Western and Mediterranean dietary patterns among Balearic Islands' adolescents: socio-economic and lifestyle determinants

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Abstract

Objective: To assess prevailing food patterns among Balearic Islands' adolescents, and socio-economic and lifestyle determinants.

Design: Cross-sectional nutritional survey carried out (2007–2008) in the Balearic Islands, a Mediterranean region. Dietary assessment was based on a 145-item semi-quantitative FFQ and two non-consecutive 24h recalls. Anthropometric measurements and questions related to socio-economic, lifestyle, physical activity and body image were assessed.

Setting: Data obtained from a representative sample of all inhabitants living in the Balearic Islands aged 12–17 years.

Subjects: A random sample (*n* 1231) of the adolescent population (12–17 years old) was interviewed.

Results: Factor analysis identified two major dietary food patterns: 'Western' and 'Mediterranean'. The 'Western' dietary pattern was higher among boys than girls, associated with spending ≥4h/d on media screen time, but less prevalent among those adolescents who desired a thinner body and those girls who desired to remain the same weight. The 'Mediterranean' dietary pattern was mainly followed by girls, and also boys who spent <2h/d on media screen time and girls with high parental socio-economic status.

Conclusions: The present study shows the existence of two major dietary patterns among Balearic Islands' adolescents: 'Western' and 'Mediterranean', but girls are more 'Mediterranean' than boys. This evidence supports that the food pattern of Balearic Islands' adolescents is in a transitional state characterised by the loss of the traditional Mediterranean dietary pattern towards a Western dietary pattern. Low parental socio-economic status, much leisure-time on sedentary behaviours such as media screen time and body image are factors associated with the 'Western' dietary pattern.

Adolescence is a transitional stage during which many changes take place at physiological and behavioural levels, representing an important life stage for the development of healthy nutrition behaviour[1]. Many different factors influence food habits in a complex interactive way[2]. Socio-economic and lifestyle factors (parental occupational status, maternal level of education, cultural and/or religious habits, the role of family and patterns of beauty) have a strong influence on eating habits in adolescents[3].

Epidemiological evidence suggests that dietary patterns in the Mediterranean countries are changing rapidly, with an increased consumption of animal products and saturated fat and a decline in intake of basic foodstuffs based on vegetables[4]. Recent nutritional surveys carried out in Spain also confirmed a progressive departure from the traditional Mediterranean diet towards a Western dietary pattern, mainly in young generations[5–11]. Because there is evidence that nutritional behaviours track from adolescence into adulthood, the promotion of healthy nutrition during adolescence has the potential to confer significant long-term health benefits[1].

Despite the worldwide promotion of the Mediterranean dietary pattern, a progressive shift to a non-Mediterranean pattern could be also developing among Balearic Islands' adolescents. Therefore, the aim of the present study was to assess prevailing food patterns among adolescents living in the Balearic Islands, as well as socio-economic and lifestyle determinants.

Methods

Study design

The study is a population-based cross-sectional nutritional survey carried out (2007–2008) in the Balearic Islands, a Mediterranean region.

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Selection of participants, recruitment and approval

The target population consisted of all inhabitants living in the Balearic Islands aged 12–17 years. The sample population was derived from residents aged 12–17 years registered in the scholar census of the Balearic Islands. The theoretical sample size was set at 1500 individuals in order to provide a specific relative precision of 5 % (type I error = 0·05; type II error = 0·10), taking into account an anticipated 70 % participation rate. The sampling technique included stratification according to municipality size, age and sex of inhabitants, and randomisation into sub-groups, with Balearic Islands municipalities being the primary sampling units and individuals within the schools of these municipalities comprising the final sampling units. The interviews were performed at the schools. The final sample size was 1231 individuals (82 % participation). The main reason for non-participation was the adolescent declined to be interviewed, or the parents did not authorise the interview.

Ethics

The study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving human subjects/patients were approved by the Balearic Islands Ethics Committee. Written informed consent was obtained from all adolescents and their parents or legal guardians.

Dietary assessment

Dietary questionnaires included two non-consecutive 24 h diet recall periods, one in the warm season (May–September) and one in the cold season (November–March) to account for the influence of seasonal variations, and a semi-quantitative FFQ that has previously been validated[12] and applied in other studies and surveys on the Spanish population[9,10,13,14]. The FFQ, which asked the participant to recall average use over the past year, consisted of 145 items (118 of the original validated FFQ plus the most characteristic Balearic Islands foods in order to make it easy for the interviewee to answer) arranged by food type and meal pattern. Frequency of food consumption was based on times that food items were consumed (per day, week or month). Consumption < 1/month was considered no consumption. The period of consumption of seasonal items was also considered. Edible fractions of foods were recorded in the database. The FFQ foods items were collapsed to twenty-nine food groups (Table 2) that may have practical importance in the daily diet and closely approximated food groups previously reported[15,16]. To account for day-to-day intake variability, the questionnaires were administered homogeneously from Monday to Sunday. Well-trained dietitians administered the recalls and verified and quantified the food records.

