

## Report of the Scientific Committee of the Spanish Agency for Consumer Affairs, Food Safety and Nutrition (AECOSAN) about objectives as well as nutritional and physical activity recommendations to tackle obesity in the framework of the NAOS Strategy

### Section of Food Safety and Nutrition

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## Abstract

According to the guidelines established by the World Health Organisation (WHO), the NAOS Strategy for Nutrition, Physical Activity and the Prevention of Obesity, which was created in 2005, sets out encouraging healthy eating and promoting physical activity as its fundamental goals. This is in order to reverse the growing trend of obesity prevalence and substantially reduce the high morbidity and mortality rates attributed to chronic illnesses.

As a step prior to develop this Strategy in its next five-year plan, the Spanish Agency for Consumer Affairs, Food Safety and Nutrition (AECOSAN) asked its Scientific Committee for conducting a critical analysis of the objectives as well as the nutritional and physical activity recommendations promoted by national and international entities to tackle obesity and non-communicable related diseases.

The Scientific Committee has reviewed the objectives and recommendations with regard to five parameters (consumption of salt, fats, sugars and fibre along with practising physical activity) in different countries and in international bodies such as WHO. However, this report was not aimed to evaluate the management measurements necessary to achieve those objectives.

In addition to analysing the objectives set by different entities according to their scientific base, target population, deadlines, results, etc., the Committee has made comments and recommendations with regards to each one of the five parameters assessed.

## Key words

NAOS, salt, fats, sugars, fibre, physical activity.

<sup>1</sup>At the request of the Working group, the modification of chapter 4 "Sugar intake" has been assessed and approved by the Section of Food Safety and Nutrition of the Scientific Committee.

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## 1. Introduction

In line with the World Health Organization (WHO), the NAOS Strategy for Nutrition, Physical Activity and the Prevention of Obesity, which was created in 2005, sets out encouraging healthy eating and promoting physical activity as its fundamental goals. This is in order to reverse the growing trend of obesity prevalence and substantially reduce high morbidity and mortality rates attributed to chronic illnesses.

As laid down in article 36 of Law 17/2011, of 5 July, on Food Safety and Nutrition, this Strategy shall be reflected in 5-year plans, in which nutritional objectives and targets for physical exercise are established for the population.

Consequently, and prior to the drafting of the Strategy or Five-year Plan, a critical analysis is required of the objectives, recommendations and general lines of action which, in line with the NAOS Strategy, are considered at national, European and international level, given the importance of the search for synergies and alliances that permit a global approach, in the face of the general epidemic that embodies obesity in the 21st century.

Obesity is directly linked to a lack of physical exercise, a sedentary lifestyle and a number of non-communicable diseases including cardiovascular disease, cerebrovascular disease, diabetes mellitus type 2 and different types of tumours, which are also linked to diet as a result of imbalances in the intake of certain nutrients, including salt, fats, sugars or fibre.

Therefore, the Executive Director of the Spanish Agency for Consumer Affairs, Food Safety and Nutrition (AECOSAN) has asked the Scientific Committee to conduct a critical analysis and review of the objectives and recommendations, in terms of both nutrition and physical exercise, concerning obesity and related non-communicable diseases, advocated by national and international organisations. The purpose of this review is to assess their suitability in Spain through the Five-Year Plan that the AECOSAN must draw up linked to the NAOS Strategy, and in development of article 36 of Law 17/2011, of 5 July, on Food Safety and Nutrition.

### 1.1 Objectives and recommendations

#### 1.1.1 Dietary patterns in Europe

In accordance with the conclusions of the Study on Diet, Physical Activity and Cardiovascular Disease Prevention in Europe (European Heart Network) one major problem that emerges on analysing diets and dietary trends is the quality of available data, as in Europe there are no available broad studies with uniform methods of evaluation, nor dietary surveys conducted in unison (EHN, 2011). Therefore, trends in actual daily intake have to be estimated from the available material, and the capacity to establish policies based on evidence is limited. This is even more difficult with regard to the analysis of physical exercise and its trends, as the data is even less solid.

Another problem is the assessment of results using population averages, as it is highly likely that an objective is being met by the population average, whereas in fact the number following a healthy diet is in fact very limited in some cases.

Broadly speaking, after studying trends in physical exercise and food consumption in Europe, it can be seen that the majority of the population do not reach the goals proposed for salt (except in Italy

and Portugal) and saturated fats. In spite of real progress in the reduction of levels of *trans* fatty acids in recent years, popular foods with a high content of *trans* fats are still easily available in Europe and there is concern about a potentially high consumption among certain subgroups of the population.

The decrease in the price of many foods and increased opportunities to buy them have contributed to stimulating the demand for foods and, consequently, to raising levels of intake.

Changes in current lifestyles have modified traditional eating and exercise habits. In the south of Europe, these changes are leading to a move away from the Mediterranean diet, and traditional food is being replaced by a more "modern" diet with a higher proportion of calories coming from oils and fats, processed sugars and starches and, in some sectors of the population, alcohol.

This increasing move away from the nutritional recommendations in Europe, combined with an excessive energy intake has resulted in a worrying increase in the prevalence of obesity and, consequently, of other non-communicable diseases including diabetes *mellitus* type 2, cardiovascular conditions and some types of cancer.

It is therefore imperative to modify European dietary patterns, and given that there are multiple factors of influence, opportunities for improvement are also numerous. Thus, in addition to interventions at individual level, a wide range of policies and actions are included at international, national and local level which affect the different sectors (EHN, 2011).

### 1.1.2 Nutritional objectives

To establish the nutritional objectives proposed at national level to combat obesity and related non-communicable diseases, a review has been made of the nutritional objectives set out at supranational or national levels, whether in Europe or in other countries.

At supranational level, the World Health Organization's Global Strategy on Diet, Physical Activity and Health deals with two of the basic risk factors responsible for non-communicable diseases (cardiovascular disease, cerebrovascular disease, diabetes *mellitus* type 2, obesity, cancer and respiratory disease). These two risk factors are the absence of a balanced diet and lack of physical exercise (WHO, 2004).

In this respect, two WHO Action Plans for the Global Strategy for the Prevention and Control of Non-Communicable Diseases have also been set up for the periods 2008-2013 and 2014-2020 (WHO, 2009, 2013a).

At European level, the WHO Regional Office for Europe validated the Second Action Plan for Food and Nutrition 2007-2012 (WHO, 2008) and the WHO Third European Action Plan 2014-2020 is currently being finalised (WHO, 2013b).

The Action Plan covers the non-communicable diseases related to diet, obesity in children and adolescents, micronutrient deficiencies and food-borne diseases.

The Plan recommends the following nutritional objectives:

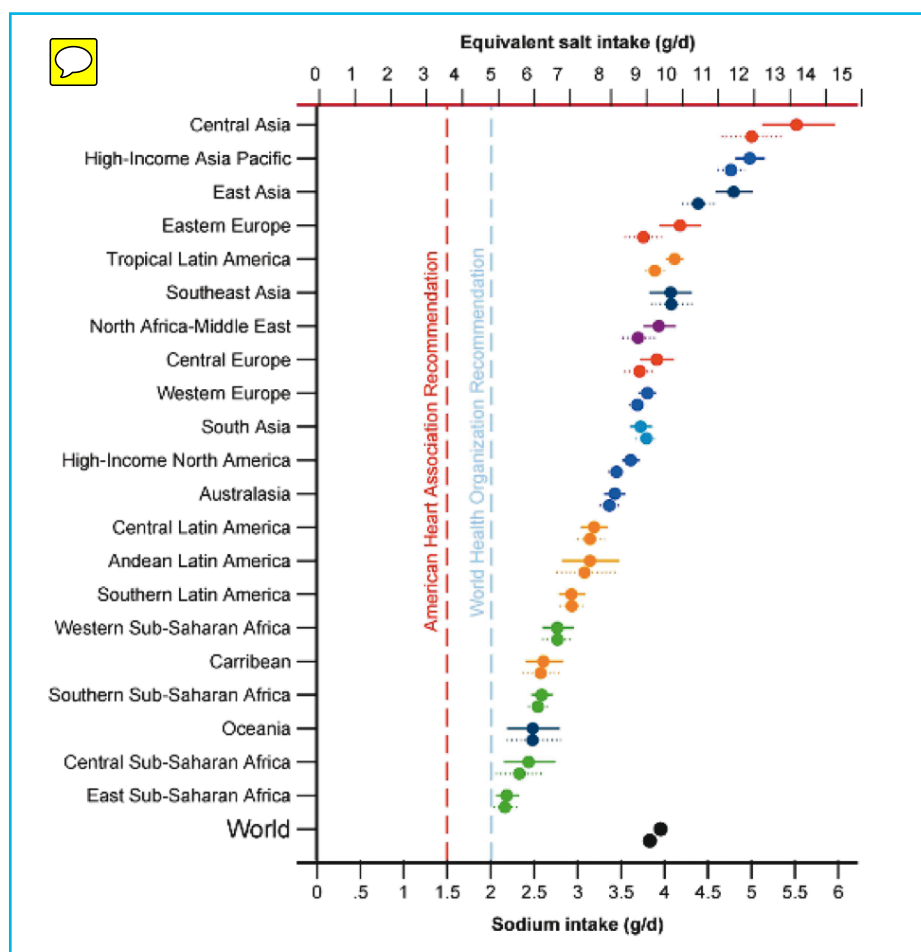
- A daily intake of salt <5 g.
- A daily energy intake from saturated fats <10 % and from *trans* fatty acids <1 %.
- A daily energy intake from free sugars <10 %.
- A daily intake of fruit and vegetables >400 g.

Different nutritional objectives with respect to the different nutrients established by supranational, national, and European institutions and those of other continents, are listed and assessed below.

## 2. Salt intake

### 2.1 Introduction

Sodium is an essential nutrient for the body, necessary in relatively small quantities. The majority of sodium is consumed in the form of sodium chloride (salt). Unfortunately, in recent decades, the consumption of sodium chloride in food has increased enormously, bringing with it an increasing problem of public health. In Europe, the current daily intake of salt is estimated to be between 8 and 10 g, figures which are higher than those of North America, Latin America and the majority of Africa (Powles et al., 2013).



**Figure 1.** Mean (uncertainty interval 95 %) sodium intake (g/day) standardised by age in 1990 and 2010 in 21 regions. Note: the upper symbol for each pair is for 2010. The regions are classified by the combination of both genders and ages over 20. **Source:** (Powles et al., 2013, with authorisation).

The importance of reducing the intake of salt for the prevention of cardiovascular disease is widely documented. The WHO estimates that high blood pressure is responsible for 13 % of global mortality in the world (WHO, 2006, 2010). There is adequate scientific evidence to indicate a dose-response relation between the consumption of salt and blood pressure levels in the population (Denton et al., 1995) (Sacks et al., 2001). Different studies have established that the quantity of salt consumed is an important risk factor in high blood pressure (Appel, 2009) (Strozullo et al., 2010). The risk of cerebrovascular disease increases progressively above normal systolic blood pressure figures (120-140mmHg) (MacMahon, 1990). There is a direct and lineal link between blood pressure levels and mortality due to cerebrovascular accident and coronary artery disease (Lewington et al., 2002). In addition, the reduction in salt consumption in the population leads to a reduction in blood pressure levels, an increase in the efficiency of antihypertensive treatment and the long-term risk of cardiovascular events and cerebrovascular accident (Appel, 2009). It is estimated that a reduction in salt intake from 10 g to 5 g per day could lead to a decrease in the rates of cerebrovascular accidents and cardiovascular disease of 23 % and 17 % respectively, thereby contributing to a significant reduction in mortality (Karppanen and Mervaala, 2006) (Cook et al., 2007).

According to the WHO, the reduction in the population's salt intake is one of the simplest and most cost-effective forms of reducing the current prevalence of cardiovascular disease and, for this reason, should be considered by public health authorities. Therefore, the Group on Nutrition and Physical Activity of the European Commission, in which each of the Member States is represented, has undertaken to achieve reductions of at least 16 % of salt in foods (EU, 2009).

## **2.2 World Health Organization (WHO)**

The WHO technical report produced by the Food and Agriculture Organization of the United Nations Expert Group (FAO/WHO) in 2003 on diet, nutrition and the prevention of chronic disease (WHO, 2003) lays out the nutritional objectives for preventing certain chronic diseases. One such objective is the reduction of salt intake. This report recommends a target salt intake in the population of less than 5 g/day (2 g of sodium) (WHO, 2003).

At a WHO technical meeting held in 2006, it was concluded that: a) there is significant scientific evidence relating excessive salt intakes with different chronic diseases; b) measures that reduce the salt intake in populations have repeatedly proved to be highly cost-effective, and therefore the implementation of strategies/policies/programmes that help to reduce salt intake is of high priority; and c) interaction with the food industry is essential for success in the implementation of strategies to reduce salt intake; the multinational food industry must be urged to harmonise the salt content of its products in accordance with the lowest possible threshold to prevent unnecessary variations in the salt content of the same food product marketed in different countries.

To attain this objective, at the WHO technical meeting (2006) different strategies were put forward which might be carried out at national level. These strategies can be divided into three groups:

1. Product reformulation.
2. Increasing consumer awareness (nutritional education, information on labelling and choice of products).

3. Environment: by creating an environment in which choosing the healthiest foods is the easiest and more affordable option for population groups from all social and economic levels (labelling and symbols, advertising, agreements with industry).

In 2012, the WHO published a guide directed at the whole population on why and how to reduce dietary salt, with recommendations aimed mainly at the prevention of cardiovascular disease, in addition to describing the impact on catecholamine levels and on renal function (WHO, 2012). The guide recommends reducing the sodium intake to less than 2 g/day (5 g/day of salt) in adults, together with a reduction in the levels of sodium intake in children, to prevent blood pressure levels from rising dangerously with age in this population group. These recommendations are considered "firm" as the working group were certain that the positive effects of the recommendation would exceed the negative effects.

More recently, the WHO has published a map of initiatives taken in different European countries to reduce the dietary intake of salt (WHO, 2013c). This map describes, by countries, the national initiatives taken in this respect, the population intake of sodium where data is available (before and after the strategies implemented), the level of consumer awareness as regards salt and its effect on health, industry's involvement in the goal to reduce sodium intakes and how the strategies introduced are being evaluated.

## 2.3 European Union

In order to follow the WHO recommendations and to establish a common forum of action in the European Union, in 2005 a European Network on Nutrition and Physical Activity was set up and the European Platform for Action on Diet, Physical Activity and Health was created, bringing together the efforts of the public sector, civil society and industry. In 2008, the European Commission High Level Group on Nutrition and Physical Activity was created, and a community framework was adopted for the national initiatives directed at reducing salt intake.

In fact, based on the recommendations of the WHO, the European Commission High Level Group on Nutrition and Physical Activity has approved the following operational frameworks: European framework for national salt initiatives (July 2008), European framework for national initiatives on selected nutrients (February 2011), and framework for the reduction of saturated fats (June 2012).

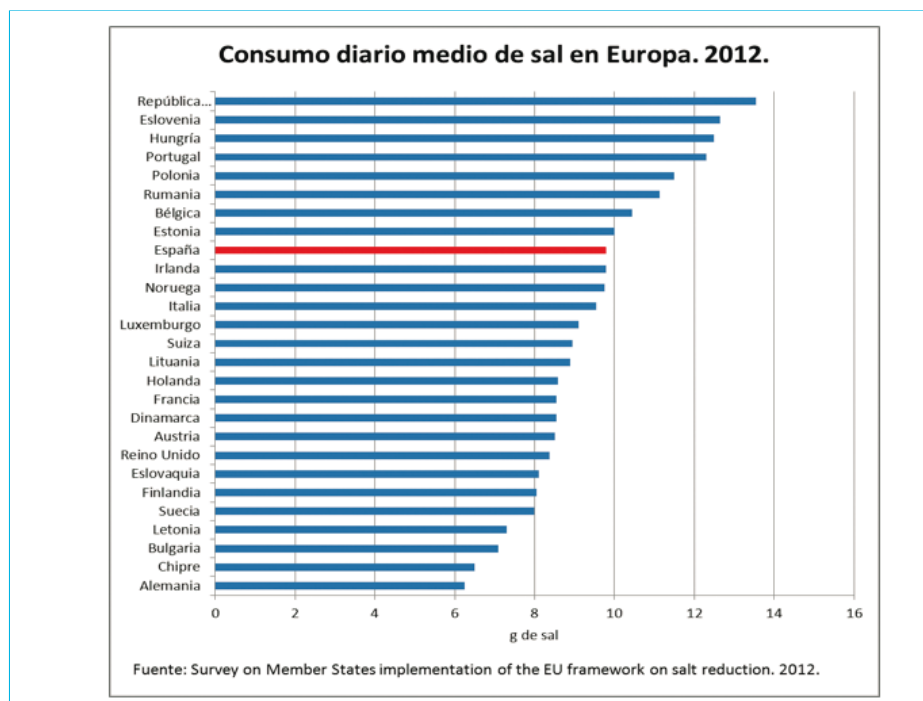
The five key points proposed for establishing national initiatives were:

1. To have national data referring to salt intake, food salt levels and the main groups of food that contribute to the intake of salt at national level.
2. To establish reference points and main groups of food on which to act, establishing at European level a minimum percentage of 16 % in salt reduction taken from the levels in 2008, in different food categories in a 4-year period (4 % per year). Of the 12 groups identified, bread, meat products, cheese and pre-cooked meals are of particular note.
3. To raise citizen awareness, acting in a coordinated manner with communication media, industry, the health sector, national platforms and organisations and NGOs.
4. To reformulate products in industry and the catering sector.
5. To monitor and evaluate actions taken.

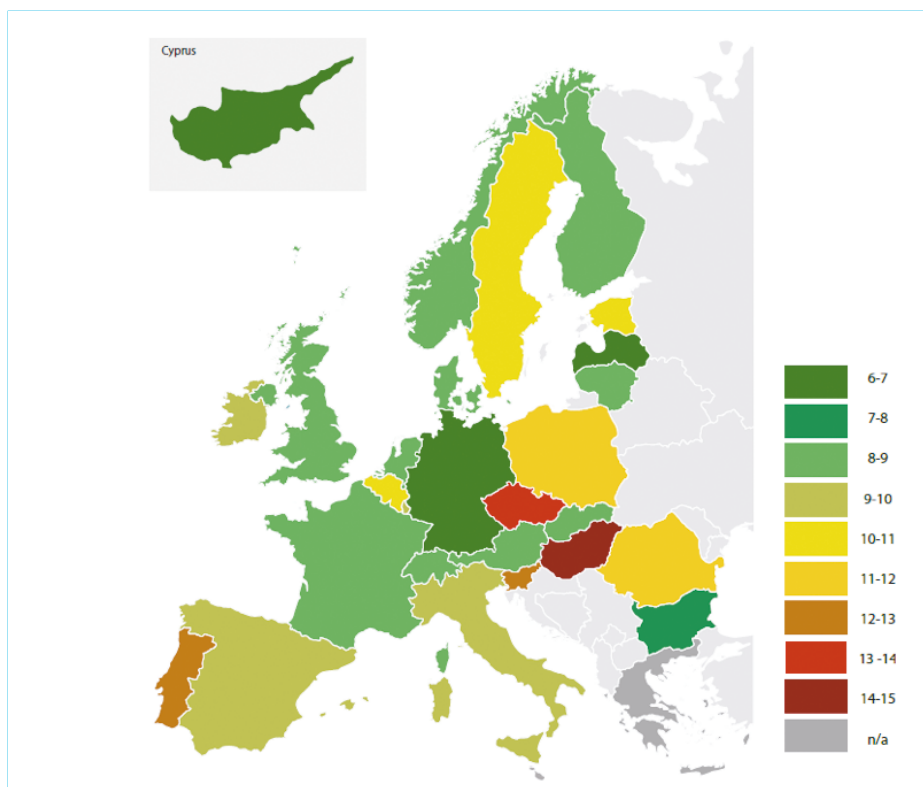


Time limits were established for setting up a programme of measures and monitoring (end of 2008) and for raising citizen awareness (2009), and member countries had to submit a minimum of collected data and a report on their progress by the end of 2009 (EU, 2009).

In 2012, the European Commission conducted a survey of Member States, on the implementation of this salt reduction framework. The report created included the mean daily intake of salt in Europe for this year.



**Figure 2.** Mean daily intake of salt in Europe in 2012, according to the survey on the implementation of the European Common Framework for salt reduction in Member States. **Source:** Survey on Member States implementation of the EU framework on salt reduction (EU, 2012).



**Figure 3.** Map of estimated daily salt intake (in grams) of European countries taking part in the European Common Framework. Survey on Member States implementation of the European Common Framework for salt reduction. **Source:** (EU, 2012).

From among the initiatives of the European Union countries, those of France, the United Kingdom, Ireland, Finland and Spain are of note for their objectives to reduce salt intake, especially in processed foods, and for raising awareness among consumers of the effects of salt on health.

## 2.4 France

Efforts to reduce salt intake among the French population come from the French Ministry of Health and from the French Agency for Food Safety [currently Agence Nationale de Sécurité Sanitaire de l'Alimentation, de l'Environnement et du Travail (ANSES)], in accordance with the policies dictated by the Ministry.

In 2000, ANSES recommended a reduction in the intake of salt in the French population and the assessment of the possibility of obtaining a gradual reduction in the salt content of processed foods (AFSSA, 2002).

In 2001, the Ministry of Health set up the First National Programme of Health and Nutrition 2001-2005 (PNNS-1), with the aim of improving the health of the population through nutritional intervention. One objective of this plan included the reduction of salt intakes to less than 8 g per day.

In the following years, a working group was created in ANSES with representatives from different areas and in which three main objectives were established:

1. To estimate the salt intake of the adult population in France.
2. To identify the main sources of salt intake.
3. To propose measures to reduce the salt intake which, according to data obtained in a survey conducted in 1998-1999, was around 9-10 g per day.

Subsequently, the working group defined various recommendations and goals based on two pillars:

- Risk prevention, which covers information to the general public and health education (by means of guides and communication campaigns).
- Adoption of measures to improve food quality through its reformulation.

The targets established by the working group were as follows:

- To reduce the population's salt intake by 20 % at the rate of 4 % every year for 5 consecutive years.
- To reduce the salt content of the products which are the main vehicles of salt (meat products, cheese, soup, pre-cooked food).
- To launch a public information campaign on nutrition in general.

Some members of the working group disagreed with the goal of generalising the 20 % reduction in salt intake in 5 years to the whole population, as they considered the objective unrealistic, and felt that a reduction in the salt content of certain processed foods would be more efficient than measures aimed at consumer education.

The annex to the Public Health Law established the reduction of salt intake to less than 8 g/day as one of the objectives for 2008 (France, 2004), whereas the second National Programme of Health and Nutrition 2006-2010 (PNNS-2) adopted the proposals of the working group.

In the last National Programme of Health and Nutrition 2011-2015 (PNNS-3) the objective was established to reduce the salt intake to less than 8 g/day for adult males and to less than 6.5 g/day for adult females and children.

With regard to the results of the strategies carried out, attempts to reduce the salt content of food showed a general decrease in breakfast cereals, some soups and cheeses, while in other food categories such as ham or bread, the salt levels remained similar or were even higher. In the case of bread, this was due to the fact that in France there are many small bread producers, unlike in the United Kingdom. This made the implementation of a potential reduction and the monitoring of the reduction in the salt content more difficult.

The salt intake in the French adult population is estimated to have fallen by approximately 5.2 % since the introduction of this strategy, up to 7.7 g of salt per day in 2006/2007 (ANSES, 2012). The best results were obtained from the group of high consumers (those with an intake of more than 12 g of salt /day).

## **2.5 United Kingdom**

The relation between the intake of salt, as the main source of dietary sodium, and blood pressure was

considered by the UK Committee on Medical Aspects of Food and Nutrition Policy (COMA) in 1996 in a study on the nutritional aspects of cardiovascular disease (COMA, 1996).

In their conclusions, the COMA recommended decreasing the average dietary intake of salt of the adult population from 9 g/day to 6 g/day (equivalent to 2.4 g of sodium/day). Depending on the caloric intake, the recommended salt intake for females was established at 5 g/day (2 g of sodium) and for males at 7 g/day (2.7 g of sodium). Similarly, a proportional reduction was recommended for children according to their weight although the report concluded that there was insufficient data available to quantify this reduction.

In November 2001, the Food Standards Agency (FSA), reflecting these recommendations, requested the Scientific Advisory Committee on Nutrition (SACN) to review the recommendations of the COMA and to carry out, in view of the new scientific data published, a new assessment of the risks associated with the intake of salt. The SACN published their report in 2003, in which, in addition to stressing the close link between a high salt intake and the development of cardiovascular disease, they maintained the COMA's recommendation to reduce salt intake in the adult population to 6 g/day and established, quantitatively, the need to reduce the salt intake in the child population to the following values (Table 1).

**Table 1.** Proposal to reduce salt intake in the child population in the United Kingdom

Age	Average intake (g/day)
0-6 months	<1
7-12 months	1
1-3 years	2
4-6 years	3
7-10 years	5
11-14 years	6

**Source:** (SACN, 2003).

The intake established by the COMA, and subsequently by the SACN, of 6 g/day was higher than the recommended dietary intake (RDI) for sodium (1.6 g, equivalent to 4 g of salt) and substantially higher than the salt intake required to maintain the body sodium levels. However, it was considered that although 6 g/day of salt was not an ideal intake, it was an attainable goal that would result in noticeable health benefits for the population (SACN, 2003).

In 2005, the FSA established the following targets:

- To reduce the average salt intake in the adult population to 6 g/day for 2010 through the 5-year Strategic Plan (2005-2010).
- To establish objectives for the salt content of certain food categories in 2006.

Based on the recommendations issued by the SACN, the FSA and the Department of Health in the United Kingdom focussed on three main areas: information campaigns to raise awareness among

consumers of the negative effects on health of a high salt intake together with advice on how to reduce this intake, the setting up of a system of voluntary nutritional labelling to give information about the content of salt and other nutrients in food, the involvement of all sectors of the food industry, retailers, manufacturers, commercial associations, catering firms, etc., to voluntarily reduce the salt content of food (mainly processed food) for 2010 through new formulations, the development of informative guides and tips for companies on how to tackle the salt reduction process.

In this respect, the FSA established an objective to reduce the salt content of processed foods by 40 % (the major source of dietary sodium in the United Kingdom [65-70 % approximately]). In this food category, cereal and meat derivatives were the foods that most contributed to salt intake.

On the whole, the main obstacles for reducing the salt intake in the population were consumer acceptance, technological barriers and microbiological safety.

According to data from the FSA resulting from a review of the progress of its measures in 2008, all the sectors of the food industry responded positively to the call to reduce levels of salt.

The detailed results, together with the conclusions and the new challenges to be faced are published regularly.

The global results of the strategy to reduce salt intake are given in Table 2.

