RESEARCH
Original Research: Brief

Association of Dietary Habits with Psychosocial Outcomes in Women with Fibromyalgia: The al-Ándalus Project

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ARTICLE INFORMATION

Article history:
Submitted 8 February 2016
Accepted 21 September 2016
Available online 24 November 2016

Keywords:
Fibromyalgia
Nutrition
Dietary habits
Mental health
Obesity

Supplementary materials:
Figure 1 is available at www.andjrnl.org

http://dx.doi.org/10.1016/j.jand.2016.09.023

ABSTRACT

Background Fibromyalgia (FM) is a complex multidimensional disorder with pain as its main symptom. Fibromyalgia imposes a psychosocial burden on individuals that negatively impacts quality of life. The relationship of dietary habits with these psychosocial aspects is still unclear.

Objective The purpose of this cross-sectional study was to assess dietary habits in a representative sample of women with FM and to explore their association with mental health, depression, and optimism in this population.

Design A cross-sectional study was conducted between November 2011 and January 2013.

Participants The study sample comprised 486 women (ages 35 to 65 years) with FM from Andalucía (southern Spain).

Main outcome measures Mental health, depression, and optimism were evaluated by means of the mental component scale of the 36-item Short-Form Health Survey, the Beck Depression Inventory (BDI-II), and the Life Orientation Test Revised, respectively. A short form of a validated food frequency questionnaire was used to assess dietary habits.

Statistical analyses performed Analysis of covariance was used to assess associations between dietary habits and mental health, depression, and optimism. The presence of severe depression (BDI-II $\geq$29) as a function of dietary habits was examined with logistic regression.

Results A daily or almost-daily consumption of fruit and vegetables and a moderate consumption of fish (2 to 5 servings per week) were associated with higher scores in mental health ($P<0.001$, $P<0.05$, and $P<0.001$, respectively) and lower levels of depression ($P<0.001$, $P<0.01$, and $P<0.01$, respectively). A daily or almost-daily consumption of vegetables and a moderate consumption of dairy products and fish were associated with higher levels of optimism ($P<0.05$, $P<0.05$, and $P<0.001$, respectively). A daily or almost-daily consumption of cured meats and sweetened beverages were associated with higher levels of depression and lower levels of optimism, respectively (both $P<0.05$).

Conclusion The results this study suggest that a daily or almost-daily intake of fruit and vegetables and a moderate intake of fish may be associated with more favorable psychosocial outcomes in women with FM. Conversely, excessive intake of cured meats and sweetened beverages was related to worse scores in optimism and depression outcomes. Future research analyzing dietary patterns as well as intervention studies evaluating the effects of healthy dietary patterns on psychosocial and physical outcomes in individuals with FM are warranted.

J Acad Nutr Diet. 2017;117:422-432.

FIBROMYALGIA (FM) IS A DISEASE CHARACTERIZED BY widespread pain[1] and a constellation of other symptoms and comorbidities[2] that cause a marked deterioration of Health Related Quality of Life (HRQoL), mental well-being, and depression.[3] Consequently, FM represents an important public health issue.[3] Individuals with FM have a remarkably consistent pattern of health status impairment marked by deterioration in physical and psychosocial well-being.[3-5] Moreover, a greater prevalence of overweight and obesity has also been observed,[6] and this finding has been found to be associated with the concurrence of FM symptoms and severity.[2,7,8]

Because no cure is available for FM,[5,9] recent guidelines suggest that the optimal treatment consists of a multidisciplinary approach[5,7,9] with a combination of pharmacological and nonpharmacological treatment modalities.[5] Among

nonpharmacological treatments, dietary intervention is a promising approach.[7] Several studies have demonstrated the importance of specific dietary habits on the mental well-being of the general population.[10-12] A recent review suggests that a treatment program including weight-loss strategies, nutritional education, specific dietary interventions, and the use of targeted nutritional supplements is recommended for individuals with FM.[7] However, little evidence-based information is available to provide nutritional advice for this specific population.[13] Furthermore, the scientific community is concerned about anecdotal nonscientific information related to the potential benefits of some products based on nutritional ingredients or botanicals[14] as well as specific diets with either no conclusive or contradictory results.[7,15-17]

Although most studies have focused on pain, little information is available about the association of dietary habits with psychosocial outcomes. Although pain is the main FM symptom, the disease has been defined as a complex multidimensional disorder, with other important psychosocial symptoms that have a massive impact on the individual's illness perception and quality of life.[18]

Therefore, the aims of this cross-sectional study were (1) to assess the dietary habits in a representative sample of women with FM from southern Spain, and (2) to examine the associations of dietary habits with mental health, depression, and optimism in this population.

METHODS

Study Sample and Design

The study assessments were carried out between November 2011 and January 2013. Briefly, a total of 617 women with FM were recruited through local associations of people with FM (via e-mail, letters, telephone, and University press) from Andalusia (southern Spain). After receiving detailed information about the aims and study procedures, participants signed informed consents before taking part in the study. Inclusion criteria for women with FM were: (1) to be previously diagnosed by a rheumatologist, (2) to meet the 1990 American College of Rheumatology fibromyalgia classification criteria,[1] and (3) to not have acute or terminal illness, or a severe dementia (Mini-Mental State Examination score <10).[19] Thirty-eight women with FM were not previously diagnosed, 92 did not meet the 1990 American College of Rheumatology criteria, and one had severe cognitive impairment. The final sample resulted in a sample size of 486 women with an age range from 35 to 65 years. The study was reviewed and approved by the local Ethics Committee ('Hospital Virgen de las Nieves,' Granada, Spain).