To estimate volumes and portion sizes, the household measures found in the participants' own homes were used. Conversion of food into nutrients was made using a computer program (ALIMENTA®; NUCOX, Palma, Spain) based on Spanish[17,18] and European[19] food composition tables, and complemented with food composition data available for Majorcan food items[20]. Identification of misreporters was conducted on the basis of the ratio of energy intake (EI) to BMR. EI:BMR < 0·92 (boys) and < 0·85 (girls) was considered to represent under-reporting[21], while EI:BMR ≥ 2·4 was considered to represent over-reporting[22,23]. Under-reporters (20 %) and over-reporters (2 %) were excluded from the analysis.

Socio-economic and lifestyle determinants

A questionnaire incorporating the following questions was used: age group; parental educational level (grouped according to years and type of education: low, < 6 years; medium, 6–12 years; high, > 12 years); and parental socio-economic level (based on the occupation of parents and classified as low, medium and high, according to the Spanish Society of Epidemiology)[24]. The number of daily meals and snacks was calculated from the total eating occasions that participants declared among the following: breakfast; mid-morning snack; lunch; mid-afternoon snack; dinner; before going to sleep; others. Three groups of eating frequency were considered: ≤ 3, 4 and ≥ 5 times/d.

Physical activity patterns

Physical activity was evaluated according to the guidelines for data processing and analysis of the International Physical Activity Questionnaire (IPAQ)[25] in the short form and its specific modification for adolescents (IPAQ-A)[26]. The specific types of activity assessed were walking, moderate-intensity activities (i.e. physical activity at school) and vigorous-intensity activities (i.e. sports practice). In accordance with the AVENA (Food and Assessment of Nutritional Status of Adolescents) study[27], the questionnaire also included information on television (TV) viewing, computer use and video games in h/d, and usual sleep duration to the nearest 10 min. Physical inactivity was established with a cut-off level of 300 min/week of moderate/vigorous physical activity, in accordance with current guidelines of physical activity for adolescents[28,29].

Assessment of other covariables

Anthropometry and adiposity

Height was determined using a mobile anthropometer (model KaWe 44444; Kirchner & Wilhelm GmbH Co. KG, Asperg, Germany) to the nearest millimetre, with the subject's head in the Frankfurt plane. Body weight was determined to the nearest 100 g using a digital scale (model sc9210; Tefal, Rumilly, France). The subjects were weighed in bare feet and light underwear, which was accounted for by subtracting 300 g from the measured weight. Triceps and subscapular skinfold thickness (ST)

were measured using a Holtain skinfold calliper (Tanner/ Whitehouse, Crosswell, Crymych, UK) and the mean of three measurements (right arm) was used. Height and weight measures were used to calculate BMI (kg/m^2). Body fat percentage (%BF) was measured from triceps and subscapular ST according to Slaughter et al.[30]. This equation has been proposed as the most accurate for estimation of %BF from ST in this particular population of adolescents[31]. %BF and height were used to calculate fat mass index (FMI; kg/m^2).

Defining overweight and obesity

In children and adolescents, BMI for age has been established as the main measurement to define overweight and obesity[32]. However, there are some limitations associated with its use as an indicator of fatness. For example, individuals with increased muscle mass may also have increased BMI[33]. On the other hand, individuals with decreased lean body mass and increased adiposity may also be misclassified by assessment with BMI[33]. Alvero-Cruz et al.[34] showed that the FMI had higher accuracy for overweight screening than BMI. The FMI is a useful measure to evaluate body composition parameters by effectively eliminating differences in body fat associated with height[35]. Nevertheless, it is difficult to exclude BMI from the normal-weight and overweight definition. For this reason, a combination of BMI and FMI was used to define overweight and obesity in the present study.

