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Adherence to dietary recommendations among Spanish and immigrant adolescents living in Spain; the AFINOS study

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Abstract

Objectives: This study compares the adherence of immigrant and Spanish adolescents residing in the Madrid region (Spain) to national dietary recommendations. The factors compared were the consumption of items from the eight basic food groups (vegetables, fruits, bread/cereals, meat, eggs, fish, legumes and milk/dairy products), including the excessive or deficient consumption of eggs, meat and fish. In addition, the evaluation of excessive sweet foods or soft drinks in the diet was also considered. Subsequently, the influence of length of residence on dietary habits was examined.

Materials and methods: Self-reported data were collected in a cross-sectional survey conducted over the period November 2007 to February 2008. The study participants were a representative sample of adolescents aged 13 to 17 years (n = 2,081, 1,055 girls) living in the Madrid region. Participants were recruited from secondary schools (grades 7th to 10th) randomly selected according to the geographic distribution of adolescents in the region.

Results: Immigrant adolescents showed a greater likelihood of not fulfilling recommendations for the consumption of meat, fish, eggs, legumes, bread/cereals, and milk/dairy products. Their diets were also more likely to lack sufficient fish and they also consumed more eggs and more sweet foods and soft drinks than their native counterparts. Spanish adolescents were more likely not to meet recommendations for the intake of vegetables. Length of residence weakly affected dietary habits, with both negative and positive effects observed.

Conclusion: The likelihood of not fulfilling dietary recommendations was higher among the immigrant adolescents with the exception of the intake of fruits and vegetables.

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Key words: *Inmigration. Nutrition. Length of residence. Acculturation. Adolecents. Spain.*

ADHERENCIA A LAS RECOMENDACIONES NUTRICIONALES ENTRE ADOLESCENTES ESPAÑOLES E INMIGRANTES RESIDENTES EN ESPAÑA; ESTUDIO AFINOS

Resumen

Objetivos: Este estudio compara la adherencia a las recomendaciones nutricionales de adolescentes inmigrantes y españoles residentes en la Comunidad de Madrid, España. Se comparó el consumo de ocho grupos principales de alimentos (verduras, frutas, pan/cereales, carne, huevos, pescado, legumbres, leche/derivados lácteos) incluyendo el consumo excesivo y deficiente de huevos, carne y pescado. También fue valorado el consumo excesivo de dulces y bebidas azucaradas. Posteriormente se analizó la influencia del tiempo de residencia en España sobre los mencionados hábitos de dieta.

Material y método: Se llevó a cabo un estudio transversal en el que fueron recogidos datos auto-reportados durante el periodo comprendido entre noviembre 2007 y febrero 2008. Se obtuvo una muestra representativa de adolescentes con edades comprendidas entre 13 y 17 años (n = 2.081, 1.055 mujeres) residentes en la Comunidad de Madrid. Los participantes pertenecían a centros de enseñanza secundaria seleccionados aleatoriamente según la distribución geográfica de los adolescentes en la región.

Resultados: Los inmigrantes adolescentes presentaron una mayor probabilidad de no cumplir las recomendaciones nutricionales para el consume de carne, pescado, legumbres, pan/cereales y leche/derivados, de consumir una cantidad insuficiente de pescado y más dulces y bebidas azucaradas que sus compañeros españoles. Los adolescentes españoles mostraron una mayor probabilidad de no cumplir con la recomendación establecida para verduras. El tiempo de residencia afectó débilmente los hábitos de dieta, asociando aspectos tanto positivos como negativos.

Conclusiones: La probabilidad de no cumplir las recomendaciones nutricionales fue mayor entre los adolescentes inmigrantes con excepción del consumo de frutas y verduras.

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Palabras clave: *Inmigración. Nutrición. Tiempo de residencia. Aculturación. Adolescentes.*

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Introduction

Acculturation is the process whereby immigrant populations change their original lifestyle and adopt the characteristic behaviour and habits of the host country[1]. Accordingly, length of residence may be considered an indirect measure of acculturation[2]. Among the lifestyle factors that may be affected by length of residence, dietary habits are particularly important, as diet is a determinant of obesity and other chronic diseases. Thus, acculturation could be an independent factor that conditions the diet of immigrant population.

Although immigration in Spain is a fairly recent phenomenon, in some regions the influx of immigrants has been extremely rapid. For example, the population of immigrants in the Madrid region grew from 2.3% in 1998 to 16.7% in 2010[3].

In several countries, the diets of immigrant and native populations have been compared through surveys. For the United States, reports indicate a healthier diet for both adults[4] and adolescents[5] of the immigrant population overall and for first generation immigrants compared to natives. Also in Europe, some dietary patterns in immigrants seem to be more positive than the eating habits of natives[6]. However, for some ethnic groups of children and adolescents, the opposite was observed[7], and both positive and negative aspects emerged when comparing the diets of first generation immigrant adolescents and native adolescents[8].

In a study conducted in the urban area of Madrid, the dietary habits of immigrants were found to be healthy including a low fat intake and high consumption of fruits and raw vegetables[9]. However, it was also concluded that diet quality among the immigrant adolescents residing in the city of Madrid was worse than among Spanish adolescents[10]. Finally, other authors have detected both positive and negative aspects of the diets of both immigrant and Spanish adolescents living in Madrid[11].

The impact of acculturation (assessed in the literature using indirect measures, such as length of residence and generation status, but also according to specific scales[12]) on diet has also been addressed. Thus, among immigrants in the United States, acculturation has been noted to have adverse effects on diet in adolescents[5,13]. As an indicator of acculturation, a similar detrimental effect of length of residence has been observed in adult immigrants living in the United States[4]. In Europe, this effect has not been as clear and the results of different studies have been mixed. For example, both positive and negative impacts on diet of length of residence have been identified in adult immigrants[14]. Other authors have concluded that first generation immigrant adolescents consume more fruits and vegetables and less milk, fast food and traditional native foods than second generation immigrants and native adolescents[8].

In studies conducted in adults living in central Madrid and its surrounding region, length of resi-dence[15] was related to a healthier pattern of diet, characterized by a high consumption of fish, fruits, vegetables, dairy products and bread and acculturation[16] was related to a more varied and balanced diet, with a higher consumption of milk, fish, meat, vegetables and legumes. Significant changes were also detected in some aspects of the diet as length of residence increased in Maghrebi and Latin American women[17].

This study was designed to identify differences in adherence to certain dietary recommendations among immigrant and Spanish adolescents living in the Madrid region, including their consumption of excessive amounts of sweet foods and soft drinks, meat, eggs and fish. After comparing these factors, we then tried to identify possible effects of length of residence on the differences detected.