PATIENTS AND PROCEDURES

Sociodemographic Data

Sociodemographic information was recorded using a self-report questionnaire that included date of birth, marital status, educational level, current occupational status, and time since FM diagnosis, among other questions such as smoking status, household members, menstrual status, use of contraceptives, use of hormone replacement therapy, number of children, number of miscarriages, household tasks, and the use of nutritional supplements such as naturalistic (eg, *Plantago ovata*, omega-3 capsules, and so forth) or homeopathic products (eg, *Aconitum* 7CH, *Arnicum* 6CH, 20CH, and so forth).

Anthropometry and Body Composition

A portable eight-polar tactile-electrode bioelectrical impedance device (InBody R20; Biospace) was used to measure weight (kg), body fat (%), and skeletal muscle mass (kg). Height (cm) was measured using a stadiometer (Seca 22). Body mass index was calculated as weight (in kilograms) divided by height squared (in meters) and categorized following the World Health Organization criteria.[20] Waist circumference (cm) was measured, with the participant standing, at the middle point between the ribs and iliac crest (Harpenden anthropometric tape, Holtain Ltd). All measurements were conducted by trained researchers.

Dietary Habits

Dietary habits for the previous year were self-reported through completion of a short form of a validated food frequency questionnaire,[21] in which participants indicated the frequency of consumption (number of times per day, week, month, or year) of 34 foods divided by food groups: fruit, vegetables, dairy products, fish, cereals, pulses, eggs, meat, fats, sweets, beverages, and nuts. Questionnaires were reviewed by research staff, and study participants were asked to fill in any missing responses. Based on this food frequency questionnaire (see Figure 1, available at www.andjrnl.org), the answers were categorized to create three levels of food consumption: a *low-consumption group* for frequencies from never up to 1 serving per week, a *moderate-consumption group* for frequencies from 2 up to 5 servings per week, and a *high-consumption group* for a daily or almost-daily frequency (from 6 servings per week to daily consumption of at least 1 serving).

Mental Health

Mental health was self-reported with the Mental Component of the 36-Item Short-Form Health Survey (SF-36),[22] which has been validated in Spanish populations[23] for the evaluation of HRQoL. The Mental Component is measured by the following dimensions: vitality, mental health, social functioning, and emotional role. The final score for each dimension ranges from 0 to 100, with higher scores corresponding to better mental health.

Depression

The Beck Depression Inventory-II (BDI-II) is a 21-item questionnaire used to assess (self-reported) depressive symptomatology.[24] Participants rated each item from 0 ("not present") up to 3 ("severe") in the context of the past 2 weeks. Thus, the BDI-II score ranges from 0 to 63, with a higher score indicating greater depression. Clinical cutoff scores have been described as follows: a score from 0 to 13 represents none or minimal depression, from 14 to 19 represents mild depression, 20 to 28 represents moderate depression, and ≥ 29 represents severe depression.[25]

Optimism

The Life Orientation Test Revised (LOT-R)[26] assessed the participants' expectations about their future and their

general sense of optimism. This self-reported test comprises 10 items rated on a 5-point Likert scale. The LOT-R score ranges from 6 to 30, with higher scores indicating higher levels of dispositional optimism. Reference values for women aged 45 to 50 years of age are 15.2±3.8 and for women aged 51 to 60 years, 14.4±4.0.[26]

Participants received instructions on how to complete all of the self-administered questionnaires (sociodemographic data, dietary habits, SF-36, BDI-II and LOT-R) by trained researchers.

STATISTICAL ANALYSIS

Descriptive statistics were used to assess the dietary habits, derived from the food frequency questionnaire, of women with FM from the study population. The associations between dietary habits (eg, fish consumption) and mental health, depression, and optimism were examined by one-way analysis of covariance with age and percent body fat as covariates. Whenever there was a significant association, pairwise comparisons with the Bonferroni's correction for multiple comparisons were performed to identify differences across food-frequency groups (ie, low-, moderate-, and high-consumption groups). In addition, standardized effect size statistics were estimated in all of the comparisons among compliance with food consumption categories. Cohen's *d* and its exact confidence interval was used for all (parametric) variables and was interpreted as small (~0.25), moderate (~0.5), or large (~0.8 or greater).[27] The exact confidence intervals for Cohen's *d* were obtained by means of the noncentrality parameter of the noncentral Student's distribution using Wolfram-Mathematica 8.0.[28] The association of dietary habits (independent variables in separate models) was further assessed with the presence of severe depression (BDI-II≥29; dependent variable) with logistic regression after adjustment for age and percent body fat. All analyses were performed using the Statistical Package for Social Sciences[29] and statistical significance was set at α=.05.

RESULTS

A total of 486 women with FM met the inclusion criteria and were included in this study. Data were missing (<3%) on some items of the food frequency questionnaire. The descriptive characteristics of the participants are presented in Table 1. Seventy-three percent of the sample were overweight or obese. Dietary aspects indicated that 21% of the sample followed a diet. Of these individuals, 43% reported following a diet because of a disease or health problem, and 31% reported following a diet for weight-loss reasons. The use of vitamins or other type of supplementation ranged from 8% to 18% of the sample.