First, subjects were classified using the age- and sex-specific cut-offs developed and proposed for international comparisons by Cole et al.[36], recommended for use also by the International Obesity Taskforce. Then, subjects were classified as normal-fat and overfat according to their FMI using the sex-specific cut-offs proposed by Alvero-Cruz et al.[34] for adolescents: $4.58 kg/m^2$ in boys and $7.76 kg/m^2$ in girls. Thus, adolescents were classified into two groups as follows: (i) not at risk (BMI for age and sex $< 25 kg/m^2$ or BMI $\geq 25 kg/m^2$ but FMI $< 4.58 kg/m^2$ in boys and FMI $< 7.76 kg/m^2$ in girls); (ii) overweight/obesity (BMI for age and sex $< 25 kg/m^2$ or BMI $\geq 25 kg/m^2$ but FMI $\geq 4.58 kg/m^2$ in boys and FMI $\geq 7.76 kg/m^2$ in girls). The variable was labelled as 'body composition'.

Body image

Self-perceived body image was measured using the Stunkard scale[37], which consists of silhouette drawings ranging from 1 to 9 with monotonic increments in overweight percentage where 1 is the leanest and 9 the heaviest. Separate figures for boys and girls were used. Participants were asked to identify of the nine body figures: 'Which silhouette looks most like yourself?' and 'Which silhouette would you like to look like?' The difference between perceived body image and desired body image was used to determine the level of dissatisfaction with current body image. Values other than zero represent dissatisfaction with perceived body image. A positive value was indicative of the participant's desire to be thinner than his/her perceived current size, while a negative value reflected the participant's desire to be thicker than his/her current perceived size[38,39].

Statistical analyses

Analyses were performed with the SPSS statistical software package version 19·0 (SPSS Inc., Chicago, IL, USA). Factor analyses by the principal components method and varimax rotation were run on Z-scored transformed food consumption variables in order to identify salient food patterns in the group. To interpret the data, only food groups with factor loading > 0.250 were retained for each factor. For each adolescent, the factor score for each pattern was calculated. These scores were categorised (quintiles), as is often done in dietary epidemiological studies that relate food patterns to health outcomes when there is not a priori knowledge of the function that best fits the data[40]. Significant differences in prevalence were calculated by means of the χ^2 test. Logistic regression models with the calculations of corresponding adjusted odds ratio and 95 % confidence interval were used to examine differences between adolescents' characteristics and dietary patterns (the fifth quintile (Q5) v. the first quintile (Q1) in each dietary pattern). Univariate analysis was first carried out for all of the socio-economic and lifestyle variables that could be associated with dietary patterns. Any factor was considered a candidate for the multivariate model. Multiple logistic regression analyses were used to simultaneously examine the effect of different socio-economic and lifestyle variables on the dietary patterns. Level of significance for acceptance was $P < 0.05$.

Results

Participants' characteristics according to gender are shown in Table 1. Factor analysis retained two major dietary pattern factors which explained 24 % of the total variance: the 'Western' pattern (factor 1, explaining 13·4 % of total variance) and the 'Mediterranean' pattern (factor 2, explaining 10·6 % of total variance; Table 2). Food group categories identified in the 'Western' pattern were yoghurt and cheese, dairy desserts, red meat, poultry, sausages, eggs, bread, cereals, pasta, rice dishes, pizza, fruit juices, canned fruits, nuts, soft drinks, high-fat foods, other oils and fats, sweets and chocolates. Those identified in the 'Mediterranean' pattern included yoghurt and cheese, red meat, poultry, fish and seafood, eggs, legumes, pasta, fresh fruit, fruit juices, vegetables, potatoes and tubercles and olive oil. 'Western' and 'Mediterranean' labels were chosen according to similarities to Western and Mediterranean dietary patterns described elsewhere[41,42]. Despite that nuts are a common Mediterranean food[43], in the present study a higher consumption was associated with the 'Western' pattern. However, this association may be

Table 1 Characteristics of the study population: representative sample of adolescents (aged 12–17 years) living in the Balearic Islands, Spain, 2007–2008

	Boys (*n* 574)	Girls (*n* 657)
	%	%
Age (years)		
12–13	25·8	25·6
14–15	49·3	49·6
16–17	24·9	24·8
Parental educational level		
Low	32·8	36·3
Medium	29·4	32·2
High	37·8	31·5
Parental socio-economic status		
Low	18·4	24·3
Medium	57·6	54·8
High	24·1	20·9
Number of daily meals and snacks		
≤3	27·7	44·1
4	34·9	30·7
≥5	37·4	25·3
Media screen time (h/d)		
<2	14·9	19·0
≥2–<4	43·4	38·1
≥4	41·7	42·9
Sleep time (h/d)		
<7	7·5	8·2
≥7	92·5	91·8
Physical activity		
Inactive	22·9	47·9
Active	77·1	52·1
Body composition		
Not at risk	68·1	77·8
Overweight/obesity	31·9	22·2
Desire to change weight		
To be thinner	35·9	57·7
To remain the same weight	37·7	35·2
To be thicker	26·5	7·1

