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Original/*Otros*

Predictors of adherence to the Mediterranean diet from the first to the second trimester of pregnancy

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Abstract

Background: **Although changes in eating patterns may occur during gestation, predictors of these changes have not been explored. This study aimed to identify predictors of adherence to the Mediterranean diet (MD) from the first to second trimester of pregnancy.**

Methods: **A prospective study was conducted with 102 pregnant women aged 18-40, from the city of Porto, Portugal. Socio-demographic and lifestyle characteristics were assessed through a questionnaire. Food consumption was assessed with a three-day food diary completed during the first and second trimesters. Participants were categorized according to their change in adherence to the MD into the *negative change* group (i.e., women who had low adherence in each trimester or had high adherence in the first trimester and then low adherence in the second) and the *positive change* group (i.e., women who had high adherence in both trimesters or had low adherence in the first trimester and then high adherence in the second). Conditional stepwise logistic regression models were performed to assess the potential predictors of negative MD change.**

Results: **Among the 102 women, 39.2% had negative change from the first to the second trimester. The logistic model´s results show that being married (OR=0.26, 95%CI: 0.10, 0.76) and having a higher intake of vegetables in the first trimester (OR=0.17, 95%CI: 0.10, 0.43) were associated with lower odds of having a negative change in adherence to the MD from the first to second trimester.**

Conclusion: **Marital status and vegetable consumption seem to be associated with a lower occurrence of negative change in adherence to the MD from early to middle pregnancy.**

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Key words: *Pregnant women. Diet change. Mediterranean diet. Prospective study.*

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LOS PREDICTORES DE LA LA DIETA MEDITERRÁNEA DESDE EL PRIMERO HASTA EL SEGUNDO TRIMESTRE DEL EMBARAZO

Resumen

Introducción: **Aunque los cambios en los patrones pueden ocurrir durante la gestación, predictores de estos cambios no han sido exploradas. Este estudio pretende identificar predictores de la adhesión a la dieta mediterránea (DM) desde el primer al segundo trimestre del embarazo.**

Metodología: **Se realizó un estudio prospectivo con 102 embarazadas de edad 18-40, de la ciudad de Oporto, Portugal. Se evaluaron las características socio-demográficas y de estilo de vida a través de un cuestionario. Consumo de alimentos se evaluó con un diario de alimentos de tres días concluido durante los primeras y segundo trimestres. Los participantes fueron categorizados según su cambio en la adhesión a la DM en el cambio negativo (es decir, las mujeres que tenían poca adhesión en cada trimestre o tenido alta adhesión en el primer trimestre y luego baja adhesión en el segundo) y el grupo de cambio positivo (es decir, las mujeres que tenían alta adhesión en ambos trimestres o tenía baja adhesión en el primer trimestre y luego elevada adhesión en el segundo). Modelos de regresión logística stepwise condicional se realizaron para evaluar los posibles predictores de la variación negativa de DM.**

Resultados: **Entre las 102 mujeres, 39,2% tenían cambio negativo del primer al segundo trimestre. Los resultados model´s logística muestran que estar casada (OR = 0,26, IC95%: 0,10, 0,76) y tener una mayor ingesta de verduras en el primer trimestre (OR = 0,17, IC95%: 0,10, 0,43) se asociaron con menor probabilidad de tener un cambio negativo en la adhesión a la DM del primer al segundo trimestre.**

Conclusiones: **Estado civil y el consumo de vegetal parecen estar asociado con una menor ocurrencia de cambio negativo en la adhesión a la MD desde temprano a medio embarazo.**

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Palabras clave: *Embarazadas. Cambio de dieta. Dieta mediterránea. Estudio prospectivo.*

Abbreviations

BMI: body mass index.
CI: confidence interval.
MUFA: monounsaturated fatty acids.
PPAQ: pregnancy physical activity questionnaire.
OR: odds ratio.
SFA: saturated fatty acids.