The dietary habits of the study participants are shown in Table 2. A daily or almost-daily (6 to 7 times per week) consumption of fruit, dairy products, cereals group (bread, rice, pasta, potatoes), and olive oil were observed in more than 50% of the participants, as well as a moderate consumption (from 2 up to 5 servings per week) of vegetables, fish, pulses, eggs, and meat. Cured meats, sweets, sweetened beverages, butter or margarine, mayonnaise, and alcoholic beverages were occasionally consumed (never or less than 1 serving per week) by most of the sample (53.1%, 45.3%, 74.9%, 81.5%, 99.8%, and 80.0%, respectively). Nut consumption presented a high variability, being slightly higher in the moderate-consumption group (39.5% of participants).

Table 3 shows the association of dietary habits with mental health, optimism, and depression after adjusting for age and percent body fat. Dairy products, cereals, pulses, eggs, meat, cured meats, sweets, sweetened beverages, butter or margarine, mayonnaise, olive oil, alcoholic beverages, and nut consumption were not associated with mental health (all P>0.05). Consumption of fruit (P<0.001), vegetables (P<0.05), and fish (P<0.001) were associated with mental health. Pairwise comparisons showed that the group with a

Table 1. Anthropometric, sociodemographic, and dietary characteristics of women with fibromyalgia (n=486) participating in the al-Ándalus project

Anthropometric and body composition	*mean±SD*[a]
Age (y)	52.2±8.0
Body mass index	28.6±5.5
Waist circumference (cm)	90.6±13.1
Body fat (%)	40.2±7.7
Muscle mass (kg)	22.7±3.3
	%
Weight status, NW/OW/OB[b]	27.2/36.1/36.7
	n (%)
Follow a diet since fibromyalgia diagnosis, yes	100 (20.6)
Reasons to follow a diet	
Lose weight	31 (31)
Maintain current weight	8 (8)
Live more healthily	15 (15)
Disease or health problem	43 (43)
Other reasons	3 (3)
Vitamins or minerals supplementation, yes	76 (15.6)
Naturalist products supplementation, yes	89 (18.3)
Homeopathic products, yes	38 (7.8)
SF-36[c], Mental Component	*mean±SD*
Social functioning	43.4±25.0
Emotional role	55.9±28.6
Mental health	45.4±20.3
Vitality	22.4±17.7
Mental Component Scale	35.6±11.9
BDI-II[d] total score	26.4±11.6
LOT-R[e] total score	13.4±4.4

[a]SD=standard deviation.
[b]NW/OW/OB=normal weight/overweight/obese.
[c]SF-36=Short-Form-36 Health Survey. The final score for each dimension ranges from 0 to 100, with higher scores corresponding to better mental health.
[d]BDI-II=Beck Depression Inventory, 2nd edition. The final score ranges from 0 to 63, with higher scores indicating greater depression.
[e]LOT-R=Life Orientation Test Revised. The LOT-R score ranges from 6 to 30, with higher scores indicating higher levels of dispositional optimism.

Table 2. Dietary habits of women with fibromyalgia (n=486) participating in the al-Ándalus Project assessed by a food frequency questionnaire[a]

	Low Consumption[b]		Moderate Consumption[c]		High Consumption[d]	
	Number	%	Number	%	Number	%
Fruit	41	8.6	118	24.7	319	66.7
Vegetables	35	7.3	265	55.6	177	37.1
Dairy products	56	11.7	80	16.7	342	71.5
Fish	78	16.3	388	81.2	12	2.5
Cereals[e]	34	7.1	81	17.0	361	75.8
Pulses	107	22.0	348	73.4	19	4.0
Eggs	119	24.9	354	74.2	4	0.8
Meat	41	8.6	407	85.1	30	6.3
Cured meats	252	53.1	191	40.2	32	6.7
Sweets	215	45.3	168	35.4	92	19.4
Sweetened beverages	356	74.9	84	17.7	35	7.4
Butter / margarine	388	81.5	58	12.2	30	6.3
Mayonnaise	476	99.8	1	0.2	0	0.0
Olive oil	6	1.3	2	0.4	470	98.3
Alcoholic beverages	380	80.0	58	12.2	37	7.8
Nuts	156	33.0	187	39.5	130	27.5

[a]Results are expressed as number of women and percentages of the study population (%). Total sample size does not add up to N=486 because of missing data.
[b]Low consumption=frequencies from 0 to 1 serving per week.
[c]Moderate consumption=frequencies from 2 to 5 servings per week.
[d]High consumption=from 6 servings per week to daily consumption of at least 1 serving.
[e]Cereals=cereals group represents bread, rice, pasta, and potato consumption.

daily or almost-daily consumption of fruit had higher scores in mental health than the low- ($P<0.001$) and moderate-consumption groups ($P<0.05$), and the group with a moderate consumption of fish presented higher scores in mental health than the low-consumption group ($P<0.05$).

Dairy products, cereals, pulses, eggs, meat, sweets, sweetened beverages, butter or margarine, mayonnaise, olive oil, alcoholic beverages, and nut consumption were not associated with depression. Consumption of fruit ($P<0.001$), vegetables ($P<0.01$), and fish ($P<0.01$) was inversely associated with BDI-II total score. Pairwise comparisons showed that the group with a daily or almost-daily consumption of fruit and vegetables had lower levels of depression than the low-consumption group (all $P<0.01$), and the group with a moderate consumption of fish had lower levels of depression compared with the low- and high-consumption groups (all $P<0.01$). The group with a daily or almost-daily consumption of cured meats showed higher levels of depression than the moderate-consumption group ($P<0.05$). Additional analyses (Table 4) showed that eating fruit every day or almost every day, in comparison with never or 1 serving per week, was associated with 60% lower risk of severe depression (odds ratio [OR]=0.40; $P=0.007$). Similarly, a moderate fish consumption, in comparison with never or 1 serving per week, was associated with 48% lower risk of severe depression (OR=0.52; $P=0.010$).