Table 2 Food patterns identified by factor analyses using the principal components method and varimax rotation: representative sample of adolescents (aged 12–17 years) living in the Balearic Islands, Spain, 2007–2008

	Dietary pattern	
Food group category	'Western'	'Mediterranean'
Dairy food		
Milk	–	–
Yoghurt and cheese	0·365	0·280
Dairy desserts	0·628	–
Meat and processed meats		
Red meat	0·502	0·291
Poultry	0·369	0·364
Sausages	0·440	–
Fish and seafood	–	0·295
Eggs	0·382	0·416
Legumes	–	0·450
Cereals, grains and derivatives		
Bread	0·270	–
Cereals	0·284	–
Biscuits	–	–
Pasta	0·265	0·274
Rice dishes	0·270	–
Pizza	0·368	–
Fruits		
Fresh fruits	–	0·426
Fruit juices	0·347	0·277
Canned fruits	0·507	–
Vegetables	–	0·897
Nuts	0·433	–
Potatoes and tubercles	–	0·897
Drinks		
Soft drinks	0·620	–
Tea and coffee	–	–
Alcoholic beverages	–	–
Fats		
High-fat foods	0·614	–
Olive oil	–	0·366
Other oils and fats	0·388	–
Sweets and desserts		
Sweets	0·598	–
Chocolates	0·424	–

Food group factor loadings: only food groups with factor loading >0·250 were retained for each factor. Only adolescents who did not misreport their energy intake were considered for this analysis.

associated with the higher consumption of nuts found in the Balearic Islands population than in the overall Spanish population[10].

The 'Western' dietary pattern was found more often among boys (OR = 4·47, 95 % CI 2·81, 7·11, $P < 0·001$), while the 'Mediterranean' dietary pattern was mainly followed by girls (OR = 1·43, 95 % CI 0·93, 2·20, $P ≥ 0·05$). Associations between dietary patterns and socio-economic and lifestyle determinants stratified by gender were assessed (Table 3 for boys and Table 4 for girls). The 'Western' dietary pattern was associated with spending ≥4 h/d on media screen time in both sexes and with being in the youngest age group (12–13 years) in girls, but was less prevalent among those adolescents who wished to be thinner and those girls who desired to remain the same weight. The 'Mediterranean' dietary pattern was mainly followed by boys who spent <2 h/d on media screen time and girls with low parental socio-economic status. Results also revealed that adolescents who spent ≥4 h/d on media screen time and were in the highest quintile for the 'Western' dietary pattern showed a higher frequency of consumption of milk (OR = 7·86, 95 % CI 1·15, 53·48; $P < 0·05$), soft drinks (OR = 6·15, 95 % CI 1·23, 30·79;

$P < 0·05$) and nuts (OR = 4·01, 95 % CI 1·02, 15·80; $P < 0·05$) than their counterparts who spent <4 h/d.

In boys, the univariate analysis also showed that the 'Western' dietary pattern was associated with being in the youngest age group (12–13 years), low parental socio-economic status, spending ≥4 h/d on media screen time, not being at risk of overweight or obesity and the wish to be thinner; whereas being in the middle age group (14–15 years) and spending <2 h/d on media screen time were associated with the 'Mediterranean' pattern. In girls, low parental educational level, low socio-economic status and spending ≥2 h/d on media screen time were associated with the 'Western' dietary pattern; whereas medium or high parental educational level, high parental socio-economic status and spending <2 h/d on media screen time were associated with the 'Mediterranean' pattern. Results also revealed a negative association between age and a desire to maintain the same body shape or a lower

Table 3 Socio-economic and lifestyle determinants of 'Western' and 'Mediterranean' dietary patterns among adolescent boys, Balearic Islands, Spain, 2007–2008