Methods

Study design and participants

Participants for the current study were recruited from those taking part in the AFINOS study (*La Actividad Física como Agente Preventivo del Desarrollo de Sobrepeso, Obesidad, Alergias, Infecciones y Factores de Riesgo Cardiovascular en Adolescentes*-Physical Activity as a Preventive Agent of the Development of Overweight, Obesity, Infections, Allergies and Cardiovascular Risk Factors in Adolescents). The rationale and methods of the AFINOS study have been described in detail elsewhere[18]. In brief, it is a cross-sectional survey conducted in 2007-2008 designed to assess lifestyle and health indicators through questionnaires administered to representative sample of adolescents ($N\sim2000$) aged 13 to 17 years from the Madrid region (Spain), as well as the potential influence of the family context. Data were collected at secondary schools (grades 8th to 11th) randomly selected according to the geographic distribution of adolescents in the region, including both rural and urban areas. In total 25 schools were selected, 10 in the city centre, 8 in the suburbs and 7 schools in villages. After acceptance, the classrooms needed to obtain the sample for each school were randomly selected among the grades specified previously. The questionnaire was administered during class time assigned by the schools, while a member of the research group supervised the process. The final sample size with valid data was 2,081 subjects (1,055 girls). Around 15% of the sample (n = 335, 186 girls) was comprised of adolescents born in a foreign country (263 from Latin American countries and 72 from European countries, mainly Eastern European). This figure of 15% is in line with the immigrant population of Madrid, which has been estimated as close to 16%[3] based on data from the National Institute of Statistics for 2010, and the countries of origin also coincide with the two largest immigrant groups living in the Madrid region according to the National Survey of Immigrants 2007[19]. Human

subject approval was sought from the Ethics Committee of the *Puerta de Hierro* Hospital (Madrid, Spain) and the Bioethics Committee of the Spanish National Research Council (CSIC, Madrid, Spain). All parents or guardians and adolescents gave their written informed consent to participate in the AFINOS study.

Instruments and variables

All variables employed were collected by questionnaire and were self-reported. The questionnaire used in the AFINOS Study was based on epidemiological questionnaires used previously in both national[20] and international studies[21,22] carried out in adolescents. The general questionnaire collected ample information about the general socio-demographic characteristics of the sample, and relevant health and lifestyle data[18]. The AFINOS questionnaire was piloted in a reference population (aged 13-16 years) to test its adaptability and compressibility, which were adequate and only slight corrections were needed.

For assessing general nutritional habits, a summary of questions from the Food Frequency Questionnaire (FFQ) was used, previously employed in the EVASYON Study on an adolescent population[23]. The validity of short versions of the FFQ for assessing general food intake in Spanish adolescent populations has been peviously demonstrated[24].

The dependent variables considered in the present study were the fulfilment of national recommendations on the consumption of foods from the eight main groups (fruits, vegetables, meat, eggs, fish, bread/cereals, legumes and milk/dairy products) defined according to SENC (*Sociedad Española de Nutrición Comunitaria*-Spanish Society of Community Nutrition) criteria[25]. The excessive or deficient consumption of meat, eggs and fish (relative to recommended quantities) were also considered. Given the lack of guidelines on the intake of sweet foods and soft drinks, we considered the daily consumption of these items as excessive.

The independent variables for the study were immigrant status and length of residence in Spain. For length of residence, two categories were defined: less than 6 years (n = 182) and 6 years or over (n = 136). This cutoff was based on dividing the sample into the most approximate halves.

The following variables were considered as co-variables: sex, age, family structure (two categories: mother and father living at home, no parent or one parent living at home), large family (defined as ≥3 children by the Spanish government), type of school (public or private), area of residence (Madrid centre/suburbs, rural Madrid), smoker (daily, occasional) or non smoker (never smoked or given up smoking), overweight (including obesity), risk of suffering from an eating disorder [estimated according the Spanish version of the SCOFF Questionnaire[26]],

being on a diet and having breakfast. To define a subject as overweight/obese we used the self-reported Body Mass Index (BMI), calculated weight/height square (kg/m²), and the BMI age- and gender -specific cut offs proposed by Cole et al. for young subjects[27]. The capacity of self-reported BMI to screen overweight and obesity status has been previously shown[28].

Data analysis

The characteristics of the sample and output results of the study are presented as percentage frequencies. Immigrant versus Spanish adolescents and immigrants living in Spain for <6 versus ≥6 years were compared using the Chi-squared test. Statistical significance was set at two-sided (p < 0.05).

Logistic regression was used to determine odds ratios (OR) and 95% confidence intervals (CI) for not meeting recommendations for the different foods, excessive or deficient meat/fish/eggs consumption and the excessive consumption of sweet foods and soft drinks in the Spanish (reference group) and immigrant populations (as a whole or stratified by length of residence). Several co-variables were controlled for in three logistic regression models. The first model was crude. In the second model, we controlled for the subject variables: gender, age, family structure, large family, type of school and area of residence. In the third model, we entered diet-related variables (those with a documented effect on diet): overweight and obesity[29], an eating disorder[30], being on a diet[31], having breakfast[32] and tobacco consumption[33]. All tests were performed using the SPSS package (v 15.0) for Windows XP.

Results

The general characteristics of the Spanish and immigrant populations are provided in table I. Significant differences between the two populations were detected in several of the variables.

Figure 1 shows the percentages of subjects not fulfilling the recommendations for the different food items. Significant differences between the Spanish native and immigrant populations were detected in adherence to recommendations for all kinds of food except fruits. Immigrant adolescents were worse at meeting recommendations for bread/cereals, legumes, meat, fish, eggs and milk/dairy products (p = 0.021 for eggs, p < 0.001 for the others). In contrast, the Spanish adolescents were worse at meeting the recommendation for vegetables (p < 0.001). According to length of residence, immigrants living in Spain for 6 years or more, better met the recommendations for the consumption of eggs (p = 0.030) and legumes (p = 0.016) than those who had spent less than 6 years in this country.

The percentages of subjects consuming excessive/insufficient meat, eggs or fish are shown in figure 2 and

Characteristics of the Spanish adolescents and immigrant population examined. Variables for the immigrant adolescents
are provided by length of residence in the Madrid region. Sample size 2,081; subject age 13-17 years

				Immigrant adolescents		
				Length of residence		
	Spanish	*Immigrants*	*p**	*< 6 years*	*≥ 6 years*	*P**
n	1743	335		182	136	
Male (%)	50.3	44.5	0.051	45.5	43.4	0.842
Age [mean, SD)]	14.7 (1.2)	14.9 n (1.2)	0.113	14.8 (1.2)	14.9 (1.2)	0.445
Age 3-14 years (%)	43.	43.6	0.867	44.5	41.9	0.644
Age 15-17 years (%)	56.9	56.4		55.5	58.1	
Living with both parents (%)	80.7	66.9	**< 0.001**	70.0	62.1	0.147
Large family (%)	7.6	20.3	**< 0.001**	20.4	20.9	0.904
Publich school (%)	85.8	81.5	0.718	89.1	78.9	**0.013**
Residing in metropolitan area + suburb (%)	65.5	67.9	0.404	61.9	75.8	**0.011**
Smokers (%)	17.3	12.7	**0.041**	12.2	13.3	0.916
Risk of eating disorder (%)	23.2	32.0	**0.001**	36.2	28.5	0.115
Being on a diet (%)	9.6	11.9	0.208	15.8	5.9	**0.006**
Overweight or obese (%)	17.0	20.0	0.196	22.4	14.5	0.081
Having breakfast (%)	87.1	78.5	**< 0.001**	78.2	78.6	0.935

