

## Special Issue: Alcohol Addiction

# Prevalence of Wine Consumption in Type 2 Diabetics after a Dietary Nutritional Intervention from Primary Care

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## Summary

**Introduction:** At present there are changes in the lifestyle that have been modifying the nutritional culture, moving away from the Mediterranean diet (DMed), with a higher consumption of alcoholic beverages, a fact that together with the acquisition of a more sedentary lifestyle, has contributed to a significant increase in Cardiovascular Risk Factors (CVRF) such as obesity and type 2 Diabetes Mellitus (DM2), and consequently to a global increase in Metabolic Syndrome (MS) and Cardiovascular Diseases (CVD), which in the 21<sup>st</sup> century continue to be the leading cause of morbidity and mortality. To reduce this pandemic and try to reduce alcohol consumption in patients with high cardiovascular risk, a multidisciplinary approach is required focused on the application of primary and secondary prevention strategies focused on nutritional education through the promotion of a healthy lifestyle from childhood and a healthier diet, such as the one included in the DMed. This dietary pattern, together with physical exercise, has been shown to contribute to the primary and secondary prevention of DM2.

**Objective:** To determine the initial adherence to the DMed, as well as the consumption of wine by sex, in patients with poorly controlled DM2 and to analyze the effects of a nutritional educational intervention from Primary Care on the consumption of wine, the degree of adherence to the DMed and the glycemic control.

**Material and Methods:** Descriptive observational study and quasi-experimental analytical study (before-after) in 93 patients diagnosed with type 2 diabetes mellitus with poor glycemic control ( $A1c \geq 7\%$ ), carried out in various health centers in Albacete and Cuenca between 2018 and 2019, in which the relationship between adherence to MedDM and CVRF is evaluated, before and after an educational intervention on MedDM. They are administered a data collection sheet that includes a MedD adherence survey (MEDAS-14) at baseline and at 6 months, after completing an education on MedD in Primary Care (PC) medical and nursing consultations).

The pre- and post-intervention variables were analyzed: age groups, sex, years of evolution of DM2, Body Mass Index (BMI), as well as Basal Glycemia (GB) and Glycosylated Hemoglobin (HbA1c). The main variable "MEDAS-14" is related to the rest of the variables. Specifically, item 8 assesses the consumption of more than or equal to 7 glasses of wine per week.

**Results:** Pre-intervention the score of the survey of adherence to the Mediterranean diet was relatively low ( $7.44 \pm 0.22$  points), being in women (7.66 points) than in men (7.1 points). Of the 14 dietary items of the MEDAS-14, high compliance with the recommended intake of wine stands out ( $\geq 7$  glasses/week, 69%), specifi-

cally there is a higher initial consumption in women (45%) than in men (28%). In general terms, despite the high consumption of olive oil, a large number of processed products are consumed (sweetened beverages, butter, commercial confectionery), with a low consumption of fruit, fish and nuts. Post-intervention, adherence to the DMED increased by  $1.09 \pm 2.56$  points (8.55 points). Men being those who present 0.4 points more (8.7 points) than women (8.4 points). The biggest changes have been in relation to the increase in the consumption of white meat, olive oil, nuts, vegetables and stir-fry. Just as a decrease in the consumption of processed foods and the weekly consumption of wine (down to 58%) is observed, specifically it has been higher in women, it has decreased by 11% (34.4%), maintaining itself in men (28%).

**Conclusions:** In diabetic patients with poor control, a nutritional educational intervention that promotes MedDM from PC improves adherence to said diet, increasing the consumption of healthy foods and decreasing harmful ones, thus optimizing metabolic control.

**Keywords:** Mediterranean diet; Type 2 diabetes; MEDAS-14; Item 8; Wine; Nutritional education

## Introduction

Human nutrition has been essential in the evolution of man, modifying eating habits throughout history. Changes in lifestyle derived from a reduction in physical activity, work pressures, new forms of teleworking, widespread use of electronic devices and unlimited access to the food consumption market in developed countries have been modifying nutritional culture, transforming the habits of our traditional diet since childhood [1]. Likewise, the state of confinement COVID-19 has implied changes in the life habits and dietary profiles of the population [2].