Fruit, cereals, pulses, eggs, meat, cured meats, sweets, butter or margarine, mayonnaise, olive oil, alcoholic beverages, and nut consumption were not associated with optimism (all $P>0.05$). Consumption of vegetables ($P<0.05$), dairy products ($P<0.05$), fish ($P<0.001$), and sweetened beverages ($P<0.05$) were associated with levels of optimism (Table 3). Pairwise comparisons indicated that the group with a daily or almost-daily consumption of vegetables had higher levels of optimism than the moderate-consumption group ($P<0.05$), the group with a moderate consumption of dairy products had higher levels of optimism than the daily or almost-daily consumption group ($P<0.05$), the group with a moderate consumption of fish had higher levels of optimism than the low- and high-consumption groups (both $P<0.001$), and the group with a daily or almost-daily consumption of sweetened beverages had lower levels of optimism than the low- and moderate-consumption groups (both $P<0.05$).

Finally, Figure 2 shows the association of fruit, vegetables, and fish consumption on the four dimensions that compose the score of the SF-36 Mental Component. A daily or almost-daily consumption of fruit was positively associated with social functioning ($P<0.01$), emotional role ($P<0.001$), and mental health ($P<0.05$), and a daily or almost-daily consumption of vegetables was positively associated with mental health and vitality (both $P<0.05$). Likewise, a moderate consumption of fish was positively associated social functioning

Table 3. Association between different food consumption groups and mental health, optimism, and depression for women with fibromyalgia (n=486) participating in the al-Ándalus project[a]

	Low consumption[b]	Moderate consumption[c]	High consumption[d]	*P* value	Effect size[e]
	←——————————*mean (SE)*——————————→				
SF-36 MCS score[f]					
Fruit	29.9 (1.90)*	33.5 (1.11)**	37.1 (0.69)*,**	<0.001	0.59 (0.38-0.81)
Vegetables	32.2 (2.08)	34.9 (0.75)	37.1 (0.91)	<0.05	0.41 (0.13-0.69)
Dairy products	36.3 (1.62)	36.9 (1.39)	35.2 (0.67)	0.480	0.17 (−0.01-0.37)
Fish	31.0 (1.38)*	36.6 (0.61)*	30.5 (3.76)	<0.001	0.64 (0.43-0.84)
Cereals[g]	32.4 (2.19)	35.3 (1.36)	36.0 (0.65)	0.282	0.29 (0.09-0.49)
Pulses	36.7 (1.20)	35.6 (0.67)	30.4 (2.78)	0.115	0.50 (0.15-0.87)
Eggs	34.9 (1.16)	35.8 (0.66)	34.8 (6.04)	0.770	0.08 (−0.13-0.29)
Meat	32.9 (1.95)	35.9 (0.61)	34.7 (2.23)	0.303	0.24 (0.06-0.43)
Cured meats	35.2 (0.79)	36.7 (0.90)	31.6 (2.16)	0.075	0.43 (0.15-0.70)
Sweets	35.4 (0.85)	36.7 (0.97)	34.2 (1.28)	0.279	0.20 (−0.04-0.44)
Sweetened beverages	35.9 (0.65)	36.2 (1.34)	30.6 (2.18)	0.062	0.45 (0.07-0.83)
Butter/margarine	35.6 (0.63)	34.1 (1.64)	37.5 (2.20)	0.440	0.27 (−0.14-0.70)
Mayonnaise	35.7 (0.57)	42.5 (12.00)	—	—	0.54 (0.36-0.76)
Olive oil	28.7 (4.85)	36.0 (8.34)	35.5 (0.56)	0.378	0.61 (−1.06-2.29)
Alcoholic beverages	35.6 (0.63)	35.8 (1.65)	35.4 (2.13)	0.988	0.03 (−0.37-0.44)
Nuts	36.8 (0.99)	34.27 (0.89)	36.49 (1.12)	0.120	0.21 (0.00-0.42)
BDI-II[h]					
Fruit	30.6 (1.80)*	29.1 (1.06)**	24.9 (0.66)*,**	<0.001	0.49 (0.27-0.69)
Vegetables	30.1 (1.96)*	27.3 (0.72)**	24.5 (0.88)*,**	<0.01	0.48 (0.21-0.76)
Dairy products	26.7 (1.56)	25.3 (1.32)	26.7 (0.64)	0.633	0.12 (−0.07-0.31)
Fish	29.6 (1.34)*	25.6 (0.59)*,**	34.4 (3.48)**	<0.01	0.76 (0.56-0.96)
Cereals[g]	27.5 (2.10)	27.8 (1.03)	26.2 (0.62)	0.803	0.14 (−0.04-0.33)
Pulses	25.2 (1.14)	26.7 (0.63)	27.6 (2.70)	0.476	0.20 (−0.15-0.56)
Eggs	26.8 (1.09)	26.2 (0.63)	34.2 (5.84)	0.381	0.67 (0.46-0.89)
Meat	29.0 (1.87)	26.3 (0.58)	25.5 (2.17)	0.348	0.29 (−0.18-0.77)
Cured meats	26.5 (0.75)	25.7 (0.86)*	31.2 (2.06)*	<0.05	0.49 (0.22-0.75)
Sweets	26.4 (0.81)	25.5 (0.91)	28.5 (1.22)	0.153	0.25 (0.01-0.50)
Sweetened beverages	26.1 (0.63)	26.8 (1.29)	29.5 (1.97)	0.241	0.28 (0.08-0.48)
Butter / margarine	26.1 (0.60)	28.9 (1.57)	26.9 (2.17)	0.240	0.23 (0.05-0.43)
Mayonnaise	26.4 (0.54)	11.8 (11.7)	—	0.213	1.23 (1.04-1.43)
Olive oil	25.8 (4.75)	29.1 (8.21)	26.6 (0.54)	0.943	0.28 (−1.36-1.93)
Alcoholic beverages	26.5 (0.61)	24.9 (1.55)	27.7 (1.98)	0.516	0.23 (−0.17-0.64)
Nuts	25.0 (0.94)	27.4 (0.85)	26.4 (1.05)	0.166	0.20 (0.00-0.42)
LOT-R[i]					
Fruit	12.3 (0.76)	12.9 (0.28)	14.2 (0.34)	0.072	0.30 (0.10-0.52)
Vegetables	12.6 (0.76)	13.0 (0.27)*	14.1 (0.33)*	<0.05	0.35 (0.08-0.62)
Dairy products	13.0 (0.59)	14.6 (0.50)*	13.2 (0.24)*	<0.05	0.37 (0.03-0.72)
Fish	12.2 (0.51)*	13.7 (0.22)*,**	9.6 (1.38)**	<0.001	0.87 (0.66-1.08)
Cereals[g]	13.7 (0.82)	13.5 (0.50)	13.3 (0.24)	0.836	0.08 (−0.11-0.28)