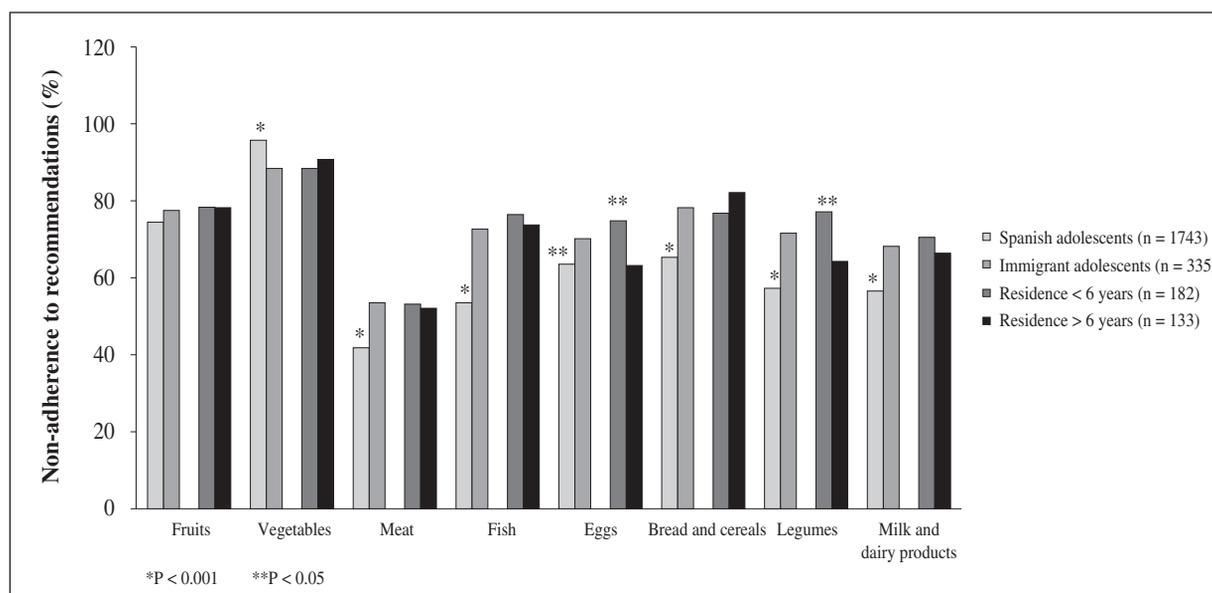**Persons χ^2 test (t-Student test used for age as a continuous variable).*

Fig. 1.—Proportions of the Spanish and immigrant adolescent populations not meeting national dietary recommendations. Results are provided for the populations as a whole and by length of residence in the Madrid region for the immigrant adolescents. Sample aged 13-17 years, surveyed 2007-8.

the percentages of subjects consuming sweet foods and soft drinks daily are provided in figure 3. The figures indicate that more immigrant adolescents eat an excess of meat and eggs than Spanish subjects (p = 0.005, p < 0.001 respectively). Also more immigrants consume insufficient meat and fish (p = 0.030, p < 0.001) and eat sweet foods and soft drinks daily (p < 0.001 for both respectively).

Table II shows the odds ratios of the logistic regression models for not meeting food recommendations. Differences between the Spanish and immigrant adolescents were detected for the consumption of vegetables, meat, fish, eggs, bread/cereals, legumes and milk/dairy products. Using the Spanish group as reference, the immigrant subjects showed less likelihood of not meeting recommendations for vegetables in the crude model (OR = 0.32; 95%CI 0.21-0.49; p < 0.001) and this likelihood did not vary when the model was adjusted for subject variables (Model 2) or diet-related variables (Model 3).

In contrast, the immigrant adolescents were found to be less likely to meet recommendations for meat (OR = 1.62; 95%CI 1.27-2.06; p < 0.001), fish (OR=2.72; 95%CI 2.07-3.59; p < 0.001), eggs (OR = 1.35; 95%CI
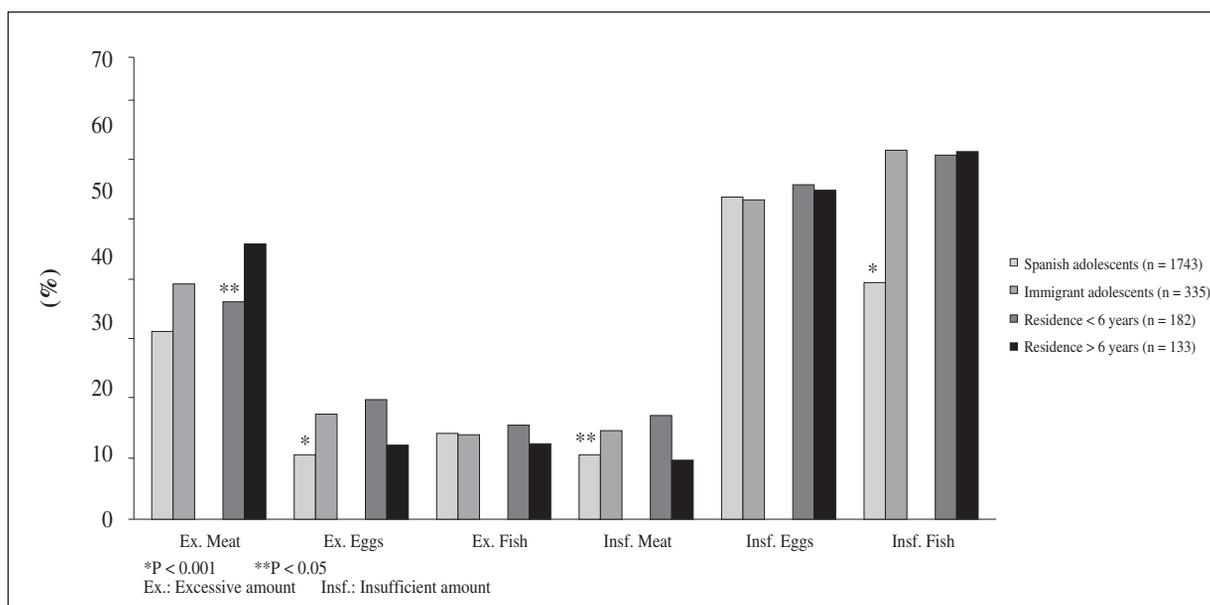
Fig. 2.—*Proportions of the Spanish and immigrant adolescent populations found to consume an excessive or insufficient amount of meat, eggs and fish. Results are provided for the populations as a whole and by length of residence in the Madrid region for the immigrant adolescents. Sample aged 13-17 years, surveyed 2007-8.*
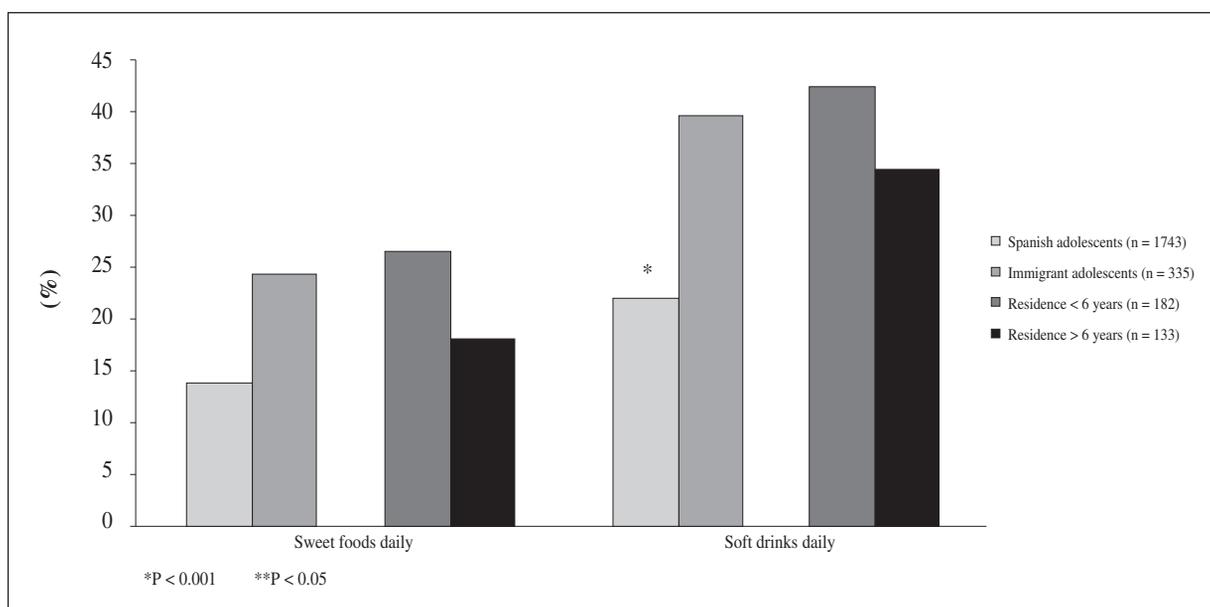

