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ORIGINAL ARTICLE

Evaluation of food consumption and dietary patterns in Spain by the Food Consumption Survey: updated information

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Background/Objectives: The Food Consumption Survey (FCS), conducted for over 20 years by the Spanish Ministry of Agriculture, Fisheries and Food (MARM), is the most reliable source of data to evaluate the food consumption and dietary patterns of Spain. The aim of this study was to assess population food availability per capita per day, which allows the calculation of energy and nutrient intake and comparison with the Recommended Nutrient Intakes for the Spanish population. In addition, different markers of the quality of the diet have been evaluated.
Subjects/Methods: The sample consisted of consumption and distribution data, obtained from the nationwide representative FCS for the period 2000–2006. A two-stage sampling method was applied, where in the first stage the units to be sampled were towns or local entities, and in the second stage households that were going to be part of the final sample from those entities were selected. Units consisted of towns or local entities in the national territory. The sample size was 619 selected entities. Units in the second stage were households from the selected towns (8200 homes). The data allowed the calculation of energy and nutrient intakes, using food composition tables. The quality of the diet was also evaluated: the adequacy of the diet in meeting the recommended intakes for energy and nutrients; energy profile; dietary fat quality; dietary protein quality; nutrient density; and Mediterranean diet adequacy indices. The present data were compared with previous data obtained by our research group in 1964, 1981 and 1991.
Results: Using the most recent data, average intake comprised milk and derivatives (379 g/person/day), fruit (310 g/person/day), vegetables and greens (302 g/person/day), cereals and derivatives (214 g/person/day), meat and meat products (179 g/day), fish (100 g/person/day), oil and fat (48 g/person/day), precooked food (34 g/person/day), eggs (32 g/person/day), and legumes and pulses (11.9 g/person/day). There was also a high consumption of non-alcoholic beverages (433 g/person/day) and alcoholic beverages (247 g/person/day). In consequence, meat and meat product consumption was higher than the recommendations, whereas for cereals and their derivatives, vegetables and greens, fruit, and legumes and pulses, consumption was below recommendations for the Spanish population. Some staple and traditional Mediterranean foods (bread, potatoes and olive oil) showed a dramatic decline when compared with data from Household Budget Surveys in 1964 data. Energy intake declined by about 300 kcal/person/day, when compared with the 1964 mean consumption. Insufficient nutrient intakes were found in the young adult population for zinc and folic acid in both sexes, and for iron in women, when compared with dietary reference values.
Conclusions: Food consumption patterns in Spain and energy and nutrient intakes have changed markedly in the last 40 years, differing at present from the traditional and healthy Mediterranean diet.
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Keywords: Food Consumption Survey; food availability; dietary intake; diet quality; Mediterranean diet

Introduction

Spain has undergone dramatic social changes since the 1960s, including massive rural–urban migration. A generalised incorporation of females into the active workforce added to rapid urbanisation processes in the 1980s, an

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accelerating factor for dietary change due to factors such as the organisation of family life and home meals (Cruz Cantera, 1995). A rapidly increasing number of people use catering services, restaurants and vending machines (Varela Moreiras *et al*., 2008), both during weekdays and leisure time, which is also a key factor in understanding changes in diet. In addition, there has been a rapid increase in the immigrant population, which now represents over 10% of the total population (Varela Moreiras *et al*., 2009). These changes in dietary pattern and lifestyle appear to have had negative consequences for both the present and future populations, as overweight and/or obesity affect >50% of the adult population and 25% of the infant/young population (Pérez Miguelsanz *et al*., 2010). The relationship between nutrition and health is well documented. A poor diet and nutrition are identified as risk factors for cardiovascular disease, obesity, diabetes mellitus, gastrointestinal disease, osteoporosis, neurodegenerative disease and several types of cancer (Eurodiet, 2000).