The Mediterranean Diet (DMed) is classically defined as the eating pattern typical of the early sixties in the countries of the Mediterranean area (Greece, southern Italy and Spain) [3]. Its main characteristics are: a) high fat consumption, mainly in the form of olive oil; b) high consumption of whole grains, fruit, vegetables, legumes and nuts; c) moderate-high consumption of fish; d) moderate-low consumption of white meat and dairy products; e) low consumption of red meat and meat products, and f) moderate consumption of wine with meals. This pattern and the proportions of the different foods that compose it are graphically displayed in the form of a "food pyramid" [4].

Alcohol consumption is a culturally approved process in society and in different scenarios of human socialization this behavior has been present in the history of humanity [6], but when this consumption becomes frequent and excessive, the consequences are multiple (accidents, liver disease, neurological and psychiatric pathologies) increased the cardiovascular risk of patients who suffer from it, generating high socioeconomic costs and health resources. It has been pointed out that alcohol has diabetogenic effects in people with DM2 that include increased obesity, induction of pancreatitis, alterations in carbohydrate and glucose metabolism, presenting periods of hypoglycemia when alcohol is consumed excessively and there are long fasting periods, however it can also cause hyperglycemia when consumed in smaller quantities or to accompany food [7]. The ADA does not prohibit a person with DM2 from consuming alcohol, but it does not advise it either, it recommends limiting moderate consumption (one drink a day for women and two a day for men).

When analyzing the current situation in Spain, a country where there is a high prevalence of DM2 together with obesity (diabesity), two of the great epidemics of the 21<sup>st</sup> century that

increase CVD, being the first cause of morbidity and mortality worldwide and in Spain, derived from current lifestyles far from a Mediterranean lifestyle. For this reason, it was proposed to assess the effects of MedDM in the prevention of this disease [8].

It has been shown that an intervention with MedD is a very effective instrument in the prevention of T2DM in subjects with high vascular risk [9,10]. The American Diabetes Association [11], among its general recommendations, makes explicit reference to MedDM, mentioning the improvement in glycemic control and its cardiovascular benefits in patients with T2DM. Although, as we said, it has been systematically shown that MedD helps protect against cardiovascular, inflammatory and metabolic diseases, as well as numerous chronic degenerative diseases [12-15]; the protective effect of MD has been very different between the studies [16-18].

Consequently, many adherence scores of the MedMD are being created to determine the relationship between diet and health [19]. Therefore, this work planet, due to its ease of use, use the MEDAS-14 in diabetic patients with poor glycemic control to assess the degree of adherence to the DMed, objectify their consumption of wine and other variables.

## Method

This is a multicenter study in which adult type 2 diabetic patients with poor glycemic control (HbA1c greater than 7%) from various health centers in Albacete and Cuenca participated during the period between June 2018 and September 2019. In the first stage, a descriptive observational study was carried out to determine the degree of adherence to the MedD, through the compilation of the MedD Adherence questionnaire (MEDAS-14) [20] (Figure 1) and anthropometric parameters (BMI, waist circumference) and glycemic biochemical parameters (GB, A1c). In a second stage, a quasi-experimental analytical study of the before-after type is carried out, relating the main variable "MEDAS-14" with the rest (IMC, GB, A1c) before and after the intervention.

The Community Nutrition Program, framed in a monographic consultation for patients with poorly controlled DM2, developed a nutritional educational intervention carried out by nurses and PC doctors for 6 months, based on promoting health

through the Mediterranean lifestyle ( DMed, physical exercise and smoking cessation) through discussion groups, theoretical-practical workshops and individual motivational interviews, to improve metabolic control in patients with DM2 (secondary prevention) and thus mitigate the appearance or aggravation of future complications and improve their quality of life.

The MEDAS-14 [20] questionnaire (Figure 1), administered at the beginning of the study and at 6 months, after carrying out an education on MedDM in the PC consultation, consisting of the assessment of adherence to the MedMD based on the validated 14-point score, also in British population. A score greater than or equal to 9 points is a good level of adherence, values less than or equal to 8 are considered poor adherence. During 6 months in the consultations they are given monthly appointments with weight and glycemia control, insisting on diet and lifestyles, referencing the foods of the DMed.