<b>Table 2.</b> Results obtained for the reduction of salt in foods in the United Kingdom	
<b>Product</b>	<b>Salt reduction achieved</b>
Breakfast cereals	44 %
Packaged sliced bread	30 % (sodium)
Sauces	29 %
Biscuits	25-45 %
Soups	25 %
Snacks	13-32 %

**Source:** (FSA, 2009).

With respect to the citizen awareness campaign, a coordinated project was carried out with the food industry with the aim of increasing citizen awareness about salt, giving clear messages regarding salt limits, the reading of labels, the choice of low salt food and informing the public that processed foods have the highest salt contents.

The results indicated that approximately one third of consumers reduced their salt intake, the number of consumers who read food labels doubled and awareness of the message of 6 g of salt per day increased ten-fold (EU, 2008).

The general reduction of the salt content in diets in the United Kingdom as a result of the FSA strategy enabled the intake of the adult population to go from 9.5 g/day in 2001 to 8.6 g/day in 2008 (WHO, 2013b).

## 2.6 Ireland

In 1999, the Department of Health and Children issued a report in which they recommended that the Food Safety Authority of Ireland (FSAI) examined the intake of salt in the Irish diet and advised on the national policy in this area.

In 2003, the FSAI established a series of objectives to reduce salt intake, based mainly on the following aspects:

- Manufacturers of the food categories with the highest content of salt, in order that they gradually reduce the salt content of their products.
- Labelling of packaged food products, to include salt content.
- Consumers, through an awareness campaign to obtain a change in behaviour when selecting food products.

Subsequently, this Agency submitted their recommendations in a report (FSAI, 2005) following the lines published by the SACN in the United Kingdom in their report *Salt and health* published in 2003 (SACN, 2003) and the report from the Institute of Medicine of the United States National Academies concerning dietary reference intakes for water, potassium, sodium, chlorine and sulphate (IOM, 2004). Based on a population intake of 10 g of salt per day, the FSAI established in their report a recommended mean intake for the adult population of 6 g of salt/day (2.4 g/day of sodium) to be reached in a reasonable time (2010), indicating nevertheless that 4 g of salt per adult and day are sufficient to meet the physiological needs of 97 % of the population.

The activities carried out included:

1. Reformulation of processed products in which the food manufacturers and retailers collaborated jointly, together with catering firms, undertaking to gradually reduce the level of salt in their processed and served food.
2. Awareness campaign directed at Irish consumers that included the media, the health sector and non-governmental organisations.
3. Definition of limits of salt content to establish labelling guidelines (the reduction in salt content must be at least 25 % so that the claim "reduced salt content" could be used).
4. Investment in research on the reduction of salt in foods (more than two million Euros in 2006).

The results obtained over these years were given on the FSAI web page in the form of annual reports detailing the commitments and advances made in the different food categories that most contribute to the total salt intake (bread, cured and processed meat products from different manufacturers) (FSAI, 2013a).

As a global result it can be said that the reduction in the salt intake of adults was approximately 1.1 g between 2001 and 2011. This reduction reflects the decreased salt content in different foods, in particular bread (-10 % at the end of 2008) (EU, 2008), sauces, soups, processed and cured meat products, fat spreads, and breakfast cereals (FSAI, 2013b).

## 2.7 Finland

Finland was one of the first countries that tried to reduce the levels of salt intake in its population, which was estimated at approximately 12 g/day at the end of the seventies (4.8 g of sodium/day) (Findiet study). From then on, the National Nutrition Council of Finland started to take measures in this respect with an intervention programme in the community (North Karelia Project), aimed at reducing mortality due to cardiovascular disease by reducing the intake of salt in the population. Three years later, this project was extended to the whole country thanks to its proven effectiveness, involving different sectors (industry, the media, health sector, schools and NGOs).

The current objective of the National Nutrition Council is to reduce the daily salt intake to below 7 g in males and 6 g in females.

The salt intake reduction policy in Finland was based on raising citizen awareness in a multi-sectoral manner and through education in personal health care, voluntary labelling as “best option” for low salt content foods and legislative measures (Finish Heart Association, 2000) (Karpanen and Mervaala, 2006) (National Institute for Health and Welfare, 2009). In addition, a study was made of the population’s salt intake using a survey conducted over five years which included an evaluation of sodium excretion in urine.

As a result of these measures, many products with a high salt content have disappeared from the market and others have been reformulated by the industry.

Sodium excretion levels have dropped significantly in the last 20 years. Based on studies of sodium excretion in urine, the salt intake has decreased by 40 % in the last 30 years, to 8.3 g/day in males and 7.0 g/day in females in 2007 (Pietinen et al., 2010) (WHO, 2013c). Blood pressure levels have also fallen at the same time.

## 2.8 United States of America

In 2008, the Committee on Strategies to Reduce Sodium Intake was created in the United States. Its work was to establish recommendations on the strategies necessary to reduce the daily intake of sodium of the American population. At that time, the daily intake was in excess of 8.64 g of salt (3.4 g of sodium).

In 2010, the final report of its work was published, *Strategies to reduce sodium intake in the United States* (IOM, 2010). The main objective was to reduce the daily sodium intake to below 2.3 g (5.84 g of salt). This is the recommended value in the Dietary Guidelines for Americans and coincides with the maximum tolerable intake established by the Institute of Medicine of the United States National Academies (IOM, 2005) (US, 2005). This strategy was directed at all population strata in the United States, including children.

The work carried out by this Committee was developed in various stages. Initially, the previous public and private initiatives were studied together with the objectives proposed until then. Subsequently, the Committee considered which were the true challenges of the proposed strategies (organoleptic properties of the food and ubiquity of sodium-rich food). In a third stage, other aspects were considered, including the actual quantification of the sodium intake of the population, sodium food sources, the technological aspects determining the quantity of sodium in food (for example, antimicrobial effects),

existing legislation and the experiences of other countries. Lastly, possible options for reducing the sodium intake in the population were considered, as well as the possible unintentional consequences of reducing the sodium intake.

This work led to a series of recommended strategies for obtaining the objective:

1. Application to the FDA (Food and Drug Administration) for obligatory national standards for sodium content in food, in addition to modifying the GRAS status (generally recognised as safe) of the salt added to processed food and of the additives containing sodium.
2. Voluntary reduction of the sodium content in food by the food industry prior to the introduction of the obligatory standards.
3. The government agencies and associations of health professionals and consumers, together with the food industry, must take the necessary measures to help to reduce sodium levels in food, including a review by the FDA of labelling regulations and nutrition claims for sodium. These regulations must also affect restaurant menus and be adapted to the needs of each sector. Consequently, the labelling exemption for products used in the catering sector must also be withdrawn.
4. In addition to recommendations to reduce sodium content in food, non-governmental agencies, associations of health professionals and consumers, the health insurance industry, the food industry and other parties involved, whether public or private, must carry out additional activities to raise awareness among consumers so that they reduce their sodium intake.
5. Federal agencies must guarantee and improve the control and monitoring of studies that provide information on sodium intake, organoleptic preferences and the sodium content in food, as well as guaranteeing that the data are provided in a suitable manner and in user-friendly formats.

In 2010, the Dietary Guidelines for Americans established a sodium intake for adults of 2.3 g/day in the general population, and a reduction of up to 1.5 g/day among individuals over the age of 51, of African American origin and those with high blood pressure or suffering from chronic kidney disease (US, 2010).

Given that in observational epidemiological studies, it has been shown that the relation between the intake of sodium and cardiovascular mortality is J-shaped (O' Donnell et al., 2011) (Whelton et al., 2011), the Institute of Medicine of the United States National Academies recently concluded that the scientific evidence in relation to studies that link the intake of sodium at below 2.3 g/day to the risk of coronary artery disease, cerebrovascular disease and total mortality is insufficient due to the number and quality of the studies made in this respect (McGuire, 2013).

## 2.9 Canada

In 2007, the Sodium Working Group (SWG) was established in Canada with the objective of developing a strategy to reduce the sodium intake among the Canadian population. The working group is formed of representatives from: a) food companies, b) non-governmental organisations whose objectives are based on the population's health, c) the scientific community, d) consumer protection groups, e) health professional organisations, and f) government departments and agencies. In 2010, the SWG published



the final report of their work: *Sodium Reduction Strategy for Canada-Recommendations of the Sodium Working Group* (SWG, 2010).

The main objective established by this working group was to obtain a provisional sodium intake of 2.3 g per day by 2016 (5.8 g of salt/day), where the mean sodium intake of the population was 3.4 g (8.6 g salt/day) at the start of the working group's mandate (2007). Ultimately, the final objective was to reduce the mean sodium intake in the population such that 95 % of the individuals have a daily intake less than the maximum tolerable intake of 2.3 g (5.8 g salt /day).

The strategy proposed by the working group in Canada consists of several stages and is based on three pillars:

1. Voluntary and structured reduction of the sodium content in manufactured foods and in foods sold in the catering trade.
2. Education and awareness of consumers, industry, health professionals and other involved parties key to the achievement of the objectives.
3. Research.

In addition a fourth pillar of a horizontal nature is also considered, for control and evaluation.

This strategy is directed at the general population, although the daily sodium intake in children is recommended at less than the proposed objective of 2.3 g.

## 2.10 Spain

The dietary reference intakes (DRI) established by the Spanish Federation of Nutrition, Food and Dietetics Societies (FESNAD) in 2010 were set at 1.5 g of sodium between 10 and 49 years of age, 1 300 mg between 50 and 69 years of age, and 1.2 g after the age of 70, without establishing any differences between genders (FESNAD, 2010). With respect to the child population, the DRI were established at 0.12 g of sodium for ages between 0 and 6 months, 0.37 g between 7 and 12 months, 1 g between 1 and 3 years of age and 1.2 g between 4 and 9 years old. During pregnancy and lactation, the DRI were also established at 1.6 g/day. Nevertheless, only the Spanish Society on Community Nutrition (SENC) established, in 2006, certain intermediate nutritional objectives based on population studies of nutrition in Spain of 7 g of salt per day, and final objectives in accordance with the current scientific evidence and based on the nutritional reference values of 6 g of salt per day (SENC, 2006).

The NAOS Strategy for Nutrition, Physical Activity and the Prevention of Obesity recommends that the salt intake from all sources be reduced to at less than 5 g/day (NAOS, 2005). Since 2009 a plan has been developed aimed at reducing the population's salt intake. The current plan aims to reduce the salt content in food by 20 % over a 4-year period (2010-2014).

According to a study commissioned by the AECOSAN from the Complutense University of Madrid, the mean salt intake in Spain calculated from sodium excretion in urine is estimated to be 9.8 g/person/day, and therefore it is estimated that more than 80 % of the population have an intake higher than the recommended intake (5 g of salt per day) (Ortega et al., 2011). This figure is one of the highest in the countries of the European Union according to a survey conducted by the European Commission of the Member States for the implementation of the salt reduction framework in Europe.

As in other developed countries, a large part of the salt consumed in Spain is estimated to come from processed foods consumed outside the home. This salt included in processed foods is known as "hidden" salt, as individuals are not aware of the quantity of salt they consume and their efforts to reduce salt intake are limited by the salt content in processed products.

The intake of salt in Spain is increasing. The quantity of salt added to home cooking and at the table is minor, compared to that consumed in processed foods, contributing in small quantities to the total intake of the average Spaniard. Although salt is found in a large variety of processed foods, the main sources, according to the ENRICA study (Study of Nutrition and Cardiovascular Risk in Spain), are bread-based products (33.6 %), cold meats and sausages (21.0 %) and cheeses (5.83 %). Bread alone is estimated to contribute 19 % to the total sodium intake. In children, the same foods are mainly responsible for the sodium intake, although bread takes second place (ENRICA, 2011).

In efforts to determine the salt content of processed food products, the AECOSAN analysed 1 256 products from 20 food categories. From this they established the average salt content (maximum and minimum) of all the food categories, enabling them to define those target foods on which to concentrate their efforts.

A special effort has also been made from the AECOSAN to raise consumer awareness through the distribution of leaflets and press reports, and through the AECOSAN Web. In 2010, the campaign distributed 100 000 copies of the leaflet on the Plan to Reduce Salt Intake, which was also made available to the autonomous regions of Spain. In addition, the Agency has carried out awareness campaigns for the public on the benefits of reducing salt intake. One of the most recent campaigns, in 2011, was conducted via Web sites, online games and social networks including Twitter. One of the available online tools allows users to print a personalised 4-week plan to reduce the intake of salt by means of tips and recommendations (AECOSAN, 2010).

To reach the objective of a 5 % reduction in the salt intake for 2014, formal agreements were signed in collaboration with the food and catering industries, and with restaurants and school dining-rooms. AECOSAN has held numerous meetings with food manufacturing associations, distribution firms and networks, although they have not reached the specific objective on the reduction of salt in specific food products, except for bread.

As bread is the food that supplies most salt to the average Spaniard, the AECOSAN agreed with the Spanish Confederation of Bakers (CEOPAN) and Spanish Association of Manufacturers of Frozen Dough (ASEMAC) to voluntarily and gradually reduce the sodium content in bread. More specifically, a reduction was agreed, for the 2005-2009 period, in the percentage of salt used in the preparation of bread, going from 22 g NaCl/kg of flour to a maximum of 18 g NaCl/kg of flour over a 4-year period, thereby decreasing by 1g per year. The manufacturers also signed up to the agreement, and at the end of the 4-year period, levels were reduced to 16.3 g of salt per kg of flour, representing a reduction of 26.4 % (Ballesteros, 2009). This reduction was confirmed in a laboratory analysis carried out by the AECOSAN.

More recently the AECOSAN has set up a collaboration agreement with the food industry, in particular with the Spanish Confederation of Meat Retailers (CEDECARNE) and the Association of Manufacturers and Distributors of Food Additives and Supplements (AFCA) for the voluntary reduction of the sodium content in meat products and charcuterie (AECOSAN, 2012). This agreement establishes

objectives to reduce the average salt content by 10 % and the average fat content by 5 % in meat products and charcuterie from the current levels and within two years.

### **2.11 List of nutritional recommendations and objectives established by different international bodies and different countries in relation to the intake of salt**

The objectives and recommendations of the different bodies/countries with respect to the intake of salt are listed below (Table 3).

**Table 3.** Summary of the recommendations established by different bodies/countries with reference to the intake of salt

Body/country	Recommendation			Report	Year
	Male intake	Female intake	Child intake		
Canada	<5.8 g salt/day (2.3 mg sodium/day)	<5.8 g salt/day (2.3 mg sodium/day)	<5.8 g salt/day (2.3 mg sodium/day)	<i>Sodium Reduction Strategy for Canada. Recommendations of the Sodium Working Group</i>	2010
European Commission (High Level Group on Nutrition and Physical Activity)	WHO	WHO	WHO	<i>EU Framework for National Salt Initiatives</i>	2008
Spain	<5 g salt/day	<5 g salt/day	<5 g salt/day	NAOS strategy	2005
United States	<5.8 g salt/day (2.3 mg sodium and in some cases 1.5 mg)	<5.8 g salt/day (2.3 mg sodium and in some cases 1.5 mg)	-	Dietary Guidelines for Americans	2010
FAO/WHO	<5 g salt/day	<5 g salt/day	Reduction of salt intake	WHO	2003
Finland	<7 g salt/day	<6 g salt/day	-	<i>Nutrition Policy in Finland</i>	2012
France	<8 g salt/day	<6.5 g salt/day	<6.5 g salt/day	PNNS-2011-2015	2011
Ireland	<6 g salt/day	<6 g salt/day	-	<i>Salt and Health: Review of the Scientific Evidence and Recommendations for Public Policy in Ireland</i>	2005
United Kingdom	<6 g salt/day	<6 g salt/day	Reduction by age	SACN	2003

## 2.12 Comments

Although the WHO and the European Plan for the reduction of the intake of salt consider that the objective in the adult population should be the average intake of quantities less than 5 g of salt per day, the objectives of the majority of European countries that have established strategies for the reduction of the intake of salt in the population have been more conservative, possibly in order to reach objectives that can be attained in the given time. The majority of European countries that stand out in their attempts to reduce the salt intake in the population have established an objective of between 6 and 7 g/day, setting lower quantities for females (between 5 and 6.5 g/day) than for males (between 7 and 8 g/day).

In the majority of countries that have managed to reduce the population's salt intake over time, this has been following the establishment of multidisciplinary strategies involving the population, the food and catering industries, government agencies and bodies and scientific societies.

To assess the effectiveness of these strategies, it is necessary to regularly evaluate the salt intake in the population, calculated from sodium excretion in urine of representative samples of the population.

## 2.13 Recommendations on salt intake

As with other international bodies, the Scientific Committee of the AECOSAN is aware that an excessive salt intake in the population may have significant harmful effects for health.

Given that the intake of salt in the Spanish population largely exceeds the nutritional objectives established by the WHO, other international bodies and different scientific societies in Spain and in other developed countries, the Scientific Committee of the AECOSAN considers the establishment of multidisciplinary strategies to reduce salt consumption, involving the population, the food and catering industries, government agencies and bodies and scientific societies, to be reasonable.

According to the Scientific Committee of the AECOSAN a reduction in salt consumption to less than 6 g/day should be promoted. This figure would not only result in major benefits for the health of the population but also it would be a reasonably attainable figure in the population following the establishment of multidisciplinary national strategies.

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### 3. Fat intake

Regulating dietary fat content is an important tool for making up the total energy balance, as this is a concentrated form of energy (9 kilocalories per gram), with a low satiating power (in comparison to proteins and carbohydrates) and a high palatability, which could result in overconsumption. However, certain fats are essential in the diet for different bodily functions and for health in general, such that the consequences for health of dietary fats go far beyond their role as a source of energy (Bray et al., 2004) (Palou et al., 2008).

Fats play a key role in the maintenance of the energy balance and body weight. High fat intakes may contribute, in predisposed populations (genetically and/or due to the lifestyle), to the development of obesity and overweight (Gil et al., 2010). In this respect, a lively scientific debate is currently underway regarding the role of fats in relation to obesity and weight gain (Hill et al., 2000) (Willett and Leibel, 2002) (Bray et al., 2004). On the whole, diets with a higher percentage of fat-based energy are associated to a higher energy intake (Macdiarmid et al., 1996) (Bray and Popkin, 1998) (Donahoo et



al., 2008). However, the direct relation between overweight or obesity is not clear. In the Nurses' Health Study, a weak positive association was observed between the total fat intake and weight gain over a period of 8 years (Field et al., 2007). Moreover, other studies show that although the energy intake is associated with weight gain, a relationship with the percentage of fat-based energy has not been established (Donnelly et al., 2008) (Forouhi et al., 2009). In the consensus document on "Evidence-based nutritional recommendations for the prevention and treatment of overweight and obesity in adults", drawn up by the FESNAD and the Spanish Society for the Study of Obesity (SEEDO), it was concluded that the intake of fats, after adjustment for the energy intake, is not associated with weight gain in healthy adults (FESNAD-SEEDO, 2011).

Although the relation with body weight is not completely clear, diets which are too rich in fats, especially saturated fats, are associated with an increased risk of coronary heart disease, diabetes mellitus type 2 and certain types of cancer (Alwan et al., 2010) (FAO, 2010) (WHO, 2012).

In addition, although the excess intake of fats may have negative effects on health, a low-fat diet is not necessarily associated with beneficial effects. In a meta-analysis of clinical trials comparing energy-restricted and low fat diets (<30 % of dietary energy in the form of fat) to non-energy-restricted and low carbohydrate diets (<60 g/day), it was concluded that low fat diets induce greater reductions in LDL-cholesterol concentrations, but that they also lower the HDL-cholesterol concentrations and increase the concentration of triglycerides (Nordmann et al., 2006). Such diets did not improve weight loss after one year, in comparison to low carbohydrate and non-energy-restricted diets.

It should also be noted that the metabolism and function of the different types of fatty acids – saturated (SFA), monounsaturated (MUFA), polyunsaturated (PUFA) and *trans* (TFA)– are different. This means that they may have different effects on health, and contribute in different ways to weight gain (Bray et al., 2002) (Field et al., 2007). Even within each category, the different fatty acids may have, for each of the specific chemical species, different effects. This is an area not yet explored and should be studied more closely.

With regard to the group of *trans* fats obtained through an industrial process from partially hydrogenated vegetable oils, there is firm evidence that these contribute significantly to an increase in the risk of cardiovascular events (WHO/FAO, 2003) (Nishida and Uauy, 2009) (EFSA, 2010a) (FAO, 2010).

### **Saturated fatty acids**

Saturated fatty acids (SFA) come from both endogenous synthesis and from food. The main SFA in our diet have 14, 16 and 18 C, except in the case of milk and coconut oil, where the SFA are more widely distributed between 4 and 18 C.

In general, SFA, particularly long-chain SFA, have a lower level of oxidation than unsaturated fatty acids, and tend to be stored more efficiently (DeLany et al., 2000). Moreover, observations in animals show that they are more difficult to mobilise through lipolytic stimuli, have regulating effects, increase the gene expression involved in the proliferation of adipocytes, and are directly linked to the development of insulin resistance (Storlien et al., 2000) (Saravanan et al., 2005). Moreover, these SFA have a lower satiating effect in comparison to the PUFA (Lawton et al., 2000).

Research that studies the relation between the intake of SFA in healthy adults and the risk of obesity has produced contradictory results, as highlighted in the consensus document (FESNAD-SEEDO, 2011). In the Nurses' Health Study (Field et al., 2007), a strong positive association was observed between the saturated fat intake and weight gain over a period of 8 years. However, in the prospective study EPIC, no significant relation was observed between the intake of SFA and weight gain, although when stratified by gender, a possible, although weak association without statistical significance was observed in females (Forouhi et al., 2009).

Individual SFA have different effects on cholesterol concentrations in the different plasma lipoproteins. For example, lauric (C12:0), myristic (C14:0) and palmitic acids (C16:0) increase LDL-cholesterol while stearic acid (C18:0) has no effect.

The FAO/WHO Expert Committee established that there is convincing evidence that (FAO, 2010):

- The substitution of SFA (C12:0-C16:0) with PUFA reduces LDL-cholesterol concentrations and the total cholesterol/HDL-cholesterol ratio. A similar effect but to a lesser degree is achieved by replacing SFA with MUFA.
- The replacement of SFA (C12:0-C16:0) with carbohydrates reduces the cholesterol concentrations, of both LDL and HDL, but does not change the total cholesterol/HDL-cholesterol ratio.
- The substitution of SFA (C12:0-C16:0) with TFA reduces HDL-cholesterol concentrations and increases the total cholesterol/HDL-cholesterol ratio.

The guide drawn up by the Joint Expert Committee from the American Heart Association (AHA) and the American College of Cardiology (ACC) on modifications to lifestyles in order to reduce cardiovascular risk, estimates, with a moderate level of evidence, that for each 1 % of dietary energy from SFA that is replaced with the same quantity of energy from carbohydrates, MUFA or PUFA (Eckel et al., 2013):

- the LDL-cholesterol concentration is reduced to about 1.2, 1.3 and 1.8 mg/dl, respectively, and
- the HDL-cholesterol concentration is reduced to about 0.4, 1.2 and 0.2 mg/dl, respectively.

In addition, it is also estimated, with a moderate level of evidence, that for each 1 % of dietary energy from SFA that is replaced with isoenergetic quantities of carbohydrates or MUFA, the triglycerides increase by 1.9 and 0.2 mg/dl, respectively, whereas if replaced with PUFA, the triglycerides are reduced by 0.4 mg/dl (Eckel et al., 2013).

Based on mortality and morbidity figures from epidemiological studies and controlled clinical trials in relation to coronary heart disease, the FAO/WHO Expert Committee concluded that (FAO, 2010):

- There is convincing evidence that the substitution of SFA with PUFA reduces the risk of coronary heart disease.
- There is likely evidence that the substitution of SFA with rapidly absorbed sugars and starches has no effect on the risk of coronary heart disease, and may even increase the risk of coronary artery disease and favour the development of metabolic syndrome.
- There is a possible positive relation between the intake of SFA and an increased risk of diabetes.
- There is insufficient evidence in relation to the effect of replacing SFA with MUFA or carbohydrates

(mainly unrefined) on the risk of coronary artery disease. However, there is indirect evidence that it may help to reduce the risk of this disease.

- There is insufficient evidence that SFA affect risk factors that are metabolic syndrome indicators.

Furthermore, according to morbidity and mortality figures for cancer, nor is there sufficient evidence to establish a link between the intake of SFA and cancer (FAO, 2010).

### **Monounsaturated fatty acids**

In general, unsaturated fatty acids increase insulin sensitivity and have greater satiating power than saturated fats (Lawton et al., 2000) (Storlien et al., 2000). However, their effect depends on the type of fatty acid.

MUFA, as with saturated fats, and unlike essential unsaturated fats, are partly the result of endogenous synthesis and partly come from food. Oleic acid is the most common and is present in significant quantities in animals and plants, olive oil being the main source.

MUFA-rich diets encourage, given the same calorific intake, a more favourable metabolic profile than SFA, with a greater reduction of total plasma cholesterol and improved lipid profiles. MUFA-rich diets have also been associated with an improvement in systolic and diastolic blood pressure, suggesting that a diet with a high MUFA content may have beneficial effects with respect to the prevention of cardiovascular disease (Schwingshackl et al., 2011). In addition, in various revised studies, no significant association has been observed between the quantity of MUFA and weight gain (Field et al., 2007) (Forouhi et al., 2009).

In relation to the effects on health of MUFA, the FAO/WHO Expert Committee concluded that (FAO, 2010):

- There is convincing evidence that the substitution of SFA (C12:0-C16:0) with MUFA reduces LDL-cholesterol concentrations and the total cholesterol/HDL-cholesterol ratio.
- There is also convincing evidence that the substitution of carbohydrates with MUFA increases HDL-cholesterol concentrations.
- There is possible evidence that the substitution of carbohydrates with MUFA increases insulin sensitivity.
- There is insufficient evidence to link the intake of MUFA with endpoints in chronic diseases, such as heart disease or cancer. Nor is there sufficient evidence to link the intake of MUFA with body weight and adiposity, or the risk of diabetes.

### **Polyunsaturated fatty acids**

The most important PUFA, both in terms of their abundance and for their relation to nutrition and human health, are the n-6 and n-3 families, also known as omega 6 and omega 3. In these fatty acids, the first double bond is found in the carbon-6 and -3, respectively, counted from the methyl end. The n-6 and n-3 series are headed by, respectively, linoleic acid (LA; 18:2, n-6) and alpha-linolenic acid (ALA; 18:2, n-3). These two fatty acids are the only ones considered to be essential for the human species, as they fulfil important biological functions but we are unable to synthesise them as we do

not have the enzymes  $\Delta 12$ - and  $\Delta 15$ -desaturases, able to catalyse the formation of double bonds in positions n-6 or n-3. Therefore, these fatty acids must be provided in diet.