Introduction

Maternal dietary intake during pregnancy plays a critical role in the outcomes of pregnancy, fetal growth and development, birth outcomes, and childhood health. The potential benefits of the Mediterranean diet during pregnancy have been described as a lower risk of excessive weight gain[1,2], reduced risk of preterm birth[3], higher levels of serum and red blood cell folate and serum vitamin B12, lower plasma homocysteine[4] and high-sensitivity C-reactive protein plasma concentrations[5]. On the other hand, low adherence to Mediterranean diet was associated with increased risk of offspring with spina bifida[4] and decreased intra-uterine size with a lower placental and birth weight[5]. Furthermore, maternal diets with a low Mediterranean diet adherence score during the first trimester may negatively affect neonatal insulin and HOMA-IR-levels[6]. The adherence to a healthy dietary pattern, such as Mediterranean diet, during pregnancy may be affected by several factors other than the nutritional requirements that are intrinsic to gestation. Evidence suggests that pregnant women with a higher educational level, higher age, higher income, and lower parity had increased adherence to a healthy dietary pattern[7-9]. Dietary changes over the course of a pregnancy may occur after women know they are pregnant or after their first prenatal visit[10] and may affect pregnancy outcomes[11]. Furthermore, the eating pattern adopted during pregnancy may be maintained after childbirth[12] and thus may affect the mother's health. It has been widely described that the Mediterranean dietary pattern offers a protective effect against cardiovascular disease, cancer, and other degenerative diseases[13-15].

However, to our knowledge, no study has explored the potential predictors of change in adherence to the Mediterranean diet during pregnancy. Thus, the objective of this study was to identify the predictors of adherence to this diet from the first to the second trimester of pregnancy.

Methods

Sampling

Data for the present prospective study came from a sample of pregnant women attending outpatient obstetrics clinics at São João Hospital in Porto, Portugal. Women were invited to participate when they came in for their first ultrasound evaluation screening. The recruitment was made consecutively from July 2010 to May 2012. From those who agreed to participate, data were collected in the first trimester between the tenth and twelfth weeks of gestation (at the time of baseline assessment) and again in the second trimester between the twentieth and twenty-second weeks (at the time of the second ultrasound).

The inclusion criteria used in this study were a spontaneous pregnancy and a gestational age of 10-12 weeks at baseline, as confirmed by ultrasound. Women were considered ineligible if they had severe heart disease (including symptoms of angina, myocardial infarction, or arrhythmia), persistent bleeding after 12 weeks of gestation, multiple pregnancies, poorly controlled thyroid disease, pregnancy-induced hypertension or preeclampsia, diabetes or gestational diabetes, an age of less than 18 or over 40 years, and lack of competence in the Portuguese language or any type of cognitive inability that would prevent them from answering a questionnaire.

A total of 137 pregnant women were invited to participate in this study, and 134 (participation rate: 97.8%) agreed to take part. Some of the 134 participants were subsequently excluded because of miscarriage (n=1), no singleton pregnancy (n=2), and age (n=1). Furthermore, 28 (20.9%) more were excluded because they did not provide their dietary data for each trimester. Thus, the final sample, which included women who participated in both trimesters and provided a three-day food record for each trimester, consisted of 102 women. Women who were excluded from the study did not differ significantly from those who were included in terms of age, educational level, marital status (single/divorced and married/cohabitate), monthly income, pre-pregnancy body mass index (BMI) and parity ($P>0.05$, for all).

All participants in this study were informed of its objectives and provided written informed consent. The study was approved by the Ethics Committee of the Hospital de São João (Reference No. 09988), and it was conducted in accordance with the World Medical Association's Helsinki Declaration for Human Studies.

Dietary assessment

Dietary intake was assessed by a three-day food diary that included two weekdays plus one weekend day, and was completed for each trimester. Oral and written instructions on how to complete the diary were given to the women by a trained nutritionist. Food portion sizes and beverages consumed were estimated using household measures (cups, glasses, spoons, slices, food wrappers, containers, etc.) as an aid in determining serving sizes. A description of each food and beverage consumed was recorded, including the method of preparation, the time it was eaten (to the

nearest five minutes), location, and, if appropriate, the brand name of the product. The nutrient analysis was performed using the software Food Processor SQL (ESHA Research Inc., Salem, OR, US). This program relies on nutritional information from the United States that has been adapted for use with typical Portuguese foods and beverages. The nutrient means of the three days were used in the analysis.