Item 8 (Do you drink wine? How much do you consume per week?) is the one that assesses alcohol consumption, specifically through weekly wine consumption ( $\geq 7$  or more glasses per week = 1 point).

### Statistic Analysis

The statistical analysis was performed with the statistical package SPSS® (Statistical Package for Social Sciences) in its version 24.0. A descriptive analysis of the variables of interest was carried out, in which their distribution was observed in order to define cut-off points. To measure adherence to MedDM, the MEDAS-14 was assessed, classifying the participants into two categories: high adherence for a score  $\geq 9$ , and low adherence if  $< 9$ . The qualitative variables were presented through the frequency distribution of the percentages of each category while in the quantitative variables it was explored whether or not they followed a normal distribution using the Kolmogorov-Smirnov test, and indicators of central tendency (mean or median) and dispersion (standard deviation or percentiles) were given. The association between these factors was investigated using hypothesis contrast tests, with comparison of proportions when both were qualitative (Chi square, Fisher's exact test); comparisons of means when one of them was quantitative (Student's t test, ANOVA), and if they did not follow a normal distribution, the Mann-Whitney U test, Kruskal-Wallis and Friedman in the case of repeated measures. Linear regression tests were performed when the dependent variable was quantitative. In the case of qualitative variables, the Relative Risk (RR) was calculated for the different proportions and their CIs. The analysis was complemented with graphic representations. The statistical significance level for this study was  $p \leq 0.05$ .

### Ethical Aspects

The study was carried out following the recognized Ethics Standards and the Standards of Good Clinical Practice. The data was protected from uses not permitted by persons unrelated to the investigation and confidentiality was respected regarding the Protection of Personal Data and Law 41/2002, of November 14, the basic law regulating patient autonomy and rights. And obligations regarding information and clinical documentation. Therefore, the information generated in this study has been considered strictly confidential, between the participating parties.

### Results

Throughout the 12 months (6 months of intervention and 6

months of post-intervention), 93 diabetic adult patients participated, of whom 60% were women with a mean age of  $64 \pm 9$  years. The BMI at the beginning was  $32 \text{ kg/m}^2$  (grade I obesity), with a basal glycemia of  $158 \text{ mg/dl}$  and a mean glycosylated hemoglobin of 7.88% (poor glycemic control). That is, the patients presented diabetes with poor metabolic control.

### Pre-Intervention MEDAS-14 Score

The initial score of the MedD adherence survey (MEDAS-14) was  $7.44 \pm 0.22$  points (optimum  $\geq 9$  points), with initial adherence being higher in women (7.66 points) than in men (7.1 points).

Table 1 represents each of the MEDAS-14 items that were initially answered affirmatively according to gender.

There is initially a high consumption of the following foods: a) Olive oil (84%), using 2 or more tablespoons per day in 60% of the patients; b) Sugary drinks (80%) more than one a day; c) Butter, margarine or cream (79%) more than one serving (12g) per day; d) Non-homemade commercial confectionery (73%) more than 3 times a week; e) Legumes (75%) three servings (450g) or more per week; f) Wine (69%) three or more glasses per week; g) Vegetables or vegetables (61%) two or more servings per day. An average consumption of: h) Red meat (56%) more than one serving (100-150g) per day; i) Fruits (55%) three or more pieces a day; j) Stir-fried (54%) two or more times a week; k) Chicken, turkey or rabbit meat (50%). And a low consumption: l) Fish (39%) three servings (300-450g) or 12-15 pieces of shellfish weekly; m) Nuts (18%) one serving (30 g) per week.

Significant differences between sexes are observed in 5 items (3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, 11<sup>th</sup> and 13<sup>th</sup>): in women the consumption of fruits (38%), vegetables (31%) and white meat (29%) is higher, and in men the consumption of red meat (92.5%) and commercial confectionery (95%). In both sexes the consumption of nuts was equally low (22%).

### Post-Intervention MEDAS-14 Score

The final score of the MedDM adherence survey (MEDAS-14) was  $8.55 \pm 1.7$  points, with adherence increasing more in men (8.7 points) than in women (8.4 points).