In animal cells, linoleic and alpha-linolenic acid are metabolised using enzymes (elongases and desaturases) that catalyse their elongation and the introduction of additional double bonds, resulting in highly unsaturated fatty acids with 20 and 22 carbons. Arachidonic acid (AA; 20:4, n-6) is obtained from LA, and eicosapentaenoic (EPA; 20:5, n-3), docosapentaenoic (DPA; 22:5, n-3) and docosahexaenoic (DHA; 22:6, n-3) acids are obtained mainly from ALA (Palou et al., 2008). AA is the most important fatty acid in the n-6 PUFA family. AA is present in low levels in meat, eggs, fish, algae and other aquatic plants. EPA and DHA are the most important fatty acids in the n-3 PUFA family. Both fatty acids are mainly found in fish and crustacean shellfish (Palou et al., 2008).

With regard to the relation of the PUFA with health, different studies have shown that the intake of EPA and DHA have beneficial effects on blood pressure, heart rate, triglycerides, and probably inflammation, the endothelial function and diastolic cardiac function. There is also consistent evidence of a lower risk of death from coronary heart disease with the intake of ~250 mg/day of EPA and DHA (Burr et al., 1989) (Mozaffarian and Rimm, 2006) (Yokoyama et al., 2007) (Tavazzi et al., 2008). With regard to the possible effects on body weight, neither the observations of the study by Field et al. (2007) nor those published by Forouhi et al. (2009) associate the intake of PUFA with weight changes or gain.

With respect to the PUFA, the opinion issued by the FAO/WHO Expert Committee is (FAO, 2010):

- There is convincing evidence that the replacement of SFA with PUFA reduces the risk of CVD.
- There is possible evidence of the relation between the intake of PUFA and the reduced risk of diabetes.
- There is insufficient evidence to relate the intake of PUFA with body weight and the percentage of adiposity, or to establish a relation between the intake of PUFA and cancer.

### **Trans fatty acids**

*Trans* fatty acids (TFA) are unsaturated fatty acids (MUFA or PUFA) with one or more double bonds in the *trans* configuration. This configuration can be produced both from a microbial fermentation process in the rumen of ruminants (which leads to the presence of TFA in dairy products or in meat) or via certain catalytic hydrogenation processes of vegetable oils carried out in the food industry (AECOSAN, 2010). The deodorisation processes, after the refining of vegetable or fish oils, or the heating and frying of oils at high temperatures also generate TFA.

The TFA obtained industrially from partially hydrogenated vegetable oils are associated with multiple pathologies and have adverse effects on the metabolism of fatty acids, the endothelial function and blood lipids: increase of the concentration of LDL and a reduction of HDL in blood to a greater extent than for saturated fats (WHO, 2003) (Nishida and Uauy, 2009). In this respect, the FAO/WHO Expert Committee has concluded that there is convincing evidence that these fatty acids are harmful to health, as they entail multiple factors of cardiovascular risk and significantly contribute to increasing the risk of coronary heart disease (FAO, 2010). There is also probable evidence that these fatty acids increase the risk of components of metabolic syndrome and diabetes, especially among people with

risk factors (for example with hyperglycaemia, overweight and obesity, or who do not take physical exercise). In particular, a meta-analysis showed that an intake of approximately 5 g per day of TFA is associated with a 25 % increase in the risk of coronary heart disease (Oomen et al., 2001). This finding represents an increase of four to five times the risk of coronary artery disease per gram of TFA intake in comparison with each gram of saturated fat.

There is evidence to suggest that the effects of TFA on the risk of coronary artery disease depend on the length of the chain and the position of the double bonds with *trans* conformation (Uauy et al., 2009). In observational studies using TFA intake biomarkers, it was observed that both isomers (18:1 and 18:2) seem to contribute to the risk of coronary artery disease, whereas the majority of studies did not observe any effect from the 16:1 TFA. The available data also suggest that the *trans* 18:2 isomers may be more associated with the risk of coronary heart disease than the *trans* 18:1 isomers, but current evidence in this area is limited and does not permit any definitive conclusions to be reached (Uauy et al., 2009).

With reference to the possible association between the intake of TFA and weight gain, available evidence is scarce. Two prospective observational studies carried out in an 8- and 9-year study period suggest that the intake of TFA encourages weight gain and, in particular, the build-up of abdominal fat (Koh-Banerjee et al., 2003) (Field et al., 2007). Changes of adiposity or weight associated with the intake of total fat, SFA, MUFA and PUFA were less consistent.

It is notable that in recent years a significant reduction has been observed in the TFA content of many foods and therefore, it is important that food composition databases used to evaluate the impact of TFA on health are kept up-to-date (SACN, 2007) (AECOSAN, 2010).

In Spain, in recent studies carried out by the National Food Centre (CNA) belonging to the AECOSAN, in which, among others, the fatty acid profile of pastries, cereals, snacks, crisps, biscuits, chocolates, chocolate spreads, margarines, pâtés and cold meats and sausages were established, TFA contents were observed to be generally less than 1 % of the total fatty acids, in line with the reduction of the TFA content of hydrogenated fats documented in other countries (Burdaspal et al., 2010). A nutritional quality index, often used, and calculated by dividing the sum of the SFA and TFA content by the sum of the MUFA and PUFA, is kept at less than one in 7 of the 12 processed food groups marketed in Spain that were analysed, with the highest levels found in chocolate-filled biscuits, children's pastries and chocolate cereals (Burdaspal et al., 2010).

In the analysed products of animal origin including butter and prepared foods made with ruminant meat, the TFA content ranged between 2-3 % of the total fatty acids (AECOSAN, 2010). Nevertheless, it is now well-established that the intake of TFA is associated with an increase in cardiovascular risk, but this effect is not demonstrated in TFA of a natural origin.

The World Health Organization recommends that the TFA intake does not exceed 1 % of the total energy intake. The Food and Drug Administration (FDA) recommends a TFA intake as low as possible and some European countries such as the Nordic countries have produced their own regulations and recommendations (a maximum of 2 % of TFA in processed foods and oils) (AECOSAN, 2010).

### 3.1 World Health Organization (WHO)

Based on the considerations described in the previous section, in 2008, the FAO/WHO Expert Committee proposed the following Acceptable Macronutrient Distribution Ranges in line with the existing WHO recommendations (FAO, 2010) (WHO, 2003):

#### Total fats

The minimum intake of total fats for adults, considering anthropometric data (age, BMI) and lifestyle characteristics, should be:

- 15 % of total energy, to guarantee in the majority of individuals the correct intake of energy, essential fatty acids and liposoluble vitamins.
- 20 % of the total energy in females in reproductive age and in adults with BMI <18.5, especially in developing countries where dietary fats may be important for reaching the correct energy intake among undernourished populations.

The maximum intake of total fats for adults, considering anthropometric data (age, BMI) and lifestyle characteristics, should be:

- 30-35 % of total energy for the majority of individuals.

#### Polyunsaturated fatty acids

The range recommended by the WHO for the total PUFA (n-6 and n-3) is 6-11 % of the total energy. The minimum intake values of the essential fatty acids for preventing symptoms of deficiency are estimated to be 2.5 % of the total energy for LA, and 0.5 % of total energy for ALA. Therefore, the correct intake for preventing the deficiency of essential fatty acids is 2.5-3.5 % of the total energy intake. Based on epidemiological studies and random controlled tests on coronary events, the minimum recommended value for the total PUFA in order to reduce LDL-cholesterol and total concentrations, to increase HDL-cholesterol concentrations and to reduce the risk of cardiovascular events is 6 % of the total energy. In addition, the risk of lipid peroxidation may increase with a high intake of PUFA (>11 % of total energy), particularly when the intake of tocopherol is low. Therefore, the acceptable range may be between 6 and 11 % of the total energy.

Other specific recommendations established by the WHO include:

- The acceptable range for the total intake of n-3 PUFA may be between 0.5 and 2 % of total energy, whereas the minimum daily requirement of ALA for adults is at least 0.5 % of total energy; this quantity helps to prevent deficiencies.
- The acceptable intake range for EPA and DHA is 0.25 to 2 g. The upper value of the combination of both fatty acids is set at 2 g/day, due to experimental evidence indicating that a high intake of long-chain n-3 PUFA supplements may increase lipid peroxidation and reduce the production of cytokines. Nevertheless, the FAO/WHO Committee of Experts recognised that the highest intake values (3 g/day) reduce other cardiovascular risk factors and have not had adverse effects on the short- and medium-term random tests, and that some individuals in populations with a high intake of fish and shellfish have higher intake values without any apparent evidence of damage.

Therefore, the Committee established the quantity of 2 g/day as the maximum, while recognising that new random controlled tests and other research may justify raising this figure at a later date.

- For the n-6 PUFA (LA), an estimated average requirement (EAR) of 2 % of the total energy has been established and an adequate intake (AI) of 2-3 % of the total energy to prevent deficiencies.
- The acceptable interval for the n-6 PUFA (LA) is 2.5 to 9 % of the total energy and is the result of accepting that the upper intake limits of total PUFA and of n-3 are 11 and 2 % of the total energy, respectively. The lower value or AI (2.5 to 3.5 % of total energy) corresponds to the need to prevent symptoms of deficiency, whereas the highest value, eaten as part of a healthy diet, contributes in the long-term to cardiovascular health by reducing levels of LDL-cholesterol and total cholesterol and, therefore, the risk of coronary heart disease.
- For children aged 6 to 12 months, and for those aged 12 to 24 months, the WHO recommends a range of 3.0 to 4.5 % of the total energy (AI) with an upper value of acceptable macronutrient distribution range of <10 % of the total energy and states that there is insufficient evidence to establish a link between the intake of n-6 PUFA and cancer.
- Arachidonic acid (AA) is not considered essential for a healthy adult whose normal diet offers levels of LA higher than 2.5 % of the total energy. For babies aged 0 to 6 months, AA must be supplied in the diet in the range of 0.2-0.3 % of the total energy, taking the composition of human milk as the criteria.

With respect to the link between n-6 and n-3 fatty acids, the WHO considers that there is no convincing scientific evidence for the recommendation of a specific value for the quotient between n-6 and n-3 fatty acids or between LA and ALA, especially if the intakes of n-6 and n-3 are within the established recommendations (FAO, 2010).

### **Saturated fatty acids and *trans* fatty acids**

With regard to the recommended intake of SFA and TFA, in 2008 the FAO/WHO Committee of Experts reached the following conclusions (FAO, 2010):

- The intake of TFA must be less than 1 % of the total energy intake, although in this case, it was concluded that it may be necessary to review this quantity to protect the different subgroups of the population from the risk of a high intake of this type of fat.
- For an average population, the intake of SFA must not exceed 10 % of the total energy intake.

As strategies to reach these recommendations, the WHO proposes the adoption of national policies aimed at the reduction of excess dietary energy, saturated fats and *trans* fats, as these are significant factors of risk for obesity and non-communicable diet-related diseases (WHO, 2013).

With regard to the *trans* fats, the WHO recommends policies for the elimination of industrial production, using as a possible indicator the adoption of national policies that eliminate partially hydrolysed vegetable oils from the food chain, replacing them with PUFA (WHO, 2012).

In addition, they suggest the adoption of national policies to reduce the impact on children of the promotion of saturated and *trans* fat-rich food, in addition to food rich in free sugars and salt.

In relation to saturated fats, the WHO recommends the replacement of SFA (C12:0-C16:0) with PUFA, MUFA or carbohydrates (preferably wholemeal), given that, as described in the above paragraph, in accordance with the conclusions of the FAO/WHO Joint Committee, there is convincing evidence that the substitution of SFA (C12:0-C16:0) with PUFA reduces the concentration of LDL-cholesterol and the quotient between the concentration of total cholesterol and HDL-cholesterol (FAO, 2010). This also occurs, although to a lesser degree, if the substitution is with MUFA. If the SFA are replaced by carbohydrates, the cholesterol concentrations linked to both lipoproteins, LDL and HDL, are reduced but the quotient between total cholesterol and HDL-cholesterol does not change.

Moreover, the WHO maintains that the design and implementation of a strategy for the control and prevention of chronic disease can be combined with intervention at both population and individual level. In this respect, the examples of intervention in Poland and Finland are of note. In Poland, between 1960 and 1990, the increasing mortality rate of the population aged between 20 and 44 years due to heart problems was slowed, mainly by replacing saturated fats with polyunsaturated fats (by eliminating aid to the butter industry and providing incentives for the use of vegetable fats and oils). In Finland, a large-scale intervention programme carried out around 1970 managed to reduce the high mortality rates due to heart problems, by focussing on the generalised use of tobacco, the high percentage of dietary fat and the low intake of vegetables. The programme involved consumers, schools and the health and social services and the drop in the mortality rate among men was 65 % (WHO, 2005).

The approach proposed by the WHO in the recent "Vienna Declaration on Nutrition and Non-communicable Diseases" is multi-sectoral, involving the interested parties at European, national, regional and local level, in order to obtain a relative reduction of 25 % in premature mortality due to non-communicable diseases for 2025 (WHO, 2013). Among the options to be considered by the authorities, the WHO includes the production, consumption, marketing, availability, access, economic measures and education-based intervention.

Consequently, from the private sector, the food industry is making significant progress in different disciplines including genetics, livestock feed, physiology, etc. Examples of technological advances in the meat sector in order to reduce the quantity of fat from food of animal origin include: the reduction in weight of all domestic species (as adiposity increases with maturity), the stopping of castration of male species (as this leads to build-ups of fat), or the creation of lean stock (for example pigs) through breeding or genetic engineering.

Another option is the partial substitution of meat products with fish products (which are usually rich in unsaturated fatty acids) as a result of progress in aquaculture and fish farming management (WHO, 1998).

In regard to the results, the review of the effectiveness of the policies adopted to reduce dietary levels of TFA, published on the WHO web page, shows that, on the whole, all the strategies reduce the concentration of TFA in food, by increasing or decreasing the saturated fat content depending on the product and keeping the total fat content stable (Downs et al., 2013). The most efficient strategies for eliminating the TFA from food were local and national bans whereas compulsory labelling (in countries such as Canada and the United States) and voluntary limits produced varying results depending on the product.



### 3.2 European Food Safety Authority (EFSA)

In 2004, the Dietetic Products, Nutrition and Allergies Scientific Panel of the EFSA issued an opinion on dietetic intakes of *trans* fatty acids and their effects on health (EFSA, 2004). They concluded that at dietetic levels of TFA equivalent to those of the SFA (both with a harmful effect on the risk of coronary artery disease due to the increase in LDL-cholesterol levels), the effect of the TFA, with respect to their heart-related effects, may be greater than that of the SFA. However, the normal intakes of TFA are generally 10 times lower than those of SFA, the intake of which exceeds dietary recommendations in many European countries.

The EFSA Scientific Panel also assessed other effects on health and concluded that scientific evidence with respect to a possible link between the intake of TFA and cancer, type 2 diabetes or allergies, is weak or inconsistent (EFSA, 2004).

Subsequently, the EFSA issued a scientific opinion on the dietary reference values for fats, which include SFA, PUFA, MUFA, TFA and cholesterol (EFSA, 2010a). This document recommends:

- For total fat, 20-35 % of the total energy as the reference intake range, and in children this is gradually reduced from to 40 % of the total energy for the 6-12 month age group to 35-40 % of the total energy in the second and third years of life.
- Not establishing a value or range for the intake of SFA and TFA, but keeping it as low as possible.
- Reference values are not established for the total intake of PUFA *cis*, the n-3/n-6 ratio, the cholesterol, arachidonic acid and conjugated linolenic acid.
- Nor is an Upper Limit (UL) established for the total or for each of the n-6 PUFA.
- Establishing Adequate Intake (AI) reference values for:
  - Linoleic acid (LA): 4 % of the total energy.
  - $\alpha$ -linolenic acid (ALA): 0.5 % of the total energy (without an established maximum limit).
  - Sum of EPA and DHA: 250 mg in adults.
  - DHA for infants (>6 months) and children <24 months: 100 mg.
  - DHA for females during pregnancy and breastfeeding: increase between 100-200 mg.

The EFSA has approved two nutritional claims relating to the maintenance of triglyceride levels and blood pressure with doses of between 2 and 3 g of DHA and EPA per day (EFSA, 2010b).

In 2012, the EFSA issued an opinion on the maximum intake levels of EPA, DHA and docosapentaenoic acid (DPA) in which they concluded that the intake of supplements of DHA and EPA combined at doses of up to 5 g/day, the intake of supplements of EPA alone up to 1.8 g/day and the intake of supplements of DHA alone of up to 1 g/day, do not pose safety concerns for the adult population (EFSA, 2012).

### 3.3 European Commission

In 2011 the European Commission High Level Group on Nutrition and Physical Activity agreed a European framework for national initiatives for a selection of nutrients. Saturated fats were one of the nutrients included in the national plans of the majority of countries and, although it was difficult to establish absolute levels for certain categories, a global reduction of 5 % of saturated fats in 4 years was proposed as a point of reference, with an additional reduction of 5 % up to 2020, taking as the

individual base line the levels at the end of 2012 (EU, 2012a). For the reduction of fat intakes, the focus was mainly on dairy products, promoting the selection and availability in the market of low-fat options, and in meat products, increasing availability and options of variants with a low-fat content.

At the sixteenth meeting of the European Commission High Level Group on Nutrition and Physical Activity (EU, 2012b), the preliminary findings of the monitoring of the assessment of the project to reduce SFA in the European Union were presented. The overall conclusions drawn from the results of the existing or proposed initiatives in relation to the reduction of saturated fats are:

- The majority of Member States have national recommendations on saturated fats and in general the initiatives mentioned form part of a broader national programme.
- Several national initiatives also include actions on total fat, fat quality and *trans* fats.
- The global reduction of 5 % of saturated fats in 4 years, and an additional reduction of 5 % up to 2020, was considered as a reduction of the population intake levels of saturated fat by two thirds (approximately) in the countries that replied (19 Member States), while the other third considered this reduction as a point of reference for product categories.
- Industry reformulation was considered as important as consumer awareness with regard to saturated fats.

In short, it was concluded that significant progress had been made and that the majority of Member States believe that it is possible to make more progress by means of agreements with industry based on specific objectives. Reformulation continues to be a key priority for members of the High Level Group.

### 3.4 Belgium

In the Five-yearly National Food and Health Plan (2005-2010) of the Ministry of Health and Social Services of Belgium, nutritional objectives were established at national level based on the results of national dietetic surveys and considering recommended nutritional intakes (NFHP-B, 2005).

In the case of the Belgian population, the excessive intake of fats is the principal factor leading to an energy excess, and therefore it was decided to establish recommendations in relation to this point, which were not only quantitative but also qualitative.

Although nutritional recommendations with respect to total lipids advocate a maximum intake corresponding to 30 % of the total recommended energy intake, given that average consumption exceeds 35 % of the total intake and considering the problems faced in changing eating habits and gastronomic customs, the Belgium government established a lower restriction level as the goal (maximum 35 % of the total recommended energy), with the objective of guaranteeing a better level of compliance in relation to lipid intake.

In relation to the qualitative aspects, the reduction of the intake of saturated fatty acids is the principal objective, due to their effect on cholesterolemia and cardiovascular risk. According to the Belgian authorities, the percentage of SFA, as a whole, must not exceed 10 % of the total recommended energy which, in addition, would be an effective measure for maintaining the daily intake of cholesterol below 300 mg (NFHP-B, 2005).

With regard to the *trans* fatty acids, an agreement has been reached with industry in recent years to reduce their content (especially in spreadable fats and cooking fats) and therefore the majority of these products currently have a low TFA content (<1 % in spreadable fats and <5 % in cooking fats).

In relation to polyunsaturated fatty acids, the total intake is not in itself a problem, but the omega 6 (linoleic acid)/omega 3 (linolenic acid) ratio is a problem, as it exceeds 5. The Belgian authorities therefore recommend increasing the intake of foods rich in omega 3 PUFA and reducing the intake of food rich in omega 6 PUFA, especially during pregnancy and for children.

As objectives for improving eating and physical exercise habits, the Belgian authorities proposed the creation of a dietary guide for the general public, in addition to other guides specifically adapted to the different population groups, the development of a favourable framework of good eating and physical exercise habits among the population, in particular among young people and adolescents, intervention in schools and social infrastructures, the increase of citizen awareness mainly through health personnel, commitments to the private sector (food industry, hotels, restaurants and catering trade), nutritional labelling, consumer information, nutritional claims, and measures related to food and drink advertising and propaganda.

According to the results published in 2008, the fat content in the average Belgian dietary intake continued to be above recommended levels, requiring therefore that the multidisciplinary approach be continued with the involvement of different bodies in the area of nutrition and health (NFHP-B, 2008).

### 3.5 France

The French Food Safety Agency (ANSES) advises, as with other nutrients, that an excessive intake of lipids may be harmful to health (AFSSA, 2010).

It recommends that the dietary available energy from lipids be between 35 and 40 %. This range ensures that basic needs and essential fatty acids are covered and considers the prevention of disease. The upper limit of this range is exceeded in France by around 43 % of adults and 34 % of children.

Recommendations underline the importance of the quality of fatty acids provided by diet, suggesting recommendations for adults (with an intake of 2 000 kcal per day), pregnant women and infants, and young children.

The recommendations include the fatty acids that are considered essential (LA, ALA, DHA), EPA, the three atherogenic SFA (in the case of excess) and oleic acid. In addition, it establishes a recommendation for all SFA, although not all have the same physiological effects (Tables 4 to 6).

The values are expressed, except for EPA and DHA, as a percentage of the energy intake without alcohol, known as the available energy. In the case of DHA and EPA, the values are expressed in milligrams, the unit used in the available studies.

**Table 4.** Recommendations in France of fatty acids for adults with an intake of 2 000 kcal/day. The data is expressed as a percentage of the total energy or in mg

	Fatty acid	Recommended nutritional intake
Essential fatty acids	Linoleic acid	4 %
	Alpha-linolenic acid	1 %
	Docosahexaenoic acid (DHA)*	250 mg
Non-essential fatty acids	Eicosapentaenoic acid (EPA)	250 mg
	Lauric+myristic+palmitic acids	≤8 %
	Total saturated fatty acids	≤12 %
	Oleic acid	15-20 %

\*DHA is considered as essential as, although it can be produced from ALA, the capacity for forming this fatty acid is limited and may be lower than requirements at certain stages of life.

**Table 5.** Recommendations in France of PUFA for pregnant women who consume 2 050 kcal/day women and breastfeeding women who consume 2 250 kcal/day. The data is expressed as a percentage of the total energy or in mg

	Pregnant woman	Breastfeeding woman
Linoleic acid	4.0 %	4.0 %
Alpha-linolenic acid	1.0 %	1.0 %
Docosahexaenoic acid	250 mg	250 mg
EPA+DHA	500 mg	500 mg

**Table 6.** Recommendations in France of PUFA for newborns and infants (first 6 months) by day. The values are expressed as a percentage of the energy intake (E) or a percentage of the total fatty acids (FA) for a milk that provides, in 100 ml reconstituted milk, 70 kcal and 3.4 g of total fat

	Linoleic acid	α-linolenic acid	Arachidonic acid	DHA	EPA+DHA
Newborns and infants (first 6 months)	2.7 % E	0.45 % E	0.5 % AG	0.32 % AG	EPA<DHA

In relation to *trans* fats, according to the report "Risques et bénéfices pour la santé des acides gras *trans* apportés par les aliments-Recommandations" (Risks and benefits to health from *trans* fatty acids provided by food-Recommendations) (AFSSA, 2005) epidemiological observational and cohort studies have concluded that there is a relation between high levels of total TFA intake and TFA of industrial origin (more than 2 % and more than 1.5 % of total energy, respectively). The French Agency has established a maximum intake limit of TFA of 2 % of the total energy, irrespective of age and gender, both for children and for adults.

In addition, in 2012 the French authorities put forward measures to reduce the intake of low quality fats such as, the application of a levy for food containing palm oil due to its effect on the environment (deforestation) and on health (obesity). This oil is used in the food industry in a wide variety of products including chocolate spread, peanut butter, biscuits and margarines. The announcement of the measure received criticism from the palm oil sector and the French Government recently announced that this oil would not be discriminated against with respect to other types of vegetable oil (GAPKI, 2013).

### 3.6 Denmark

With respect to the *trans* fats, the Danish government and Danish margarine producers have been world leaders in the reduction of the industrially-produced *trans* fat content in food. As a result of the report from the Danish Nutrition Council (issued in 1994) on the effects of *trans* fats on health, the margarine producers agreed to voluntarily reduce the content of these fats in their processed products. In 2001, the Danish Nutrition Council concluded that this action had had a significant impact on the intake of *trans* fats in the country, as it had been reduced to approximately 1 g of *trans* fat per day. However, there was still some concern about a subgroup of the population who continued to have a high intake of industrially-produced *trans* fats from crisps, micro-waved popcorn, chocolate bars and fast food, which may be equivalent to an intake of more than 5 g per day of *trans* fat (Stender et al., 2006).

In 2003, in response to the recommendations of the Danish Nutrition Council, the Government banned, from January 2004, the use of oils with more than 2 % of industrially-produced *trans* fats (with respect to the total fat content) in food (Stender et al., 2006). Recent analysis of food that has traditionally been a major source of industrially-produced TFA shows that these *trans* fats have been almost eliminated from food in Denmark. It is of note that, according to the Danish authorities, the application of the Regulation did not have any noticeable effect on the availability, price or quality of the food that previously contained high quantities of industrially-produced *trans* fats (Health Canada, 2006). In addition, the *trans* fats were eliminated from the margarines without increasing the quantity of saturated fats and, often, with an increase in monounsaturated fats. The same changes were observed in margarines sold in Canada.

The Danish experience revealed that, in spite of the efforts of the Danish margarine producers, it was only after the Regulation came into effect that the processed *trans* fats were virtually eliminated from the food supply (Health Canada, 2006).

With respect to saturated fats, in 2011 the first global tax on fats was created in Denmark to reduce the dietary fat intake in the population (SKAT, 2011). This measure consisted in increasing the price of the food products that contained more than 2.3 % of saturated fat, including dairy products, meat and processed food, in order to reduce the high percentage of overweight and obese individuals in Denmark (about 50 and 13 %, respectively) (Danish Ministry of Taxation, 2010).

An analysis conducted by Copenhagen University suggests that the introduction of the tax on saturated fats in various food products had some effect on the market of these products (Jensen and Smed, 2012). The level of fat consumption was reduced by 10-20 %. Although, according to the report, a longer study period is required to obtain definitive conclusions, the Danish Government recommended extending the tax to other products including drinks with a high sugar content.

One year after its creation, the Government announced the elimination of the tax on saturated fats and the cancellation of the tax on products with a high sugar content, arguing that the increase in prices mainly affected the lowest income sectors of society (Danish Ministry of Taxation, 2012).