	'Western'							'Mediterranean'						
				Q1 v. Q5							Q1 v. Q5			
	Q1 %	Q5 %	P	Crude OR†	95% CI	Adjusted OR‡	95% CI	Q1 %	Q5 %	P	Crude OR†	95% CI	Adjusted OR‡	95% CI
Age group (years)														
12–13	44·4	55·6	0·108	0·36*	0·14, 0·98	0·47	0·12, 1·80	40·5	59·5	0·091	2·59*	1·07, 6·28	2·07	0·67, 6·35
14–15	29·4	70·6		0·70	0·28, 1·73	0·75	0·22, 2·53	57·5	42·5		1·30	0·61, 2·77	1·24	0·48, 3·21
16–17	22·5	77·5		1·00	Ref.	1·00	Ref.	63·8	36·2		1·00	Ref.	1·00	Ref.
Parental educational level														
Low	31·1	68·9	0·363	1·43	0·61, 3·33	1·67	0·42, 6·72	65·2	34·8	0·128	0·47	0·21, 1·03	0·49	0·16, 1·49
Medium	25·6	74·4		1·88	0·77, 4·55	1·77	0·52, 6·00	60·9	39·1		0·56	0·26, 1·23	0·93	0·33, 2·57
High	39·2	60·8		1·00	Ref.	1·00	Ref.	46·6	53·4		1·00	Ref.	1·00	Ref.
Parental socio-economic status														
Low	13·3	86·7	0·038	4·69*	1·32, 16·74	3·22	0·56, 18·45	45·7	54·3	0·047	1·05	0·40, 2·74	1·32	0·37, 4·71
Medium	35·1	64·9		1·33	0·57, 3·15	0·65	0·17, 2·49	66·7	33·3		0·44	0·19, 1·02	0·58	0·20, 1·71
High	41·9	58·1		1·00	Ref.	1·00	Ref.	46·9	53·1		1·00	Ref.	1·00	Ref.
Number of daily meals and snacks														
≤ 3	38·7	61·3	0·347	0·53	0·21, 1·31	0·93	0·25, 3·48	63·2	36·8	0·577	0·66	0·29, 1·50	0·73	0·25, 2·14
4	33·3	66·7		0·67	0·29, 1·55	1·21	0·39, 3·77	53·8	46·2		0·97	0·47, 2·02	0·83	0·32, 2·13
≥ 5	25·0	75·0		1·00	Ref.	1·00	Ref.	53·1	46·9		1·00	Ref.	1·00	Ref.
Media screen time (h/d)														
< 2	57·7	42·3	0·001	0·15***	0·05, 0·41	0·11**	0·03, 0·47	41·2	58·8	0·011	3·05*	1·30, 7·14	3·59 *	1·33, 9·68
≥ 2–< 4	34·6	65·4		0·38*	0·16, 0·92	0·23*	0·06, 0·83	45·7	54·3		2·54*	1·18, 5·49	2·93*	1·11, 7·71
≥ 4	16·7	83·3		1·00	Ref.	1·00	Ref.	68·1	31·9		1·00	Ref.	1·00	Ref.
Sleep time (h/d)														
< 7	16·7	83·3	0·255	2·42	0·51, 11·51	1·73	0·17, 17·32	54·5	45·5	0·952	1·04	0·30, 3·56	2·00	0·30, 3·56
≥ 7	32·6	67·4		1·00	Ref.	1·00	Ref.	55·5	44·5		1·00	Ref.	1·00	Ref.
Physical activity														
Inactive	40·9	59·1	0·103	0·56	0·26, 1·19	0·53	0·19, 1·52	65·0	35·0	0·149	0·58	0·27, 1·22	1·02	0·37, 2·84
Active	28·0	72·0		1·00	Ref.	1·00	Ref.	51·8	48·2		1·00	Ref.	1·00	Ref.
Body composition														
Not at risk	26·4	73·6	0·037	2·26*	1·04, 4·88	0·95	0·26, 3·50	56·8	43·2	0·549	0·80	0·39, 1·66	0·55	0·39, 1·66
Overweight/obesity	44·7	55·3		1·00	Ref.	1·00	Ref.	51·3	48·7		1·00	Ref.	1·00	Ref.
Desire to change weight														
To be thinner	57·6	42·4	0·000	0·18**	0·06, 0·48	0·18*	0·04, 0·86	55·6	44·4	0·430	1·38	0·60, 3·15	0·97	0·25, 3·69
To remain the same weight	24·1	75·9		0·74	0·29, 1·91	0·88	0·27, 2·87	50·8	49·2		1·67	0·77, 3·61	1·51	0·56, 4·06
To be thicker	19·1	80·9		1·00	Ref.	1·00	Ref.	63·3	36·7		1·00	Ref.	1·00	Ref.