The degree of adherence to the Mediterranean diet was calculated according to the revised scale developed by Trichopoulou et al.[16,17]. This scale is based on nine components (vegetables, legumes, fruits and nuts, cereals, fish, meat and meat products, dairy products, alcohol and fat). The fat component was expressed as the ratio of monounsaturated (MUFA) to saturated (SFA) fatty acids. For the beneficial components (vegetables, legumes, fruits and nuts, cereals, fish, and fat), a value of 1 was given to women with a consumption intake (g/day) equal to or above the median of the total sample and a value of zero for a daily intake below the median. For the detrimental components (meat and meat products, dairy products), a value of 1 was given to women with a consumption intake (g/day) below the median of the total sample and a value of zero for a daily intake equal to or above the median. Ethanol was not included in the calculations for the total score of adherence to the Mediterranean diet due to none of the women in our sample reporting alcohol consumption[18]. Thus, the Mediterranean diet score was calculated by the sum of the eight components, and ranged between 0 (minimal adherence) to 8 (maximal adherence). Then, based on the total score, each woman was categorized into one of two groups for each trimester: low adherence (<4 points) or high adherence (≥4 points). Furthermore, the sample was divided into two groups according to the change in adherence to the Mediterranean diet: women who had low adherence in each trimester (n=19) or had high adherence in the first trimester and then low adherence in the second (n=21) were categorized in the *negative change* group, while women who had high adherence in both trimesters (n=46) or had low adherence in the first trimester and then high adherence in the second (n=16) were categorized in the *positive change* group.

Assessment of socio-demographic and maternal lifestyle characteristics

Data were collected at the time of the first ultrasound (baseline) by researchers who administered structured and self-reported questionnaires. The questionnaires were designed to cover personal and socio-demographic data and lifestyle variables.

Height was measured to the nearest mm in bare or stocking feet, with participants standing upright against a Holtain Portable Stadiometer (Crymych, Pembrokeshire, UK). Weight at baseline was measured to the nearest 0.10 kg, with participants lightly dressed (underwear and t-shirt) and with the use of a portable digital beam scale (Tanita Inner Scan BC 532, Tokyo, Japan). Weight gain was computed as the difference between weight before pregnancy and weight assessed at baseline divided by weeks of gestation at the time of measurement.

Pre-pregnancy BMI was estimated by using the ratio of weight/height^2 (kg/m^2) with a self-reported pre-pregnancy weight. Participants were classified as non-overweight, overweight, or obese according to World Health Organization criteria[19]. The underweight participants (1%) were combined with the normal weight participants in the non-overweight category due to the fact that the former represented such a small proportion of the overall sample.

Professional status was assessed via a self-reported questionnaire, and the participants were divided into three categories: *employed* (full- or part-time), *unemployed*, and *student*. Since only two subjects fell into the *student* category, they were pooled with the members of the *employed* category.

Each respondent was asked to estimate the total income (including pensions, allowances, and investments) received by all household members in the last month by using a single measure comprised of three narrowly-ranged income categories: < 500 Euros, [500-1250] Euros and ≥1250 Euros.

For the variable educational level, subjects were divided into three categories that reflected the organization of the Portuguese educational system: *mandatory or less* (≤9 school years), *secondary* (10 to 12 school years), and *college/university* (>12 school years).

Concerning parity, women were considered primiparous if this was their first gestation and multiparous if they had at least one previous gestation.

Information regarding physical activity was gathered with the Pregnancy Physical Activity Questionnaire (PPAQ) validated by Chasan-Taber et al.[20]. PPAQ is a self-reported questionnaire that evaluates the type, duration, and frequency of physical activities performed by pregnant women. Respondents were asked to select the category that best approximated the amount of time they spent per day or per week on various activities during the first trimester. Possible durations ranged from 0 to 6 or more hours per day and from 0 to 3 or more hours per week. At the end of the questionnaire, an open-ended section allowed respondents to add activities not already listed. Each activity was classified according to intensity: sedentary (<1.5 METs), light (1.5-3.0 METs), moderate (3.1-6.0 METs), or vigorous (>6.0 METs). Time reportedly spent on each activity was then multiplied by the activity's intensity to achieve a measure of average weekly energy expended (MET hours.week^1).

Anxiety was measured using the Zung Self-rating Anxiety Scale[21] that was translated into Portuguese by Ponciano et al.[22]. This scale comprises of 20 statements with 4 answer choices per question. The total score ranges between 20 and 80. Higher values correspond to worse states of anxiety. Women were catego-

rized according to their total score into anxious (40-80 points) or non-anxious (20-39 points).