The Food Consumption Survey (FCS), conducted in Spain since 1987, shows trends in consumption of different food groups and provides data on the place of consumption, that is, either at home, in institutions, catering, restaurants and so on (Ministry of Environment and Rural and Marine Affairs (MARM), 1987–2006). The Spanish Nutrition Foundation (FEN) is at present in charge of evaluating the dietary trends and nutritional status of the population derived from the FCS. This information is also essential in order to obtain information on the nutritional parameters that allow the identification of dietary patterns.

The purpose of this study was to assess food consumption in the young adult population per capita per day, at a national level in Spain for the period 2000–2006, allowing the calculation of energy and nutrient intakes and comparison with the Recommended Nutrient Intakes (RNI) for the Spanish population (Moreiras *et al*., 2007). Other dietary markers, such as energy profile, fat quality or adherence to the Mediterranean diet, have been also analysed. The evolutionary trends observed in comparison with data obtained through Household Budget Surveys, carried out in a statistically significant sample of households, conducted by the National Statistical Offices of Spain in the years 1964, 1981 and 1991 are also discussed (Varela *et al*., 1971, 1991).

Methods

The data sample is about shopping and product entrance into the home obtained from the FCS from 2000 to 2006, and consumption carried out in catering trade and institutions. In order to estimate whether energy and nutrient intakes were adequate, intake data were compared with recommendations for men and women aged between 20 and 40 years because this age group represented the biggest population segment in Spain in 2006 (as assessed by the National Statistical Institute).

The analysis of intake data was carried out on household level. A 'household' is considered to be the person or group of people who occupy a family house together or part of it, and consume food and other goods bought from the same budget. Data for the products in the home were registered by a scanner on the same day as product acquisition for seven consecutive days.

Data from the households have also been considered according to geographical areas; socioeconomic level; size of habitat; number of household members; age of the person responsible for food purchase; profession of the person in charge of purchases; and number of children and age. The location of the study was inland Spain plus the Balearic and Canary Islands.

A two-stage sampling method was carried out for the whole sample studied (2000–2006). In the first stage, the units to be sampled were towns or local entities in the national territory, and in the second stage, households that were going to be part of the final sample from those entities were selected. The sample size following stage one was 619 selected entities. Following stage two, the final sample constituted of 6000 homes from years 2000 to 2005 and 8200 homes for the year 2006.

The obtained data allowed calculation of energy and nutrient intakes, using food composition tables containing over 500 foods, distributed in 15 groups and 18 subgroups. The data were also compared with the most recent RNI for the Spanish population to evaluate the adequacy of the diet (Moreiras *et al*., 2007).

In order to evaluate the adherence to the traditional Mediterranean diet, different indicators were used (Bach-Faig *et al*., 2006). The first one, the so-called 'Mediterranean Diet Score (MDS)', is composed of nine variables (Knoops *et al*., 2006): monounsaturated fatty acids/saturated fatty acids (SFAs), alcohol, legumes and pulses, cereals, fruit, vegetables and greens, meat and meat products, dairy products and fish. Each of these variables is given a value of zero or one. Using the MDS, when the consumption of the typical Mediterranean food groups in the Mediterranean diet (vegetables and greens, pulses and legumes, fruit, cereals and fish) is below the median consumption, it scores zero; whereas, if consumption is above the median, the score is one. Food groups that are traditionally not included in the Mediterranean diet score zero when consumed at levels above the median and one when consumption is below the median consumption. Alcohol scores one when consumption is between 10 and 50 g/day for men and between 5 and 25 g/day for women. Altogether, the MDS score would be zero when adherence to the traditional MD was minimum, and nine when it was maximum. The 'Healthy Diet Indicator' (Huijbregts *et al*., 1997) is based on the World Health Organisation guidelines for the prevention of chronic diseases: when consumption is within ranges established in these guides it is scored one (for example, SFA <10%; polyunsaturated fatty acids (PUFAs) 3–7%; carbohydrates 50–70%; fruit, vegetables and greens >400 g/day and so on), and when it is not within the

proposed range it is scored as zero. Here again, the highest theoretical score is 'nine'.