Q1, first quintile; Q5, fifth quintile; Ref., reference category.
†Univariate analysis (logistic regression analysis considering the effect of one explanatory variable).
‡Multivariate analysis (multiple logistic regression analysis considering the simultaneous effect of all explanatory variables). Only adolescents who did not misreport their energy intake were considered for this analysis.
Significant differences between Q5 and Q1 in each dietary pattern (χ^2 test): *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

Table 4 Socio-economic and lifestyle determinants of 'Western' and 'Mediterranean' dietary patterns among adolescent girls, Balearic Islands, Spain, 2007–2008

| | 'Western' | | | | | | | 'Mediterranean' | | | | | | |
| | Q1 % | Q5 % | | Q1 v. Q5 | | | | Q1 % | Q5 % | | Q1 v. Q5 | | | |
			P	Crude OR†	95% CI	Adjusted OR‡	95% CI			P	Crude OR†	95% CI	Adjusted OR‡	95% CI
Age group (years)														
12–13	51·3	48·7	0·005	5·16**	1·86, 14·33	4·30*	1·13, 16·37	43·5	56·5	0·679	0·96	0·41, 2·26	1·36	0·42, 4·41
14–15	65·4	34·6		2·87*	1·17, 7·05	2·77	0·89, 8·55	49·5	50·5		0·76	0·36, 1·59	1·15	0·45, 2·92
16–17	84·4	15·6		1·00	Ref.	1·00	Ref.	42·5	57·5		1·00	Ref.	1·00	Ref.
Parental educational level														
Low	54·1	45·9	0·038	2·44*	1·14, 5·22	0·90	0·27, 3·03	59·3	40·7	0·005	0·28**	0·13, 0·61	0·65	0·21, 2·03
Medium	71·4	28·6		1·15	0·52, 2·53	0·45	0·14, 1·43	46·7	53·3		0·47	0·22, 1·02	0·70	0·25, 1·99
High	74·2	25·8		1·00	Ref.	1·00	Ref.	29·1	70·9		1·00	Ref.	1·00	Ref.
Parental socio-economic status														
Low	50·0	50·0	0·005	4·50**	1·72, 11·75	3·75	0·93, 15·17	66·7	33·3	0·000	0·14***	0·05, 0·40	0·13**	0·03, 0·54
Medium	69·7	30·3		1·96	0·81, 4·77	2·15	0·68, 6·82	42·1	57·9		0·39*	0·15, 0·98	0·32	0·10, 1·08
High	81·8	18·2		1·00	Ref.	1·00	Ref.	21·9	78·1		1·00	Ref.	1·00	Ref.
Number of daily meals and snacks														
≤3	67·5	32·5	0·004	0·46*	0·22, 0·97	0·58	0·21, 1·56	46·8	53·2	0·837	0·84	0·41, 1·74	0·49	0·18, 1·33
4	79·0	21·0		0·25**	0·11, 0·59	0·40	0·14, 1·15	48·2	51·8		0·80	0·37, 1·74	0·69	0·25, 1·89
≥5	48·9	51·1		1·00	Ref.	1·00	Ref.	42·6	57·4		1·00	Ref.	1·00	Ref.
Media screen time (h/d)														
<2	82·4	17·6	0·028	0·29*	0·11, 0·78	0·23*	0·05, 0·99	28·1	71·9	0·062	2·76*	1·13, 6·73	1·82	0·62, 5·40
≥2–<4	70·5	29·5		0·56	0·28, 1·10	0·51	0·22, 1·18	50·0	50·0		1·08	0·56, 2·09	0·85	0·38, 1·90
≥4	57·1	42·9		1·00	Ref.	1·00	Ref.	51·9	48·1		1·00	Ref.	1·00	Ref.
Sleep time (h/d)														
<7	71·4	28·6	0·715	0·80	0·24, 2·66	0·99	0·21, 4·69	41·7	58·3	0·731	1·23	0·38, 4·03	1·03	0·26, 3·99
≥7	66·7	33·3		1·00	Ref.	1·00	Ref.	46·8	53·2		1·00	Ref.	1·00	Ref.
Physical activity														
Inactive	67·8	32·2	0·943	0·98	0·53, 1·80	0·90	0·39, 2·06	51·6	48·4	0·132	0·63	0·35, 1·15	0·69	0·31, 1·50
Active	67·3	32·7		1·00	Ref.	1·00	Ref.	40·2	59·8		1·00	Ref.	1·00	Ref.
Body composition														
Not at risk	65·6	34·4	0·278	1·57	0·69, 3·59	1·41	0·45, 4·38	48·7	51·3	0·205	0·59	0·25, 1·35	0·34	0·12, 1·01
Overweight/obesity	75·0	25·0		1·00	Ref.	1·00	Ref.	35·7	64·3		1·00	Ref.	1·00	Ref.
Desire to change weight														
To be thinner	74·5	25·5	0·000	0·08***	0·02, 0·30	0·13*	0·03, 0·63	45·3	54·7	0·194	3·22	0·81, 12·82	3·27	0·63, 16·94
To remain the same weight	69·7	30·3		0·10**	0·03, 0·39	0·17*	0·03, 0·82	43·9	56·1		3·40	0·83, 13·98	4·44	0·87, 22·80
To be thicker	18·8	81·3		1·00	Ref.	1·00	Ref.	72·7	27·3		1·00	Ref.	1·00	Ref.