Women were considered to have nutritional counselling and current pregnancy planned if they gave a positive answer to these specific questions: *Are you attending nutritional counseling during your first trimester*? *Was the current pregnancy planned?* Regarding smoking habits, women were classified as smokers if they smoked at least one cigarette a day during the first trimester.

Statistical analysis

The outcome variable of interest was defined as having negative change in adherence to the Mediterranean diet from the first to the second trimester. The potential predictors were pre-pregnancy BMI, weight gain rate, baseline physical activity, age, educational level, marital status, professional status, monthly income, smoking, parity, nutritional counseling, anxiety, current pregnancy planned, baseline consumption of fruits, vegetables, meat, fish, legumes, cereals, and dairy, the MUFA/SFA ratio, and the baseline score of adherence to the Mediterranean diet.

The Kolmogorov-Smirnov test was used to verify the variables' normality. An independent-samples t-test or the Mann–Whitney test was performed to compare continuous variables between groups, while the χ^2 test was used for categorical variables. A paired t-test or Wilcoxon test was used to compare paired continuous variables. A univariate logistic regression model was fitted to verify the relationships between negative change and each potential predictor (Supplemental file 1). Variables from the univariate analysis with $P \leq 0.25$ were considered potential independent variables and were thus entered into the logistic regression model as candidate variables for inclusion[23,24]. Then, we used a conditional stepwise logistic regression model to identify significant variables associated with negative change in adherence to the Mediterranean diet from the first to the second trimester. A cut-off value of $P < 0.05$ was used to determine which variables to include in the multivariate model.

An odds ratio (OR) lower than one expresses an optimal attainment of the Mediterranean diet from the first to the second trimester, whereas an OR greater than 1 means lower success and higher odds for negative change.

A P value of <0.05 was regarded as significant. All analyses were performed using the statistical software package IBM SPSS Statistics Version 22.

Results

Among the 102 women, 34.3% and 39.2% had low adherence to the Mediterranean diet during the first and second trimester, respectively; furthermore, 39.2% had negative change from the first to the second trimester. table I shows the baseline characteristics of the participants according to change in adherence to the Mediterranean diet from the first to second trimester. Participants in the positive group were less anxious, and a higher proportion of them were married compared to participants in the negative group ($P < 0.05$ for all). No significant differences were seen in age, weight gain, physical activity, pre-pregnancy BMI, educational level, professional status, monthly income, smoking, parity, nutritional counseling, or current pregnancy planned across groups.

As shown in table II, the women had higher energy (1894.0±462.4 kcal/day vs. 1713.7±401.6 kcal/day, $P<0.001$), MUFA intake (23.3(18.0-28.1) g/day vs. 20.4(16.4-24.1) g/day) in the second trimester than they had in the first trimester. According to changes in adherence to the Mediterranean diet from the first to second trimester, women in the negative group had a lower intake of fruits and nuts and, vegetables and a lower Mediterranean diet score at baseline compared to the positive group ($P<0.05$, for all).

Figure 1 displays the proportion of women by the median of total the sample for components of the Mediterranean diet and the Mediterranean diet score during the first trimester according to changes in Mediterranean diet adherence from the first to second trimester. A lower proportion of the participants in the negative group consumed above or equal to the median for fruits and nuts (32.5% vs. 64.5%, $P=0.002$) and vegetables (30% vs. 69.4%, $P<0.001$) compared to the participants in the positive group.

The variables that remained in the model after the conditional stepwise method are presented in table III. Being married (OR= 0.26 95%CI: 0.10, 0.76) and having a higher intake of vegetables during the first trimester (OR= 0.17 95%CI: 0.10, 0.43) were associated with lower odds of having negative change in adherence to the Mediterranean diet from the first to second trimester.

Discussion

This prospective study explored the predictors associated with higher accomplishment adhering to the Mediterranean diet from the first to second trimester of pregnancy. Results showed that being married and having a higher vegetable intake during the first trimester predicted lower odds of not following adherence to the Mediterranean diet from the first to second trimester.