(*continued on next page*)

Table 3. Association between different food consumption groups and mental health, optimism, and depression for women with fibromyalgia (n=486) participating in the al-Ándalus project[a] (*continued*)

	Low consumption[b]	Moderate consumption[c]	High consumption[d]	*P* value	Effect size[e]
Pulses	13.6 (0.44)	13.4 (0.24)	11.5 (1.05)	0.174	0.46 (0.10-0.82)
Eggs	13.5 (0.42)	13.4 (0.24)	11.5 (2.22)	0.672	0.43 (0.08-0.80)
Meat	13.4 (0.72)	13.5 (0.22)	12.3 (0.83)	0.392	0.26 (0.08-0.46)
Cured meats	13.4 (0.28)	13.6 (0.33)	11.7 (0.79)	0.078	0.46 (0.18-0.73)
Sweets	13.4 (0.31)	14.1 (0.35)	12.3 (2.47)	0.762	0.12 (−0.12-0.37)
Sweetened beverages	13.5 (0.24)*	13.6 (0.49)**	11.3 (0.79)***	<0.05	0.52 (0.14-0.90)
Butter/margarine	13.4 (0.23)	13.8 (0.60)	12.1 (0.81)	0.228	0.37 (−0.05-0.80)
Mayonnaise	13.4 (0.21)	17.9 (4.37)	—	0.296	0.98 (0.79-1.17)
Olive oil	11.9 (1.81)	14.3 (3.13)	13.4 (0.21)	0.706	0.54 (−1.12-2.21)
Alcoholic beverages	13.4 (0.23)	13.5 (0.60)	13.1 (0.77)	0.940	0.08 (−0.32-0.49)
Nuts	13.7 (0.37)	13.2 (0.33)	13.4 (0.41)	0.637	0.10 (−0.10-0.32)

[a]Results are expressed as mean (standard error, SE) after adjusting for age and % body fat.
[b]Low consumption=frequencies from 0-1 serving per week.
[c]Moderate consumption=frequencies from 2-5 servings per week.
[d]High consumption=from 6 servings per week to daily consumption of at least 1 serving.
[e]Effects size statistics are expressed as Cohen's *d* (95% exact confidence interval).
[f]SF-36 MCS score=Short-Form-36 Health Survey Mental Component Scale score. The final score for each dimension ranges from 0 to 100, with higher scores corresponding to better mental health.
[g]Cereals=Cereals group represents bread, rice, pasta, and potato consumption.
[h]BDI-II=Beck Depression Inventory-second edition. The final score ranges from 0 to 63, with higher scores indicating greater depression.
[i]LOT-R=Life Orientation Test Revised. The LOT-R score ranges from 6 to 30, with higher scores indicating higher levels of dispositional optimism.
***Common superscripts in a same row indicate a significant difference ($P<0.05$) between the groups with the same symbol. Pairwise comparisons were performed with Bonferroni's adjustment.

($P<0.05$), emotional role ($P<0.01$), and mental health ($P<0.05$).

DISCUSSION

This cross-sectional study presents descriptive data on the dietary habits in a representative sample of women with FM and reveals the association of dietary habits with important psychosocial outcomes in this population. The main findings indicate that a daily or almost-daily consumption of fruit is positively associated with better mental health and a lower risk of severe depression. Similarly, daily or almost-daily consumption of vegetables and moderate consumption of fish are positively associated with better mental health and optimism and inversely associated with depression levels. Furthermore, a moderate but weekly consumption of fish is associated with a lower risk of severe depression. Finally, a moderate but weekly consumption of dairy products is positively associated with more optimism. In contrast, a daily or almost-daily consumption of cured meats and sweetened beverages are associated with less favorable psychosocial outcomes.