Q1, first quintile; Q5, fifth quintile; Ref., reference category.
†Univariate analysis (logistic regression analysis considering the effect of one explanatory variable).
‡Multivariate analysis (multiple logistic regression analysis considering the simultaneous effect of all explanatory variables). Only adolescents who did not misreport their energy intake were considered for this analysis.
Significant differences between Q5 and Q1 in each dietary pattern (χ^2 test): *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$.

one and 'Western' dietary pattern in girls; whereas it was positively related to the 'Mediterranean' dietary pattern (despite the lack of statistical significance). To consume < 5 daily meals was associated with a low probability to follow a 'Western' dietary pattern among girls, but this variable lost statistical significance after being adjusted for all explanatory variables.

Discussion

The Mediterranean dietary pattern has been widely reported to be a model of healthy eating for its contribution to favourable health status and best quality of life. However, a progressive shift to a non-Mediterranean pattern, even in countries bordering the Mediterranean Sea, has been observed[44]. Previous studies carried out in Spain confirmed that young generations[5–11] are further away from the Mediterranean dietary pattern. Lately, we found that the average adherence to the Mediterranean dietary pattern in our adolescent population was 58 %[11]. The present study has identified two major dietary patterns among adolescents ('Western' and 'Mediterranean'), supporting evidence for a nutrition transition from a traditional healthy diet towards a Western diet among Mediterranean youth. The literature has reported that girls paid more attention to foods than boys, met nutritional recommendations, and tried to prevent or reverse the obese state and improve health status[45]. Accordingly, we found that girls were more likely to follow the 'Mediterranean' but not the 'Western' dietary pattern than boys.

Socio-economic and lifestyle characteristics are important determinants of the health status in a community. Parental educational level and socio-economic status have a marked effect on children's and adolescents' lifestyles and dietary habits[46]. In previous studies, we found that maternal educational level was associated with diet quality[9] and adherence to the Mediterranean dietary pattern[11]. Moreover, low socio-economic status and maternal educational level have also been related to high consumption of sweets, high-fat bakery products, sugary and salty snacks[5,47–49]. It has also been pointed out that food cost is another factor that may influence people's dietary choices, and to follow a 'Mediterranean' dietary patterns is usually more expensive than following a 'Western' one[50]. Our study shows that low parental socio-economic status is strongly associated with the 'Western' pattern, whereas high parental socio-economic status is associated with the 'Mediterranean' pattern.

Children and adolescents usually spend much leisure time on sedentary behaviours, such as TV viewing, computer use and video games, collectively known as screen time[28]. An association between watching TV for > 2 h/d and major consumption of high-fat snacks and high-sugar drinks has been demonstrated[5,51]. TV is clearly related to exposure to the advertising of unhealthy foods[45]. However, whereas media screen time was a good proxy for either dietary pattern in the present study, no significant differences were observed when TV and computer use were assessed separately. Thus, adolescents who spent ≥ 4 h/d on media screen were more likely to follow a 'Western' dietary pattern. However, those who spent < 2 h/d showed the highest probability for a 'Mediterranean' dietary pattern.

Physical activity level has been associated with food choice, and cereals, fruits and vegetables often appear in the diet of active adults and children[52]. Children who follow a healthy diet are those who might also maintain high levels of physical activity[53]. Despite no significant association between physical activity and the dietary patterns being obtained in the present study, in a previous study we found that sedentary and low-active adolescents showed the lowest adherence to the Mediterranean dietary pattern[11].

On the other hand, no statistically significant association between dietary patterns ('Western' and 'Mediterranean') and sleep time was found in the present study. Taheri[54] suggested that sleep loss leads to more opportunities for food intake. The evidence linking sleep and weight has been stronger for younger children and adults[55,56]. In a previous work we found that short sleep (< 7 h/d) was associated with obesity compared with longer sleep in boys, whereas no association was found in girls[57]. Recently Lytle et al.[58] have found more evidence for younger adolescents as compared with older adolescents. Despite that further studies are needed, adequate sleep during this critical time period is important[58].