Fig. 3.—*Proportions of the Spanish and immigrant adolescent populations found to consume an excessive amount of sweet foods and soft drinks (daily consumption). Results are provided for the populations as a whole and by length of residence in the Madrid region for the inmigrant adolescents. Sample aged 13-17 years, surveyed 2007-8.*

1.04-1.75; p = 0.022), legumes (OR = 1.93; 95%CI 1.48-2.52; p < 0.001), bread/ cereals (OR = 1.91; 95%CI 1.44-2.54; p < 0.001), and milk/dairy products (OR = 1.67; 95%CI 1.30-2.15; p < 0.001) in the crude model. No considerable variations in this trend were detected in Models 2 and 3.

Table III shows the odds ratios recorded in the logistic regression models for the daily consumption of sweet foods and soft drinks. According to all three models, the immigrant population showed a greater likelihood of consuming sweets and soft drinks every day than their Spanish counterparts (OR from 1.98 to 2.05, p < 0.001 for sweet foods and OR from 2.29 to 2.37; p < 0.001 for soft drinks).

The influence of length of residence on the risk of not fulfilling adherence to the dietary recommendations varies. Thus, length of residence does not seem to lower the higher likelihood of not meeting dietary

Table II
Logistic regression models for not meeting dietary recommendations among the Spanish adolescents and immigrant populations. Results are provided for the populations as a whole and by length of residence in the Madrid region for the immigrant adolescents. Sample size 2081; subject age 13-17 years

	Model 1			Model 2			Model 3		
	OR	*95%CI*	*P*	*OR*	*95%CI*	*P*	*OR*	*95%CI*	*P*
Fruit									
Spanish	1.00			1.00			1.00		
Immigrants	1.00	0.75-1.33	0.977	0.98	0.72-1.34	0.924	0.98	0.70-1.38	0.0945
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	1.06	0.72-1.55	0.753	0.98	0.66-1.47	0.954	0.88	0.57-1.37	0.600
Immigrants residence ≥ 6 years	1.05	0.68-1.62	0.822	1.12	0.70-1.79	0.622	1.25	0.74-2.11	0.398
Vegetables									
Spanish	1.00			1.00			1.00		
Immigrants	0.32	0.21-0.49	**< 0.001**	0.35	0.22-0.56	**< 0.001**	0.35	0.20-0.60	**< 0.001**
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	0.33	0.19-0.56	**< 0.001**	0.37	0.21-0.66	**0.001**	0.39	0.19-0.77	**0.007**
Immigrants residence ≥ 6 years	0.41	0.21-0.78	**0.007**	0.47	0.23-0.94	**0.033**	0.52	0.22-1.21	0.133
Meat									
Spanish	1.00			1.00			1.00		
Immigrants	1.62	1.27-2.06	**< 0.001**	1.65	1.28-2.13	**< 0.001**	1.41	1.07-1.86	**0.014**
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	1.64	1.20-2.24	**0.002**	1.64	1.17-2.28	**0.003**	1.41	0.98-2.04	0.063
Immigrants residence ≥ 6 years	1.50	1.06-2.14	**0.022**	1.56	1.07-2.27	**0.020**	1.31	0.87-1.97	0.189
Fish									
Spanish	1.00			1.00			1.00		
Immigrants	2.72	2.07-3.59	**< 0.001**	2.73	2.03-3.66	**< 0.001**	2.80	2.03-3.86	**< 0.001**
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	2.83	1.96-4.09	**< 0.001**	2.85	1.92-4.23	**< 0.001**	2.96	1.91-4.60	**< 0.001**
Immigrants residence ≥ 6 years	2.42	1.62-3.63	**< 0.001**	2.40	1.57-3.68	**< 0.001**	2.39	1.51-3.79	**< 0.001**
Eggs									
Spanish	1.00			1.00			1.00		
Immigrants	1.35	1.04-1.75	**0.022**	1.35	1.02-1.78	**0.032**	1.38	1.01-1.87	**0.037**
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	1.74	1.21-2.49	**0.002**	1.64	1.12-2.39	**0.010**	1.63	1.07-2.48	**0.022**
Immigrants residence ≥ 6 years	0.99	0.68-1.43	0.967	1.06	0.71-1.56	0.769	1.15	0.74-1.78	0.521
Legumes									
Spanish	1.00			1.00			1.00		
Immigrants	1.93	1.48-2.52	**< 0.001**	1.80	1.36-2.37	**< 0.001**	1.78	1.31-2.42	**< 0.001**
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	2.53	1º.74-3.66	**< 0.001**	2.27	1.54-3.33	**< 0.001**	2.33	1.51-3.60	**< 0.001**
Immigrants residence ≥ 6 years	1.38	0.95-2.00	0.088	1.31	0.88-1.94	0.173	1.28	0.83-1.97	0.250
Bread and cereals									
Spanish	1.00			1.00			1.00		
Immigrants	1.91	1.44-2.54	**< 0.001**	1.72	1.27-2.32	**< 0.001**	2.00	1.43-2.81	**<0.001**
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	1.72	1.19-2.47	**0.003**	1.55	1.06-2.28	**0.023**	1.83	1.19-2.83	**0.006**
Immigrants residence ≥ 6 years	2.45	1.54-3.89	**< 0.001**	2.18	1.34-3.55	**0.002**	2.45	1.43-4.20	**0.001**
Milk/dairy products									
Spanish	1.00			1.00			1.00		
Immigrants	1.67	1.30-2.15	**<0.001**	1.55	1.19-2.03	**0.001**	1.58	1.17-2.13	**0.002**
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	1.85	1.32-2.59	**<0.001**	1.78	1.25-2.55	**0.001**	1.74	1.16-2.60	**0.007**
Immigrants residence ≥ 6 years	1.52	1.04-2.21	**0.027**	1.36	0.92-2.02	0.118	1.47	0.95-2.28	0.081