**Table 1:** MEDAS-14 items answered affirmatively by sex. Source: self made.

ITEMS MEDAS-14	MAN	WOMAN	TOTAL	p
1. Olive oil I	36,6% (n=34)	47,3% (n=44)	83,9% (n=78)	NS
2. Olive oil II	25,8% (n=24)	34,4% (n=32)	60,2% (n=56)	NS
3. Vegetable	29,6% (n=27)	31,2% (n=29)	(61,2% (n=56)	<0,033
4. Fruit	17,2% (n=16)	37,6% (n=35)	54,8% (n=51)	<0,053
5. Red meat	7,5% (n=7)	36,6% (n=34)	44,1% (n=41)	<0,000
6. Butter	3,2% (n=3)	18,3% (n=17)	21,5% (n=20)	NS
7. Sugary drinks	7,5% (n=7)	12,9% (n=12)	20,4% (n=19)	NS
8. Wine	23,7% (n=22)	45,2% (n=42)	68,9% (n=64)	NS
9. Legumes	32,3% (n=30)	43% (n=40)	75,3% (n=70)	NS
10. Fish	19,4% (n=18)	19,4% (n=18)	38,8% (n=36)	NS
11. Pastry	5,4% (n=5)	21,5% (n=20)	26,9% (n=25)	<0,015
12. Nuts	6,5% (n=6)	11,8% (n=11)	18,3% (n=17)	NS
13. White meat	20,4% (n=19)	29,1% (n=27)	49,5% (n=46)	<0,0466
14. Sauté	19,4% (n=18)	34,4% (n=32)	53,8% (n=50)	NS



**Table 2:** Final MEDAS-14 items affirmative, by sex. Source: self made.

ITEMS MEDAS-14	HOMBRE	MUJER	TOTAL	P
1. Olive oil I	34,4% (n=32)	54,8% (n=51)	89,2% (n=83)	NS
2. Olive oil II	37,6% (n=35)	49,5% (n=46)	87,1% (n=81)	NS
3. Vegetable	31,2% (n=29)	52,7% (n=49)	83,9% (n=78)	NS
4. Fruit	17,2% (n=16)	38,7% (n=36)	55,9% (n=52)	<0,037
5. Red meat	24,7% (n=23)	40,9% (n=38)	65,6% (n=61)	NS
6. Butter	18,3% (n=17)	34,4% (n=32)	52,7% (n=49)	<0,009
7. Sugary drinks	23,7% (n=22)	20,4% (n=19)	44,1% (n=41)	<0,013
8. Wine	23,7% (n=22)	34,4% (n=32)	58,1% (n=52)	NS
9. Legumes	33,3% (n=31)	51,6% (n=48)	84,9% (n=79)	NS
10. Fish	15,1% (n=14)	24,7% (n=23)	39,8% (n=37)	NS
11. Pastry	24,7% (n=23)	25,8% (n=24)	50,5% (n=47)	<0,053
12. Nuts	22,6% (n=21)	22,6% (n=21)	45,2% (n=42)	<0,053
13. White meat	32,3% (n=30)	52,7% (n=49)	85% (n=79)	NS
14. Sauté	36,6% (n=34)	37,6% (n=35)	74,2% (n=69)	<0,001

Table 2 shows each of the items of the MEDAS-14 questionnaire that were answered affirmatively after the nutritional intervention according to sex. Being statistically significant ( $p < 0.005$ ) 6 of the 14 items (item no. 4, 6, 7, 11, 12 and 14).

There is a high consumption of the following foods: a) Olive oil (89%) as the main fat for cooking, using 2 or more tablespoons per day in 87% of the patients; b) Legumes (85%) three servings (450 g) or more per week; c) Vegetables or vegetables (84%) two or more servings per day; d) Chicken, turkey or rabbit meat (85%); e) Stir-fried (74%) two or more times a week; There is an average consumption of: f) Wine (58%) three or more glasses per week; g) Fruit (56%) three or more pieces a day; Sugary drinks (56%) more than one a day; h) Non-homemade commercial confectionery (49.5%) more than 3 times a week; i) Butter, margarine or cream (47%) more than one serving (12 g) per day; j) Nuts (45%) one serving (30g) per week. There is a low consumption of: k) Fish (40%) three servings (300-450g) or 12-15 pieces of shellfish a week.