### 3.7 Nordic Council (Denmark, Finland, Iceland, Norway and Sweden)

The first official Nordic nutritional recommendations (NNR) were published in 1980, and stressed the need for a reduction in the total fat intake to a quantity equal to or less than 35 % of the energy intake and to an increase in the intake of carbohydrates and dietary fibre. Later editions of the NNR, published in 1989 and 1996, recommended an intake of fats equal to or less than 30 % of the energy intake, highlighting the importance of the quality of the fat and the energy balance (SCNF, 1989, 1996). In more recent documents, the Nordic nutritional recommendation, with respect to the intake of fat, recommended on the one hand, the reduction of the total fat intake and of SFA and, on the other, the increase of the PUFA intake (NNR, 2004, 2013).

In adults and children over 2, the maximum recommended total intake of SFA and TFA is approximately 10 % of the total energy, and the intake of TFA from partially hydrogenated fats should be as low as possible. The total fat intake (including glycerol and other lipid components) must provide between 25 and 35 % of the total energy, and the population goal is 30 %.

Cis-monounsaturated fatty acids should represent between 10 and 20 % of the total energy, and the PUFA 5-10 %, of which, the n-3 PUFA should provide at least 1 % of the total energy. The combined intake of MUFA and PUFA should be equivalent to at least two thirds of the total fatty acids in diet. Within the PUFA, linoleic acid (n-6) and  $\alpha$ -linolenic acid (n-3) should represent at least 3 % of the total energy, and  $\alpha$ -linolenic acid should represent at least 0.5 % (see summary in Table 7).

**Table 7.** Fat recommendations in the adult population. The data is expressed as a percentage of the total energy

Nutrient	Recommended nutritional intake
Saturated fatty acids	<10 %
Monounsaturated fatty acids	10-20 %
Polyunsaturated fatty acids	5-10 % (of which at least 1 % is n-3)
Trans fatty acids	As low as possible
Total fat	25-40 %

**Source:** (NNR, 2012).

In the case of pregnant women and nursing mothers, the energy from essential fatty acids should be at least 5 % of the total energy, including 1 % from omega 3 fatty acids, of which 200 mg/day must be DHA. As regards the intake of PUFA, this should not be more than 10 % of the total energy, and it has been specified that there are no benefits for health associated with a higher intake.

With respect to the infant population, the intake of TFA from partially hydrogenated fats must be kept as low as possible during the first year of life. After 12 months, the recommendation is to follow that established for TFA and SFA for older children and adults.

The percentage of energy from total fat must be reduced from the age of 2 years to ensure that from then on the recommended level for children and adults is consumed.

With respect to omega 6 fatty acids, at least 4 % of the total energy intake must be provided for children aged between 6 and 11 months and 3 % for children between 12 and 23 months old. The recommended intake of omega 3 fatty acids is 1 % of the total energy for children aged 6 to 11 months and 0.5 % for children aged 12 to 23 months.

The above-mentioned document establishes that a balance between carbohydrates and fats in combination with a high dietary fibre content is suitable as a method for preventing diseases associated with excess weight (NNR, 2004, 2012).

With respect to the effects of the different types of fat on cholesterol, *cis*-monounsaturated fatty acids (such as oleic acid) are almost as efficient in reducing serum levels of LDL-cholesterol as the PUFA, and are therefore good substitutes for the SFA. In turn, the reduction in the intake of these is usually accompanied by a reduction in the intake of cholesterol.

The present results show that the total intake of TFA in Norway has been reduced to 0.5 to 0.8 % of the total energy intake even though legislation similar to that in place in Denmark for the reduction of TFA content in food has not been adopted (Uauy et al., 2009).

### 3.8 United Kingdom

In 1991, the Committee on Medical Aspects of Food Policy of the United Kingdom updated the dietary reference values (DRV) established in 1969 and 1979 (COMA, 1991). The DRV established for fats are listed in Table 8.

<b>Table 8.</b> Dietary reference values (DRV) for fats, expressed as a percentage of the total energy value	
<b>Fats</b>	<b>Dietary reference values (DRV)</b>
Total fat	Not more than 35 %
Saturated fat	Not more than 11 %
<i>Trans</i> fat	Not more than 2 %

In 2006, the British Food Safety Authority published a guide on food and nutrition based on the recommendations of the COMA (the established DRV) and the *Scientific Advisory Committee on Nutrition* (SACN) (FSA, 2006). The reference values established for the MUFA were the average population intake. The recommendation for the intake of fats is shown in Table 9.

**Table 9.** Recommended intake of fat in the United Kingdom

Nutrient	Recommendation (% of the total energy)
Saturated fatty acids	Not more than 11 %
Polyunsaturated fatty acids	6.5 %
Monounsaturated fatty acids	13 %
Trans fatty acids	Not more than 2 %
Total fat	Not more than 35 %

**Source:** (FSA, 2006).

Following the national survey on food and nutrition carried out in the United Kingdom in 2008-2009 and 2010-2011 (National Diet and Nutrition Survey Headline), the results were analysed and compared with the previously established DRV (COMA, 1991) (NDNS, 2012):

- The results of the survey reveal that the mean daily intake of total fat matches the DRV, and does not suppose more than 35 % of dietary energy in all the age and gender groups, except for men and women over 65, where the total fat reached 36.9 and 35.4 % of total energy, respectively.
- The mean intake of SFA is greater than the DRV and provides more than 11 % of dietary energy in all age groups. The mean intake of saturated fats was equivalent to 13.3 % of total energy for children aged 4 to 10, 12.6 % for children aged 11 to 18, 12.7 % for adults aged 19 to 64 and 14.2 % for adults over 65.
- The mean intake of *cis*-monounsaturated fatty acids in the United Kingdom is from 11 to 13 % of total energy in children and from 12 to 13 % in adults.
- The mean intake of TFA matches the DRV, providing no more than 2 % of the total energy in all age groups; the intake of these fatty acids represents between 0.7 and 0.8 % of the total energy. The intake for the top 2.5 percentile also matches the DRV for all age groups.

### 3.9 Canada

Canada was the first country in the world to introduce compulsory labelling for *trans* fats in prepacked foods (January 2003). Since its introduction a series of food companies have reduced or even eliminated *trans* fats in their products (Health Canada, 2007).

Furthermore, the Department of Public Health of the Government of Canada (Health Canada), together with the Heart and Stroke Foundation of Canada, worked through a working group (The *Trans* Fat Task Force) to develop recommendations and strategies for the reduction of *trans* fats in Canadian foods to the lowest possible level. The working group was aware of the impressive programmes carried out by certain sectors of the food industry to reduce the quantity of *trans* fats in processed foods sold in Canada. However, they concluded that a regulating approach was required to ensure that the *trans* fats in processed foods were effectively eliminated or reduced to the lowest possible levels. In June 2006, the working group published their report "TRANSforming the Food supply" in which they included recommendations for limiting the *trans* fat content to 2 % of the total fat content for vegetable oils and soft spreadable margarines, and 5 % of the total fat content for all other food, including ingredients



sold to restaurants (Health Canada, 2006). This limit would not apply to food where the source of the fat is exclusively ruminant meat or dairy products.

In June 2007, Health Canada approved the recommendations and asked the health industry to reduce the levels of *trans* fats in foods to the recommended levels within two years (Health Canada, 2007).

It has been proven that the strategies for the reduction of *trans* fatty acid levels had the required effect (Uauy et al., 2009).

With respect to the total fat intake, the Canadian Government recommendation is that this should be in the range of 20-35 % of total dietary calories (Health Canada, 2012).

### 3.10 United States of America

In the United States, the acceptable distribution range with respect to the total recommended fat intake is also 20-35 % of the total calories (US, 2010). The intake of saturated fat must be less than 10 % and of cholesterol less than 300 mg/day.

With respect to *trans* fats, in January 2006, the FDA introduced obligatory labelling of its content on food products, in addition to the saturated fat and cholesterol content (FDA, 2006).

Other measures were also introduced to reduce the intake of *trans* fats in restaurants and other food service establishments, both at national level and in the different cities (Uauy et al., 2009). For example, in 2005 the New York Department of Health conducted education campaigns to voluntarily reduce the presence of *trans* fats in restaurants, however the results were not very successful (NYC, 2014). Therefore stricter regulatory measures were adopted. On 5 December 2006 an amendment to the Health Code was passed in New York to eliminate artificial *trans* fats in all the restaurants and other catering establishments in New York. This process was planned in two stages: in the first stage (1 July 2007), all the restaurants had to ensure that all the oils, butters and margarines used for frying or spreading had less than 0.5 g of *trans* fats per portion; in the second stage (1 July 2008) all food sold in restaurants was required to have less than 0.5 g of *trans* fats per portion if it contained any *trans* fat derived industrially.

The results of these measures are considered to have been hugely successful, as the percentage of restaurants using oils with artificial *trans* fats dropped significantly from 50 % in 2005 to 1.6 % in 2008. In 2013, 94 % of the restaurants in the city complied with this regulation (NYC, 2014).

Other cities and states have also approved similar regulations to restrict the use of *trans* fats in restaurants.

### 3.11 Australia and New Zealand

The recommendation of the governments of Australia and New Zealand regarding total fat intake in order to reduce the risk of chronic disease is that this should be in the range of 20-35 % of the total dietary energy (NHRMC, 2006). In addition, the combined total of saturated and *trans* fats should not be more than 10 % of the energy intake.

In 2007, the governments of these countries appointed a working group to study and adopt measures directed at reducing the TFA content in food, without increasing the intake of SFA (Australia

New Zealand Collaboration on *Trans* Fats). That same year, the Food Standards Australia New Zealand (FSANZ) issued a report showing that the intake of TFA in both countries was below the objective established by the WHO (2003) of less than 1 % of dietary energy, and was comparable or even lower than the estimated intake in other countries (FSANZ, 2007). Therefore specific legislation regulating the TFA content in food did not seem necessary. The adoption of non-regulatory measures was recommended to encourage a decrease in the quantity of TFA in food.

The ministers responsible for food regulation in these countries (Australia and New Zealand Food Regulation Ministerial Council) supported the conclusions of the scientific review that specific legislation regarding TFA was unnecessary. It was also established that regular monitoring would be made of the TFA intake in these countries to assess the results of the voluntary initiatives carried out by the industry to reduce the levels of these fatty acids in foods.

The report produced in 2009 by the FSANZ reveals that the intake of TFA in manufactured products in Australia and New Zealand had fallen by approximately 25-45 % since 2007, reflecting improvements in the industrial processes (FSANZ, 2009). In 2009, the mean intake of TFA through manufactured products was estimated to be 0.4 g/day or less for Australians and 0.6 g/day or less for New Zealanders. Expressed in terms of total energy intake, the total average intake of TFA from ruminants and manufactured foods was estimated at 0.5 to 0.6 % of total dietary energy, with more than 90 % of Australians and more than 85 % of New Zealanders with an intake of less than 1 % of the energy. This report also revealed that the reductions in TFA intake in manufactured food had not been accompanied by an increase in the intake of SFA.

As a result of this find, in October 2009 Ministers agreed that the non-regulatory approach towards TFA should be continued.

At present in these countries, TFA labelling is not obligatory, although manufacturers may provide this information voluntarily. Nevertheless, the content of these fatty acids must be declared on the label of a food if the manufacturer makes a health claim regarding cholesterol or saturated, *trans*, polyunsaturated, omega-3, omega-6 or omega-9 fatty acids.

### 3.12 Spain

In 2001, the Spanish Society on Community Nutrition published a consensus document on the nutritional objectives for the Spanish population (SENC, 2001). The document established intermediate and final nutritional objectives. The intermediate objectives essentially corresponded to the 75th or 25th percentile depending on the circumstances (favourable or unfavourable) of the population nutrition studies conducted in Spain. The final nutritional objectives were established in accordance with current scientific evidence and based on the nutritional reference values. Table 10 offers a summary of these nutritional objectives, comparing them with the recommendations established by the FAO/WHO for the prevention of cardiovascular disease (FAO, 2010).

The recommendations established by the SENC are very much in line with the recommendations made by the WHO and subsequently those made by the FAO/WHO (WHO, 2003). In turn, the FAO/WHO also establishes recommendations for the n-3 and n-6 PUFA, and for the EPA+DHA combination, where the highest values are directed at the prevention of cardiovascular disease (FAO, 2010).

**Table 10.** Nutritional objectives for the Spanish population proposed by the SENC in relation to the intake of fats, compared to the recommendations of the FAO/WHO

	SENC (2001)		FAO/WHO (2010)
	Intermediate nutritional objectives	Final nutritional objectives	
Total fat	<35 % E*	30-35 % E	15-30 % E
Saturated fatty acids	<10 % E	7-8 % E	<10 % E
<i>Trans</i> fatty acids	-	-	<1 % E
Monounsaturated fatty acids	20 % E	15-20 % E	-
Polyunsaturated fatty acids	5 % E	5 % E	6-11 % E
Fatty acids n-3	-	-	0.5-2 % E
ALA	-	2 g	>0.5 % E
DHA	-	>200 mg	-
EPA+DHA	-	-	0.25-2 g
Fatty acids n-6	-	-	2.5-9 % E (LA)

\*E: Energy intake. **Source:** (SENC, 2001).

### 3.13 List of recommendations and nutritional objectives established by different international organisms and different countries in relation to the intake of fat

To sum up, Table 11 lists the recommendations established by different organisations/countries in reference to total fat, *trans* fats and saturated fats.

**Table 11.** Summary of recommendations established by different organisations /countries in reference to the total fat, *trans* fats and saturated fats

Body/ country	Recommendation			Report	Year
	Total fat	<i>Trans</i> fat	Saturated fat		
FAO/WHO	Minimum: 15 % E* ♂ 20 % E ♀ Maximum: 30-35 % E	<1 % E	<10 % E	Joint FAO/WHO Expert Consultation on Fats and Fatty Acids in Human Nutrition	2008
EFSA	20-35 % E	-	-	Ruling of dietary reference values for fats, saturated fatty acids, polyunsaturated fatty acids, monounsaturated fatty acids, <i>trans</i> fatty acids and cholesterol	2010
European Commission (High Level Group on Nutrition and Physical Activity)	-	-	Global reduction: 5 % of saturated fats /4 years+additional reduction of 5 % up to 2020	Annex I of the EU Framework for National Initiatives on Selected Nutrients on saturated fat	2012
Belgium	Maximum: 35 % E	Reduction of % especially in spreadable fats and cooking fats	<10 % E	National Food and Health Plan 2005- 2010	2005
France	35-40 % E	<2 % E	-	Risques et bénéfices pour la santé des acides gras <i>trans</i> apportés par les aliments- Recommandations	2005
Denmark	-	Content in food: <2 % of total fat content	Tax on foods with >2.3 % and subsequent elimination	-	-
Nordic countries	Maximum: 30 % E	Lowest possible	<10 % E	Nordic nutritional recommendations	2004

**Table 11.** Summary of recommendations established by different organisations /countries in reference to the total fat, *trans* fats and saturated fats

Body/ country	Recommendation			Report	Year
	Total fat	<i>Trans</i> fat	Saturated fat		
United Kingdom	Maximum: 35 % E	<2 % E	<11 % E	Analysis of the NDNS	
Canada	20-35 % E	<2 % of total fat content (for margarines and oils) <5 % (for other food)	-	Health Canada. "TRANSforming the Food supply" ( <i>Trans</i> Fat Task Force, Health Canada, 2006)	2012
United States of America	20-35 % E	Lowest possible	≤10 % E	US Dietary Guidelines	2005
Australia and New Zealand	20-35 % E	-	≤10 % E (SFA+TFA)	NHMRC. Australia and New Zealand, 2006.	2009
Spain	30-35 % E	-	7-8 % E	Consensus of the Spanish Society on Community Nutrition (SENC)	2001

E: energy intake.

### 3.14 Comments

#### Fat intake in the Spanish population

To assess whether or not the fat intake of the Spanish population meets nutritional objectives, and, where applicable, to establish new nutritional objectives, the evaluation data for the nutritional status of the Spanish adult population obtained in the National Survey of Spanish Dietary Intake (ENIDE, 2010), conducted by the AECOSAN, has been used as this data is relatively recent and fairly representative of the Spanish population. This study was conducted in 2009 and 2010, included 1 500 men and 1 500 women aged between 18 and 64. The nutritional composition data contained in the Spanish Food Composition Database was used (BEDCA, 2010).

The data provided in the ENIDE survey shows that the average intake of total fat in the Spanish population is 42 % of the total energy intake. This value is far higher than the recommendation of a maximum value of 30-35 % of the total energy intake, established by the FAO/WHO and other organisations/countries (EFSA, 2010a) (FAO, 2010). To the contrary, the intake of carbohydrates (40 % of total dietary energy) is below the recommended values (50-55 % of dietary energy). Thus, with respect to the quality of dietary energy, the Spanish population exceeds the recommended

intake of total fats and the nutritional objectives regarding calorific distribution. The survey also indicates that almost 100 % of the population is above the upper range of 35 % of total calories. As with dietary energy, the intake of total fat is higher in men than in women and the tendency is to decrease with age in both sexes.

The majority of dietary fat comes from fats and oils (27 %), followed by meat products (25 %), eggs and derivatives (11 %) and dairy products (11 %). Fish, molluscs, crustaceans and derivatives only provide 7 %, as do cereals and derivatives.

In relation to the saturated fatty acid intake, the distribution median of the usual intake is between 28 and 33 g/day, without any significant differences between males and females, or in the different age groups (ENIDE, 2010). From the data presented, it is deduced that the average intake of SFA in males and females represents around 12.1 % of dietary energy. This intake is above the 10 % limit established by the FAO/WHO (FAO, 2010). It is also above the 7 % recommendation established by the American Dietary Guidelines Advisory Committee for preventing chronic diseases associated with an excessive intake (DGAC Report, 2010). The EFSA does not establish a reference intake, but recommends consuming "the lowest possible quantity". It is also notable that at least 5 % of the population comply to the recommended values of a maximum of 10 % of total energy (EFSA, 2010a). Meat products are the main source of dietary SFA (31 %), followed by dairy products (22 %), fats and oils (12 %) and eggs (11 %).

The intake of monounsaturated fatty acids in the Spanish population is the highest of all the different families of fatty acids. The distribution median of the usual intake ranges between 43 and 49 g/day, representing around 17.6 % of the total energy consumed (ENIDE, 2010). This value is in accordance with the recommendations for the intake of these fatty acids, established between 15 and 20 % of the total energy (SENC, 2001) (FAO, 2010). The EFSA does not specify recommendations in relation to the MUFA (EFSA, 2010a). The authors of the ENIDE study also highlighted that more than 95 % of the population exceed the lower reference value and between 8 and 13 % exceed the upper value. Fats and oils, and in particular olive oil, provide the highest proportion of dietary MUFA (40 %), followed by meat and its derivatives (23 %).

With respect to polyunsaturated fatty acids, the usual intake of these fatty acids is around 14-15 g/day, representing between 5.3 and 5.6 % of the total energy intake (ENIDE, 2010). Although the EFSA (2010) has not established reference values for total PUFA, the WHO (2003) has established, in their nutritional objectives, that their intake should represent between 6-10 % of total dietary energy. Subsequently, the FAO/WHO established as the recommended intake values, the range between 6-11 % of total dietary energy (FAO, 2010). The assessment of the PUFA intake made by the authors of the ENIDE study is that these fatty acids are consumed in percentages of total energy close to the recommended values, although it is also of note that only between 12 and 20 % of the population meet the objectives. Fats and oils (22 %), meat products and derivatives (19 %), pulses, seeds, dried fruit and nuts and derivatives (15 %), fish (14 %) and eggs (11 %) are the food groups contributing in a higher percentage to the daily intake of PUFA. Considering the different implications for health of the different types of PUFA, it is important to have the figures for the individual intake of essential PUFA (ALA and LA) and their long-chain derivatives EPA, DHA and AA, and the global data for fatty acids belonging to the n-3 and n-6 families (WHO, 2003) (EFSA, 2010a).

With respect to total fat, more than 40 % of the energy provided by this nutrient is from MUFA, between 26-30 % from SFA and between 13 and 15 % from PUFA (ENIDE, 2010).

Data about the intake of TFA was not presented in the ENIDE survey. An earlier study (Camacho, 2003) shows that the average intake of TFA in the Spanish population is 2.1 g/day (0.7 % of the total energy intake). This figure is below the upper bound for intake (1 % of the total energy intake) proposed in 2003 by the WHO (2003) and subsequently by the FAO/WHO (2010).

Other surveys conducted in different Spanish regions have similar results. Specifically, the survey conducted in 2002-2003 (ENCAT) in Catalonia, on a total of 2 160 males and females aged between 10 and 80 years old, shows that the intake of fat represents 40.2 % of total dietary energy, with a contribution from SFA of 12.6 %, from MUFA of 17.9 % and from PUFA of 6.4 %. The study also shows that the contribution of the different types of fatty acids is very similar to the data obtained in Catalonia in 1992, although the percentage intake of total fat has increased from 39.3 (1992) to 40.2 % (2002).

In addition, the survey conducted in Galicia in 2007 (Survey of eating habits among the Galician adult population), in a sample of 3 148 individuals aged over 18 years old, shows results that are somewhat different to those obtained in the Spanish population in relation to the fat intake. In Galicia, the total fat intake represents 31 % of the total energy content, a value that is lower than the national average and which is within the range of recommendations. Of the total energy, SFA contribute 9.5 %, a value which is lower than the national average; MUFA provide 12.4 % and PUFA 5.5 %. This study also states that the global prevalence of obesity in the population studied is 23 %, almost 42 % overweight, whereas 34 % of the individuals are at their ideal weight.

To sum up, based on the results for the fat intake of the Spanish population, it is deduced that an important objective would be to reduce the total fat intake, specifically that of saturated fats. In accordance with the conclusions of the ENIDE study, it is also important to continue with the intake of monounsaturated fats.

### **3.15 Recommendations on fat intake**

The Scientific Committee of the AECOSAN is aware that the specific recommendation for the intake of fat and for different types of fat, in relation to the beneficial effects for health may vary from one individual to another, depending on genetic factors and genotypes in general, environmental factors, individual history, etc. Nevertheless, from a public health approach and having assessed the average intake data for the Spanish population and the objectives established by the different organisations / countries, the following recommendations may be established:

- The intake of total fat and saturated fat in the Spanish population is, in general, higher than the recommendations established by different organisations/countries. A decrease in the intake of saturated fats should be encouraged by maintaining the objectives established with an upper bound of 30-35 % of the total dietary energy (for total fat) and of 10 % (for saturated fat).
- The intake of MUFA in the general population is in line with the recommendations. It is advisable to maintain the intake levels of these fatty acids.
- The intake of PUFA in the general population is in line with the recommendations. Up-to-date figures for the intake of essential PUFA and their long-chain derivatives should be obtained.

- The intake of industrially produced TFA in the population is below the upper intake limit established by different organisations, without prejudice to the fact that the presence of TFA in certain food categories should be controlled.

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#### 4. Sugar intake

One of the peculiarities in the dietary recommendations regarding the calorific distribution of carbohydrates is that this macronutrient is not a homogenous entity. Many epidemiological and dietary intervention studies refer to diets with a high or low carbohydrate content (high or low in carbohydrates), without specifying, or barely specifying, the nature of this macronutrient. In addition to the considerations relating to simple sugars or added sugars, the structure of the food, the source of the carbohydrates and the processing may all affect the physiological effects and the quantity in which they may be consumed to optimise the overall nutritional status and reduce the risk of chronic disease.

The excessive intake of food rich in added sugars and, in particular, sweetened beverages is, at present, a subject of debate and concern due to the significant increase in obesity in Spain and all over the world. Nowadays obesity is considered to be a global pandemic. At the same time, the prevalence of another chronic disease, subsequent to obesity, such as type 2 diabetes *mellitus*, has undergone a significant increase in the last decade and is expected to continue to do so in the near future. The high intake of foods and beverages with added sugars has also been linked not only to obesity but also to diabetes *mellitus* type 2. Furthermore, the high intake of sugars in the diet has been linked to the incidence of dental caries and other chronic disorders such as the metabolic syndrome (Hu, 2013).

The above, together with the fact that the intake of high quantities of food and beverages rich in added sugars may compromise the correct intake of micronutrients due to a reduction in the nutritional density of the diet, justifies the inclusion, in food-based dietary guides and the nutritional objectives of different international and national organisations and institutions, of a reference to the intake of sugars with respect to reducing their intake (WHO, 2003) (Joyce and Gibney, 2008) (EFSA, 2010).

These recommendations are not based on standard criteria as the justification in each of the recommendations is different and is based, in certain cases, on the maintenance of body weight, and in others on the prevention of dental caries or on the risk of a low nutritional density that endangers the correct intake of micronutrients.

There is also huge confusion as to what sugar terminology refers to and consequently, knowledge of the content of these in foods. Reference is made to simple, refined, added, total sugars, etc. Some of these may be determined analytically, however added sugars can only be calculated from the qualitative composition data of the food or beverages. Table 12 lists the different terminology used for dietary sugars and their definitions. The different organisations establishing the dietary recommendations use different terms and, therefore, comparison is sometimes complicated.

**Table 12.** Dietary sugar nomenclature

Term	Definition
Sugars	All monosaccharides and disaccharides including those naturally present and those added to a food or beverages such as sucrose, fructose, maltose, lactose, honey, corn syrup, molasses and fruit juice concentrates).
Added sugars	Taken separately or used as ingredients in processed or prepared foods (for example white, brown and unrefined sugar, corn syrup, malt syrup, maple syrup, fructose sweeteners, liquid fructose, honey, molasses anhydride and crystalline dextrose). May contain oligosaccharides.
Free sugars	All monosaccharides and disaccharides (including refined cane, beet and corn sugars) added to food by the manufacturer, cook or consumer, in addition to the sugars naturally present in honey, syrups and fruit juices.
Sugar	Contains sucrose as an ingredient.

**Adapted from:** (Sigman-Grant and Morita, 2003) (Hess et al., 2012).

It is important to understand that the debate still continues as to whether there is clear evidence that a high dietary intake of food with added sugars, and more specifically, of sweetened beverages, leads to an increase in energy intake and consequently overweight and obesity, and whether a reduced intake prevents obesity and helps to reduce weight (Hu, 2013) (Kaiser et al., 2013).

This section on sugars revises the recommendations drawn up by different international and national organisations regarding dietary sugar intake limits (total, refined, added, etc.) in order to prevent weight gain, the inadequate intake of micronutrients and/or dental caries, in addition to other chronic diseases such as diabetes *mellitus* type 2 or the metabolic syndrome. We only look at the recommendations made by international organisations and certain national organisations, by way of example and due to the significant weight of the scientific evidence as is the case in the United Kingdom and the United States. The recommendations made by the remaining countries are listed in Table 15.

#### 4.1 World Health Organization (WHO)

With regard to the role of dietary carbohydrates, the FAO/WHO Expert Consultation on Carbohydrates in Human Nutrition, at a meeting in 1997 declared that the role of carbohydrates was not limited to providing a source of energy but that they also had a significant import on the maintenance of health (WHO/FAO, 1998).