To our knowledge, this is the first study to explore factors associated with changes in adherence to the Mediterranean diet during pregnancy. Among populations that are not pregnant, determinants of dietary change have been explored by Zazpe et al.[25] whose study aimed to identify predictors of the higher suc-

Table I
Maternal socio-demographic and lifestyle characteristics according to change in adherence to the Mediterranean d iet from the first to second trimester

	*Change in adherence to the Mediterranean diet from the first to second trimester**		P
	Negative (n=40)	*Positive (n=62)*	
Pre-pregnancy BMI (kg/m^2)[c, d]	23.2(21.8-26.6)	23.3(21.3-27.2)	0.956
Weight gain (g/week)[a, b]	224.7±213.3	236.2±227.4	0.799
Total physical activity[†] (MET.hour.week^{-1})[c, d]	242.7(149.3-372.2)	239.8(190.7-348.1)	0.537
	n(%)	n(%)	
Age (years)			
[18, 30]	23(57.5)	24(38.7)	0.063
[31, 40]	17(42.5)	38(61.3)	
Educational level			
Mandatory or less	17(42.5)	17(27.4)	0.134
Secondary	15(37.5)	22(35.5)	
College/university	8(20.0)	23(37.1)	
Marital status[†]			
Single/Divorced	14(35.0)	9(14.5)	0.016
Married/Cohabitate	26(65.0)	53(85.5)	
Professional status[†]			
Unemployed	7(17.5)	10(16.1)	0.856
Employed/Student	33(82.5)	52(83.9)	
Monthly income (€)[†]			
<500	13(32.5)	13(21.0)	0.230
[500-1250[	21(52.5)	32(51.6)	
≥1250	6(15.0)	17(27.4)	
Smoking[†]			
Yes	8(20.0)	8(12.9)	0.336
No	32(80.0)	54(87.1)	
Parity			
Primiparous	27(67.5)	34(54.8)	0.203
Multiparous	13(32.5)	28(45.2)	
Pre-pregnancy weight status			
Non-overweight	25(62.5)	37(59.7)	0.776
Overweight/Obese	15(37.5)	25(40.3)	
Anxiety[†]			
Yes	9(22.5)	5(8.1)	0.039
No	31(77.5)	57(91.9)	
Nutritional counseling[†]			
Yes	2(5.0)	4(6.5)	0.761
No	38(95.0)	58(93.5)	
Current pregnancy planned			
Yes	16(40.0)	17(27.4)	0.185
No	24(60.0)	45(72.6)	

BMI, body mass index.
[a]Data are mean±standard deviation; [b]analysis by Student's *t-test* for continuous variables; [c] data are median (P25-P75); [d] analysis by Mann-Whitney test.
[†]At baseline.

cess of an intervention intended to increase adherence to a Mediterranean diet in individuals who were at high cardiovascular risk and participating in a trial for the primary prevention of cardiovascular disease. Twelve months after the intervention, the results indicated that a low baseline consumption of fruits and vegetables in both men and women, having a family history of cardiovascular disease among men, and being married among women were predictors of successful dietary changes. In contrast with these, our study verified

Table II
Dietary and nutritional characteristics of the sample according to assessed trimesters, and change in adherence to the Mediterranean diet from the first to second trimester

	First trimester (n=102)	*Second trimester (n=102)*	P	*Change in adherence to the Mediterranean diet from the first to second trimester**		P
				Negative (n=40)	*Positive (n=62)*	
Total energy intake (kcal/day)[a]	1713.7±401.6	1894.0±462.4	<0.001[e]	1720.1±321.1	1709.6±448.2	0.898[b]
SFA (g/day)[c]	18.1(14.7-22.7)	18.5(15.523.4)	0.294[f]	19.6(15.0-24.6)	17.0(14.1-21.3)	0.096[d]
MUFA (g/day)[c]	20.4(16.4-24.1)	23.3(18.0-28.1)	0.014[f]	21.6(18.5-24.1)	19.1(15.6-24.1)	0.119[d]
MUFA/SFA (g/day)[c]	1.12(0.95-1.30)	1.17(1.02-1.39)	0.080[f]	1.12(0.95-1.32)	1.11(0.92-1.36)	0.768[d]
Fruits and nuts (g/day)[a]	240.2±147.1	266.6±156.6	0.070[e]	184.9±124.3	275.9±150.5	0.002[b]
Vegetables (g/day)[c]	39.7(11.4-73.9)	54.5(13.1-98.9)	0.071[f]	13.6(6.5-50.7)	50.2(33.3-82.7)	<0.001[d]
Legumes (g/day)[c]	0(0-7.1)	0(0-7.3)	0.387[f]	0(0-7.1)	0(0-8.7)	0.911[d]
Cereals (g/day)[a]	252.0±75.0	261.5±80.5	0.352[e]	250.0±61.1	253.2±83.2	0.832[b]
Fish (g/day)[c]	37.3(0-69.8)	33.3(0-440.4)	0.572[f]	33.3(0-65.0)	39.3(14.6-72.1)	0.228[d]
Dairy products (g/day)[a]	347.6±150.5	336.4±148.8	0.478[e]	339.2±160.2	353.0±145.0	0.655[b]
Meat and meat products (g/day)[a]	127.2±62.0	137.9±58.3	0.150[e]	123.0±58.5	130.0±64.5	0.583[b]
Mediterranean diet score[c]	4(3-5)	4(3-5)	0.681[f]	3.6±1.5	4.3±1.4	0.018[d]