Current scientific evidence supports an association between nutrition and health and the importance of healthy dietary habits on the well-being of the population.[11,30] However, in FM, neither observational nor prospective studies have been conducted to date to assess dietary habits of this population, although several intervention trials have been conducted to facilitate and evaluate dietary habit modification.[14-16,31,32] Most of these dietary interventions, which have not shown conclusive results, have focused on isolated nutrients, or supplements, and others on restrictive diets, which might promote long-term deficiencies,[9,16] as well as being unsustainable over time.[7] A recent review study highlights the importance of nutrition in the multidisciplinary treatment approach of this disease.[7]

The direct association observed in this study between the daily or almost-daily consumption of fruit and vegetables and mental health and the inverse association with depression in women with FM is not surprising, but it is promising. Eating fruit every day as well as fish from 2 to 5 times per week was associated with a reduced risk of major depression. The postulated ability of certain nutrients contained in fruit and vegetables (complex carbohydrates, B vitamin complex, folate, antioxidants, minerals, and so forth) to influence mental health[33] may partially explain the observed association. Folate and vitamins B-12 and B-6, through methionine conversion, are involved in 1-carbon metabolism that acts in several methylation reactions, such as those that involve serotonin and other monoamine neurotransmitters. Folate is required for the synthesis of methionine from homocysteine, and vitamins B-12 and B-6 also serve as cofactors for enzymes involved in homocysteine metabolism.[33,34] The findings observed in the current study are in line with previous studies that have shown a direct association between the intake of the recommended 5 daily servings of fruit and vegetables (as defined by the Mediterranean diet[35]) and lower psychological distress,[36] as well as lower levels of

Table 4. Association between different food consumption groups and the presence of severe depression (BDI-II[a] ≥29) in women with fibromyalgia (n=486) involved in the al-Ándalus project

Food frequency	OR[b]	SE[c]	95% CI[d]	*P* value[e]
Fruit				
Low consumption[f]	Ref[g]			
Moderate consumption[h]	0.678	0.250	0.330, 1.396	0.292
High consumption[i]	0.398	0.136	0.204, 0.778	0.007
Vegetables				
Low consumption	Ref			
Moderate consumption	0.758	0.274	0.373, 1.540	0.443
High consumption	0.495	0.186	0.237, 1.034	0.061
Dairy products				
Low consumption	Ref			
Moderate consumption	1.166	0.415	0.581, 2.344	0.666
High consumption	1.012	0.301	0.565, 1.812	0.968
Fish				
Low consumption	Ref			
Moderate consumption	0.516	0.132	0.313, 0.851	0.010
High consumption	1.540	1.036	0.412, 5.754	0.521
Cereals[j]				
Low consumption	Ref			
Moderate consumption	0.806	0.338	0.354, 1.835	0.608
High consumption	0.632	0.233	0.307, 1.304	0.215
Pulses				
Low consumption	Ref			
Moderate consumption	1.356	0.313	0.862, 2.132	0.187
High consumption	0.896	0.483	0.312, 2.577	0.839
Eggs				
Low consumption	Ref			
Moderate consumption	0.924	0.203	0.600, 1.422	0.720
High consumption	1.482	1.517	0.199, 11.026	0.701
Meat				
Low consumption	Ref			
Moderate consumption	0.583	0.195	0.303, 1.123	0.107
High consumption	0.444	0.225	0.164, 1.199	0.109
Cured meats				
Low consumption	Ref			
Moderate consumption	0.903	0.182	0.608, 1.342	0.614
High consumption	1.414	0.535	0.673, 2.968	0.360
Sweets				
Low consumption	Ref			
Moderate consumption	1.072	0.230	0.704, 1.632	0.746
High consumption	1.285	0.327	0.780, 2.116	0.325

(*continued on next page*)

Table 4. Association between different food consumption groups and the presence of severe depression (BDI-II[a] ≥29) in women with fibromyalgia (n=486) involved in the al-Ándalus project (*continued*)

Food frequency	OR[b]	SE[c]	95% CI[d]	*P* value[e]
Sweetened beverages				
Low consumption	Ref			
Moderate consumption	1.064	0.267	0.651, 1.739	0.804
High consumption	1.257	0.451	0.622, 2.540	0.524
Butter/margarine				
Low consumption	Ref			
Moderate consumption	1.608	0.461	0.917, 2.820	0.097
High consumption	0.920	0.366	0.421, 2.001	0.834
Mayonnaise				
Low consumption	Ref			
Moderate consumption	0.980	0.012	0.958, 1.004	0.105
High consumption	—	—	—	—
Olive oil				
Low consumption	Ref			
Moderate consumption	5.211	9.331	0.156, 174.161	0.356
High consumption	3.313	3.650	0.382, 28.709	0.277
Alcoholic beverages				
Low consumption	Ref			
Moderate consumption	0.912	0.266	0.515, 1.617	0.754
High consumption	1.253	0.448	0.622, 2.524	0.528
Nuts				
Low consumption	Ref			
Moderate consumption	1.428	0.321	0.919, 2.219	0.113
High consumption	1.169	0.293	0.715, 1.911	0.533

[a]BDI-II=Beck Depression Inventory-second edition. The final score ranges from 0 to 63, with higher scores indicating greater depression.
[b]OR=odds ratio.
[c]SE=standard error.
[d]CI=confidence interval.
[e]*P* value adjusted for age and % body fat.
[f]Low consumption=frequencies from 0 to 1 serving per week.
[g]Ref=reference.
[h]Moderate consumption=frequencies from 2 to 5 servings per week.
[i]High consumption=from 6 servings per week to daily consumption of at least 1 serving.
[j]Cereals=Cereals group represents bread, rice, pasta, and potato consumption.

depression[37] with a "fruit and vegetables–rich diet." The largest study conducted to date examining the association of fruit and vegetable consumption with psychosocial well-being[38] showed an inverse association with depression, psychological distress, the presence of mood and anxiety disorders, and self-perceived poor mental health status in the general population.