In 2003, the Joint WHO/FAO Expert Consultation report on diet, nutrition and the prevention of chronic disease, admitted that free sugars (referring to all monosaccharides and disaccharides added to food by the manufacturer, cook or consumer, and the sugars naturally present in honey, syrup and fruit juice) contribute to the energy density of the diet, promoting a positive energy balance and, sweetened beverages increase the total energy intake by reducing appetite control (WHO, 2003). However, it also recognised that the establishment of a population objective for the intake of free sugars of <10 % of the total dietary energy is controversial. In fact, in the recommendations based

on the evidence, the only convincing evidence of increased risk, in relation to the intake of free sugars (in terms of both frequency and quantity), is dental caries, there not being any evidence for type 2 diabetes, cardiovascular disease and cancer.

In 2007, the FAO/WHO Expert Consultation carried out a scientific update of the terminology and classification of carbohydrates, their characterisation, measurement and physiological effects, given that in recent years there have been a series of adverse changes in diet, including a higher intake of sugars in food and a reduction in the intake of complex carbohydrates. This phenomenon was more marked in developing countries and in countries experiencing socio-economic change, and has contributed to the increase of nutrition- and diet-related non-communicable diseases including obesity, diabetes *mellitus* type 2, cardiovascular disease, some forms of cancer, high blood pressure and cerebrovascular accidents (WHO/FAO, 2007).

Recently, the European Plan of Action on Nutrition and Diet Policies 2007-2012 underlined that the objective of recommendations concerning sugar was to maximise the intake of minimally-processed carbohydrates and to minimise the intake of free added sugars (<10 % of total energy intake) (WHO, 2008).

The WHO European Action Plan 2015-2020 states that the excessive consumption of sugar, as well as other energy-dense and micronutrient-poor foods (*trans* fats, saturated fats and salt) is linked to obesity and other chronic diseases. Consumption of these foods should be limited as recommended on the paper without proposing any concreated figures. It is also recommended the implementation of public health policies with special consideration on high energy foods, saturated fats, *trans* fats, sugars or salt, in order to avoid its excessive consumption and restrict the advertising messages exposure, especially for children, to achieve a healthier diet (WHO, 2014a).

Strategies to achieve these goals range from measures concerning marketing, the use of new communication media involving social networks, price and accessibility policies, etc.

#### 4.2 European Food Safety Authority (EFSA)/European Heart Network (EHN)

The scientific opinion published by the EFSA on dietary reference values for carbohydrates and fibre, mentions that, although there is evidence that a high intake of sugars (>20 % of total energy) may increase serum triglycerides (TG) and cholesterol concentrations, and that an intake of more than 20-25 % of total energy may have a negative effect on glucose and the insulin response, there is insufficient data to establish a maximum limit for the intake of added sugars (EFSA, 2010). The Panel of experts considers that in establishing nutrient limits and recommendations for the population and developing dietary guidelines, evidence regarding the link between sugar-containing food consumption patterns and dental caries, weight increase and the intake of micronutrients should be considered.

As a consequence of the labeling information of those food and beverages commercialized in the European Union, EFSA adopted a recommended 18 % of calories from dietary sugars intake, which means an amount of 90 g for a 2 000 kcal diet, although this amount can vary depending on the adjustment of the total calorie intake of the diet (EFSA, 2009).

With regard to an upper limit for the intake of added sugars, the Panel of experts has observed that the authorities in several countries have established upper limits for the average intake of the population or individual intake of added sugars at <10 % total energy (E). On the whole, recommendations should

reflect a sugar intake level that is realistically attainable, as part of a nutritionally correct diet, based on known patterns of food and nutrient intake in specific populations; nevertheless, there is insufficient available data for establishing a maximum limit for the intake of added sugar.

With respect to the risk of dental caries, the group of experts states that the frequent intake of food containing sugar may increase the risk, especially when oral hygiene and fluoride prophylactics are inadequate. Nevertheless, the available data does not permit the establishment of an upper limit for the intake of added sugars as a basis for reducing the risk of dental caries, as the development of caries in relation to the consumption of sucrose and other cariogenic carbohydrates does not only depend on the quantity of sugar consumed, but is also influenced by the frequency of consumption, oral hygiene, exposure to fluoride and other factors.

Regarding the link between the intake of added sugars and body weight, at present, although there is evidence that the high intake of sugars in the form of food and beverages sweetened with sugar may contribute to weight gain, there is insufficient evidence to establish a maximum limit for the intake of added sugars as a function of their effects on body weight.

In addition, negative associations have been observed between an excessive intake of food and beverages with added sugars and the density of dietary micronutrients, a relation that may occur not so much due to the intake of added sugars as such, but due to the intake of food which is a source of added sugar.

The document published by EFSA in 2009 states that the average intake of added sugars in some Member States of the European Union is around 18 %, establishing this quantity as the maximum amount identified in labelling. The maximum amount fixed by the American College of Medicine was 25 %. For children, essential attention should be paid to the percentages in order to keep the suitable nutritional contribution, especially adequate to macro and micronutrients with important physiological functions.

The document *Diet, Physical Activity and Cardiovascular Disease Prevention in Europe* published by the EHN establishes quantitative objectives for the intake, on the one hand of added sugars and on the other of sweetened beverages (EHN, 2011). In the first case, the immediate objective is to reach an intake of <10 % of the energy content, and in the long-term of 5 % of the energy content. For sweetened beverages (including dairy products), the proposal is to reduce the intake as much as possible, and as an ambitious long-term objective, to eliminate the consumption of this type of beverages. However, up to now EFSA does not echo this document.

The recommendations for the intake of sugars drawn up by the competent organisations in different countries are listed below. Table 15 gives a summary of these recommendations in many other countries.

### 4.3 Belgium

The Belgian authorities proposed a reduction in the intake of simple added carbohydrates.

The Belgian National Food and Health Plan (PNNS-B) mentions that simple carbohydrates (mono- and disaccharides) are naturally present in fruit (glucose, fructose, sucrose) and dairy products (lactose), and are included as simple carbohydrates in many foods in the form of sucrose, glucose syrup, glucose or fructose (PNNS, 2005). Although from a purely metabolic point of view there is no real difference



between these carbohydrates, depending on their origin (naturally present or added), the nutritional context in which they are found must be considered.

Therefore, it is important, in the framework of the PNNS-B, to develop strategies intended to promote the intake of complex carbohydrates and the reduction of simple added carbohydrates.

The measures and recommendations of the Plan include an information and educational section aimed at citizen education. It is also complemented by a series of measures directed at individuals, with the aim of modifying medium- and long-term behaviour.

The Plan is monitored according to different areas:

- Dietary intake.
- The application of dietary recommendations.
- Dietary behaviour, rates and abuse.
- The efficiency and the conditions required for measures to handle the problems.
- The efficiency of the information and the messages used for promotion and communication.
- Public health measures.
- Monitoring and evaluation of nutritional problems.

A multidisciplinary control is recommended, not only with the support of the scientists but also with that of the health professionals (nutritionists, etc.), food behaviour specialists, specialists in the promotion of education and health, public health specialists, epidemiologists, etc.

#### **4.4 United Kingdom**

In 1991, in the United Kingdom the dietary reference values established in 1969 and 1979 were updated. That is the values for the recommended daily intake (RDI) and the recommended daily amounts (RDAs) for the different nutrients. The new reference values established in 1991 were presented by the COMA (1991). These dietary reference values (DRV) for carbohydrates are:

- DRV for total carbohydrates: 50 % of the energy from food.
- DRV for non-milk extrinsic sugars: 11 % of the energy from food (excluding alcohol) or 10 % of the energy in contained in food (including alcohol).
- DRV for intrinsic and milk sugars and for starch: 37 % of total energy or 39 % of energy from food.

In 2006, the British Food Safety Agency published a guide on nutrition and food for institutions in the United Kingdom in which the recommendation for the intake of sugars was as shown below in Table 13.

**Table 13.** Recommendations for certain nutrients

Nutrient	% population average energy from food
Carbohydrate total	50
Non-milk extrinsic sugars	Not more than 11
Intrinsic and milk sugars and starch	39

**Source:** (FSA, 2006, 2007).

Following the national survey carried out in 2008-2009 and 2010-2011 (UK, 2011), the data obtained was analysed, and the average daily intake of macronutrients compared to the dietary reference value (DRV) in the United Kingdom based on the report from the COMA (1991). The average intake of total carbohydrates ranged from 46.5 % of food energy for adults aged 65 and over to 51.9 % for children aged between 4 and 10 years. The average intake of extrinsic milk sugars exceeded the dietary reference value, contributing more than 11 % of the energy from food in all age groups and genders, ranging from 11.4 % for adults aged 65 and over and from 11.8 % for children aged 1.5 to 3 years old to 15.3 % for children and adolescents aged between 11 and 18.

The average intake of non-starch polysaccharides was 8.2 g/day for children aged between 1.5 and 3 years old and 11.3-11.8 g/day for children from 4 to 18. For adults over 18, the DRV was established at an average population intake of 18 g/day, with average intakes far below this (13.3-13.8 g/day).

In a document published by the FSA in 2010, the following voluntary recommendations are listed for the food industry with respect to the reduction of added sugars in beverages and food as a means to reducing the intake of dietary energy (FSA, 2010). Reduce in 2012 the content of sugars added to beverages (carbonated, fruit-juice based drinks) by at least 4 % with respect to its content in 2008 (drinks with 8 % of added sugars). In addition, by the end of 2015 the size of individual portions of these drinks should be reduced to 250 ml or less to encourage consumers to choose these over larger portions in terms of cost.

## 4.5 Ireland

The "Guide to healthy eating" published by the FSAI recommends that the average intake of sugar is less than or equal to 10 % of the total energy consumed, based on the premise that foods with a high sugar content also usually have high levels of calories, fats, saturated fats and *trans* fats, and do not provide the necessary vitamins and minerals (FSAI, 2011). In addition, a high sugar intake may lead to a high calorie intake, favouring the appearance of dental caries.

The guide recommends not eating foods such as biscuits, cakes, salted snacks and pastries that are rich, among other ingredients, in sugars in large quantities or too often, although these should not be totally eliminated from diet. It also recommends avoiding the excessive intake of sugared beverages (fizzy drinks and sweetened juices, etc.) and only occasionally drinking "diet" (sugar-free) soft drinks.

As regards the consumption data, of the 22 healthy eating patterns used for the revision of the "Guides to healthy eating", almost all the dietary patterns conformed to the sugar targets. In these

patterns, the intake of added sugars, non-milk extrinsic sugars, ranged between 6 and 11.5 % of the total calories.

#### 4.6 Germany

In the guides based on the evidence of the Germany Nutrition Society for the intake of carbohydrates and the prevention of chronic disease, a likely relation is established between the intake of sweetened beverages and obesity and diabetes *mellitus* type 2 in adults and this relation only reaches the possible level in children. With respect to metabolic syndrome, the level of evidence is only possible. With cancer, high blood pressure, cardiovascular disease and dyslipidemia there is no association or the evidence is insufficient. Therefore, the final recommendation is to reduce the intake of sweetened beverages and to encourage their replacement by sugar-free or low-energy drinks (Hauner et al., 2012).

#### 4.7 Nordic Council (Denmark, Finland, Iceland, Norway and Sweden)

In the Nordic nutritional recommendations the recommended range of the total intake of carbohydrates is from 45 to 60 % of the total energy, where 52-53 % of the total energy is a suitable objective for planning a balanced diet (NNR, 2013). The intake of refined added sugars should be restricted to ensure an adequate intake of micronutrients and dietary fibre (nutrient density) and to obtain a healthy dietary pattern. This is particularly important for children and individuals with a low energy intake. The high intake of beverages containing refined added sugars has been associated with an increase in the risk of diabetes *mellitus* type 2, weight gain and dental caries. Therefore, a maximum daily intake that does not exceed 10 % of the total dietary energy is recommended.

It is recommended that the consumer limit the intake of refined sugars and beverages and food rich in refined sugars, and increase the intake of food naturally rich in carbohydrates, such as potatoes, fruit and vegetables.

In order to implement these recommendations, the Finnish authorities recommend:

1. That all population groups have sufficient information to help them obtain a lifestyle that will improve their health.
2. Offering encouragement, support and guidance to individuals and communities, especially the more vulnerable ones.
3. Having an influence through culture, living conditions, work and social conditions, on the products and structures required to improve levels of physical exercise and achieve healthy diets in all population groups (Valsta et al., 2008).

**Table 14.** Carbohydrate recommendations for children aged 6 to 23 months old

Age	Percentage of Energy (E %)
6-11 months Carbohydrates*	45-60
12-23 months Carbohydrates*	45-60

\*Intake of added sugars less than 10 % of total energy. **Source:** (NNR, 2013).

## 4.8 United States of America

The Food and Nutrition Board of the Institute of Medicine (IOM) in their publication dated 2002 on dietary reference intakes (DRI) for energy, carbohydrates, fibre, fat, fatty acids, cholesterol, protein and amino acids, establishes that the evidence existing for establishing daily intake targets for sugars or added sugars is insufficient. Nevertheless, in the same document they indicate that no more than 25 % of the dietary energy intake should come from added sugars. This maximum intake limit is justified to ensure an adequate intake of micronutrients which, in the majority of cases, are present in very small quantities in the food and beverage that is a dietary source of added sugars in the American population (IOM, 2002).

The American Heart Association (AHA) recommends, with respect to added sugars, an intake equivalent to half of the discretionary calories in diet, once the nutritional objectives and recommended intakes have been met. In practice, for the majority of American women this would be equivalent to  $\leq 100$  kcal/day (six teaspoons per day) and for men  $\leq 150$  kcal/day (nine teaspoons per day) (Johnson et al., 2009).

This Association recommends a series of actions for the population to reduce the intake of sugars. These include: purchasing sugar-free or low calorie drinks, choosing fresh fruit or fruit canned in unsweetened liquids, adding fruit juice to cereals, adding less sugar to homemade desserts, substituting sugar with extracts of orange, almond, vanilla, and using non-caloric sweeteners.

The Advisory Committee of the Departments of Agriculture and Health and Human Services of the United States in their report for the preparation of dietary guides for the Americans (2010) states that food containing added sugars supplies calories, but few or no essential nutrients or dietary fibre, both natural sugars and added sugars leading to an increased risk of dental caries. By reducing the intake of food containing added sugars, the calorie content of the diet is reduced, without endangering the nutrient density, and in particular, ensuring the correct intake of micronutrients (USDA/HHS, 2010).

The proposed recommendation is that sweetened food and beverages be replaced by unsweetened ones or ones with a low added sugar content. One example would be to replace sweetened beverages with water and sugar-free ones (US, 2010).

To prevent the intake of dietary sugars the guides recommend eating the most nutrient-dense forms in all food groups, limiting the quantity of added sugars when cooking and at the table, consuming fewer portions of food and beverage containing added sugars and less frequently. It also recommends consuming beverages with added sugars only when the objectives of a nutrient-rich balanced diet have been achieved, without exceeding the recommended daily calories.

Recommendations for sweet pastries and added sugars range from fewer than two portions per week in diets with a calorie content of more than 2 500 kcal to five or fewer or three or fewer portions per week for diets with a content of less than 2 500 kcal. A portion is defined as a spoon of sugar or jam or a glass of lemonade.

#### **4.9 Spain**

In Spain, the Spanish Society on Community Nutrition in the Nutritional Objectives for the Spanish Population decided, in view of the controversy existing regarding the maximum quantity of sugar to be consumed in diet, not to quantify the limitation on consuming sugars and sweetened food (SENC, 2001). It therefore only establishes qualitative recommendations of moderation. Specifically, it refers to dental caries and establishes an intake of fewer than four portions a day of sugar and food containing sugar such as sweet pastries. Ten years later, in 2011 these nutritional objectives were again revised in view of new scientific evidence and the situation in Spain, and an agreement reached that establishes an intake of mono- and disaccharides, non-milk and non-intrinsic, from fruit and vegetables (added), of less than 10 % of the total calorific value (SENC, 2011).

In 2012, the consensus document of the FESNAD and SEEDO on the prevention and treatment of obesity, established that the relation between the intake of free or total sugar in solid food is controversial; nevertheless, the intake of sweetened beverages has a significant relation to weight gain expressed as the body mass index, and recommended restrictions in the intake of this type of drink which would lead to lower weight gain. This evidence is established at grade 2+ and the recommendations at level A (Gargallo et al., 2012).

The decalogue published by the NAOS Strategy mentions, in item 6, the need to moderate the intake of products rich in simple sugars such as sweets, pastries and soft drinks (AECOSAN, 2005).

#### **4.10 List of recommendations and nutritional objectives established by different international organisms and different countries in relation to the intake of sugar**

To sum up, Table 15 lists the dietary recommendations relating to the intake of sugars in different countries:

**Table 15.** Summary of the dietary recommendations relating to sugar

Body/country	Recommendations	Source	Year
Germany	Food and beverages containing sugar should only be consumed occasionally	German Nutrition Society	2012
Argentina	Limit the intake of sugar	Food Guides. Association of Dieticians and Nutritionists of Argentina <a href="http://www.assal.gov.ar/assa/documentacion/guias_alimentarias.pdf">http://www.assal.gov.ar/assa/documentacion/guias_alimentarias.pdf</a>	2003
Australia	Eat only moderate quantities of sugars and food containing added sugars	National Health and Medical Research Council <a href="http://www.eatforhealth.gov.au/sites/default/files/files/the_guidelines/n55_australian_dietary_guidelines.pdf">http://www.eatforhealth.gov.au/sites/default/files/files/the_guidelines/n55_australian_dietary_guidelines.pdf</a>	2013
Belgium	<10 % E	Summary National Food and Health Plan 2005-2008	2008
Belgium	Intake of added sugars should be limited	National Food and Health Plan 2005-2010	2005
Bolivia	Avoid the excessive intake of sugars, sweetened food and beverages	(Hess et al., 2012)	-
Brazil	Avoid sugar, non-alcoholic drinks and sweets in the early years of life	(Hess et al., 2012)	-
Bulgaria	Limit the intake of sugar, sweets and pastries; avoid non-alcoholic drinks containing sugar	(Hess et al., 2012)	-
Chile	Reduce the regular intake of sugar	(Hess et al., 2012)	-
European Commission (High Level Group on Nutrition and Physical Activity)	Promote the intake of complex carbohydrates Reduce simple added carbohydrates	European Commission	2012
Cuba	Reduce the intake of sugar	(Hess et al., 2012)	-
Denmark	<10 % E Maximum 10 % of Energy from refined sugars for children and individuals on low-calorie diets	National Action Plan against Obesity	2003

**Table 15.** Summary of the dietary recommendations relating to sugar

Body/country	Recommendations	Source	Year
EFSA	Not quantified	Scientific Opinion on Dietary Reference Values for carbohydrates and dietary fibre	2010
United States of America USDA/HHS	Reduce the intake of added sugars	Report of the Dietary Guidelines Advisory Committee 2010. Dietary Guidelines for Americans	2010
United States IOM	<25 %	Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids	2002
United States of America AHA	≤100 kcal/day for women and ≤150 kcal/day for men	7th Statement from the American Heart Association	2009
Spain	Use in moderation. <4 portions/day Use in moderation. Moderate intake	SENC FESNAD-SEEDO AECOSAN. NAOS strategy	2001 2012 2005
FAO/WHO	<10 % E	Joint WHO/FAO Expert Consultation on diet, nutrition and the prevention of chronic disease	2003
FAO/WHO	Not quantified	Scientific Update on carbohydrates in human nutrition	2007
France	10 % of the energy from added sugars for obese and diabetic individuals. National Health and Nutrition Programme: Simple sugars should be reduced by 25 %	<i>Programme national nutrition santé 2011-2015</i> <i>Ministère du Travail, de l'Emploi et de la Santé</i>	2011
Greece	Limit the intake of sweet desserts to one every 2 days	(Hess et al., 2012)	-
Hungary	Avoid frequent intake of food or drink rich in added sugars	(Hess et al., 2012)	-
India	Sugar should be used sporadically	(Hess et al., 2012)	-
Ireland	≤10 % E	Food Safety Authority of Ireland (FSAI)	2005

**Table 15.** Summary of the dietary recommendations relating to suga

Body/country	Recommendations	Source	Year
Ireland	Limit intake of food and beverages containing sugar Limit intake of food that contains more than 5 g/100 g of sugar	FSAI <a href="http://www.dohc.ie/publications/pdf/YourGuide_HealthyEating_FoodPyramid.pdf?direct=1">http://www.dohc.ie/publications/pdf/YourGuide_HealthyEating_FoodPyramid.pdf?direct=1</a>	2012
Italy	≤10 % E	Istituto Nazionale di Ricerca per gli Alimenti e la Nutrizione (INRAN)	2003
Malaysia	Reduce the intake of sugar and choose food low in sugar	(Hess et al., 2012)	-
Mexico	Eat sugar (drinks, honey, jams, sweets and table sugar) in moderation	(Hess et al., 2012)	-
Nigeria	Limit the intake of sugar	(Hess et al., 2012)	-
Nordic Countries	<10 % E	Nordic nutritional recommendations	2013
New Zealand	Select ready-prepared food and snacks which are low in sugar	(Hess et al., 2012)	-
Poland	Moderate intake of sugar and sweets	(Hess et al., 2012)	-
Portugal	<20-30 g/day	Faculty of Food Science and Nutrition, Porto University (FCNAUP)	2006
United Kingdom	<11 % of non-milk extrinsic sugars	Analysis of the NDNS	2008-2009 2010-2011
Czech Republic	1-3 teaspoons per day (<15 g/day)	(Brázdová et al., 2000)	2000
Singapore	Reduce the intake of refined and processed sugars to <10 % of the total energy intake 40-55 g (8-11 teaspoons) per day	Health Promotion Board <a href="http://www.hpb.gov.sg/HOPPortal/health-article/2758">http://www.hpb.gov.sg/HOPPortal/health-article/2758</a>	2003 (under revision)
South Africa	Eat food and beverages containing sugar only occasionally and not between meals	(Hess et al., 2012)	-
Switzerland	Moderate intake	(Hess et al., 2012)	-
Thailand	Avoid sweet foods	(Hess et al., 2012)	-
Turkey	9-10 % of energy from sugar, or 40 g/day (males) and 30 g/day (females)	Ministry of Health General Directorate of Primary Health Care Food Safety Department Community Nutrition Division	2006
Venezuela	Moderate intake of sugar	(Hess et al., 2012)	

**Adapted from:** (WHO, 2003) (FAO, 2009) (Ruxton et al., 2009) (Hess et al., 2012).



#### 4.11 Comments

The review of scientific literature on the relation between the excessive intake of dietary sugars and health and the population recommendations established by national and international organisations to achieve a balanced and healthy diet reveals a series of aspects that we must mention.

- The nomenclature used to name the sugars is not homogenous. The different studies and recommendations refer to sugars, simple, refined, added sugars, etc. From an analytic point of view, determining the content in different foods and drinks is difficult because, for example, the sugars added to a food cannot be analysed or calculated directly. It is important to understand that when dealing with recommendations for dietary carbohydrates, not only is the quantity found in the diet of significance (high or low carbohydrate diets), but also the quality. With respect to quality, we should not only mention whether the food contains intrinsic sugars or refined, simple extrinsic (added) sugars but also the structure of the food matrix containing them, the source of the sugars and the process to which they have been subjected. All these nuances have an important physiological effect on the body and therefore on the pathological consequences. For example, we might mention the different sources of sugars added to sweetened beverages and their proportions of glucose and fructose (whether the source is sucrose or whether it is a corn syrup with a high fructose content). This proportion may determine the physiological effects and consequences for the development of certain metabolic alterations and chronic diseases (Ventura et al., 2011) (Bray, 2013).
- Another aspect of note is the huge diversity of interpretations regarding the relation between an excess intake of sugars and health problems. The different studies carried out (cohort, case-control and randomised controlled) and different meta-analyses give conclusions. These sources of discrepancy are the result, in some cases of the different considerations of the quality of the sugars in question (added, refined, etc.), of the food matrix (sugared food or beverages sweetened with sugars), of the final controlled result (outcome) such as weight gain, other cardiovascular parameters or dental caries, micronutrient deficit, etc. The results are also varied when the target population is different, adults or children and adolescents. Different results are also obtained when the effects of excess dietary sugar and their pathological consequences are compared with the capacity of a reduced intake of these sugars to reverse the consequences of the excess (Hu, 2013) (Kaiser et al., 2013).
- In any case, the available studies reveal that an excessive intake of added sugar in the diet has a negative effect on health with a higher prevalence of overweight and obesity. A relation is also established between the high intake of food and beverages sugar-rich and the incidence and prevalence of dental caries. Lastly, other studies establish a relation between the excessive intake of added sugars and the nutrient density, especially micronutrients, in the diet which may lead to their deficiency. Nevertheless, the levels of evidence in each case and the studies considered are different (Morenga et al., 2012).
- Recommendations for the dietary intake of sugars that the national and international organisations establish for the population are heterogeneous. This heterogeneity is the result of the varied nomenclature used for sugars in the recommendations (for example, does or does not include the

intrinsic sugars in food) and the final objectives of these recommendations, such as the prevention of dental caries, the prevention of weight gain and obesity, nutritional density and micronutrient deficit, etc. Therefore, as described above in Table 15, we may find quantitative recommendations expressed in g/day or as a % of total dietary energy or qualitative recommendations referring to moderating consumption or reducing intake, etc. In some cases, maximum intake limits are not established due to a lack of definitive studies.

With respect to the strategies that different national and supranational regulating organisations have proposed for reducing the intake of added sugars, in food and in drink, there is also huge diversity and each one highlights a certain strategy depending also on the sector of the population at which it is directed, children, adolescents, adults, the elderly, etc.

Nevertheless, in all cases these measures fall into four main areas: 1) information, training and education; 2) the food industry; 3) marketing, advertising and access; and 4) economic interventions (National Board of Health, 2003) (Valsta et al., 2008) (CDC, 2010).

In addition, the information contained in the labelling of the added sugar content and its calorific equivalence, information regarding the high calorific density and low nutritional density, the associated risk of micronutrient deficiencies, the prevention of caries, the link between a high sugar content and different diseases, etc. must be easily accessible by the consumers of these products. In addition, these contents must be included in nutritional education programmes in schools and in the medical advice given in primary health care centres, following training of health personnel in this area. In addition, information must be provided regarding the alternatives to consuming this type of food and beverages, recommending food rich in carbohydrates and dietary fibre with a low glycemic index and load, access to adequate water, consumption of low-energy drinks with calorie-free sweeteners.

Another general aspect given concerning the strategies to be followed, referring to individual portions of this food and beverages, is the recommendation and even the commitment with the food industry to reduce the size of food and drink portions with more than 5 g/100 g (or ml) per individual portion. This undoubtedly would lead to a lower intake of sugars, especially among the groups of children and adolescents. And also encourage the food industry to reformulate their products, reducing the added sugar content and changing the source (sources with a lower proportion of fructose).