Model 1, crude model. Model 2, adjusted for sex, age, living with parents, large family, type of school and area of residence. Model 3, adjusted for sex, age, living with parents, large family, type of school, area of residence, smoking, eating disorder, being on a diet, overweight or obesity, having breakfast.

Logistic regression models for daily consumption of sweet foods and soft drinks among the Spanish and immigrant adolescents. Results are provided for the populations as a whole and by length of residence in the Madrid region for the immigrant adolescents. Sample size 2081; subject age 13-17 years

	Model 1			Model 2			Model 3		
	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P
Sweet foods									
Spanish	1.00			1.00			1.00		
Immigrants	2.01	1.50-2.68	**< 0.001**	1.05	1.50-2.79	**< 0.001**	1.98	1.40-2.79	**< 0.001**
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	2.30	1.60-3.30	**< 0.001**	2.22	1.51-3.27	**< 0.001**	2.26	1.46-3.48	**< 0.001**
Immigrants residence ≥ 6 years	1.40	0.88-2.23	0.150	1.52	0.93-2.48	0.091	1.46	0.85-2.49	0.162
Soft driks									
Spanish	1.00			1.00			1.00		
Immigrants	2.30	1.78-2.96	**< 0.001**	2.37	1.81-3.12	**< 0.001**	2.29	1.69-3.08	**< 0.001**
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	2.52	1.82-3.49	**< 0.001**	2.60	1.83-3.70	**< 0.001**	2.46	1.67-3.63	**< 0.001**
Immigrants residence ≥ 6 years	1.84	1.26-2.68	**0.002**	1.86	1.24-2.81	**0.003**	1.92	1.23-2.99	**0.004**

Model 1, crude model. Model 2, adjusted for sex, age, living with parents, large family, type of school and area of residence. Model 3, adjusted for sex, age, living with parents, large family, type of school, area of residence, smoking, eating disorder, being on a diet, overweight or obesity, having breakfast.

recommendations for meat, fish and bread/cereals (Table II: Models 1, 2, 3; all p < 0.05) along with the daily consumption of soft drinks (Table III, all p < 0.05), though for meat this lack of effect is not observed when the model is adjusted for co-variables related to diet (Table II: Model 3, OR = 1.41, p = 0.063 for a residence length of <6 years and OR = 1.31, p = 0.189 for a residence length of ≥6 years). Furthermore, our results suggest an increased likelihood of not meeting recommendations for bread/cereals shown by immigrant adolescents living in Spain for ≥6 years (risk increased from OR = 1.55-1.83 to 2.18-2.45, p < 0.05 and p < 0.01 respectively). An influence of the length of residence was also observed in regard to the lower likelihood of immigrant adolescents not meeting recommendations for the consumption of vegetables when the model was adjusted for co-variables related to diet. This lower likelihood disappears for adolescents living in Spain for more than 6 years (Table II: Model 3, OR = 0.52, p = 0.133).

On the contrary, an influence of length of residence in not fulfilling dietary recommendations was observed for eggs, legumes, milk/dairy products (Table II: Models 1, 2 and 3) and sweet foods (Table III: Models 1, 2 and 3). This meant that adolescents who had lived less than 6 years in Spain showed a higher likelihood than the Spanish adolescents to not meeting these recommendations or to consuming an excessive amount of sweet foods (all p < 0.05 in all models, except for sweet foods p < 0.001 in all models) while those living in this country for more than 6 years showed a likelihood similar to the Spanish individuals (all p > 0.05 in all models, except for Model 1 for milk products, p = 0.027).

An analysis of recommendations not fulfilled due to the excessive or deficient consumption of meat, eggs and fish also revealed certain tendencies. Thus, no differences were observed between the Spanish and immigrant adolescents in excessive fish consumption and deficient egg consumption (Tables IV and V; no differences in all regression models; all p > 0.05) while consistent differences across all regression models emerged for the factor insufficient fish consumption (Table V). These differences determined that immigrant adolescents were more likely to show a low fish intake in their diet (OR from 2.39 to 2.48; p < 0.001).

Results were less consistent when we compared the two populations in terms of their excessive or deficient consumption of meat and excessive intake of eggs. Thus, Models 1 and 2 revealed slight differences in the likelihood of eating too much or too little meat between the Spanish and immigrant adolescents (OR increased from 1.41 to 1.52, p < 0.05) but these differences vanished when the model was adjusted for co-variables related to diet (Model 3). Table IV reveals a higher likelihood of including too many eggs in the diet of immigrants across all regression models (OR increased from 1.70 to 1.81; p < 0.01) but in this case an effect of length of residence was detected. This meant that this heightened likelihood was lost in the immigrants who had lived for at least 6 years in Spain while it persisted in those who had spent less time in this country (OR increased from 1.91 to 2.16, p < 0.01).