In the same context, the significant association of moderate fish consumption with mental health, optimism, and reduced depression observed in this study also concurs with the conclusions derived from a recent systematic review[37] in which moderate fish consumption was shown to be protective against depression, although an intake above a designated threshold seemed to have the opposite effect. A recent meta-analysis has shown an inverse relationship between fish consumption and depression,[39] especially when the fish were rich in omega 3 fatty acids. Although Spanish dietary recommendations suggest 4 servings of fish per week,[40] higher intakes could lead to an accumulation of mercury compounds, polychlorinated biphenyls, and dioxins, exerting a toxicological effect that could increase the risk of depression[41] and also may have adverse effects on cardiometabolic health.[42]

Finally, in previous studies conducted in different populations, a significant adverse linear trend was observed for cured meats and sweetened beverages,[34,43] which is in line

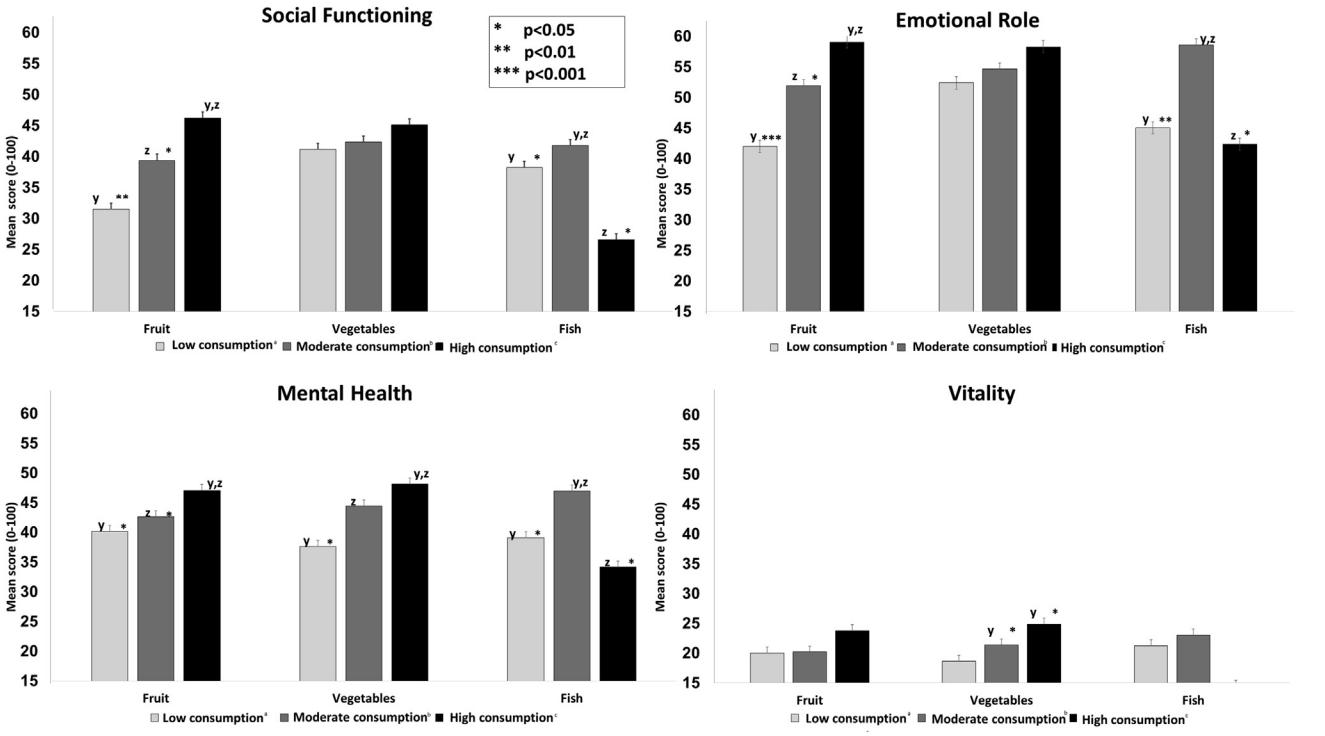

Figure 2. Association between fruit, vegetables, and fish consumption on the four dimensions of the Mental Component of the 36-item Short-Form Health Survey (SF-36) in women with fibromyalgia (n=486) participating in the al-Ándalus project: Social functioning, emotional role, mental health, and vitality. Bars represent mean and 95% confidence intervals after adjusting for age and % body fat. The final score for each dimension of the SF-36 Mental Component Scale ranges from 0 to 100, with higher scores corresponding to better mental health. [a]Low consumption=frequencies from 0 to 1 serving per week; Moderate consumption=frequencies from 2 to 5 servings per week; High consumption=from 6 servings per week to daily consumption of at least 1 serving. [yz]Common superscripts in the same consumption group indicate a significant difference (*$P<0.05$; **$P<0.01$; ***$P<0.001$) between the groups with the same letter.