The impact of aggressive marketing and advertising in the different means of communication and social networks on an ever-increasing intake of sugar by the population is important. Therefore, different organisations have proposed regulating the advertising of food and beverages with high amount of sugars and, in particular, those messages directed at minors or broadcast at times when there is a larger audience from this population segment. On the other hand, limiting access to this type of food and beverages, especially for this population segment (up to the age of 18), has proven to be an important measure. The limited presence of food and drink with a high added sugar content in automated vending machines, together with a greater offer of alternatives containing fewer calories and sugars is one of the proposals in addition to the absence of this food and drink in machines found in primary and secondary schools.

Lastly, the proposal to increase the price of products with a higher content of added sugars has already been formulated by various regulating organisations. This price policy concerns the taxes on this type of food or the more advantageous taxing of food with a lower, or zero, content of added sugars encouraging intake thanks to the lower prices (Brownell et al., 2009).

#### 4.12 Recommendations on the intake of sugars

The Scientific Committee of the AECOSAN is aware that in spite of the current debate in the scientific community, there is no doubt that the moderation of the intake of added sugars in the diet, particularly food and beverages sweetened with sugars, by replacing them with food and beverages with a low sugar content and with a low sugar content and high dietary fibre content, leads to a healthier diet (Hu, 2013) (Kaiser et al., 2013) (Klurfeld, 2013). This is supported by the recent public enquiry conducted by the WHO for the publication of recommendations on the intake of sugars. This establishes that added sugar intake levels are below 10 % of total dietary calories and that a reduction to below 5 % of added sugars would have additional benefits (WHO, 2014b).

At present there are no reliable figures regarding the intake of sugars in the Spanish population and even fewer on the intake of added sugars. Therefore, we consider it necessary to determine the figures for the usual intake of total and added sugars in the Spanish population and to establish, based on these, recommendations for the consumption of these nutrients. Until these figures are known, we believe it is necessary to make the population aware that the intake of dietary sugars, both in food and beverages containing them, should be reduced. This would be linked to an improved nutritional density in diet, improved dental health thanks to a reduced incidence of caries and a lower rate of weight gain and obesity as a consequence of an excess calorific intake in the diet.

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## 5. Fibre intake

### 5.1 Introduction

Fibre includes a wide variety of polymer compounds that are non-digestible by humans and which a number of *ad hoc* organisations and panels have tried to classify. The great majority of the definitions refer to their vegetable origin, that would exclude a number of polymers which, although they may produce health benefits and are non-digestible, they are from animal sources, such as chitin, chitosan and chondroitin sulphate. There are a number of definitions of dietary fibre and fibre classifications, which we have summarised in Table 16. Briefly, fibre included in a food or manufactured product will be the sum of the intrinsic fibre of its plant ingredients, plus that added during the manufacturing process. There is no clear consensus on the use of the terms "dietary fibre", since some definitions consider dietary fibre to be intrinsic to plants, distinguishing it from added fibre, functional fibre or "new dietary fibres" (IOM, 2005) (EFSA, 2010a) (Health Canada, 2010). However, once they are included in a food they cannot be differentiated by analytical means, therefore both, EFSA and Codex only differentiate either glycaemic carbohydrates or, dietary fibre in a wide sense including lignin and non-digestible carbohydrates in the small intestine, present in plants, as well as added fibre and food supplements (Codex Alimentarius, 2008) (EFSA, 2010a). These carbohydrates include non-starch polysaccharides (cellulose, hemicelluloses, beta-glucans, pectic substances, hydrocolloids such as gums, mucilages, glucans), resistant oligosaccharides (fructo-oligosaccharides [FOS], galacto-oligosaccharides [GOS], other resistant oligosaccharides) and resistant starch (physically protected starch, some types of starch granules, retrograded amylose and chemical or physically modified starches) (EFSA, 2010a).

A number of reviews have been published outlining various definitions and classifications of polysaccharides considered as dietary fibre, which point out that depending on their structure and size, polysaccharides that constitute dietary fibre can have different physiological properties and points out that the terms "soluble fibre" and "non-soluble fibre" are often used in literature to classify water-soluble and insoluble viscous fibre (Cummings and Stephen, 2007). According to EFSA, this classification should not be used because it depends on the method used and the solubility in water does not always predict the physiological effects of dietary fibre (EFSA, 2007).

**Table 16.** Definitions and classifications of fibre

Reference	Term	Definition
(FAO, 2003)	Non-starch polysaccharides	( <i>Non-Starch Polysaccharides</i> , NSP) Polysaccharides that, even when not digested in the small intestine, can be fermented in the large bowel to short chain fatty acids that are absorbed and can therefore provide energy. Conversion factor: 8 kJ/g (1.9 kcal/g)
US Food and Nutrition Board	Dietary fibre	Non-digestible carbohydrates and lignin that are intrinsic and intact in plants
(IOM, 2005)	Functional fibre	Isolated non-digestible carbohydrates that have beneficial physiological effects in humans
	Total fibre	Dietary fibre+functional fibre
(EFSA, 2007)	Dietary fibre	Includes polysaccharides present in foods, that are not digested in the human small intestine and which are non-starch, resistant starch, oligosaccharides with a polymerisation level equal to or above 3 and other components that are naturally associated with dietary fibre, such as lignin
WHO Expert Commission (Cummings and Stephen, 2007)	Dietary fibre	Intrinsic plant cell-wall polysaccharides
Codex, ALINORM 09/32/26 (Codex Alimentarius, 2008)	Dietary fibre	Carbohydrate polymers with two or more monomeric units, which are not hydrolysed by the endogenous enzymes in the small intestine of humans and belong to the following categories: <ul style="list-style-type: none"> <li>• Edible carbohydrate polymers naturally occurring in the food as consumed</li> <li>• Carbohydrate polymers, which have been obtained from food raw material by physical, enzymatic or chemical means and with scientific evidence of benefit to health</li> <li>• Synthetic carbohydrate polymers with scientific evidence of benefit to health</li> </ul>
(Health Canada, 2010)	Dietary fibre	Carbohydrates with a DP (degree of polymerization)>2 or more that naturally occur in foods of plant origin and that are not digested and absorbed by the small intestine and include products accepted as novel dietary fibres
	Novel dietary fibres	Ingredient obtained from natural sources or produced synthetically with the properties of dietary fibres and with demonstrated beneficial physiological effects in humans
(EFSA, 2010a)	Dietary fibre	Carbohydrates that are not digested in the small intestine, plus lignin Includes plant fibres+added fibre+food supplements

### 5.1.1 Health benefits of dietary fibre

Through the review of intervention and observational studies, various panels of experts have collected scientific evidences of the benefits of dietary fibre intake for different treatments. Many of these studies have assessed the level of evidence generically, indicating whether or not there is sufficient evidence for a specific indication, with the understanding that other indications or benefits have also been evaluated and have not received a positive qualification. As with other foods, current studies by experts try to offer an objective assessment with a grading system that depends on the type of study (meta-analysis, placebo-controlled randomised clinical trials and double blind tests, crossed tests, cohort studies, etc.) and the level of “no-confusion” that they offer. The score given also enables to make recommendations. Table 17 includes the conclusions of some studies or reports prepared by a Panels of experts, it reflects the existence of scientific evidence and the level of evidence obtained.

The physiological effects will depend on the fibre administered, and as the degree of solubility can be different in each case and it depends on the the viscosity of the resulting solution. This viscosity shall determine the effect on the metabolism of lipids and carbohydrates and to a different degrees, its potential anticancer effects (Escudero and González, 2006). Furthermore, the physiological effects on humans depend on the mode of administration and dose. This is why “dietary fibre”, as a whole, does not have demonstrated “health benefits” (Health Claims) (EFSA, 2010b).



**Table 17.** Health benefits described for dietary fibre

Reference	Fibre	Benefit	Evidence
(SACN, 2008)	Non-starch polysaccharides (NSP)	Improves bowel function (faecal bulk and transit time)	Yes
	Soluble fibre	Lower total cholesterol and LDL	Yes
(EFSA, 2009)	Glucomannan	Maintains normal level of cholesterol in blood in normal and hypercholesterolaemic adults at daily doses of 4 g/day	Yes
(Health Canada, 2010) (Lattimer and Haub, 2010)	Dietary fibre	Reduces risk of coronary artery disease, improves bowel function and blood lipid levels	Yes
(EFSA, 2010b)	Glucomannan	Reduces body weight in adults in the context of an energy-restricted diet. 3 g/day in three doses	Yes
(FESNAD-SEEDO, 2011)	Food of plant origin	Better weight control	2++
World Gastroenterology Organization (Guarner et al., 2011)	Oligofructose	Prevents constipation	2a
(EFSA, 2014)	Non-digestible carbohydrates (Inulin)	Lowering of blood glucose after eating foods	Yes

EFSA's Panel of Dietetic Products, Nutrition and Allergies has studied a great number of files requesting functional attributes for various types of fibre, mainly soluble oligosaccharides with a composition defined pursuant to article 13 of Regulation (EC) No 1924/2006. Those approved are outlined in Table 17, however, a favourable general report for dietary fibre was not issued because, according to the Panel, its composition is extremely varied and a cause and effect relationship cannot be established (EFSA, 2010b). Others have been dismissed, such as the consumption of isomalto-oligosaccharides for maintaining normal levels of cholesterol (EFSA, 2009), xanthan gum for bowel function (EFSA, 2011a), or galacto-oligosaccharides for the improvement of intestinal wellbeing and reduction of potential pathogens (EFSA, 2011b), among others. Also, a number of infant formula and products have been marketed with fructo-oligosaccharides (FOS) and galacto-oligosaccharides (GOS), which some studies have attributed soft stools and a bifidogenic effect to, however, clinical benefits have not been demonstrated yet (Agostoni et al., 2004) (Thomas et al., 2010).

### 5.1.2 Dietary fibre and overweight

With regard to obesity and overweight, it has been demonstrated that the diets of obese and overweight subjects contain significantly more total fats and cholesterol and contain less carbohydrates and dietary fibre than control individuals. It has even been suggested that the low intake of dietary fibre and fruits could contribute to the etiology of obesity (Davis et al., 2006). Some studies relate the increase in total fibre intake with weight loss and waist perimeter reduction due to the loss of body fat (Koh-Banerjee et al., 2004) (Tucker and Thomas, 2009) (Du et al., 2010). It has been suggested that this may be due to the indirect feeling of satiety, a decrease in total energy intake or the reduced digestibility of fat, which reduces the total metabolizable energy.

With regard to the effect of the different types of fibre, although weight loss has been described by reduction of energy consumption for both soluble and insoluble fibre (Tucker and Thomas, 2009), other studies in humans and in animals, indicated a reduction of metabolizable energy only with insoluble fibre, therefore further research is required in this area (Lattimer and Haub, 2010).

Finally, as it reaches the large intestine without any degradation, the amount of dietary fibre consumed directly affects the bacterial populations that develop in this last section of the digestive process. Various studies have recently underlined the huge importance of the composition of bacterial flora (microbiota) residing in the colon and its direct relationship with a number of diseases (De Vos and De Vos, 2012). The composition of the microbiota is also directly related to obesity in adults, which rapidly changes with diet (DiBaise et al., 2012). Also in infants it is a possible conditioning or prediction factor of the future development of obesity or overweight (Kalliomäki et al., 2008).

Guidelines and recommendations of various public agencies, or documents commissioned by them to panels of experts, on the consumption of dietary fibre for the prevention of obesity and excess weight are described below. A last chapter also includes guidelines and recommendations on the consumption of dietary fibre as part of a healthy diet.

## 5.2 Guidelines and recommendations concerning the consumption of dietary fibre for the prevention of obesity and overweight

### 5.2.1 World Health Organization (WHO)

#### Joint WHO/FAO consultation to the Committee of Experts on Diet, Nutrition and the Prevention of Chronic Diseases (2003)

This extensive study considers that there is convincing evidence that regular physical activity and a high intake of dietary fibre in the diet reduces the risk of gaining weight and obesity.

The recommended amount is  $\geq 400$  g/day of fruit and vegetables, of which more than 20 g/day of non-starch polysaccharides (NSP) shall come from whole grain (WHO, 2003).

#### WHO/FAO conclusions on the update on the intake of carbohydrates as part of human nutrition (2007)

The high content of dietary fibre in whole-grain, vegetables, legumes and fruit is associated with relatively low energy density, promotion of satiety and, in observational studies, with a lesser degree of weight gain than in cases with lower fiber input. Although it is difficult to establish with certainty

that dietary fibre has a greater participation than other diet components, recommending whole-grain cereals, vegetables, legumes and fruits as the most appropriate sources of dietary carbohydrate is considered correct. Available evidence for the use of glycaemic index (GI) of carbohydrate-containing foods is considered insufficient to predict if they can reduce the risk of obesity in normal weight individuals or promote weight loss in those who are overweight or obese (Mann et al., 2007).

### 5.2.2 United States of America

#### **Obesity prevention programmes by the United States Agency for Research on Health and Quality of Life reporting to the U.S. Department of Health and Human Services**

This Agency has commissioned a number of studies to propose recommendations based on the levels of scientific evidence found by panels of experts, in which evidence was rated as low or insufficient when only a few published studies were found, or if these had a high, or moderate risk of bias or there were contradictory results in the different studies.

#### **Obesity prevention programmes: Comparative effectiveness review and meta-analysis (2013)**

This document describes studies on the effectiveness of childhood obesity prevention programmes through meta-analysis. It proposes a series of key questions (KQ#) on the effectiveness of interventions from different environments for the prevention of childhood obesity or excessive weight gain. The dietary fibre factor was always included as part of whole grains, fruits and vegetables.

Based on studies carried out over periods of 6 months and 6 years, the Panel of Experts found very clear evidence when school-based interventions took place with a focus on dietary intake with physical exercise, with a significant contribution from home and in different combinations of factors in which food in schools or physical activity are key elements.

Based on the different evidence found, the Panel recommends that obesity prevention programmes at school could help to fight the increase in obesity and overweight among children. The Panel's recommendation is only applicable to children in high-income countries (Wang et al., 2013).

Given that different measurements were used for the amount of fibre in most the studies examined, studies that associated a significant effect with fibre intake described:

- Increase in fibre consumption in the diet of 1 g/day of the intervention group compared with the control group was beneficial (95 % confidence interval) (Treviño et al., 2004).
- Healthy Eating and Exercise (HEE) recommends <30 % of daily energy from fats, <10 % of saturated fats and 20 to 30 g/day of dietary fibre (Melancon and Dwyer, 2002) (Newton et al., 2010).
- Intake of <33 % fat, <12 % sugar and >25 g/day fibre (Vandongen et al., 1995).
- General substitution of sugars in diet by low sugar content products (<6 g sugar), high fibre content (>2 g of fibre), whole grain cereals and whole grain bread (Chomitz et al., 2010).

#### **Strategies to prevent weight gain among adults (2011)**

This document compares the effectiveness, safety and impact on the quality of life of strategies to prevent weight gain among adults (average 0.5 to 1.0 kg per year in middle-aged adults can develop

obesity over time). Although there is not much available evidence, significant weight loss differences could be determined in low-fat diets, out-of-home meals and, above all, and following a diet with high-fibre and low fat content, in the context of a healthy dietary pattern.

The members of the Panel point out that in adults, personal and cultural preferences for types of food should be taken into account but above all, the will to change. The pleasure of eating should be maintained, limiting the choice of foods only when there is enough scientific evidence (Hutfless et al., 2013).

### 5.2.3 United Kingdom

**National Institute for Health and Clinical Excellence. Obesity: Prevention, identification, evaluation and management of overweight and obesity among adults and children (NICE, 2006)**

The recommendations in this document include consuming abundant high-fibre foods, such as oat, beans, peas, lentils, grains, seeds, fruit and vegetables, as well as whole meal bread, rice and pasta. With regard to fruit and vegetables, eating at least five portions per day instead of high fat or higher calorie food is recommended. This document also includes other recommendations related to adults changing sedentary lifestyles, the stimulus of ludic activities and non-sedentary games for children and guidelines for losing weight always under the guidance of professionals, as well as implementation measures. The recommended average daily intake of dietary fibre in a healthy diet should be more than 18 g (NICE, 2006).

## 5.3 Guidelines and recommendations on the consumption of dietary fibre as part of a healthy diet

### 5.3.1 World Health Organization (WHO)

The WHO discussion paper of 2012, established the objective that the population should consume 400 g of fruit and vegetables per day (WHO, 2012).

The basis of this target is that approximately 1.7 million deaths worldwide could be attributed to a low consumption of fruits and vegetables. Eating more fruits and vegetables would reduce the risk of suffering cardiovascular diseases, stomach and colorectal cancer. Furthermore, there are clear evidences that the consumption of large amounts of high calorie foods, such as processed food with high levels of fat and sugars, promote obesity, while this is not the case with hypo-energetic foods, such as fruits and vegetables (WHO, 2012).

### 5.3.2 European Food Safety Authority (EFSA)

Based on the available evidence on bowel function, the EFSA Panel considered dietary fibre intakes of 25 g per day to be adequate for normal laxation in adults. There are no conclusive evidences to establish the adequate intake for children, therefore this Panel of Experts considered that the adequate dietary fibre intake (AI) for children should be based on that of adults but adjusted according to energy intake. A fibre intake of 2 g/MJ is considered adequate for normal laxation in children from the age of one year and for their growth and normal development (EFSA, 2010a).

The role of dietary fibre in bowel function was considered the most suitable criteria for establishing an adequate intake. The Panel observed that there are evidences for health benefits associated with the

consumption of diets rich in fibre in the case of adults. Therefore, intakes above 25 g/day, for example, have been shown to reduce the risk of suffering from coronary heart diseases and type 2 diabetes mellitus as well as helping to maintain weight. This should be taken into account when developing dietary guidelines.

### 5.3.3 Ireland

The FSAI "Guide to healthy eating" recommends an average intake of fruits and vegetables of five to six portions per day and a minimum amount of fibre of 25 g per day for older than 18 year, while for those under the age of 18, a daily fibre consumption of "age+5 g" is recommended for both men and women.

It also recommends frequent consumption a wide variety of different coloured fruits and vegetables. Choosing for example:

- Dark green vegetables such as broccoli, spinach, cabbage, etc.
- Orange/red fruit and vegetables such as oranges, tomatoes, carrots, etc.
- Orange/red/yellow ones such as peppers.

The FSAI document outlines the bases of these recommendations, stating that fruit and vegetables are "protective" foods, that is, they provide a wide variety of substances called phytochemicals, flavonoids and phytoestrogens, which help to prevent some common diseases, such as heart diseases and some types of cancer. They also provide fibre, as well as a whole series of vitamins and minerals such as vitamin C, vitamin B, potassium and magnesium with beneficial effects. Legumes are also a good source of soluble fibre (FSAI, 2011).

The frequent consumption of these foods imply the limitation of others, which are high in fat, salt and/or sugar, which is key to a healthy diet.

With regard to the consumption of fruit, it recommends eating whole fruits instead of in juices, given that it provides more fibre and it is more beneficial as it contains less added sugar. With regard to the consumption of vegetables, the form of cooking them must be taken into account, as the vegetables may lose properties.

Therefore, overcooking vegetables should be avoided, as vitamins and minerals are lost in the water. However, steaming vegetables, cooking them in the microwave or frying them (in very little oil) are good ways of cooking them.

One way of increasing the intake of vegetables is adding a good portion of salad (lettuce, onion, tomato) to dishes and to sandwiches.

Frozen vegetables or canned vegetables are as good as fresh ones with regard to fibre. Eating vegetables preserved in brine should be restricted because of the high salt content.

With regard to the consumption of fibre in Ireland, food patterns of adults (83 %) do not provide enough dietary fibre, with the exception of men aged between 19-50 years. In relation to children and teenagers, one fifth (20 %) of those aged between 5 and 18 years did not meet the fibre intake target ("age+5 g of fibre per day"). Therefore, the fibre consumption target was not met.

The FSAI document also concluded that fibre intake depends on calorie intake. Therefore, the more food one consumes, the easier it is to meet the fibre targets. Therefore adults needing around 2 200 calories per day will find it easier to cover their needs, while those needing lower calories, for example 1 800 calories per day or less, will find it harder.

This document also refers to more active people; as they need more calories, it is easier for them to obtain sufficient quantities of this nutrient, which firmly supports the recommendations of living an active life, as it leads to an increased consumption of food and therefore a reduction in the risk of getting an insufficient amount of nutrients.

### 5.3.4 Belgium

In the document on the National Food and Health Plan for Belgium, the objectives proposed in relation to fibre were (PNASB, 2005):

- Eat at least 400 g/day of fruit and vegetables.
- Reduce the number of people that eat very few fruits and vegetables, particularly young people (school children and adolescents).

As a basis for these recommendations, this document states that fruit and vegetables contain a low energy content, very little fat and provide a number of nutrients and compounds that protect our body (vitamins, minerals, dietary fibre, antioxidants and other phytochemicals).

It is generally understood that a high intake of fruit and vegetables reduces the risk of important heart diseases and cancers. Although this protection mechanism has not been completely clarified, the connection between this category of foods and health is probably the clearest solid evidence in nutritional science (PNASB, 2005).

Measures and recommendations to reach these targets have a multidisciplinary character, with not only the support of scientists but also that of health professionals (doctors, nutritionists), specialists in food behaviour, specialists in the promotion of health and food intake education, specialists in public health, epidemiologists, etc., as well as each of the parties involved in civil society.

In relation to the consumption of fibre in Belgium, the PNASB shows that only around 38 % of men and 56.1 % of women eat fruit every day. 9.5 % and 8.6 % roughly eat fruit five to six times per week, 21.7 % and 17.8 % just two to four times per week, while 14.5 % and 8.1 % do so only once per week. 16.3 % of the male population and 9.5 % of the female population eat less than one piece of fruit a week.

The daily consumption of fruit increases with age, 35.2 % of the group made up of 15-18 year olds to 66.1 % of those over the age of 75 years. There were no significant differences in the consumption of fruit with regard to the level of education.

Regarding the consumption of vegetables, the figures do not differ greatly: only 31.3 % of men and 43.8 % of women claim to eat vegetables every day, while 10.2 % and 6.6 %, respectively, claim to only eat vegetables once a week or less (PNASB, 2005).

### 5.3.5 Nordic Council (Denmark, Finland, Iceland, Norway and Sweden)

The NNR (2004) document recommends a daily intake of dietary fibre for adults of 25-35 g (approximately 3 g/MJ) (NNR, 2004).

As a basis for these recommendations, the document states that an adequate intake of fibre in foods, together with an adequate balance of carbohydrates and fats, helps to reduce the risk of developing excess weight and other diseases related to it.

An adequate intake of dietary fibre reduces the risk of constipation and can help to protect against colorectal cancer.

This recommendation involves the majority of people increasing the intake of carbohydrates and dietary fibre. This increase should be carried out by eating, for example, cereals, potatoes, vegetables and fruits and berries, which are also a source of vitamins and minerals.

The adequate intake of dietary fibre from a wide variety of foods is also important for children. From the school age, intake of fibre should be gradually increased until the recommended level is reached in adolescence.

In order to ensure an adequate intake of essential nutrients and dietary fibre, particularly in children and adults with low energy intake, the intake of refined sugars should be restricted.

In relation to the intake data, the initial nutritional recommendations of the Nordic Council (NNR) in 1980 highlighted a reduction in the total fat intake to under 35 % of the total energy expended and an increase in the intake of carbohydrates and dietary fibre.

### 5.3.6 United States of America

The Dietary Guidelines for Americans outlined the three reasons to support the target of increasing the intake of fruit and vegetables (US, 2010):

- First, most fruit and vegetables are the main providers of a series of nutrients that are consumed under the recommended amounts in the United States, including folic acid, magnesium, potassium, dietary fibre and vitamins A, C and K. A number of them are low enough to be of public health concern (for example, dietary fibre and potassium) or a specific group (for example, folic acid for women capable of becoming pregnant).
- Specifically, evidence indicates that a moderate intake of at least two and a half cups of vegetables and fruits per day is associated with a reduced risk of cardiovascular disease, including heart attack and stroke. Some vegetables and fruits may be protective against certain types of cancer.
- Third, most vegetables and fruits, when prepared without added fats or sugars are relatively low in calories. Eating them instead of higher calorie foods can help adults and children achieve and maintain a healthy weight.

In order to meet these objectives the Dietary Guidelines for Americans recommends consuming them as a whole fruit, including fresh, tinned, frozen and dry, instead of in juices. When consumed as juice, it should be 100 % juice. To restrict the consumption of added sugars, fruit tinned in 100 % fruit juice is recommended instead of fruit tinned in syrup (US, 2010).

The Institute of Medicine of the United States National Academies (IOM) recommends a dietary fibre intake of 25 g/day for women and 38 g/day for men (IOM, 2005). This amount has also been established in Canada (Canada 2010).

### 5.3.7 Australia and New Zealand

The document "The Nutritional Reference Values for Australia and New Zealand" from 2005 recommended the following dietary fibre values (VNRAN, 2005). There is no recommended intake for babies up to 12 months. For children/adolescents, boys/girls of 1-3 years, 14 g/day; 4-8 years, 18 g/day. From 9 to 13 year old, 24 g/day for boys and for girls 20 g/day, and for 14-18 year olds, for boys 28 g/day and for girls 22 g/day.

The recommended dietary fibre intake in boys/girls was established according to the median dietary fibre intake in Australia and New Zealand for children of these ages, using as a base the national dietary surveys carried out in Australia in 1995 and in New Zealand in 2002, as well as assigning around 2-4 g/day to the different ages/gender groups as resistant starch (RS) was not include in the database of foods used in these surveys (ABS, 1998).

In adults, of any age the recommended intake of total fibre is 30 g/day for men and 25 g/day for women. The recommended dietary fibre intake in adult women was established according to the median dietary fibre intake in Australia and New Zealand using Australia's National Nutrition Survey of 1995 as a base and New Zealand's National Nutrition Survey of 1997 (ABS, 1998) (NS, 1999). The value within each gender was established for all ages based on the highest median of any of the age groups and an allowance of a little more than 4 g/day was assigned for men and a little less than 3 g/day for women, given that resistant starch was not included in the food databases used for these surveys. During pregnancy, 25 g/day is recommended for very young women (14-18 years) and 28 g/day for the rest.

An increase in body weight of pregnant women leads to an increase in energy requirements and therefore an increase of around 12 % in the dietary fibre intake is recommended. There is no evidence for increased metabolic needs in pregnancy.

The increase of energy needs during lactation produces an increased recommended intake of dietary fibre of around 20 %.

The Food Standards Australia-New Zealand (FSANZ) highlighted the role of dietary fibre in the proper functioning of the gut and its relation to risk reduction for a number of chronic diseases, including heart diseases, certain types of cancer and diabetes mellitus.