MUFA, monounsaturated fatty acids; SFA, saturated fatty acids. *Values are presented according to dietary intake at first trimester. [a]Data are mean±standard deviation; [b]analysis by Student's *t-test* for continuous variables; [c] data are median (P25-P75); [d] analysis by Mann-Whitney test; [e] analysis by paired t test for continuous variables; [f] analysis by Wilcoxon test.

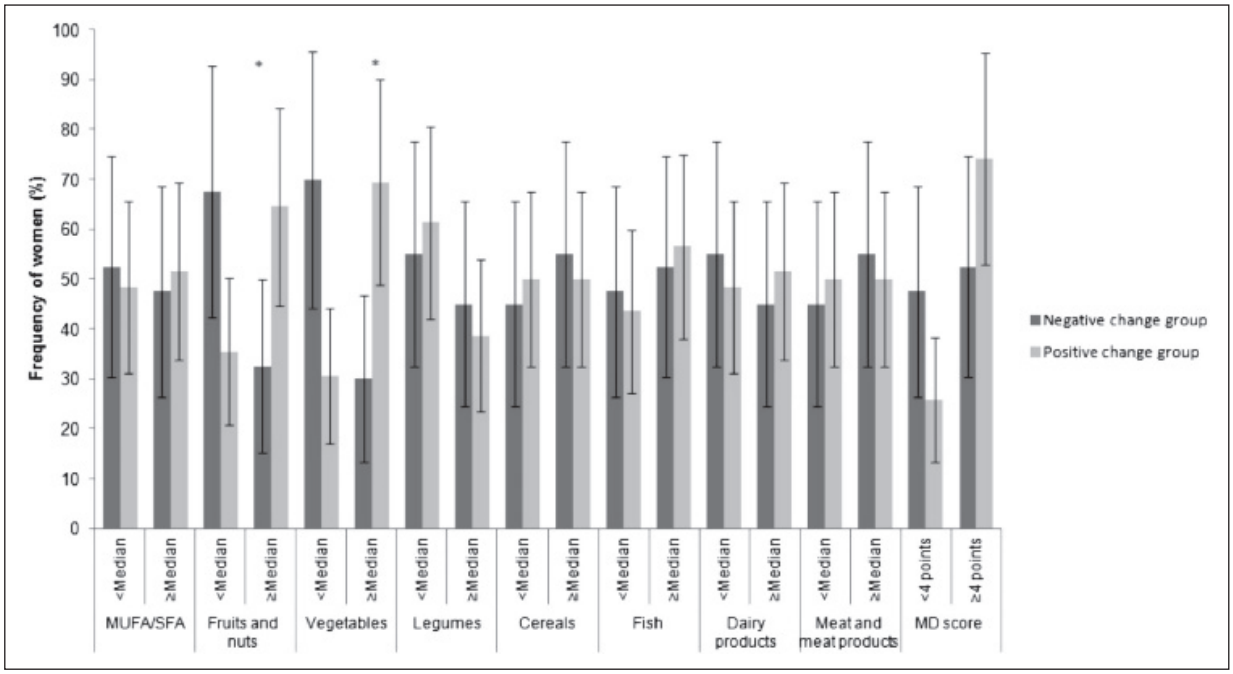

Fig. 1.—Proportion by the median of total the sample for components of the Mediterranean diet and the Mediterranean diet score during the first trimester according to changes in Mediterranean diet adherence from the first to second trimester.
*MD, Mediterranean diet; MUFA, monounsaturated fatty acids; SFA, saturated fatty acids. * P<0.05.*
MUFA/SFA median: 1.12 g/day; Fruits and nuts median: 240.7 g/day; Vegetables median: 39.7 g/day; Legumes median: 0 g/day; Cereals median: 257.7 g/day; Fish median: 37.3 g/day; Dairy products median: 356.0 g/day; Meat and meat products: 130.0 g/day.