with the present findings, and supports the idea that a western dietary pattern, characterized by consumption of processed meats, sugar, flavored drinks, pizza, and so forth, increases the odds for severe depression.[43]

The assessment of dietary habits in a representative sample of women with FM from southern Spain showed some deviations from dietary guidelines.[44] One-third of the study sample reported not eating fruit on a daily basis, whereas the figure for vegetables rose to nearly two-thirds of the sample. Notwithstanding, nearly half of the population overate cured meats and sweets.[44] The rest of the food groups assessed appear to be close to dietary guidelines.[44] These results are in line with the general trend observed in Spain[45] in which an insufficient dissemination and implementation of these guidelines as well as a progressive distancing from the Mediterranean diet[45,46] has been observed. The Mediterranean diet (characterized by an abundance of plant-based foods such as fruit, vegetables, whole-grain cereals, nuts and legumes; olive oil as the main source of fat; moderate amounts of fish, poultry, dairy products, and eggs; relatively low amounts of red meat and sweets; and moderate consumption of red wine with meals[30]) has extensive scientific evidence for its role in general health, showing a direct relationship with better SF-36 Mental Components.[12,30,36,47] The main elements of the Mediterranean diet ensure an adequate intake of several nutrients that negatively correlate with depression and mental disorders.[11,12] We hope that the results of the current study will stimulate future research in the FM population, assessing dietary patterns as a whole and not just individual nutrients or foods. Future research is also needed to provide a complete picture of the relationship of diet with HRQoL and well-being, taking into account the complex interactions among nutrients.[48]

This study has some limitations that should be noted. First, a specific questionnaire assessing the Mediterranean dietary pattern was not used. Thus, studying associations with Mediterranean diet adherence was not possible. Second, the cross-sectional study design precluded establishing causal relationships. Further prospective research is needed to better understand the interrelationships between diet and psychosocial outcomes in fibromyalgia. Finally, this study was carried out only in women, and future studies should be conducted in men with FM. The main strength of this study was the relatively large and representative sample size, which enabled assessment of dietary habits and their association with relevant psychosocial outcomes in this population. In addition, this study used a clinical measure of depression to evaluate the relationship between dietary patterns and psychosocial outcomes, unlike most studies, which employ only QOL measures as primary outcomes for mental health.

CONCLUSION

The results of this study suggest that a daily or almost-daily intake of fruit and vegetables and a moderate intake of fish may be associated with more favorable psychosocial outcomes in women with fibromyalgia. Conversely, excessive intake of cured meats and sweetened beverages were related to worse scores for depression and optimism. Future research analyzing dietary patterns as well as intervention studies evaluating the effects of healthy dietary patterns on psychosocial and physical outcomes in individuals with FM are warranted.

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STATEMENT OF POTENTIAL CONFLICT OF INTEREST

No potential conflict of interest was reported by the authors.

FUNDING/SUPPORT

This study was supported by the Spanish Ministry of Economy and Competitiveness (I+D+I DEP2010-15639; BES-2011-047133; BES-2014-067612). V. A. Aparicio was supported by the Andalucía Talent Hub Program launched by the Andalusian Knowledge Agency, co-funded by the European Union's Seventh Framework Program, Marie Skłodowska-Curie actions (COFUND — Grant Agreement n° 291780) and the Ministry of Economy, Innovation, Science and Employment of the Junta de Andalucía, Spain. P. Ruiz-Cabello presented the results of this article in partial fulfillment of the requirements for a PhD degree in the Human Nutrition Doctoral Program at the University of Granada.

FOOD FREQUENCY QUESTIONNAIRE (Short-Form)

FOOD GROUPS	NEVER	SERVINGS/DAY	SERVINGS/WEEK	SERVINGS/MONTH	SERVINGS/YEAR
MEAT					
Meat					
Cured meats					
FISH					
Fish					
Shellfish (shrimps, clams, mussels, etc)					
EGGS					
Fried, boiled, omelet, etc					
PULSES					
Lentils					
Chickpeas					
White beans					
Green peas					
CEREALS					
Bread					
Rice					
Pasta (noodles, spaghetti, pizza)					
Potatoes (fried, boiled, grilled, in omelet, etc)					
DAIRY PRODUCTS					
Milk					
Yoghurt					
Pudding/Flan					
Cheese					
FATS					
Butter / Margarine					
Mayonnaise					
Olive Oil					
VEGETABLES					
Servings of vegetables					
FRUITS					
Number of fresh fruit servings per day					
Canned fruit					
SWEETS					
Sugar					
Chocolate					
Cookies, cakes,					
pastries					
BEVERAGES					
Water					
Packaged fruit juices					
Fresh fruit juices					
Sweetened beverages (soda, sweetened tea...)					
Beer					
Wine Red.....White.....					
Distilled alcoholic beverages (rum, whisky, gin...)					
NUTS					
Servings (a handful)					

Figure 1. Translated short form of the Spanish validated Food Frequency Questionnaire (FFQ). Participants indicate the frequency of consumption (times per day, week, month, or year) of 34 foods divided by food groups: fruit, vegetables, dairy products, fish, cereals, pulses, eggs, meat, fats, sweets, beverages, and nuts.