Discussion

The findings of this study reveal that the adolescent immigrants in Spain examined here showed a less probability of not meeting recommendations for the consumption of vegetables and a likelihood of not

	Model 1			Model 2			Model 3		
	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P
Meat									
Spanish	1.00			1.00			1.00		
Immigrants	1.41	1.10-1.81	**0.005**	1.42	1.09-1.84	**0.008**	1.23	0.92-1.65	0.154
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	1.28	0.93-1.77	0.126	1.28	0.91-1.80	0.154	1.13	0.76-1.66	0.532
Immigrants residence ≥ 6 years	1.59	1.11-2.28	**0.011**	1.60	1.09-2.34	**0.015**	1.38	0.91-2.11	0.126
Eggs									
Spanish	1.00			1.00			1.00		
Immigrants	1.81	1.31-2.52	**< 0.001**	1.74	1.22-2.48	**0.002**	1.70	1.15-2.52	**0.007**
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	2.16	1.44-3.22	**< 0.001**	1.91	1.23-2.96	**0.004**	1.99	1.23-3.24	**0.005**
Immigrants residence ≥ 6 years	1.19	0.69-2.05	0.528	1.31	0.74-2.30	0.342	1.28	0.69-2.38	0.428
Fish									
Spanish	1.00			1.00			1.00		
Immigrants	0.99	0.70-1.40	0.979	1.06	0.74-1.54	0.718	1.10	0.73-1.64	0.635
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	1.12	0.72-1.72	0.607	1.23	0.78-1.94	0.363	1.29	0.78-2.14	0.308
Immigrants residence ≥ 6 years	0.84	0.49-1.45	0.540	0.87	0.49-1.57	0.665	0.87	0.45-1.67	0.685

Model 1, crude model. Model 2, adjusted for sex, age, living with parents, large family, type of school and area of residence. Model 3, adjusted for sex, age, living with parents, large family, type of school, area of residence, smoking, eating disorder, being on a diet, overweight or obesity, having breakfast.

	Model 1			Model 2			Model 3		
	OR	95%CI	P	OR	95%CI	P	OR	95%CI	P
Meat									
Spanish	1.00			1.00			1.00		
Immigrants	1.46	1.03-2.06	**0.031**	1.52	1.05-2.20	**0.026**	1.43	0.95-2.16	0.083
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	1.77	1.16-2.70	**0.008**	1.77	1.13-2.78	**0.013**	1.64	0.99-2.72	0.054
Immigrants residence ≥ 6 years	0.93	0.51-1.69	0.823	1.01	0.54-1.89	0.962	0.91	0.44-1.87	0.813
Eggs									
Spanish	1.00			1.00			1.00		
Immigrants	1.01	0.79-1.28	0.910	1.00	0.77-1.29	0.969	1.03	0.78-1.37	0.807
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	1.08	0.79-1.48	0.617	1.10	0.79-1.54	0.562	1.06	0.73-1.54	1.724
Immigrants residence ≥ 6 years	0.92	0.64-1.31	0.668	0.94	0.65-1.37	0.780	1.03	0.68-1.55	0.879
Fish									
Spanish	1.00			1.00			1.00		
Immigrants	2.48	1.93-3.17	**< 0.001**	2.39	1.84-3.12	**< 0.001**	2.43	1.82-3.25	**< 0.001**
Spanish	1.00			1.00			1.00		
Immigrants residence < 6 years	2.40	1.74-3.31	**< 0.001**	2.28	1.61-3.22	**< 0.001**	2.30	1.57-3.37	**< 0.001**
Immigrants residence ≥ 6 years	2.45	1.69-3.53	**< 0.001**	2.38	1.61-3.51	**< 0.001**	2.39	1.56-3.66	**< 0.001**

Model 1, crude model. Model 2, adjusted for sex, age, living with parents, large family, type of school and area of residence. Model 3, adjusted for sex, age, living with parents, large family, type of school, area of residence, smoking, eating disorder, being on a diet, overweight or obesity, having breakfast.

meeting recommendations for the intake of fruits similar to that observed in Spanish adolescents. However, they also exhibited a greater likelihood of not meeting dietary recommendations for meat, fish, eggs, bread/cereals, legumes and milk/dairy products. In addition, we also detected that immigrant adolescents were more likely to include an excessive amount (daily consumption) of sweet foods and soft drinks, too many eggs and insufficient fish in their diet.

Studies comparing dietary patterns of immigrant and native populations, and those evaluating the effect of acculturation on diet are so diverse and heterogeneous, and employ such disparate methods that it is complex to compare them. At any rate our results are inconsistent with those studies conducted in the United States and Europe with the exception of dietary habits regarding the intake of fruits and vegetables. Thus, these reports revealed that the general population and first generation immigrants had a healthier diet or better met national recommendations among both adults[4,6] and adolescents[5]. Although the results of a study performed in German children and adolescents are in agreement with our observations, the authors of the study identified some immigrant groups who were worse at meeting national dietary recommendations[7]. In Croatia, first generation adolescent immigrants were reported to show some healthier dietary patterns than second generation immigrants and native Croatian adolescents, for example, a higher consumption of fruits and vegetables and a lower consumption of fast foods, though some less recommendable habits were also observed[8].

In a study conducted in Spain, 9 to 15-year-old immigrants living in central Madrid were found to have a worse quality diet than natives[10]. Another study revealed that first generation immigrants aged 6-12 years living in central Madrid, consumed more fruits, vegetables, legumes and eggs but less dairy products and fish than Spanish children[11]. In addition, another study found that an adult Bubi population (from Equatorial Guinea) in central Madrid consumed more carbohydrates and proteins and less fat than the native Spanish population. This ethnic group also consumed large amounts of fruits, raw vegetables and dairy products[9].

The length of residence in the host country may have a beneficial or detrimental influence on eating habits. In the present study, we observed that immigrant adolescents that had been living in Spain for ≥6 years acquired a similar likelihood to their Spanish counterparts of not meeting national recommendations for the consumption of eggs, legumes, milk/dairy products (adjusting for subject-related and diet-related variables) along with a similar trend to include too many sweet foods in their diets. In addition, their likelihood of not meeting recommendations for bread and cereals slightly increased with time of residence and their lower likelihood of not meeting recommendations for vegetables disappeared when these immigrants had spent ≥6 years in Spain (see Model 3).

Our results partially contradict those observed in studies from the United States that report a detrimental effect of acculturation on diet in adolescents[5,13]. Length of residence was found to have a similar effect in adult migrants to the United States[4].

In a study carried out in adults, male Tunisian migrants living in France for more than 9 years consumed more meat, less carbohydrates (mainly sugar and sweet foods) and had a higher potassium intake than those whose length of residence was shorter[14]. However, in adult immigrants living in The Netherlands no relationship was detected between acculturation and quality of diet[6]. Finally, in Croatia, second generation adolescent immigrants were reported to have a similar diet to their Croatian counterparts, eating less fruits and vegetables but more meat, fast foods and Mediterranean food (fish, seafood and olive oil) than first generation immigrants[8].

Several studies performed on adults living in the city or region of Madrid have also addressed this issue. The first of these revealed that more acculturated Moroccan immigrants had a more varied and balanced diet[16] and another study concluded that a longer length of residence was associated with a healthier dietary pattern in adult Bubi immigrants[15]. Finally, in a third study the authors observed that the consumption of dairy products and cereals by South American women significantly varied with time of residence[17].