Despite finding no significant association between number of daily meals and snacks and dietary patterns, the present results indicated that ≥ 5 eating occasions per day may promote high daily consumption of energy-dense foods and drinks. However, meal pattern and omission of meals, especially skipped breakfast, have also been suggested as markers of an inappropriate dietary intake among adolescents[59], and in a previous study eating frequency was identified as a risk factor for obesity in both boys and girls[57]. Therefore, a promotion of at least 5 daily meals and snacks should be considered in nutrition education programmes for adolescents aimed at reducing risk of disease. However, education programmes could also focus on strategies to promote healthy food choices following the Mediterranean diet.

Our results also revealed that adolescents without risk to be overweight or obese were more likely to follow the 'Western' dietary pattern than the 'Mediterranean' dietary pattern (despite that statistical significance was found only in boys). The Mediterranean diet is an example of a healthy diet[42]. However, controversial results in adherence to the Mediterranean diet and obesity in children and adolescents have been found in the literature. Some studies observed an inverse association between Mediterranean dietary pattern and BMI[53,60,61], but others found no correlation[62]. On the other hand, a study among 2513 Spanish children

and adolescents aged 10–24 years which assessed adiposity by waist circumference and weight:hip ratio found an inverse association of both indicators with adherence to the Mediterranean diet[63]. We have also previously observed that both obese boys and girls avoided sweets and salty snacks consumption to counteract the obesity[57].

Body image has been found to be a powerful determinant of adolescent nutritional habits and food choices[64]; and in the present study a desire for a thinner body shape was associated with low risk for the 'Western' dietary pattern. Therefore, understanding how satisfaction with current body shape affects food preferences and the overall adolescent diet is a key issue for the development of strategies aimed at influencing dietary behaviour.

Limitations of the study

Dietary and physical activity data were based on self-reports[16]. The literature reports that food under-reporting is usually associated with gender and weight status[65,66]. Self-report of physical activity also can lead to over-report the physical activity due to social desirability bias, and therefore the number of inactive individuals may be greater than that reported[67,68], especially among children and adolescents, and also among the obese[67]. However, in many cases, self-reporting is the only feasible method of assessing physical activity[69] and dietary intake in epidemiological studies. Although epidemiologists made every effort to get as accurate data as possible, there is a possibility that misreporting occurred[16].

The FFQ did not differentiate between wholegrain and white bread. However, Ribas-Barba et al.[70] found a slight percentage of daily wholegrain consumers (14·2 %) among the Catalonia population aged 10–75 years, with a high percentage of never consumers of wholegrain bread (71·3 %). Therefore, we would expect that bread, which was one of the main foods related to the 'Western' dietary pattern in the present study, was consumed mostly as white bread.

The statistical methods usually applied in nutritional epidemiology to define dietary patterns based on collected dietary information contain a posteriori approaches, such as cluster and factor analyses, and a priori dietary index approaches[40]. In the present study an exploratory statistical analysis based on factor analyses was chosen. Factor analysis is a useful technique to summarise food patterns and relate them to different socio-economic and lifestyle factors[5] and body self-perception. However, it must be acknowledged that the method is data-specific, thus the patterns and their associations extracted in one study population may not be reproduced in other populations[5,71]. This kind of analysis can facilitate the development of interventions aimed at modifying eating patterns, rather than specific components of the diet[5].

Body fat was calculated using Slaughter et al.'s equations [30] which have been suggested previously by Rodríguez et al.[31]. However, the present study did not take into account pubertal development despite that chronological age may vary dramatically during this phase. Therefore, as in a previous study[72] in which adolescents have been classified according to their pubertal stage, boys were divided into two groups: pubertal (12–14 years old) and post-pubertal (15–17 years old).

Conclusions

The present study shows the existence of two major dietary patterns among Balearic Islands' adolescents: 'Western' and 'Mediterranean', but girls are more 'Mediterranean' than boys. This evidence supports that the food pattern of Balearic Islands' adolescents is in a transitional state characterised by the loss of the traditional Mediterranean dietary pattern towards a Western dietary pattern. Low parental socio-economic status, much leisure time on sedentary behaviours such as media screen time and body image are factors associated with the 'Western' dietary pattern.

Adolescents constitute priority targets for action and should be more aware about the Mediterranean diet and its health benefits. Programmes to promote the traditional Mediterranean dietary pattern among not only adolescents but also their families, combined with an active lifestyle, would likely result in a more favourable future health profile.

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