### 5.3.8 Spain

It is a well-known fact that the NAOS Strategy was the Ministry of Health's (2005) initiative for nutrition, physical activity and prevention of obesity. Dietary fibre is defined as the "indigestible plant residue". It is found in plant cell walls: Legumes, wholegrain cereals, vegetables, nuts and fruits. The recommended fibre intake was established at 16-24 g/day which is easy to meet if vegetables are included in meals and the "5 a day" recommendation is followed. The diet of Spaniards, on the date of the report, had fibre deficiencies.

With the aim of homogenising the dietary habits related to the prevention and the dietary-nutritional



treatment of obesity among adults, in 2011 the Spanish Federation of Nutrition, Food and Dietetics Societies, together with the Spanish Society for the Study of Obesity established a series of nutritional recommendations based on evidence for the prevention and treatment of excess weight and obesity among adults (FESNAD-SEEDO, 2011). This highly important initiative underlines the existence of solid evidence (2++ level) that a diet rich in foods from vegetable origin is associated with better weight control in healthy adults and therefore it recommends (B grade recommendation) an increased fibre intake through vegetable origin foods, as this can prevent weight gain among healthy adults.

#### **5.4 List of nutritional recommendations and objectives established by various international organisations and different countries in relation to fibre intake**

Table 18 includes a summary of the objectives and recommendations related to the intake of fibre, fruits and vegetables.

<b>Table 18.</b> Summary of the fibre, fruit and vegetable recommendations			
<b>Body/country</b>	<b>Recommendation</b>	<b>Report</b>	<b>Year</b>
Australia and New Zealand	25 g/day fibre (adult women) 30 g/day fibre (adult men)	Australia and New Zealand reference nutritional values	2005
Belgium	400 g/day fruit and vegetable	Belgium Food and Health National Plan	2009
Canada	25 g/day for women and 38 g/day for men	Proposed Policy: Definition and Energy Value for Dietary Fibre	2010
EFSA	25 g/day fibre (adults)	Scientific Opinion on Dietary Reference Values for Carbohydrates and Dietary Fibre	2010
Spain	16-24 g/day	NAOS strategy	2005
United States of America	25 g/day for women and 38 g/day for men	Institute of Medicine of the United States National Academies	2005
United States of America	20-30 g/day fibre	Healthy Eating and Exercise	2010
United States of America	Greater intake of fruit and vegetables	Dietary Guidelines for Americans	2010
United States World Cancer Research Fund/ American Institute for Cancer Research	>600 g/day fruit and vegetable	Food, Nutrition and Physical activity: a Global Perspective	2009
Ireland	5-6/day: fruit and vegetable ≥25 g/day fibre (adults) "age+5 g"/day fibre: Under 18 year	Scientific Recommendations for Healthy Eating Guideline in Ireland	2011
WHO	≥400 g/day fruit and vegetable	Diet, Nutrition and the Prevention of Chronic Diseases (916 report)	2003, 2007 and 2012
WHO	>20 g/day NSP from whole grains	Diet, Nutrition and the Prevention of Chronic Diseases (916 report)	2003
Nordic Countries	25-35 g/day fibre (adults)	Nordic Nutrition Recommendations	2004
United Kingdom	≥ 18 g/day dietary fibre	Obesity: The Prevention, Identification, Assessment and Management of Overweight and Obesity in Adults and Children	2006

## 5.5 Comments

In Europe, the main sources of dietary fibre are wholegrain cereals, legumes, fruit, vegetables and potatoes. The average daily intake among children (<10-12 years) ranges between 10 and 20 g/day, in adolescents it is 15 to 30 g/day while among adults it is 16 to 29 g/day. With regard to energy intake

(MJ), the average dietary fibre intake ranges between 1.7 and 2.5 g/MJ in children and from 1.8 to 2.9 g/MJ among adults (EFSA, 2010a).

According to data published recently by the Spanish National Diet Survey (ENIDE) in Spain the majority of fibre in the diet is provided by fruit and derivatives (30 %), legumes, seeds and nuts (26 %), wholegrain cereals and derivatives (22 %) followed by vegetables, and derivatives (14 %) (AECOSAN, 2014). By age and gender, the daily intake of dietary fibre ranges between 17.05 g/day in young women (18-24 years) and 21.68 g/day in older men (45-64 years), with the greater consumption by men (average=20.94 g/day) than women (average=18.85). These statistics show that only between 1.5 and 6.8 % of the population consumes dietary fibre according to the levels recommended by EFSA and the entire population would be below the levels recommended by the Institute of Medicine of the United States National Academies (Table 18). According to the ENIDE report, the daily intake is particularly low among women probably due to the low consumption of legumes.

Although there are different types of dietary fibre, with very different physicochemical and biological characteristics, verified studies have demonstrated that the intake of dietary fibre (or a specific type of dietary fibre) is beneficial to health, as it controls the intestinal transit, reduces lipemia and the levels of total cholesterol and LDL cholesterol, as well as the risk of heart disease and type 2 diabetes *mellitus*. Nevertheless, it also helps to maintain a stable body weight, by possibly reducing the caloric index of total food intake, but it has been shown that depending on the type of fibre it can also decrease postprandial glycaemia or promote satiety. According to the FESNAD-SEEDO (2011) report, evidence has been provided by systematic high quality studies to suggest that eating more plant-based foods contributes to a better body weight control, therefore it recommends eating fibre from vegetables to avoid weight gain (grade B recommendation). However, as with other healthy diet factors, dietary fibre does will not affect weight loss or prevent weight gain if the energy balance (energy intake-energy expenditure) remains positive. Although, as a result of consuming fibre, the total metabolizable energy may decrease, thus enabling weight loss (FESNAD-SEEDO, 2011).

In this regard, there is no evidence to suggest that increased dietary fibre intake in children or in adults contributes towards weight loss, unless a constant energy intake is accompanied by physical activity.

## 5.6 Recommendations on fibre intake

To adopt the EFSA nomenclature and to consider dietary fibre to be a fibre that "is part of the diet", either as an intrinsic component of vegetables or as added fibre or supplement.

The previous recommendation of the NAOS Strategy of 16-24 g/day is very low when compared to international standards. Taking into account that men and women have very different intake levels and given that there is a high consumption of fruit, vegetables and legumes in the traditional diet, EFSA's recommended intake (25 g/day) seems an achievable minimal target with thresholds of 20-25 g/day for women and 25-30 g/day for men.

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## 6. Physical activity target

The WHO defines physical activity (PA) as any bodily movement produced by skeletal muscles that requires energy expenditure and it establishes that regular moderate-intensity physical activity provides health benefits in relation to reducing the risk of certain chronic diseases (mainly cardiovascular diseases, diabetes, colon and breast cancer) and alterations such as depression, overweight and obesity (WHO, 2010). The benefits of physical activity are based on scientific evidence from different levels depending on the effect.

In the past, studies on physical activity were focused on exercise, defined as “planned, structured and repetitive bodily movement carried out to improve or maintain one or more components of physical fitness”, likely in work-related vigorous activity, which could be beneficial to human health. At the end of the 1980s and the beginning of the 1990s, with the results of a number of prospective cohort studies, the beneficial effects of lower intensity physical activity were acknowledged for both adult and children subjects. Today it is accepted that the term “physical activity” should not be confused with “exercise”. Physical activity is a wider term that covers not only exercise, but also activities that involve bodily movement, such as active transport, domestic task, leisure activities, or work-related activities.

Physical inactivity is associated to some leading causes of death, chronic morbidity and disability. Lack of physical activity is the fourth risk factor with regard to global mortality (6 % of the deaths registered worldwide), being the main factor for 21-25 % of breast and colon cancer cases, 27 % of diabetes cases and approximately 30 % of cases of ischemic cardiomyopathy (WHO, 2010).

The following table includes a summary of the scientific evidence concerning physical activity and health benefits (Table 19).

**Table 19.** Levels of evidence of the positive effects of physical activity (Physical Activity Guidelines for Americans)

Population	Level of evidence	Positive effects of exercise
Adults and older people	Strong evidence	Reduced risk of premature death
		Reduced risk of coronary artery disease
		Reduced risk of stroke
		Reduced risk of high blood pressure
		Reduced risk of adverse dyslipidemia
		Reduced risk of type 2 diabetes
		Reduced risk of metabolic syndrome
		Reduced risk of colon cancer
		Reduced risk of breast cancer
		Prevents weight gain
		Improved cardiorespiratory fitness
		Enhanced muscle fitness
		Prevents falls
		Enhanced cognitive performance (elderly)
	Moderate to strong evidence	Improved functional health
		Reduced abdominal obesity
	Moderate evidence	Reduced risk of breaking hip
		Reduced risk of lung cancer
		Reduced risk of endometrial cancer
		Weight control after slimming
		Higher bone density
		Improved sleep quality
Children and adolescents	Strong evidence	Improved cardiorespiratory fitness
		Enhanced muscle fitness
		Improved bone health
		Improved markers for cardiovascular health
		Improved body composition
	Moderate evidence	Fewer symptoms of depression

**Source:** (US, 2008).



The factors that affect the possibility of being physically active include socio-environmental factors, economic factors, as well as perceptions concerning safety, accessibility and weather conditions.

Nowadays, recommendations for PA are expressed as periods of time that should be spent in a given physical activity with a specific intensity. In this regard, the WHO has defined different levels of PA (WHO, 2004):

- Level 1, physical activity (inactive) is defined as "lack of physical exercise or doing no or very little physical activity at work, at home, for transport or in discretionary time".
- Level 2, insufficiently active, is defined as "doing some physical activity but less than 150 minutes of moderate-intensity physical activity or 60 minutes of vigorous-intensity physical activity a week accumulated across work, home, transport or discretionary domains".
- Level 3, (sufficiently active), is defined as "doing more than 150 minutes of moderate-intensity physical activity or 60 minutes of vigorous-intensity physical activity a week accumulated across work, home, transport or discretionary domains".

In relation to the compilation of data concerning physical activity, the majority of the available data are from surveys that refer to spare time and somewhat less to work activities and there are fewer data concerning activities at home and active transport.

With regard to population groups, there is less data available for children and adolescents than for adults.

The monitoring and surveillance of physical activity in different countries is carried out using different assessment instruments and not all countries or instruments include the same scope, such as work, transport or discretionary domains. This, together with the fact that the questionnaires used in national surveys are very diverse and not always standardised, means there is a lack of comparability between the different countries.

## **6.1 World Health Organization (WHO)**

Based on the report "World health 2002", the WHO created the project: "WHO Global Strategy on Diet, Physical Activity and Health", in which a series of recommendations are established for preparing national and regional strategies and action plans with the aim of reducing mortality and morbidity resulting from non-communicable diseases related to diet and physical activity (WHO, 2004).

This document is aimed at the States, the private sector, civil society and non-governmental organisations.

The objectives set out in relation to physical activity are:

- To reduce the risk factors for chronic diseases that stem from physical inactivity through public health actions.
- To increase public awareness with regard to the influence of physical activity on health and the positive impact thereof on preventive interventions.
- To develop, strengthen and implement national, regional and local policies, as well as action plans with the aim of increasing physical activity and involving the various sectors.
- To promote research related to physical activity.

In 2010, the WHO published the “Global recommendations on physical activity for health”, the aim of which was to create a guide for those responsible for local and regional public health policies, offering guidelines about the dose-response relationship between physical activity and health benefits (i.e. frequency, duration, intensity, type and total amount of physical activity required to improve health and prevent non-communicable diseases) (WHO, 2010).

The document indicates the recommended levels of physical activity for three age groups: From 5 to 17 years, 18 to 64 years and 65 years and over. These groups have been selected taking into account the nature and availability of scientific evidence related to the selected health aspects. The recommendations do not refer to the group of under 5 year olds given that, although physical activity is beneficial to them, further research is needed to determine the amount of physical activity required to provide the maximum health benefits.

Each section includes observations on the target population, a descriptive summary of the scientific evidence, a series of recommendations on physical activity for health and an interpretation and justification of the outlined recommendations.

<b>Table 20.</b> Global recommendations on physical activity (PA) for health		
<b>Age group</b>	<b>Physical activity recommendation</b>	<b>Additional comments</b>
5-17 years	<ul style="list-style-type: none"> <li>• Children and youth aged between of 5 and 17 years should accumulate at least 60 minutes of moderate to vigorous-intensity physical activity daily</li> <li>• Amounts of physical activity greater than 60 minutes provide additional health benefits</li> <li>• Most of the daily physical activity should be aerobic Vigorous-intensity activities should be incorporated, including those that strengthen muscle and bone, at least three times per week</li> </ul>	For children and young people, physical activity includes play, games, sports, transportation, chores, recreation, physical education, or planned exercise, in the context of family, school, and community activities
18-64 years	<ul style="list-style-type: none"> <li>• Adults aged 18–64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate - and vigorous-intensity activity</li> <li>• Aerobic activity should be performed in bouts of at least 10 minutes duration</li> <li>• For additional health benefits, adults should increase their moderate-intensity aerobic physical activity to 300 minutes per week or engage in 150 minutes of vigorous-intensity aerobic physical activity per week or an equivalent combination of moderate and vigorous intensity activity</li> <li>• Muscle-strengthening activities should be done involving major muscle groups on two or more days a week</li> </ul>	In adults aged 18-64, physical activity includes leisure time physical activity, transportation (e.g. walking or cycling), occupational (i.e. work), household chores, play, games, sports or planned exercise, in the context of daily, family, and community activities

**Table 20.** Global recommendations on physical activity (PA) for health

Age group	Physical activity recommendation	Additional comments
65 years and above	<ul style="list-style-type: none"> <li>• Adults aged 65 years and above should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous- intensity activity</li> <li>• Activity should be performed in bouts of at least 10 minutes duration</li> <li>• For additional health benefits, older adults should increase their moderate-intensity aerobic physical activity to 300 minutes per week or engage in 150 minutes of vigorous-intensity aerobic physical activity per week or an equivalent combination of moderate and vigorous intensity activity</li> <li>• Older adults, with poor mobility, should perform physical activity to enhance balance and prevent falls on 3 or more days per week</li> <li>• Muscle-strengthening activities, involving major muscle groups, should be done on 2 or more days a week</li> <li>• When older adults cannot do the recommended amounts of physical activity due to health conditions, they should be as physically active as their abilities and conditions allow</li> </ul>	In older adults of the 65 years and above age group, physical activity includes leisure time physical activity, transportation (e.g. walking or cycling), occupational (if the individual is still engaged in work), household chores, play, games, sports or planned exercise, in the context of daily, family, and community activities

**Source:** (WHO, 2010).

The WHO (2012) discussion document on the objectives for disease control and prevention, established the objective of reducing physical inactivity by 10 % and this objective has been included in the Action Plan 2013-2020 for the prevention and control of non-communicable diseases (WHO, 2013).

A fundamental intervention for achieving the objective of reducing physical inactivity consists in using the media to promote physical exercise. Furthermore, this can be promoted by applying national guidelines on physical activity, national policies that ensure the accessibility and safety of walking and cycling activities, sports and recreational activities and other forms of public policies in various sectors, such as transportation, education, sports and urban design. Places in which physical activity should be promoted include schools, workplaces and locally.

Participating in a sport is one way of being physically active. It has been demonstrated that people that practice a sport are more likely to meet the recommendations on physical activity than those that do not (Lamprecht et al., 2005). When the socio-demographic data are analysed, there would appear to be significant differences depending on the characteristics of the groups surveyed. Males do more exercise or practice more sports than women; the amount of sports activities reduces with age; those with higher levels of education show higher levels of physical activity, people that live alone are less committed to sport and people with financial problems tend to be insufficiently active.

## 6.2 European Union

Following the recommendation proposed by the WHO, the EU's physical activity guidelines (2010) are in agreement with the principles of the "White paper on Sport" (EU, 2007a) and the "European strategy on nutrition, overweight and obesity-related health issues" (EU, 2007b). These documents offerer "action guidelines" which are addressed to public and private authorities at different levels (European, national, regional and local) (EU, 2010).

The recommended objectives are as follows:

- For healthy adults, aged between 18 and 65 years: The objective recommended by the WHO is to achieve a minimum of 30 minutes of moderate-intensity physical activity over 5 days or at least 20 minutes of vigorous physical activity 3 days per week. Activity should be performed in bouts of at least 10 minutes duration and may also combine moderate and vigorous periods. Muscle-strengthening activities should be carried out involving major muscle groups two or three times a week.
- For adults over the age of 65 years: They should in principle reach the same objectives as healthy younger adults. Also, strength and balance exercises are extremely important in this group to prevent falls. These recommendations should be added to daily activities, which are usually light and lasting less than 10 minutes.
- School-age children: Should take part in moderate or vigorous and fun physical activities, suited to development and which involve a variety of activities for 60 minutes or more per day. The complete dose may be accumulated in bouts of at least 10 minutes duration. Special attention should be given to the development of movement skills in younger groups. Different types of activities should be taken into account pursuant to the requirements of each age group: Aerobic and strength exercises, weight bearing exercises, balance, flexibility and movement development exercises.

A transversal approach is proposed with the collaboration of many sectors to make the change.

Six areas of action are mentioned, which include:

- Education (promoting physical activity in schools and education and training of health professionals).
- Transportation, environment, urban planning and public safety.
- Work environment.
- Services for the elderly.

This approach is complemented with the European Union Work Plan 2011-2014, which establishes work areas, including Sport, Health and Participation, which should govern any future actions of the European Commission and of the European Council (EU, 2011).

Recently, a Recommendation was published by the Council of the European Union on the promotion of health-enhancing physical activity in various sectors. Specifically, the Council of the European Union recommends the following for the Member States (EU, 2013):

1. To work on effective policies with regard to Health-Enhancing Physical Activity (HEPA), promoting a cross-sectoral approach that covers political areas such as sport, health, education, the

environment and transportation, as described in the European Union's guidelines on physical activity and pursuant to national particularities, which should include:

- Creating and gradually applying cross-sectoral measures aimed at the promotion of HEPA in accordance with national legislation and practices.
  - The establishment of specific actions for the creation of strategies or policies, when appropriate in the form of an action plan.
2. To monitor physical activity levels and the implementation of HEPA policies by making use of the monitoring framework and indicators set out in the Annex to the Recommendation, according to their national circumstances.
  3. Designate, within 6 months of the adoption of this Recommendation, national reference centres for HEPA, pursuant to national legislation and practices, that support the aforementioned monitoring framework and that inform the Commission of said designation. National reference centres in the field of HEPA shall be in charge of, specifically coordinating the process of making the data on physical activity available for the monitoring framework; these data shall be included in the WHO European database for nutrition, obesity and physical activity; and they shall also enable cooperation between services in relation to HEPA policies.
  4. Cooperate closely among themselves and with the Commission by engaging in a process of regular exchange of information and good practice on HEPA promotion within relevant Union level structures in the fields of sport and health, as a basis for strengthened political coordination.

Furthermore, in the document on diet, physical activity and cardiovascular disease prevention in Europe by the European Heart Network (EHN, 2011) in relation to physical activity, the following objectives are established: Doing a minimum of 150 minutes of moderate-intensity physical activity per week, to be increased to 300 minutes of moderate-intensity activity per week to prevent weight gain and obesity and also includes a target of one hour of moderate-intensity physical activity per day for the public in general.

### **6.3 France**

The French National Nutrition and Health Programme (2001-2005) included nine priority objectives for the general population related to diet, specific nutritional markers (cholesterol, blood pressure and obesity) and physical activity in daily life (MASS, 2001).

The programme had a multi-sectoral approach including ministries, educational and research institutions, health agencies, farming and food industries, catering, consumer organisations and scientific experts.

The proposed strategies included those aimed at education, communication, information, nutrition, food composition, availability and accessibility thereof.

The target population was the general population and specific groups of the population and also included actions aimed at other target groups such as health professionals, social workers, local and regional administration staff, NGO and economic agents.

With regard to physical activity, the aim was to increase daily physical activity by increasing by 25 % the number of people doing the equivalent of 30 minutes fast walking per day. Another objective was to limit the sedentary lifestyle among children.

Among the strategic themes established by the National Programme, were the measures aimed at specific groups, for example, physical activity among pregnant women as a way of reducing iron deficiencies during pregnancy.

After the implementation of the 2001-2005 programme, in 2006 the French Nutrition and Health Survey (ENNS) was carried out to review the situation of the French population focusing on nutritional status and physical activity among adults (18-74 years) and children (3-17 years). No objective devices were used, such as pedometers or accelerometers, only questionnaires. Given the lack of prior assessments of these characteristics, the results could not be assessed based on the actions carried out.

The ENNS 2006 results were obtained from an assessment of 5 200 individuals. The study determined that 63.2 % of the adult population (63.9 % men and 62.5 % women) engaged in at least 30 minutes of moderate-intensity exercise and that 53.3 % of the population (58.8 % men and 48.8 % women) spent more than 3 hours in front of a screen. With regard to children aged between 11 and 14 years, 65 % of boys and 55 % of girls carried out at least 30 minutes of moderate-intensity physical activity; between the ages of 15 and 17 years, this percentage rose to 78 % for boys and 65 % for girls. 39.4 % of subjects between the ages of 3 and 17 years spent more than 3 hours per day in front of a screen.

Given these results, in the second phase of the French National Health and Nutrition Programme, which was carried out between 2006 and 2010, the target of increasing physical activity in daily life was maintained, with an increase of 25 % in the entire population, equivalent to at least half an hour active walking per day or another moderate-intensity physical activity at least five times per week (MASS, 2006).

In general terms, there is continuity between the strategies included in the National Health and Nutrition Programmes 2001-2005 and 2006-2010 (Hercberg et al., 2007), with various actions being established and which are briefly described below (Hercberg et al., 2006):

- Provide and promote communication on nutrition and physical activity among consumers:  
It highlights the creation of a logo and the promotion thereof, the creation of a website, the publication of guides aimed at the different population groups, media advertising campaigns that included television programmes to show how easy it is to implement the national plan's guidelines. Law 806/2004 should be mentioned, pursuant to which, advertising of processed foods or soft drinks had to be accompanied by health messages such as "stay healthy, with daily physical exercise" (JORF, 2004).
- Implementing measures in public health aimed at specific population groups:
  - Children and adolescents: In 2005 a leaflet was issued on diet and physical activity for adolescents and was distributed among science teachers.
  - Population at risk of social exclusion: Information for groups receiving social aid by means of guides on nutrition and physical activity adapted to their cultural environment and their financial limitations.

- Actions aimed at health professionals and social services: Documents and tools developed for professionals as instruments for calculating body mass index delivered together with health assistance guides or software for managing growth data and anthropometrics for health professionals.
- Response from local authorities: Integration of health and nutrition objectives in the Regional Public Health Plan signed by 26 of the 27 French regions to actively take part in the development of a favourable local environment (MASS, 2005).
- Establishment of systematic studies to monitor the health and nutrition situation of the population and enable initiatives from the National Programme to be assessed such as the National Health and Nutrition Study, the next edition of which shall be carried out in 2013-2014.

Among the specific measures of the 2006-2010 Programme related to PA, is the promotion of active transportation, an increase in promotional advertising for physical activity, the encouragement to use stairs or the development of cooperation programmes between doctors and sports instructors.

It also included measures to strengthen collaboration with the private sector by promoting sports facilities in the workplace as part of corporate social responsibility.

In the national 2011-2015 programme, one of the four focal points is to promote physical and sports activities and to limit sedentary behaviours (MASS, 2011).

This area includes the aim of increasing the percentage of adults that have a high level of physical activity (20 % of men and 25 % of women) and to increase by 20 % the population with a moderate level of physical activity (Table 21).

With regard to children and adolescents, the aim over the next 5 years is for at least 50 % of those aged between 3 and 17 years to practice some form of high-intensity physical activity three times a week for 1 hour. It also establishes this same period for reducing the average time spent on daily activities in front of a screen by at least 10 % in this population group.

The objectives established in the three national programmes carried out until now show an increase in the importance of physical activity. Although in the first two programmes the same objective for physical activity was established (a 25 % increase in the number of adults that carry out a moderate-intensity physical activity), the 2006-2011 programme establishes four focal areas to achieve the objectives, one of which concerns physical activity. This shows the importance of physical activity in the French national programme as a way of achieving a healthy lifestyle, to such a point that, after a number of changes, it has become one of the main pillars of the current programme.

#### **6.4 Nordic Council (Denmark, Finland, Iceland, Norway and Sweden)**

The Nordic Nutrition Recommendations drawn up by the Working Group on Diet and Nutrition by the Nordic Council of Ministers, made up of Denmark, Finland, Iceland, Norway and Sweden, include recommendations concerning physical activity given its close relationship with the prevention of lifestyle-related diseases such as cardiovascular diseases, osteoporosis or some forms of cancer (NCM, 2004). These recommendations are based on the recommendations of the American College of Sports Medicine carried out during the 1990s.

- Children and adolescents: At least 60 minutes of physical activity every day is recommended. The activity can be divided into short intervals of activity throughout the day. Activities should be as diverse as possible in order to provide optimal opportunities for developing all aspects of physical fitness, including cardio-respiratory fitness, muscle strength, flexibility, speed, mobility, reaction time, and coordination.
- Adults: Adults should engage in 30 minutes of moderate-intensity and/or high-intensity physical activity daily with an energy expenditure of approximately 630 kJ, an amount that should be additional to the energy expended by the daily activity itself and which can be carried out in intervals of at least 10 minutes. For additional health benefits adults should increase the time spent doing their physical activity and the intensity thereof. 60 minutes of moderate or high-intensity physical activity daily is required to prevent weight gain.

After a study that established that over half the Nordic population did not meet these principles, the Nordic Council in 2006 established, via the Nordic Action Plan on Health, Food and Activity, a target that in 2011 the majority of the population would follow the recommendations of physical activity and halt the increasingly inactive adult and infant population.

It also included a long-term objective for 2021, for at least 75 % of the adult population to engage in some form of moderate-intensity physical activity for at least 30 minutes per day and for all children aged between 1 and 12 years and 85 % of those aged between 12 and 16 years, to carry out at least 1 hour of daily moderate-intensity physical activity (NCM, 2006).

These recommendations led to a series of action plans carried out for each of the countries that form part of the council and which are included in the document "A better life for children and adolescents through diet and exercise" (NCM, 2009).

These plans are aimed at the infant and children population, divided into subgroups in which different strategies will be used, although some countries have increased the number of population groups for their actions:

- Newborns (0-2 years): Strategy aimed at parents, through the nursing staff providing advice on good practices for the child.
- Pre-school age children (3-6 years): The message is still aimed at parents, combined with the promotion of physical activity through the available infrastructures.
- School age children (7-15 years): Actions focused on the physical activity alternatives within the environment of the relevant individuals.

Some examples of the measures implemented by the Nordic countries are:

- Denmark. Inter-ministerial actions carried out include the creation of informative material concerning healthy diets and healthy lifestyles for socially vulnerable families with children aged between 1 and 6 years (MFAF, 2008) and the dissemination of general guides for municipal authorities on health and physical activity.
- Norway. Particular mention should be given to the project "Physical Activity and Diet in Schools" implemented in 2004, with the aim, among others, of introducing at least one hour of daily



exercise. This project is of particular importance given the annual assessment of the results (NME, 2003).