Results

Analysis of food consumption data for per capita availability based on the food surveys by the Ministry of Agriculture, Fisheries and Food (MARM) panel, over the period of 2000–2006, allows estimation of the average Spanish daily menu and the associated distribution of the different food groups as shown in Figure 1.

Milk and derivatives consumption was quantitatively one of the most important in the present Spanish diet (Table 1). However, a significant decrease in the purchase of dairy products was observed between the years 2000 (416 g/person/day) and 2006 (379 g/person/day). When comparing the present data with those obtained by Varela *et al*. in 1991, dairy product intake has increased by ~150g/person/day since 1964. Compared with other European countries, Finland (507 g/day), Ireland (481 g/day), Sweden (445 g/day), Norway (387 g/day) and Poland (381 g/day) all reported a higher intake of milk and milk derivatives (DAFNE (The Data Food NEtworking project), 2006).

Egg consumption has steadily decreased since the year 2000 (Table 1). In that year, 4.3 medium-sized eggs per week were consumed, whereas for the year 2006 the mean consumption of medium-sized eggs was just 3.7 per week.

Consumption of vegetables and greens, including potatoes, remained largely unchanged from 2000 (300 g/person/day) to 2006 (302 g/person/day) (Table 1). This was not the case when comparing the results with those obtained in 1964, when the consumption was clearly higher (451 g/person/day) (Varela *et al*., 1971). However, consumption of vegetables and greens, without potatoes, showed an increase of >50 g per person per day since 1964 (from 151 to 208 g/person/day in 2006).

A steady decrease in potato consumption has been observed since 2000 (2000: 106 g/person/day; 2006: 94 g/person/day). In fact, a large decline of >200 g/person/day

Table 1 Trends in food groups consumption (g/person/day) from years 2000 to 2006 for the Spanish adult population

Year	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*
Cereals and derivatives	222	222	224	222	224	220	214
Milk and derivatives	416	406	403	397	394	392	379
Eggs	36.6	35.4	34.7	35.7	34.6	33.8	32.1
Sugar and sweets	30.1	30.8	30.8	31.3	30.5	29.8	29.0
Oils and fat	49.2	49.1	49.4	49.5	50.2	50.4	48.6
Vegetables and greens	300	293	301	303	307	309	302
Pulses and legumes	13.5	13.0	12.4	12.5	12.5	12.4	11.9
Fruit	278	288	295	302	307	310	310
Meat and meat products	180	181	187	185	182	180	179
Fish and seafood	88.9	96.7	100	100	102	101	100
Alcoholic beverages	259	252	247	253	257	250	247
Non-alcoholic beverages	384	406	410	425	425	424	433
Precooked food	23.3	25.1	27.8	29.6	32.9	33.4	34.2