Table III
Logistic regression model[a] for factors related to negative change in adherence to the Mediterranean diet from the first to second trimester according to baseline characteristics among pregnant women

	Adjusted OR (95% CI)	P
Marital status		
Single/ Divorced	1 (Ref.)	0.014
Married/Cohabitate	0.26 (0.10, 0.76)	
Vegetables (g/day)[b]		
<Median	1 (Ref.)	<0.001
≥Median	0.17(0.10, 0.43)	

CI, confidence intervals; OR, odds ratio.
[a]Conditional stepwise elimination was used for selecting the variables included in the model.
[b]Median= 39.7 g/day.

lower odds of having a negative change in adherence to the Mediterranean diet with a higher baseline vegetable intake. A reason that may explain this discrepancy is that pregnant women are usually more motivated to change their dietary pattern to respond to gestation requirements and child health and that these changes may occur after they know about their pregnancy[10]. In line with this explanation, Gardner et al[26] reported that perceived benefits for mother and offspring enhanced intentions to increase consumption of fruits and vegetables and to decrease consumption of high-fat foods during pregnancy. Likewise, findings from a study of Belgian women found that pregnant women reported higher intakes of fruits, beef, dairy products, and fat, and a lower intake of alcohol and food products with heightened safety-related risks compared to non-pregnant women[27].

Moreover, in our sample, married women were more likely to follow adherence to the Mediterranean diet from the first to second trimester. It has been described that individuals who live alone may be less motivated to cook for themselves and had an increasing likelihood to skip meals and to eat unhealthy foods[2]. On the other hand, married women are generally responsible for food purchasing and preparing meals[25] and ultimately for controlling the health of other family members[28,29].

In contrast to our results, evidence has been suggested that age, educational level, and income were positively associated with adherence to the Mediterranean diet or to a healthy dietary pattern during pregnancy[7-9]. Discrepancies between these previous studies and ours may due to differences in the study design, the methods of assessing diet, and the fact that the between-subject variability in age, educational level, and income were to small in the present study to find significant associations.

No significant association was observed between pre-pregnancy BMI and adherence to the Mediterranean diet during pregnancy. Although studies examining this relationship are limited, it seems that there is an association between pre-pregnancy BMI weight status and diet quality[30,31]. However, our results and those of other studies suggest no association[12,32].

A highlight of the present study is that the proportion of women who had low adherence in both trimesters or had high adherence in the first trimester and then low adherence in the second is almost 40%. Revealingly, it has been suggested that the diet adopted during pregnancy may be maintained after pregnancy. A study among overweight and obese women reported a decreasing dietary quality for the duration of the pregnancy, which was maintained in early post-partum (4 months after delivery)[12]. Furthermore, the authors of that study demonstrated that the decrease occurred from early pregnancy to 28 weeks of pregnancy, highlighting early pregnancy as a critical stage for targeting dietary interventions. Indeed, as previously described, pregnancy represents a "teachable moment" where the perceived value of healthy eating and exercise is enhanced[33] and where the opportunity to instill positive dietary change is improved.

The present study has limitations that should be acknowledged. First, our relatively low number of participants may have prevented us from identifying small effects[26]. Second, although a wide range of potential predictors were evaluated we acknowledge that other predictors may be associated with our outcome. However, according to evidence, we believe we have accounted for many of them. Third, similarly to other indexes, the Mediterranean diet score has some limitations, such as the variability in defining cut-off points for the scoring components and the lack of agreement over the definition of the Mediterranean diet. Moreover, the population in this study may differ from the population for which the index was originally designed[34,35]. Nevertheless, the worth of the Mediterranean diet indexes has been demonstrated[35], and the benefits' relation with maternal and baby health outcomes has been established[1-6]. Finally, the completion of a food diary may influence or change habitual eating patterns, and the omission of less socially acceptable dietary habits may have occurred[36]. However, women were given oral and written instructions not to change their dietary habits during the recording process and to complete adequate descriptions of their diet regarding the specification of foods, amounts, and cooking methods, which may have improved the quality of information.