**Comparison of Pre- and Post-Intervention Data**

After 6 months of the nutritional educational intervention given from PC, adherence to the DMed has increased by  $1.09 \pm 2.56$  points (8.55 points). Men being those who present 0.4 points more (8.7 points) than women (8.4 points).

Figure 2 shows the evolution of adherence to the MedD in T2DM before and after the intervention. At a global level, the greatest changes have been in relation to the increase in the consumption of white meat (35.5%), olive oil (27%), nuts (26.9%), vegetables (22.7%), stir-fry (20.4%), legumes (9.6%), decreased consumption of butter (31.5%) and decreased consumption of carbonated beverages (23.7%), pastries (23.6%), red meat (21.5%) and wine (10.8%).

Figures 3 and 4 show the evolution in adherence to the DMed according to sex: In women the consumption of white meat (23.6%), vegetables (21.5%), oil olive (15%), nuts (10.8%), legumes (8.6%), stir-fry (3.2%) and the consumption of butter (16%), wine (10.8%), carbonated drinks (7.5%), red meat (4.3%) and pastries (4.3%). In men, the consumption of stir-fry (17.2%), nuts (16.1%), olive oil (12%), white meat (12%), vegetables (1.6%) has increased), legumes (1%) and the consumption

1. ¿Usa usted el aceite de oliva como principal grasa para cocinar? Si = 1 punto

2. ¿Cuanto aceite de oliva consume en total al día (incluyendo el usado para freír, comidas fuera de casa, ensaladas, etc.)? 4 o más cucharadas = 1 punto

3. ¿Cuántas raciones de verdura u hortalizas consume al día? (los guarniciones o acompañamientos = 1/2 ración) 1 ración = 200g. 2 o más (al menos una de ellas en ensalada o crudas) = 1 punto

4. ¿Cuántas piezas de fruta (incluyendo zumo natural) consume al día? 3 o más al día = 1 punto

5. ¿Cuántas raciones de carnes rojas, hamburguesas, salchichas o embutidos consume al día? (ración: 100 - 150 g) menos de 1 al día = 1 punto

6. ¿Cuántas raciones de mantequilla, margarina o nata consume al día? (porción individual: 12 g) menos de 1 al día = 1 punto

7. ¿Cuántas bebidas carbonatadas y/o azucaradas (refrescos, colas, tónicas, bitter) consume al día? menos de 1 al día = 1 punto

8. ¿Bebe usted vino? ¿Cuánto consume a la semana? 7 o más vasos a la semana = 1 punto

9. ¿Cuántas raciones de legumbres consume a la semana? (1 plato o ración de 150 g) 3 o más a la semana = 1 punto

10. ¿Cuántas raciones de pescado-mariscos consume a la semana? (1 plato pieza o ración: 100 - 150 de pescado o 4-5 piezas o 200 g de mariscos) 3 o más a la semana = 1 punto

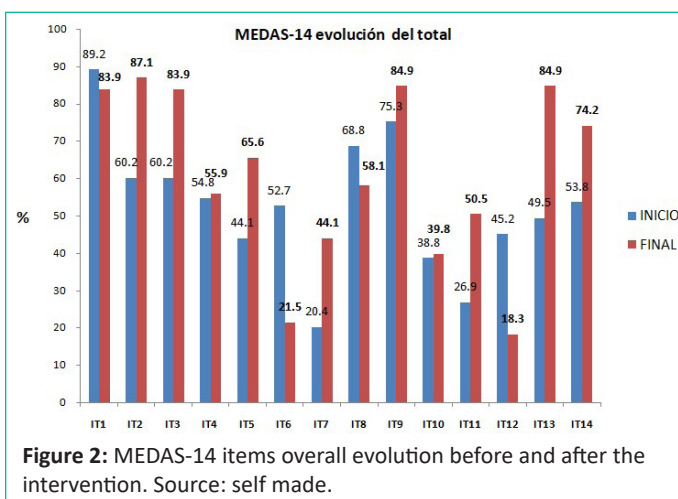
11. ¿Cuántas veces consume repostería comercial (no casera) como galletas, flanes, dulce o pasteles a la semana? menos de 2 a la semana = 1 punto

12. ¿Cuántas veces consume frutos secos a la semana? (ración 30 g) 3 o más a la semana = 1 punto

