediterranean food such as dairy products and meat, and lower consumption of traditional foods, such as fish and vegetables (25). There are several reasons why Moroccan celiac patients adhere so closely to the MD: on the one hand, Morocco has a Mediterranean-type diet, and on the other hand, as we know, celiac patients have to follow a gluten-free diet, which poses several problems for them, such as; the high price of gluten-free products, unpleasant taste and difficult to prepare.

Sometimes, the wrong treatment can lead to complications such as nutritional deficiencies and to avoid these problems, today, celiac patients are directed to choose a healthy, balanced diet that can help them benefit from the essential nutrients that a typical gluten-free diet may lack, and all these benefits are found in the MD.

On the other hand, the results of the Khi^2 test which revealed a significant association between MDSS and SCOFF (P=0.024). The prevalence of celiac patients who adhere to the Mediterranean diet and who do not have eating disorders is 55.55%, in addition to this, 16.04% of adults with celiac disease who do not adhere to the Mediterranean diet and do not have eating disorders. While, of all celiac adults with eating disorders (n=23); 12 adhere to the Mediterranean diet and 11 do not. In addition, logistic regression showed that MDSS was significantly associated with eating disorders (P=0.025) in adults with celiac disease. On the other hand, the following variables were significantly associated with eating disorders: weight (P=0.027), height (P=0.025), BMI (P=0.034) and MDSS (P=0.025) in adults without celiac disease.

Conclusion

These results may suggest that patients with celiac disease who adhere to the Mediterranean diet are less likely to develop eating disorders.

The findings of this study need to be complemented by future studies that investigate adherence to the Mediterranean diet and eating disorders not only in adults but also in children and adolescents in different regions of the world.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interests.

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