In summary, our results suggest that marital status and vegetable intake are associated with a successful adherence to the Mediterranean diet from the first to second trimester. Knowing the factors associated with changes in dietary pattern may help health professionals to identify who is more vulnerable and to persuade them against poor eating choices. Thus, further research is needed to identify other possible factors associated with healthy eating patterns during pregnancy.

Suplemental table

Univariate logistic regression models for factors related to negative change in adherence to the Mediterranean diet from the first to second trimester according to baseline characteristics among pregnant women

	Unadjusted OR (95% CI)	P
Weight gain (g/week)	0.79(0.13, 4.82)	0.796
Total physical activity (MET.h.wk^{-1})	1.00(0.99, 1.00)	0.549
Age (years)		
[18, 30]	1 (Ref.)	0.065
[31, 40]	0.47(0.21, 1.05)	
Educational level		
Mandatory or less	1 (Ref.)	0.141
Secondary	0.68(0.27, 1.75)	
College/university	0.35(0.12, 0.99)	
Marital status		
Single/ Divorced	1 (Ref.)	0.018
Married/Cohabitate	0.32 (0.12, 0.82)	
Professional status		
Unemployed	1 (Ref.)	0.856
Employed /Student	0.91 (0.31, 2.62)	
Monthly income (€)		
<500	1 (Ref.)	0.239
[500 -1250[	0.66(0.26, 1.69)	
≥1250	0.35(0.11, 1.18)	
Smoking (at baseline)		
Yes	1 (Ref.)	0.339
No	0.59(0.20, 1.73)	
Parity		
Primiparous	1 (Ref.)	0.205
Multiparous	0.59(0.26, 1.34)	
Pre-pregnancy weight status		
Non-overweight	1 (Ref.)	0.776
Overweight/Obese	0.89(0.39, 2.01)	
Anxiety (at baseline)		
Yes	1 (Ref.)	0.046
No	0.30(0.09, 0.98)	
Nutritional counseling (at baseline)		
Yes	1 (Ref.)	0.762
No	1.31(0.23, 7.51)	
Current pregnancy planned		
Yes	1 (Ref.)	0.187
No	1.77(0.76, 4.10)	
MUFA/PUFA (g/day)		
<Median	1 (Ref.)	0.685
≥Median	0.85(0.38, 1.88)	
Fruits and nuts (g/day)		
<Median	1 (Ref.)	0.002
≥Median	0.27(0.11, 0.61)	
Vegetables (g/day)		
<Median	1 (Ref.)	<0.001
≥Median	0.19(0.08, 0.45)	
Legumes (g/day)		
<Median	1 (Ref.)	0.529
≥Median	1.30(0.58, 2.90)	

Suplemental table *(cont.)*

Univariate logistic regression models for factors related to negative change in adherence to the Mediterranean diet from the first to second trimester according to baseline characteristics among pregnant women

	Unadjusted OR (95% CI)	P
Cereals (g/day)		
<Median	1 (Ref.)	0.622
≥Median	1.22(0.55, 2.71)	
Fish (g/day)		
<Median	1 (Ref.)	0.695
≥Median	0.85(0.38, 1.89)	
Dairy products (g/day)		
<Median	1 (Ref.)	0.515
≥Median	1.30(0.59, 2.89)	
Meat and meat products (g/day)		
<Median	1 (Ref.)	0.622
≥Median	0.82(0.37, 1.82)	
Mediterranean diet score		
<4 points	1 (Ref.)	0.026
≥4 points	0.38(0.17, 0.89)	

CI, confidence intervals; MUFA, monounsaturated fatty acids; OR, odds ratio; SFA, saturated fatty acids.
MUFA/SFA median: 1.12 g/day; Fruits and nuts median: 240.7 g/day; Vegetables median: 39.7 g/day; Legumes median: 0 g/day; Cereals median: 257.7 g/day; Fish median: 37.3 g/day; Dairy products median: 356.0 g/day; Meat and meat products: 130.0 g/day.

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Conflict of interest statement

The authors declare that they have no conflict of interests.

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