Length of residence has also been found not to affect certain dietary habits. In two studies conducted in adults living in Madrid, immigrants were observed to show a high consumption of fruits and vegetables regardless of time of residence[9], and Moroccan and South American women were found to maintain their levels of vegetable and fruit consumption after migrating[17]. However, the likelihood of consuming too many eggs decreased with time of residence although a greater likelihood of consuming insufficient fish persisted among immigrants irrespective of how long they had been living in Madrid. Surprisingly, Moroccan and South American women stopped consuming fish after migrating to Spain[17].

The less-recommendable dietary habits observed here among immigrant adolescents as compared to Spanish adolescents could be attributable, first, to the fact that the Mediterranean diet has been considered a healthy dietary pattern[34], which could culturally approach Spanish adolescents to a more recommendable diet, and second, the diet of immigrants recently arrived in Spain could be far from recommendable from a nutritional standpoint. This is probably the outcome of the nutritional transition occurring in several countries, among them Latin American countries, which is where most of our immigrant adolescents were from. Data supporting this change in nutrition status exist in the literature. For example, it has been documented that the inhabitants of Chile, whose low income has recently improved, today tend to consume more meat and high-fat/high-carbohydrate

energy-dense foods[35]. Also the tendency observed in Mexico has been an increased fat consumption in women and higher consumption of sweet foods and refined carbohydrates in general[36]. Accordingly, some of these new eating habits could explain the greater consumption of meat and sweet foods and soft drinks observed among the immigrant adolescents in our study sample. We could also speculate that more processed, energy-dense foods are replacing less calorific foods since they are cheaper and quicker to prepare and this could lead immigrants with a lower family income than native subjects to adhere less well to dietary recommendations.

The typical diet of the inhabitants of Eastern European countries, the second main source of immigrants in our study sample, is rich in animal fat, especially meat[37], in agreement with the high consumption of meat observed here among immigrant adolescents. Their low fish consumption could also be the outcome of a diet less rich in fish in South America[38], which could also occur in Eastern European countries.

The dietary habits of immigrant adolescents could also be partly explained by their often lower socioeconomic status compared to the hosting population. Unfortunately, we lack information on socioeconomic status for much of the sample included in the AFINOS study due to the low response rate to the home questionnaire on the part of the participants' parents. Notwithstanding, the lower socioeconomic status of the immigrant population has been previously reported for the Madrid city area[39] and the Catalonia region[40]. Furthermore, several studies have revealed the effects of socioeconomic status on diet and that a low status could be related to a poorer quality of diet[7,41].

In conclusion, our findings indicate that immigrant adolescents living in the Madrid region are not as good at fulfilling dietary recommendations as their Spanish counterparts, with the exception of their intake of fruit and vegetables. Immigrants were also found to eat more sweet foods and soft drinks and were more likely to include an insufficient amount of fish and too many eggs in their diet. As the length of residence of the immigrants increased, their adherence to recommendations for the consumption of eggs, legumes and milk/dairy products improved (though adherence was slightly worse for the intake of vegetables and bread/cereals), and the likelihood of eating too many sweet foods and eggs was reduced. In this respect, immigrant adolescents should be specially targeted within preventive programmes due to their worse adherence to nutritional recommendations, which could imply a risk of suffering various pathologies in the future.

This study has several limitations. First, all variables were self-reported. This poses limitations to the quality of data inherent to data collection through questionnaires. Second, the sample of immigrants examined was diverse and multiethnic. Thus, each country of origin could determine a different response when indi-viduals come into contact with another culture. Third, information on socioeconomic status (e.g., family income, work activities or level of parent studies) was not available because of the low rate of completion of the questionnaire by the parents (under 40%) in the AFINOS study. Consequently, this relevant information could not be included as a co-variable in the regression models. Fourth, the size of the immigrant sub-sample was limited (n = 335) such that males and females could not be separately assessed. Finally, the cross-sectional design of the study does not allow for establishing cause-effect relationships. Future studies, preferable longitudinal, are therefore needed to clarify the meaning of the present results.

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References

1. Lindstrom M, Sundquist K. The impact of country of birth and time in Sweden on overweight and obesity: a population-based study. *Scand J Public Health* 2005; 33 (4): 276-84.
2. Singh GK, Siahpush M. Ethnic-immigrant differentials in health behaviors, morbidity, and cause-specific mortality in the United States: an analysis of two national data bases. Hum Biol. 2002; 74(1): 83-109.
3. INE (*Instituto Nacional de Estadística* -National Institute of Statistics-). Available in: http://www.ine.es/jaxi/menu.do?type =pcaxis&path=%2Ft20%2Fe245&file=inebase&L=0.
4. Bermudez OI, Falcon LM, Tucker KL. Intake and food sources of macronutrients among older Hispanic adults: association with ethnicity, acculturation, and length of residence in the United States. *J Am Diet Assoc* 2000; 100 (6): 665-73.
5. Allen ML, Elliott MN, Morales LS, Diamant AL, Hambarsoomian K, Schuster MA. Adolescent participation in preventive health behaviors, physical activity, and nutrition: differences across immigrant generations for Asians and Latinos compared with Whites. *Am J Public Health* 2007; 97 (2): 337-43.
6. Nicolaou M, van Dam RM, Stronks K. Acculturation and education level in relation to quality of the diet: a study of Surinamese South Asian and Afro-Caribbean residents of the Netherlands. *J Hum Nutr Die*. 2006; 19 (5): 383-93.
7. Kleiser C, Mensink GB, Neuhauser H, Schenk L, Kurth BM. Food intake of young people with a migration background living in Germany. *Public Health Nutr* 2010; 13 (3): 324-30.
8. Skreblin L, Sujoldzic A. Acculturation process and its effects on dietary habits, nutritional behavior and body-image in adolescents. *Coll Antropol* 2003; 27 (2): 469-77.
9. Gil A, Vioque J, Torija E. Usual diet in Bubis, a rural immigrant population of African origin in Madrid. *J Hum Nutr Diet* 2005; 18 (1): 25-32.
10. Prado C FR, Anuncibay J. Evaluación de la calidad de la dieta y su relación con el estatus nutricional en niños y adolescentes de 9 a 15 años de la ciudad de Madrid. *Antropo* 2007; 14: 61-73.
11. Montoya PT, E.; Torres, A. . [Diet and anthropometric of migrant and spanish children]. *Pediátrika* 2003; 23 (1): 6-15.
12. Arcia E, Skinner M, Bailey D, Correa V. Models of acculturation and health behaviors among Latino immigrants to the US. *Soc Sci Med* 2001; 53 (1): 41-53.

13. Gordon-Larsen P, Harris KM, Ward DS, Popkin BM. Acculturation and overweight-related behaviors among Hispanic immigrants to the US: the National Longitudinal Study of Adolescent Health. *Soc Sci Med* 2003; 57 (11): 2023-34.