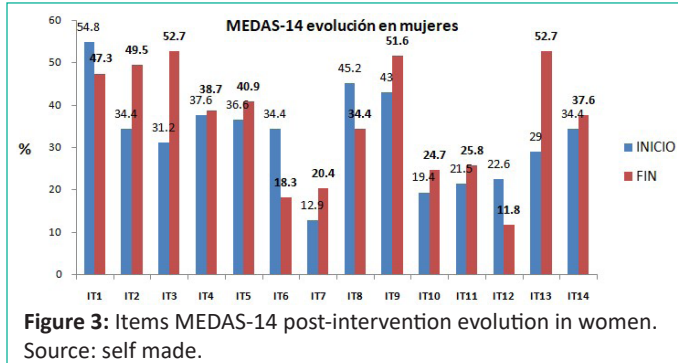
13. ¿Consume usted preferentemente carne de pollo, pavo o conejo en vez de ternera, cerdo, hamburguesas o salchichas? (carne de pollo: 1 pieza o ración de 100 - 150 g) Si = 1 punto

14. ¿Cuántas veces a la semana consume los vegetales cocinados, la pasta, arroz u otros platos aderezados con salsa de tomate, ajo, cebolla o puerro elaborada a fuego lento con aceite de oliva (sofrito)? 2 o más a la semana = 1 punto

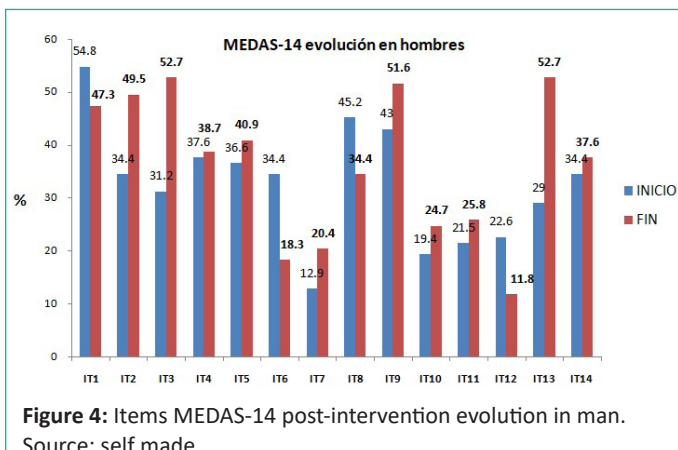
**Figure 1:** MedD adherence test (MEDAS-14) from the PREDIMED study.



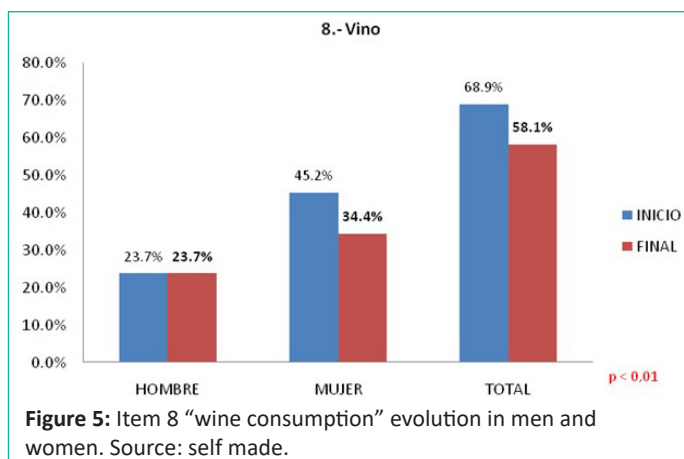
**Figure 2:** MEDAS-14 items overall evolution before and after the intervention. Source: self made.



**Figure 3:** Items MEDAS-14 post-intervention evolution in women. Source: self made.



**Figure 4:** Items MEDAS-14 post-intervention evolution in man. Source: self made.



**Figure 5:** Item 8 "wine consumption" evolution in men and women. Source: self made.

of pastries (19.3%), red meat (17.2%), carbonated beverages (16.2%), butter (15%), unchanged wine consumption.

Specifically, Figure 5 shows the evolution in pre- and post-intervention wine consumption based on sex, showing that it has decreased by 11% in women and has been maintained in men.