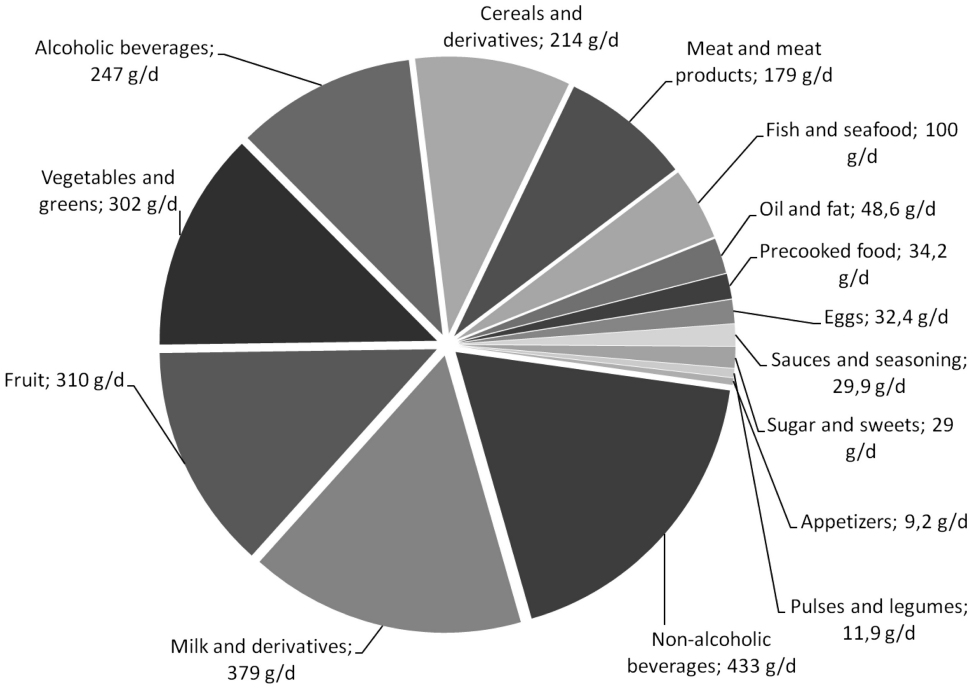

Figure 1 Consumption of various foods and food groups in Spanish households in 2006 (g/person/day).

has been observed over the last 40 years (1964: 300 g/person/day). This decrease represents a marked trend of traditional staple foods being increasingly replaced by more processed alternatives.

Fruit consumption, including dried fruits, showed an increasing trend from the year 2000 (278 g/person/day) to 2006 (310 g/person/day). When compared with 1964 data, fruit consumption has nearly doubled.

The consumption of legumes and pulses has decreased (11.9 g/day at present) when compared with the 1991 results (20.2 g/day).

Cereals and derivatives consumption has shown a marked decrease over the last 40 years (434 g/day in 1964 vs 214 g/day in 2006). Bread was still the most important food within this group. However, a steady decline has also been observed (368 g/day in 1964 vs 134 g/day in 2006). White bread is the type of bread for which the most rapid decline has occurred. Rice consumption has also changed, being much lower in 2006 (15.6 g/day) vs 1964 (26.5 g/day).

Oils and fats consumption was 48.6 g/person/day in 2006. An overall decrease over the last 40 years has been observed ($\sim$20 g/person/day since 1964). The decrease in consumption was more noticeable for olive oil (a fall of over 25 g/person/day). However, $>$90% of the total consumption of oils and fats were still of vegetable origin, mainly olive oil (27.7 g/person/day in 2006), which represented roughly 60% of the total. Mean butter and margarine consumption in 2006 represented just 7% of the total oils and fats consumed.

As for the meats group, the most consumed type was chicken. The present consumption of this food group has increased by roughly 300% when compared with the 1964 data (77 g/person/day). The mean consumption of fish and shellfish was considered high but beneficial (100 g/person/day), according to the present national dietary guidelines. There has been a marked increase since 1964 (63 g/person/day). Oily fish represented $\sim$40% of total fish consumption; this may make a clear contribution to adequate intake of omega-3 fatty acids, although eicosapentanoic acid and docosahexaenoic acid contribution to the total energy intake was markedly below recommended levels (Mataix, 2005).

Alcoholic beverage consumption has undergone a slow decline during recent years. Within this group, wine, a beverage traditionally included in the Mediterranean diet, represented 25.5% of total alcoholic beverage consumption in the year 2006, in contrast to representing 62% of the total consumption in 1991. In the last few years, a gradual substitution of wine with beer has occurred, which represented 65.6% of the total alcoholic beverage consumption in 2006. An important additional point is that almost 70% of these beverages were consumed in catering establishments. For non-alcoholic drinks, an almost 10-fold increase was observed since 1964 (46 g/person/day vs 433 g/person/day at present).

Another food group of current importance, for which a marked rise in consumption was noticed, was precooked foods or ready meals (23.3 g/person/day for year 2000 vs 34.2 g/day in 2006). For this group, there were no previous data available for the comparison of evolution trends.