14. Mejean C, Traissac P, Eymard-Duvernay S, Delpeuch F, Maire B. Influence of acculturation among Tunisian migrants in France and their past/present exposure to the home country on diet and physical activity. *Public Health Nutr* 2009; 12 (6): 832-41.

15. Delisle HF, Vioque J, Gil A. Dietary patterns and quality in West-African immigrants in Madrid. *Nutr J* 2009; 8: 3.

16. Montoya Saez PP, Torres Cantero AM, Torija Isasa ME. [Nutrition among Moroccan immigrants in the community of Madrid: factors affecting the choice of food]. *Aten Primaria* 2001; 27 (4): 264-70.

17. Acevedo P CM, Prado C, FR. Cambio alimentario asociado a la migración en mujeres magrebíes y latinoamericanas de Madrid. *Rev Esp Antrop Fís* 2003/4; 24: 71-82.

18. Veiga OL, Gomez-Martinez S, Martinez-Gomez D, Villagra A, Calle ME, Marcos A. Physical activity as a preventive measure against overweight, obesity, infections, allergies and cardiovascular disease risk factors in adolescents: AFINOS Study protocol. *BMC Public Health*. 2009; 9: 475.

19. INE (I*nstituto Nacional de Estadística* -National Institute of Statistics-). Available in: http://www.ine.es/jaxi/tabla.do?path=/t20/p319/a2007/p02/l0/&file=04006.px&type=pcaxis&L=0

20. Wärnberg J RJ, Ortega FB, Romeo J, Gónzalez-Gross M, Moreno LA, García- Fuentes M, Gómez S, Nova E, Díaz LE, Marcos A and AVENA Group. [AVENA study. (Food and Nutritional Evaluation in Adolescents). Results obtained 2003-2006]. *Pediatr Integral* 2006; Supl (1): 50-5.

21. Brener ND, Kann L, Shanklin S, Kinchen S, Eaton DK, Hawkins J et al. Methodology of the Youth Risk Behavior Surveillance System-2013. *MMWR Recomm Rep* 2013; 62 (RR-1): 1-20.

22. Roberts C, Freeman J, Samdal O, Schnohr CW, de Looze ME, Nic Gabhainn S et al. The Health Behaviour in School-aged Children (HBSC) study: methodological developments and current tensions. *Int J Public Health* 2009; 54 Suppl 2: 140-50.

23. Martinez-Gomez D, Gomez-Martinez S, Puertollano MA, Nova E, Warnberg J, Veiga OL et al. Design and evaluation of a treatment programme for Spanish adolescents with overweight and obesity. The EVASYON Study. *BMC Public Health* 2009; 9: 414.

24. Rodriguez IT, Ballart JF, Pastor GC, Jorda EB, Val VA. [Validation of a short questionnaire on frequency of dietary intake: reproducibility and validity]. *Nutr Hosp* 2008; 23 (3): 242-52.

25. Dapcich V, Salvador Catell G, Ribas Barba L, Pérez Rodrigo C, Aranceta Bartrina J, Serra Majen L. Guía de la alimentación saludable. 1ª ed. Madrid: Sociedad Española de Nutrición Comunitaria-Sociedad Españoa de Medicina de Familia y Comunitaria; 2004.

26. Rueda Jaimes GE, Diaz Martinez LA, Ortiz Barajas DP, Pinzon Plata C, Rodriguez Martinez J, Cadena Afanador LP. [Validation of the SCOFF questionnaire for screening the eating behaviour disorders of adolescents in school]. *Aten Primaria* 2005; 35 (2): 89-94.

27. Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. *BMJ* 2000; 320 (7244): 1240-3.

28. Fonseca H, Silva AM, Matos MG, Esteves I, Costa P, Guerra A et al. Validity of BMI based on self-reported weight and height in adolescents. *Acta Paediatr* 2010; 99 (1): 83-8.

29. Roseman MG, Yeung WK, Nickelsen J. Examination of weight status and dietary behaviors of middle school students in Kentucky. *J Am Diet Assoc* 2007; 107 (7): 1139-45.

30. Misra M, Tsai P, Anderson EJ, Hubbard JL, Gallagher K, Soyka LA et al. Nutrient intake in community-dwelling adolescent girls with anorexia nervosa and in healthy adolescents. *Am J Clin Nutr* 2006; 84 (4): 698-706.

31. French SA, Jeffery RW. Current dieting, weight loss history, and weight suppression: behavioral correlates of three dimensions of dieting. *Addict Behav* 1997; 22 (1): 31-44.

32. Arora M, Nazar GP, Gupta VK, Perry CL, Reddy KS, Stigler MH. Association of breakfast intake with obesity, dietary and physical activity behavior among urban school-aged adolescents in Delhi, India: results of a cross-sectional study. *BMC Public Health* 2012; 12 (1): 881.

33. Lloveras G, Ribas Barba L, Ramon JM, Serra Majem L, Roman Vinas B. [Food consumption and nutrient intake in relation to smoking]. *Med Clin* (Barc) 2001; 116 (4): 129-32.

34. Willett WC, Sacks F, Trichopoulou A, Drescher G, Ferro-Luzzi A, Helsing E et al. Mediterranean diet pyramid: a cultural model for healthy eating. *Am J Clin Nutr* 1995; 61 (6 Suppl): 1402S-6S.

35. Albala C, Vio F, Kain J, Uauy R. Nutrition transition in Chile: determinants and consequences. *Public Health Nutr* 2002; 5 (1A): 123-8.

36. Rivera JA, Barquera S, Campirano F, Campos I, Safdie M, Tovar V. Epidemiological and nutritional transition in Mexico: rapid increase of non-communicable chronic diseases and obesity. *Public Health Nutr* 2002; 5 (1A): 113-22.

37. Ulijaszek SJ, Koziel S. Nutrition transition and dietary energy availability in Eastern Europe after the collapse of communism. *Econ Hum Biol* 2007; 5 (3): 359-69.

38. Nkondjock A, Receveur O. Fish-seafood consumption, obesity, and risk of type 2 diabetes: an ecological study. *Diabetes Metab* 2003; 29 (6): 635-42.

39. Gutierrez-Fisac JL, Marin-Guerrero A, Regidor E, Guallar-Castillon P, Banegas JR, Rodriguez-Artalejo F. Length of residence and obesity among immigrants in Spain. *Public Health Nutr* 2010; 13 (10): 1593-8.

40. Malmusi D, Borrell C, Benach J. Migration-related health inequalities: showing the complex interactions between gender, social class and place of origin. *Soc Sci Med* 2010; 71 (9): 1610-9.

41. Wang Y, Chen X. How much of racial/ethnic disparities in dietary intakes, exercise, and weight status can be explained by nutrition- and health-related psychosocial factors and socioeconomic status among US adults? *J Am Diet Assoc* 2011; 111 (12): 1904-11.