## Discussion

Today, the relationship between MedDM and its benefits on CVRF (DM2, HBP, Obesity, dyslipidemia and smoking) and on alcoholism is accepted and documented [21-23], since the origin of many diseases are inadequate lifestyle habits. Therefore, currently being recognized as one of the healthiest dietary patterns, it is being imposed as an alternative worldwide for the control of CVD [7,13,14,23].

In this work, it is shown that patients with poorly controlled DM2 have low adherence to the initial MedDM (7.21 points), adherence to the MedMD of women was higher (7.66 points) than adherence of the men (7.1 points). These findings are consistent with previous studies such as the Spanish EPIC cohort [24] (n=41,078), the SUN study [25,26] (n=13,609) and the ENRICA [27] study (n=12,948), in which a healthier diet was observed in women. In the PREDIMED [29] and PREDIMED-PLUS [30] studies, respectively, MEDAS-14 scores of 8 points and MEDAS-17 scores of 8.7 points were obtained, without specifying by sex.

In our study, when breaking down the 14 items of the MEDAS-14 questionnaire, significant differences ( $p < 0.001$ ) were observed between sexes, the consumption of fruits, vegetables, white meat and wine being higher in women. In men, however, the consumption of red meat and commercial pastries was higher. The low consumption of nuts is the same. In other words, women initially have healthier habits than men.

Sociodemographic characteristics similar to the study by Torres [28], since in patients diagnosed with DM2, it was observed that the consumption of alcoholic beverages in one day predominated in women with 52.8% and a mean of 4.1 drinks and an AUDIT questionnaire score, of 8.5. In contrast, in the DIME-EAHFE [31] study, the analysis shows that older age and the greater presence of cardiac failure in women justify a lower consumption of oil, wine, legumes, nuts and stir-fry, as well as a higher consumption of fish. In turn, the 2011 National Addiction Survey (ENA) showed a higher proportion in men than in women (72.2% of men and 42.7% of women aged 12 to 65 in urban areas who consumed alcohol in the last year) [32].

In our study we can observe how a minimal educational intervention in favor of MedD, without modifying other treat-

ments or imposing a hypocaloric diet, increases the degree of adherence from 7.44 to 8.55 points. A modification of eating habits is achieved in both sexes, with a greater consumption of healthy foods, a decrease in processed foods and in women weekly wine. This improves the glycemic parameters: basal glucose (from 157.6mg/dl to 126mg/dl) and glycosylated hemoglobin (from 7.8% to 6.9%).

Despite the fact that women initially presented 0.56 points more (MEDAS-14), after the nutritional intervention, adherence improved somewhat more in men (8.7 points) than in women (8.4 points), increasing almost 2 points and 1 point respectively, however, wine consumption did not change in men, showing that despite its good predisposition, it is the most difficult habit to change in them. Similar results to the study by Mora et al [33] carried out in the region of Murcia, since from the perspective of motivational adequacy, it was shown that males and adolescents with lower BMI are those who are more motivated, with lower alcohol consumption, increasing this motivation as adolescents are more physically active. Unlike what was observed by Sánchez Villegas et al [33] in that women were more compliant.

In short, a nutritional educational intervention from primary care will improve adherence to MedDM, and this will imply better overall control of diabetics, since, as the Lyon Diet Heart [34] study or PREDIMED [29] and PREDIMED-PLUS [30] showed, better adherence to MedDM (11-17 points) had inverse associations with hypertension, dyslipidemia, and obesity.

## Conclusions

People with diabetes and poor metabolic control present poor initial adherence to the MedDM, highlighting a high level of wine in both sexes, increasing their cardiovascular risk. By approaching it holistically and individually through a nutritional dietary intervention that promotes this MedDM, it has been shown to improve adherence to the MedDM, reducing wine consumption in these patients, and thereby optimizing their metabolic control.

Due to the fact that the efficacy of a MedDM pattern that recommends moderate but not excessive consumption of wine with meals has been demonstrated, in the prevention of CVD, greater attention should be paid to hygienic-dietary measures, through dietary interventions from an approach multidisciplinary from primary care, to promote the Mediterranean lifestyle and achieve from childhood the acquisition of eating habits as a guarantee of a healthier lifestyle, which reduces morbidity and mortality due to CVD and improves the quality of life of diabetics.

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