For this study, the MDS value was four, which may be considered to be below the expectations for a typical and traditional Mediterranean country such as Spain. As for the Healthy Diet Indicator, only two points were scored for the Spanish population.

Adherence to the recommended serving sizes for the Spanish adult population

Comparing data from the Spanish FCS with current dietary guidelines for the Spanish population (Dapcich *et al*., 2007) shows that meat and meat product consumption was clearly above the recommended amount, but consumption of cereals and derivatives, vegetables and greens, fruit, and legumes and pulses was lower than that considered optimum. Groups for which intakes were closer to the recommendations are milk and derivatives, fish and eggs.

Energy and nutrient intake

The mean energy consumption for the Spanish population in 2006 was 2761 kcal/person/day, which is clearly lower than in 1964 (3008 kcal/person/day). The food groups contributing the most to energy consumption in 2006 were cereals and derivatives (25%), meat and meat products (16%), milk and derivatives (14%), and oils and fat (12%). The contribution (%) of macronutrients and alcohol to energy consumption in Spain from 1964–2006 is shown in Figure 2.

Figure 3 compares energy, macronutrient and micronutrient consumption with the RNI for the Spanish population aged 20–40 years. The mean intake of micronutrients showed that vitamin C intake exceeded the RNI by $>$200%. Other vitamins and minerals consumed in high amounts compared with the RNI were vitamin B_{12}, iodine

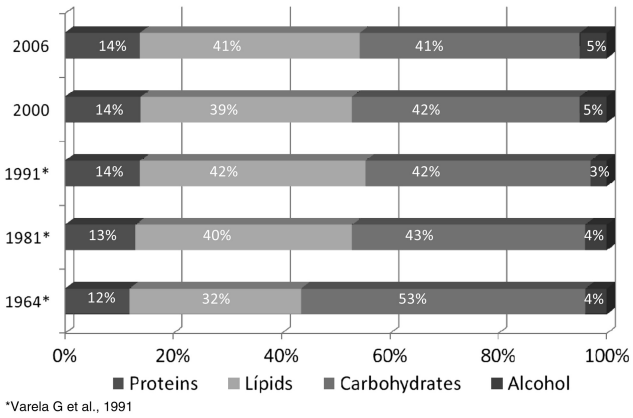

Figure 2 The contribution (%) of macronutrients and alcohol to energy consumption from 1964 to 2006.

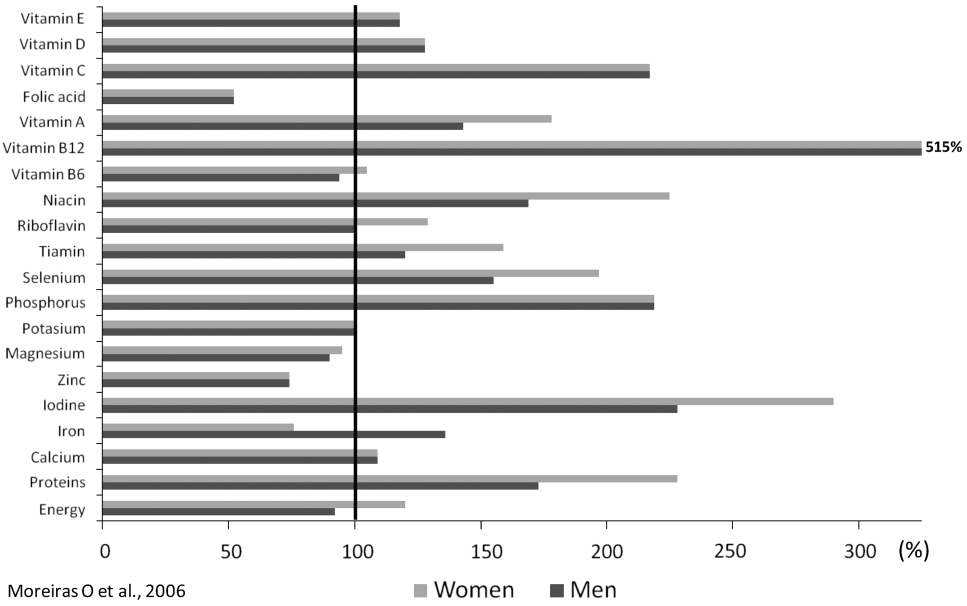

Figure 3 Comparison of energy, macronutrient and micronutrient consumption with RNI for the Spanish population (2006).