- Sweden. The project "Physical Activity on Prescription" (PaP) has been carried out in which physical activity is prescribed in the same way as medicine (PAPA, 2003).
- Finland. In this case authorities collaborate with NGOs and private institutions, with the administration's function being solely informative. An important initiative is the "Strategy for Physical Activity Promoting Health" which includes around 40 projects from various ministries (MSAH, 2008).
- Iceland. Established its own 2006-2010 action plan with initiatives aimed at promoting a healthier lifestyle in schools. Other national strategies include the strategy "Pedal to Work" to promote active cycling transportation (NOSAI, 2003) or the strategy "Walk to School" (NOSAI, 2007).

The five Nordic countries have monitored the results through surveys and telephone interviews to analyse the nutrition situation and the level of physical activity carried out. The first study, carried out in autumn 2011, assessed nearly 9000 adults and 2500 children with simple questions about diet and how often they engaged in physical activities. The results obtained in the different countries are not comparable given that they were based on different situations and the objectives and plans were prior to the 2004 recommendations. However, in general terms, the results show an improvement with regard to the amount of physical activity carried out by the population compared with the situation at the beginning (NCM, 2012).

In October 2013 the results obtained until now were published and new recommendations were issued. In the case of physical activity, the recommendations issued did not vary with regard to those established in 2004 (NCM, 2012).

## **6.5 United Kingdom**

The recommendations of the United Kingdom's programme "At Least 5 a Week" (Table 21) include 30 minutes of moderate-intensity activity during at least 5 days per week for the adult and elderly population and 60 minutes of moderate-intensity physical activity during at least 5 days a week for children and youngsters in intervals of no less than 10 minutes until the recommended time is completed. For the majority of the population 45-60 minutes of moderate-intensity physical activity is necessary to prevent obesity (Department of Health, 2004).

The report by the Department of Health in the United Kingdom in 2004 established that the recommended physical activity for adults was only met by 35 % of men and 24 % of women. The National Nutrition and Diet Study of 2004 (Ruston et al., 2004) and the Low Income Diet and Nutrition Survey (Nelson et al., 2007) showed significant differences between the amount of physical activity carried out by ethnic groups in the United Kingdom and low income groups and middle and upper income groups, with the latter two groups engaging in more physical activity. Therefore, lack of physical activity can be linked to unemployment and low incomes.

The British Health Study, carried out annually and which includes estimates on the level of physical activity carried out by the population via telephone surveys, indicates that the variety of studies carried

out in the United Kingdom makes it hard to obtain quantitative estimates with regard to physical activity carried out. However, based on the number of studies carried out, it has been established that during the 1997-2004 period, the level of physical activity carried out by adults in the United Kingdom has risen while the amount of PA among children has remained stable and even dropped, mainly as a result of a reduction in active transportation and hours dedicated to PA in schools (BNF, 2007).

The National Institute for Clinical Excellence (NICE) regularly publishes action guides to promote physical activity aimed at different groups. In 2006 it issued a Guide for the promotion of physical activity among adults (NICE, 2006), in 2009 it established a Guide for the promotion of physical activity among children and young people (NICE, 2009) and in 2010 the Guide for the prevention of cardiovascular disease (NICE, 2010).

However, the NICE regularly publishes a large number of detailed guides and regular results on the different methods of promoting physical activity (NICE, 2013).

## 6.6 United States of America

The American College of Sports Medicine (ACSM) and the American Heart Association (AHA) began issuing public recommendations based on data, concerning levels of physical activity carried out, obtained since the 1970s. From then on, government initiatives such as the "Healthy People Report: Comprehensive general report on health promotion and disease prevention" (HHS, 1979) were developed and subsequently the "Comprehensive general report on physical activity and health" (HHS, 1996).

The United States Department of Health and Social Services, based on the recommendations of the ACSM, started issuing general recommendations (ACSM, 1990). Thus, in 1990, it issued the "Healthy People Report 2000: national health promotion and objectives for disease prevention" (HHS, 2000). This established a strategy to improve the health of the North American population over a decade (1990-2000 Plan) and established three general targets: "increase the lifespan of the population maintaining health", "reduce health disparities" and "access to health prevention services". In the 1990-2000 Plan, physical activity was considered to be high priority with a number of different objectives being carried out, differentiated according to age or population group. These were carried out thanks to a total of 376 targets grouped into 22 priority areas that are reviewed on a regular basis in order to analyse and modify the objectives in subsequent programmes.

With regard to the results of the 1990-2000 Plan, more than half the targets concerning physical activity were reached or showed improvements, with only four exceptional cases that did not reach the target (HHS, 2000).

The following 2001-2010 Plan (HHS, 2000) had a similar structure to that of the previous decade and, with regard to the content, the number of targets increased and some changes were made. Four sections were defined in the priority area of physical activity: 1) physical activity among adults; 2) muscle strength-resistance and flexibility; 3) physical activity among children and adolescents; and 4) access to physical activity. The physical activity standards for children and adolescents were now classed as extremely important, as well as physical activity in schools. A new objective was included aimed at limiting the use of television, particularly for children and adolescents. The objective related to

advice acquired a new level as it was merged with other objectives related to access to health services. Education, with regard to physical activity, became top priority.

With regard to the results of the 2001-2010 Plan (HHS, 2010a), it should be pointed out that none of the objectives established in the area of physical activity were reached, although progress was made in the majority of them (regressions were seen in four of them).

The results from the 2001-2010 Plan led to modifications in the new 2011-2020 Plan. The differences with regard to physical activity between the 2010 objectives and those of 2020 are summarised below.

The new report increased the number of physical activity objectives with regard to the previous plan. Some of them were already included in the previous plan, in particular those concerning physical inactivity during discretionary time, the requirements of physical education, the involvement in physical education in schools and access to school facilities for physical activities

The objectives concerning physical activity and strength exercises among adults and adolescents were modified to include the federal recommendations for physical activity of 2008 (US, 2008).

The objectives concerning physical activity programmes in the workplace, walking or cycling as means of transport, were changed to "under development"<sup>1</sup> due to the lack of initial data.

Objectives concerning flexibility and the calculation of physical education in schools were archived through a variation in the PA recommendations and due to a lack of national data sources, respectively.

The objective concerning medical assistance in physical activity was modified to include two objectives concerning assistance in physical activity and education related to exercise.

A high number of objectives concerning PA programmes were added for adolescents and children, playground times, physical education in institutes and schools as well as in nursery centres.

The objective concerning time employed watching television was extended with seven new objectives related to other types of activities in front of screens such as computers, videos and computer games among children and adolescents under the age of 17 years.

Lastly, it included new objectives concerning the environment and measures for monitoring policies that enable access and availability of opportunities related to physical activity.

The objectives of the 2011-2020 plan concerning physical activity can be included in the following areas (HHS, 2010b):

- a) Percentage of population engaging in physical activity:
  - Reduce the percentage of adults that do not engage in physical activity during their spare time from 36.2 % to 32.6 %.
  - Increase the percentage of adults that meet the federal guides on physical activity, for aerobic physical activity and for muscle strengthening activities. Therefore, the intention is to increase the percentage of population engaging in moderate-intensity physical activity for 150 minutes/week or high-intensity activity for 75 minutes/week from 43.5 % to 47.9 % and to increase the percentage of population engaging in moderate-intensity physical activity during 300 minutes/week or high-intensity activity during 150 minutes/week from 28.4 % to 47.9 %.

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<sup>1</sup>An objective is called "under development" when there is not sufficient initial data while being developed but it is a source for collecting future data. When the initial data are obtained, the objective will no longer be "under development" and will become a measurable objective.

Furthermore, it intends to increase the population that engages in muscle improvement activities two or more times per week from 21.9 % to 24.1 % and the percentage of adults that meets the aerobic physical activity objectives and muscle improvement activities from 18.2 % to 20.1 %.

With regard to the adolescent population the intention is:

- To increase the percentage of adolescents taking part in physical education in schools from 33.3 % to 36.6 %.
- To increase the percentage of adolescents that meet the federal guides on physical activity, for aerobic physical activity and for muscle strengthening activities.

It therefore wants to increase the percentage of adolescents that meet the federal guides on aerobic physical activity from 18.4 % to 20.2 %, those that meet the federal guides on muscle strengthening activities and those that meet the federal guides on physical activity for both aerobic physical activity and muscle strengthening activities (the latter two objectives are still under development).

b) Education/training in relation to physical activity. With regard to school education, it aims to:

- To increase the percentage of schools and institutes, both public and private that establish daily physical activity among the educational activities. It establishes it at 3.8 to 4.2 % in Primary Education, 7.8 to 8.6 % in Secondary Education and in pre-university education from 2.1 to 2.3 %.
- To increase the break time in elementary schools by increasing the number of States that have breaks (from 7 to 17 States) and to increase the percentage of school districts with regular breaks in their schools from 57.1 % of districts to 62.8 %. Furthermore, it intends to increase the percentage of school districts that have or recommend a rest or break for an appropriate length of time from 61.5 % of the districts to 67.7 %.
- To increase the percentage of visits to medical centres that include advice or education related to physical activity. Therefore, the objective establishes an increase in the percentage of medical centres visited by patients diagnosed with heart diseases, diabetes or hyperlipidemia that include advice or education related to exercise from 13 to 14.3 % and an increase in the percentage of medical visits by all types of children and adults that involve advice on exercise from 7.9 to 8.7 %.

c) Time in front of a screen. It intends to increase the percentage of children and adolescents that do not exceed the recommended limits of time in front of a screen, particularly so that children between the ages of 0 and 2 years do not watch television or videos for 1 day a week, so that 2 to 18 year olds do not to watch more than 2 hours of television or similar screens per day.

This second group of 2-18 year olds, three subgroups are established, 2 to 5 years (aims to increase the 75.6 % that do not do so to 83.2 %), from 6 to 14 years (to increase the 78.9 % that do not do so to 86.8 %) and 15 to 18 years (increase the 67.2 % that do not do so to 73.9 %).

This strategy intends to increase the percentage of children aged between 2 to 18 years that do not use a computer or play video games outside of school for more than 2 hours per day, segmenting them again into population groups. Therefore the aim is to increase the percentage of

children aged between 2 and 5 years (the target percentage has not been set yet), children aged between 6 to 14 years (from 93.3 % to 100 %) and children aged between 15 to 18 years (from 75.1 % to 82.6 %).

- d) Legal measures. It intends to increase the number of States that have licences for governing physical education in nurseries. It therefore wants to increase the number of States with licences for nursery schools that involve physical activity programmes aimed at gross motor skills and the larger groups of muscles from 25 States that already do so, to 35, that involve moderate and high-intensity physical activity from 3 to 13 States and that involve more minutes of daily physical activity in relation to the time spent in the nursery from 1 State that currently meets this objective to 11.

From an urban point of view, it wants to establish urban policies that improve access and availability of opportunities to engage in physical activity. It has therefore established a higher number of local and district political measures to improve access and availability of opportunities for engaging in physical activity (objective under development). Likewise, it wants to increase the number of transport and mobility policies that improve access and the availability of opportunities for engaging in physical activity (objectives under development).

- e) Environmental factors. It includes objectives aimed at increasing the percentage of public and private schools that provide access to areas intended for physical activity and facilities for all types of people outside of class hours from 28.8 % of institutions to 31.7 %.

In the workplace, it aims to increase the percentage of adult employees that have access and take part in exercise programmes and that make use of the facilities intended for exercise in the workplace (objective under development).

For transportation it aims to obtain and increase the percentage of the walking population. Differences are established according to age, it aims to increase the percentage of adults of 18 years and over that walk one mile or less and to increase the percentage of children aged between 5 and 15 years that walk one mile (both under development).

With regard to cycling, it aims to increase the percentage of cycling trips covering distances of up to 8 km (5 miles or less) by adults (over 18 years) and the percentage of cycling trips covering distances of 3.2 km (2 miles or less) by children aged between 5 and 15 years (under development).

The current recommendations concerning physical activity issued by the American College of Sports Medicine together with the Centres for Disease Control and Prevention are (ACSM, 2011) (CDC, 2011):

- Adults (ACSM):

- Engaging in moderate-intensity cardiorespiratory physical activity during  $\geq 30$  minutes/day and  $\geq 5$  days a week (total  $\geq 150$  per week). For additional benefits increase to 300 minutes per week.
- Engaging in vigorous-intensity cardiorespiratory exercise during  $\geq 20$  minutes/day and  $\geq 3$  days

per week or a combination of moderate and high-intensity physical activity until an energy expenditure of  $\geq 500\text{-}1000 \text{ MET.min}^2$  per week is achieved ( $\geq 75$  minutes of exercise per week). For additional benefits increase to 150 minutes per week.

- Carrying out resistance exercises 2-3 days a week for each large muscle group and neuromotor exercises that involve balance, agility and coordination. It is essential to complete a series of flexibility exercises for 60 seconds for each of the tendons of the large muscle groups during 2 or more days per week in order to maintain joint movement.
- Children and adolescents (CDC):
  - Engaging in physical activity for  $\geq 60$  per day.
  - Aerobic physical activity. Most of the  $\geq 60$  minutes/day should be moderate-intensity physical activity but must include vigorous-intensity physical activity at least three times a week.
  - Muscle strength. As part of the  $\geq 60$  minutes/day physical activity, children and adolescents should include muscle toning exercises at least three times a week.
  - Bone-strengthening. As part of the  $\geq 60$  minutes/day physical activity, children and adolescents should include bone-strengthening exercises at least three times a week.

## 6.7 Spain

Our country, as some others of the Mediterranean region, has a high level of sedentary lifestyle, with 44 % among the adult population and 18 % among 18 year olds (AECOSAN, 2013). Together with these values, there is a high percentage of excess weight and obesity among adults (54 %) (17 % obesity) and among children (28 %) (aged between 2 and 17 years) (ENSE, 2011/2012).

The Spanish Federation of Sports Medicine, in a Consensus Document, issued the following recommendations (FEMEDE, 2008).

With regard to exercise in children and adolescents, it should be carried out for at least 60 minutes per day (moderate to intense physical activity most days) in order to maintain good health, fitness and to maintain a healthy weight during growth. Even 30 minutes of low or moderate-intensity each day (climbing stairs) can be beneficial. The objective of 60 minutes of physical activity can be met by accumulating activities in sessions throughout the day.

This same document indicates that it does not matter if performed physical activities are of short duration or low intensity when they are done daily. This may reflect more natural models of physical activity in children such as: walking or riding a bicycle to school, games during break time at school vs. scheduled activities such as physical education and sports. Furthermore, it insists on the fact that parents need to limit “screen” time (television, videogames, computers...) to less than 2 hours per day and to replace sedentary activities with others that require been physically active.

However, data from the study on “Sports Habits among Students in Spain” from 2011 reflects the following situation (CSD, 2011):

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<sup>2</sup>MET.min is a measurement for establishing the energy cost of the physical activity equivalent to 1 kcal/(kg x min) with kcal being: kilocalories, kg: kilogrammes and min: minutes.

- Four out of ten students (43 %) follow the experts' recommendations of 1 hour per day of physical-sports activities, while 35 % are sedentary.
- There is a decrease in physical-sports activities in 12 year-boys and girls.
- The lowest physical-sports activity figures are for girls born abroad.

Spain has implemented a number of initiatives related to the promotion of physical exercise, supported by central and regional governments and science institutes and societies, among others. Also, the decentralisation in terms of health enables regional communities to develop their own policies for promoting physical activity, implementing programmes and editing guides and plans.

One example of this is the Integrated Plan for Physical Activity and Sports which was implemented in November 2010 (CSD, 2010). The aim is to promote universal access to quality sports for the entire population, promoted by the Superior Sports Council, in close collaboration with regional communities, local entities, universities and other ministerial organisations, together with the essential involvement of the private sector.

This plan specifies the practicing sports and physical activity goals that Spain should achieve at the end of 2020. We listed here some items that could be integrated in a public health prevention strategy:

- To increase sport participation in the general population till 50 %, based on the current figure of 39.9 % for people over 15 years (Sporting habits survey for Spaniards 2010).
- To diminish the difference between men and women in practicing sports from 17.9% to 5-8 %.
- To reduce the sedentary population percentage (50 %) to a level of around 35% in the whole population.
- To achieve a 30% of over 65 year-subjects engaging in sports and physical activity, being the current level of 18.8 %.

In children and adolescents, a crucial objective is to achieve a level of sports participation among the school age population of 1 hour per day, 3 to 5 times per week.

Also, the different promotion strategies for physical activity carried out by autonomous communities must also be taken into account. Chodzko-Zajko et al. (2012) have analysed some of these initiatives implemented by health ministries. 55 documents were found –available on the respective websites– of which: 14 are programmes, 25 guides and 16 plans. They analysed their conformity to the WHO and Europe's international recommendations on physical activity and they came across the following strengths:

- 84 % of the autonomous communities carry out some form of recommendations concerning physical activity.
- The recommended times to spend doing a physical activity range between 10 and 60 minutes per day and nearly one third of the documents recommends 30 minutes per day.

And among the weaknesses:

- Only seven documents recommend that the periods spent doing a physical activity should have a

minimum duration of 10 minutes, despite being one of the most cited recommendations in guides on physical activity.

- Muscle strengthening physical exercise does not appear very often in the documents analysed, despite being essential among all the population groups: It benefits muscle and bone development, prevents osteoporosis and sarcopenia and it is vital in order to maintain good health.
- If we take into account the different age groups, the results suggest that the children/adolescent population and the elderly have been neglected. 50 % of the autonomous communities do not have documents aimed at the children/adolescent population. There is very little information aimed at the elderly.

According to this analysis, the main improvement points include adjusting the recommendations to bring them into line with those of the WHO for the target population and to include muscle strengthening periods and activities. Also, according to our authors, a general framework still needs to be established in Spain that includes general guidelines on the characteristics of physical activity that each segment of the population needs to carry out in order stay healthy during the different stages of life: (childhood and adolescence, adulthood and advanced adulthood) and which can serve as a guide for the strategies implemented in the autonomous communities.

## 6.8 List of nutritional objectives and recommendations

Table 21 presents a summary of the recommendations established by different bodies/countries with regard to physical activity.



**Table 21.** Summary of the recommendations established by different bodies/countries with regard to physical activity (PA) and sedentary lifestyles in different population groups according to age

Age group	5-17 years	18-65 years	Over 65 years	Other characteristics
World Health Organization (2010)	<ul style="list-style-type: none"> <li>At least 60 minutes/day of moderate or vigorous PA</li> <li>Most of the daily physical activity should be aerobic Vigorous-intensity activities should be incorporated, including those that strengthen muscle and bone, at least three times per week</li> </ul>	<ul style="list-style-type: none"> <li>At least 150 minutes of moderate-intensity aerobic physical activity throughout the week or 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity</li> <li>Aerobic activity should be performed in bouts of at least 10 minutes duration</li> <li>At least 300 minutes of moderate-intensity aerobic physical activity throughout the week or 150 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity</li> <li>Muscle-strengthening activities should be done involving major muscle groups on two or more times per week</li> </ul>	<ul style="list-style-type: none"> <li>The same as the 18 to 65 year age group</li> <li>Older adults, with poor mobility, should perform physical activity to enhance balance and prevent falls on 3 or more days per week</li> <li>When older adults cannot do the recommended amounts of physical activity due to health conditions, they should be as physically active as their abilities and conditions allow</li> </ul>	-
European Union (2010)	<ul style="list-style-type: none"> <li>At least 60 minutes/day of moderate or vigorous PA in sessions of at least 10 minutes</li> <li>Exercises according to age (movement, strength, balance, flexibility, motor development)</li> </ul>	<ul style="list-style-type: none"> <li>30 minutes 5 days/week of moderate PA or 20 minutes of vigorous PA 3 days/week</li> <li>The complete dose may be accumulated in bouts of at least 10 minutes duration</li> <li>Exercises to increase strength and resistance should be carried out two or more times per week</li> </ul>	<ul style="list-style-type: none"> <li>The same objectives as for younger adults</li> <li>Strength and balance exercises</li> <li>Routine everyday light activities with a duration of less than 10 minutes</li> </ul>	<ul style="list-style-type: none"> <li>Promote an environment that enables PA to be practiced and limit sedentary behaviours</li> <li>Promote initiatives aimed at developing the practice of PA by developing communication and awareness by health professionals, education and social services</li> <li>Services for promoting PA among the elderly</li> </ul>

**Table 21.** Summary of the recommendations established by different bodies/countries with regard to physical activity (PA) and sedentary lifestyles in different population groups according to age

Age group	5-17 years	18-65 years	Over 65 years	Other characteristics
European Heart Network (EHN, (2011))	-	<ul style="list-style-type: none"> <li>• Minimum objectives: Moderate PA during 150 minutes/week</li> <li>• Moderate PA during 300 minutes/week to prevent excess weight and obesity</li> <li>• Ideal objective: 1 hour per day of moderate PA</li> </ul>	-	-
France (2011)	<ul style="list-style-type: none"> <li>• In 5 years' time for at least 50 % of children aged between 3 and 17 years to engage in vigorous PA three times/week during 60 minute</li> <li>• In 5 years' time to reduce the time dedicated to daily activities in front of a screen by at least 10 % among this population group</li> </ul>	<ul style="list-style-type: none"> <li>• Increase the percentage of men by 20 % and women by 25 % with a high level of PA and by 20 % the population with a moderate level of PA</li> </ul>	-	<ul style="list-style-type: none"> <li>• Promote PA and sports adapted to people with disabilities, socially excluded persons over the age of 50 and those with chronic diseases</li> <li>• Promote an environment that enables PA to be practiced and limit sedentary behaviours</li> <li>• Promote initiatives aimed at developing the practice of PA by developing communication and awareness by health professionals, education and social services</li> </ul>
Nordic countries (2004-2011)	<ul style="list-style-type: none"> <li>• 60 minutes of physical activity per day Varied throughout the day, to promote the development of all aspects related to fitness</li> </ul>	<ul style="list-style-type: none"> <li>• 30 minutes of moderate and or vigorous PA per day with an energy expenditure of 630 kJ, in intervals of at least 10 minutes</li> <li>• Greater amount of moderate or vigorous PA up to 60 minutes/day to prevent weight gain</li> </ul>	-	-

<b>Table 21.</b> Summary of the recommendations established by different bodies/countries with regard to physical activity (PA) and sedentary lifestyles in different population groups according to age				
Age group	5-17 years	18-65 years	Over 65 years	Other characteristics
United Kingdom (2004)	<ul style="list-style-type: none"> <li>• 60 minutes of moderate PA 5 days/week for children and young people in intervals of no less than 10 minutes</li> </ul>	<ul style="list-style-type: none"> <li>• 30 minutes of moderate PA at least 5 days per week among the adult and elderly population.</li> <li>• For most people 45-60 minutes of moderate PA is needed to avoid obesity</li> </ul>	-	-
United States (2011)	<ul style="list-style-type: none"> <li>• Increase the percentage of children and adolescents that do not exceed the recommended limits of time in from of a screen, particularly among children aged between 0 to 2 years to ensure they do not watch television or videos during 1 day a week and that those of 2 to 18 years do not look at screens for more than 2 hours per day</li> </ul>	<ul style="list-style-type: none"> <li>• Increase the number of people engaging in moderate PA during 150 minutes/week or vigorous PA during 75 minutes/week from 43.5 % to 47.9 % and increase the number of people engaging in moderate PA 300 minutes/week or vigorous PA during 150 minutes/week from 28.4 % to 47.9 %</li> <li>• Reduce the percentage of adults that do not engage in physical activity during their spare time from 36.2 % to 32.6 %</li> </ul>	-	-

**Table 21.** Summary of the recommendations established by different bodies/countries with regard to physical activity (PA) and sedentary lifestyles in different population groups according to age

Age group	5-17 years	18-65 years	Over 65 years	Other characteristics
Spain	<p>The Spanish Federation of Sports Medicine (2008):</p> <ul style="list-style-type: none"> <li>• Moderate to intense PA at least 60 minutes/day in various sessions</li> <li>• Limit "screen" time to less than 2 hours per day and replace sedentary activities with others that require greater movement.</li> </ul> <p>Integrated Plan for PA and Sport (Superior Sports Council, 2010):</p> <ul style="list-style-type: none"> <li>• Among children and adolescents, the vital objective is to achieve a level of sports participation among the school age population of 1 hour per day, 3 to 5 times per week</li> </ul>	<p>Integrated Plan for PA and Sport (Superior Sports Council, 2010):</p> <ul style="list-style-type: none"> <li>• Increase the general participation in sport to 50 %</li> <li>• Reduce the difference between men and women that practice sports from 17.9 percentage points as it currently stands to percentages between 8 % and 5 %</li> <li>• Reduce the sedentary population percentage (50 %) to a level of around 35 % for the entire population</li> <li>• Achieve a percentage of people engaging in sports and physical activity of 30 % for people over the age of 65 years, which is a considerable increase from the current level of 18.8 %</li> </ul>	-	-

## 6.9 Comments

There is no doubt that, as indicated by the recommendations of some countries, if the population is to be physically active, the direct route is for the population to engage in sports activities suited to their age and situation. Hence some of the programmes have specific chapters aimed at specific groups such as school children, young people, people over the age of 65 years, pregnant women, disabled people or socially excluded people, etc.

Another important aspect of the plans and programmes of other countries is that they are based on real figures obtained through quality surveys and studies and they establish measurable objectives, which is extremely effective. In our country we also have to take into account the north-south gradient, in which the percentage of physically active people decreases.

There can be no doubt that the strategy for achieving greater physical activity in society as a whole, should be holistic and should involve politicians, administrations, educators, health professionals, companies, the media, in other words, a larger range of professionals.

## 6.10 Recommendations on physical activity

Given that there is enough scientific evidence to recommend more health enhancing physical activity among the entire Spanish population and in accordance with the European framework (Recommendation of the Council of the European Union) (26 November de 2013)), we can suggest the following:

1. National strategies need to be established and multi-sectoral measures aimed at promoting health enhancing physical activity in accordance with national legislation and practices; i.e., there should be a national recommendation on health enhancing physical activity.
2. The programmes or action plans to meet the WHO minimum recommendation concerning health enhancing physical activity should share the objective of increasing:
  - The percentage of adults that engage in at least 150 minutes of moderate-intensity physical activity per week or 75 minutes of high-intensity physical activity, or an equivalent combination.
  - The percentage of children and adolescents that engage in at least 60 minutes of moderate to high-intensity physical activity each day or at least five days a week.
3. National reference centres need to be designated for health enhancing physical activity, pursuant to national legislation and practices. These centres shall be responsible for specifically coordinating the process of making the data on physical activity available for the monitoring framework; these data shall be included in the WHO European database for nutrition, obesity and physical activity; and they shall also enable cooperation between services in relation to HEPA policies.

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