and phosphorus. Nutrients that did not reach 80% of the RNI for adults aged 20–40 years, which may be indicative of insufficiency, were zinc and folic acid in both sexes, and iron in women only. Other nutrients with a potentially insufficient intake were vitamin B_6 and magnesium.

Fibre consumption (18.8 g/person/day) was insufficient compared with the recommended amounts (25–30 g/day).

Discussion

Several nutrition surveys based on the National Institute of Statistics' Household Budgetary Surveys provide evidence of evolving trends in energy and nutrient intake estimates between 1961 (data in the results are compared with those of 1964, as the methods used were more similar and the data more comparable) and 1991 (Varela *et al*., 1971, 1991, 1995; INE, 1985). Since the beginning of the 1990s, a number of Spanish regions have also accomplished randomised population nutrition surveys, including food intake surveys of individuals. These are a valuable source of information from a public health perspective, enabling a more descriptive analysis of the food and nutrition situation of the Spanish population (Aranceta *et al*., 1994, 1998). This study, conducted at national level, updates the food habits and nutritional aspects of importance for the Spanish population. In addition, trends emerging from the other surveys mentioned above were considered.

An overview of food consumption patterns at present and evolutionary trends reveals some significant findings. A large proportion of the young adult Spanish population, mainly women, wrongly considers that potatoes and bread are 'fattening' foods. However, a recent study (Academia Española de Gastronomía, 2006) confirmed that potatoes are still included among the five most consumed types of food by >95% of the population. The decline in egg consumption is probably due to the general concern that eggs are 'unhealthy', based on their cholesterol content. Although it is true that eggs contain cholesterol, it must be remembered that the consumption of SFAs has a higher influence on cholesterol levels than dietary cholesterol.

When compared with other countries, in the pan-European DAFNE study, only Greece presented a higher consumption of the vegetables group at 271g/person/day (Naska *et al*., 2006). From a nutritional point of view, the vegetables and greens group contributed 66% of total carotenoid intake in the diet in 2006. The high fruit consumption is clearly a positive aspect, as this food group will provide antioxidant vitamins and other components, such as pectins, fructose, β-carotenoids and polyphenols, which may be beneficial in helping to prevent chronic degenerative diseases. In 2006, the fruit group contributed 41% of the total vitamin C consumed within the diet in Spain, mostly from fresh unprocessed foods.

However, consumption of legumes and pulses seems to be too low according to the nutritional importance of this group; moreover, this group also provides high-quality dietary protein and fibre. The cereals and derivatives group contributed 43% of total dietary carbohydrate consumption and 72% of starch.

The mean consumption of meat and meat products (179 g/person/day) may be considered to be very high according to the traditional Mediterranean dietary patterns. Paradoxically, in the DAFNE study, Spain showed a higher

consumption of meats than Ireland, Norway or the United Kingdom, whereas other traditional Mediterranean countries, such as Greece, showed a similar trend to Spain (Naska *et al*., 2006).

Although total fish consumption may be considered high, the ratio of omega-6/omega-3 fatty acids in the diet in Spain was not aligned with recommendations (16/1 vs the recommended 4/1–5/1). In addition, this food group contributed 87% of total dietary vitamin D and 64% of the total vitamin B_{12} consumption The recommendation is to encourage the maintenance of this valuable characteristic of the Spanish diet, a high consumption of fish, even though a slow decline in fish consumption was seen among the younger population.

Adherence to the traditional Mediterranean diet

The food culture of the Spanish society is established within the Mediterranean diet frame, which is considered a healthy eating pattern mainly due to its potential protective role against the most common chronic diseases. It is generally agreed that the main components of the Mediterranean diet include a high intake of plant foods (vegetables, fruits, cereals, legumes, nuts and seeds, and olive oil); a low to moderate intake of dairy products (in the form of cheese or yogurt); low to moderate consumption of poultry and eggs; a moderately high intake of fish and shellfish; low intake of red meat and processed meat products; and a moderate intake of wine during meals (Keys *et al*., 1986).

At present, there is a high concern that the so-called Mediterranean diet is more a theoretical reference pattern based on the diet that existed in the 1960s in some regions on the Mediterranean coast, and that it has been preserved to some extent in just a few Mediterranean locations (Willett *et al*., 1995). This also seems to be the case for Spain. Paradoxically, Spain is a major producer and exporter of typical Mediterranean products, a factor that amplifies the importance of maintaining a Mediterranean diet pattern.

The percentage contribution of carbohydrates has steadily decreased since 1964. In that year, the energy profile was in line with recommendations. This worsening is linked to the decline in the consumption of the cereals and derivatives, legumes and pulses, and potato groups. However, as expected, cereals and derivatives represented the highest contribution (43%) to total carbohydrates, followed by the milk and derivatives food group (12%). In contrast, the percentage of lipids (41%) markedly exceeded the recommendations at the expense of carbohydrates. The main contributors to total dietary lipid consumption were oils and fats (30%), meat and derivatives (28%), milk and derivatives (15%), cereals and derivatives (9%), and fish and fish products (6%). In order to evaluate the dietary fat quality, the lipid profile was calculated (percentage contribution of the three fatty acid classes to the total energy), as well as relationships between PUFA/SFA and (PUFA + monounsaturated fatty acid)/SFA. The SFA and PUFA fractions were well above the recommended levels. A positive aspect that should be maintained was the high proportion of monounsaturated fatty acid because of the common occurrence of olive oil in the Spanish diet. In this study, total omega-3 PUFA consumption was adequate but the percentage contribution of eicosapentaenoic acid plus docosahexaenoic acid to total energy consumption, which is recommended to be between 0.25 and 0.5%, was markedly below recommendations. As far as the omega-6/omega-3 ratio is concerned, the nutritional objectives for the Spanish population indicate that it should be between 5/1 and 4/1 (Mataix, 2005). However, the ratio was found to be deviating markedly towards the omega-6 fraction (16.6/1), which may compromise the potential benefits provided by the omega-3 fatty acids. Therefore, it would be of considerable interest and urgency to equilibrate the ratio.

The percentage contribution of protein to total energy intake (14%) was unchanged since the survey in 2000 and is aligned with the recommended profile, although it is advisable to decrease the proportion of animal protein in the total protein intake. The mean protein intake at present for the Spanish population was 93.5 g/person/day, the main contributors being: 28% from the meat and derivatives group; 19% from milk and derivatives; 17% from cereals and derivatives; and 16% from fish and fish products.

In conclusion, social and economic changes have led to important modifications in food patterns in the last few decades, as has also been observed in previous studies (Rodríguez-Artalejo *et al*., 1996; Garcia-Closas *et al*., 2006; Balanza *et al*., 2007). Some changes have had a potential positive impact, such as increasing variety in the diet and improved access to food, but are not consistent with an adequate food selection as described for a healthy Mediterranean type of diet. On the other hand, some changes have moved the Spanish diet away from the traditional Mediterranean diet pattern (Moreno *et al*., 2002). Therefore, strategies that encourage a healthy diet and that also allow the recovery of the traditional characteristics of the Mediterranean diet are a priority for nutritional policies. This may partly be achieved by an adequate use of new technologies, which deal with food production, food conservation, food marketing and food distribution.

Conflict of interest

The authors declare no conflict of interest.

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