Historical overview of diet assessment and food consumption surveys in Spain: assessment methods and applications

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Abstract

The food consumption assessment methods are used in nutrition and health population surveys and are the basis for the development of guidelines, nutritional recommendations and health plans. The study of these issues is one of the major tasks of the research and health policy in developed countries.

Major advances nationally in this area have been made since 1940, both in the reliability of the data and in the standardization of studies, which is a necessary condition to compare changes over time.

In this article the history and application of different dietary surveys, dietary history and food frequency records are analyzed.

Besides information from surveys conducted at a national level, the main data currently available for public health planning in nutrition comes from nutritional analysis of household budget surveys and food balance sheets, based on data provided by the Ministry of Agriculture.

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Resumen

Los métodos de valoración del consumo de alimentos, son utilizados para evaluar la salud nutricional de la población y sirven de base para la elaboración de guías, recomendaciones nutricionales y planes de salud, y el estudio de estos temas constituye una de las grandes tareas de la investigación y de las políticas sanitarias en los países desarrollados.

Los principales avances en este área en nuestro país se han realizado a partir de 1940, avanzándose tanto en la fiabilidad de los datos, como en la estandarización de los estudios, lo que es una condición necesaria para poder comparar los cambios ocurridos a lo largo del tiempo.

En este artículo se analizan la historia y aplicación de las diferentes encuestas dietéticas, de la historia dietética y de los Registros de frecuencia de alimentos.

Además de la información procedente de algunas encuestas realizadas a nivel nacional, los principales datos de que disponemos actualmente para planificación en salud publica Nutricional, proceden de la explotación nutricional de las encuestas de presupuestos familiares y de las hojas de balance alimentario, basadas en datos proporcionados por el Ministerio de Agricultura.

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Eating is a primary need for humans and assessment of food consumption and diet both individually and collectively, has raised interest for a long time.

Initially the study of diet focused on the distinction between foods that favored survival and those who were harmful to health or poisonous, experiences based on trial and error. The empirical knowledge acquired at the high cost of many lives among our ancestors has been incorporated and passed down from generation to generation as a valuable knowledge in the cultural heritage of civilizations.

The study of diet, not only to survive but to maintain good health, came later. Etymologically the word “diet” comes from the Greek DAYTA, meaning ‘way of life’. It is accepted as a synonymous to diet, which refers to ‘set and amounts of foods or food mixtures commonly consumed’. It can also mean food choices made by healthy, ill or convalescing people, in certain circumstances, in eating, drinking and sleeping.

Information about diet is available before writing appeared. However it was not until the last 200 years when major developments took place in food consumption assessment, applying the scientific method. Nowadays the study of these issues is one of the major tasks of research and health policies in developed countries.

This article reviews the attempts to study food consumption from its initial steps to date. We have also reviewed the use of the methods and techniques in major Public Health interventions.

Ancient Times

For millions of years humanity fed on what people could find around, without any scientific knowledge about food, the first aim of feeding for humans was to satisfy hunger. Survival of human groups was conditioned by access to food.

The original habitats of our ancestors mainly consisted of forests and wood areas in a tropical-like climate. Dental morphology analysis shows that the feeding of primates 12 million years ago was particularly frugivorous, including fresh and dried fruits, leaves, stems, seeds, etc. The subsequent climate changes on our planet changed the landscape and food distribution which in turn, conditioned the evolution of species. With the settlement and the emergence of the first civilizations, human left behind nomadic hunter-gathering and gave way to a diet based on foods produced.

Probably the first dietary experiment, with documented evidence, is described in the Biblical story of Daniel, which took place 600 years a.C. when David rejected a diet based on delicate viands and wine offered by King Nebuchadnezzar of Babylon. In return, David managed to persuade the cook to feed himself and his colleagues with a diet rich in legumes and change the wine for water during ten days. After these ten days, they saw the satisfying appearance of these young people and were allowed to continue on the same diet. Even three years later, the king himself noticed that they were ten times better than all the magicians and enchanters in his kingdom. Perhaps this was the beginning of the assessment of “Scientific” truths, although at that time knowledge was scarce and confusing: trust in magic began to decrease.

Primitive humans had guidance only based on self-experience and therefore it should not be surprising that many misconceptions prevailed. Traditional beliefs gave illness a divine character as a “punishment from the gods”. Hippocrates (460 years a.C.) was the first person who firmly confronted these superstitions. He offered a rational view, relating the development of medicine with the development of nutrition; he believed that diseases were the result of vital habits, food and the environment. However, although Greeks and Romans considered appropriate to use diet in the treatment of diseases, they didn’t know exactly which foods were useful or why. But at that time we have knowledge of one of the first data on food consumption in the population. At the time of the Republic of Ancient Rome, trade of basic foods like wheat, was controlled with known prices regulation and quantities stored in their warehouses, or consumed by the population.

The period since the fall of the Roman Empire (year 476 a.C.) until the Middle Ages was the period of the spread of Christianity, and not much attention to medicine or science was given.

The experimental method

To our knowledge, Hippocrates was the first one who modified the old concepts related to food; but it was not until the beginning of the Christian Age the experimental method was developed. Galen, a Greek physician (130 a 200 d. C) learned from animal experiments and dissections in human cadavers that food is fragmented into particles small enough to be absorbed in the stomach. He revealed the functions of kidney and bladder and demonstrated that arteries carry blood, ending the common understanding at the time that they carried air. He gave a powerful impetus to the experimental method as a necessary element in the study of medicine. However, over the next ten centuries after his death little progress was made in this field and his writings were considered as the last word on the matter for almost 1200 years.

Sanctorius (1561 -1636), Italian physician, recorded his own weight, all food he ate and all products of excretion from his own body for several weeks. He was probably the first one who began the study of human nutrition and his book published in Leipzig in 1614 can be considered the first one on the study of human basal metabolism.

Since then, new progress in medicine came; William Harvey (1578 – 1657) showed blood circulation; the
French René Réamur (1683 -1757) showed digestion as a chemical process and the existence of acid in the gastric juice, the Russian Pedro Iván Pavlow (1849-1936), published his work ‘Lectures on the Work of the Digestive Glands’. Chemistry made big progress during the XIX Century. Gastric juice was identified as hydrochloric acid, and also the presence of another agent responsible for the dissolution of food, the pepsin enzyme (1835).

Another remarkable advance in the world of nutrition was the discovery of metabolism. In the 18th century, Antoine Lavoisier was the first one to measure metabolism in humans. His work was continued by scientists like Liebig, Voit and Rubner. Lavoisier showed that in science it is essential to measure weights and all measures accurately. His experiments provided the basis for understanding the metabolic processes occurring in the human body and thereafter he was assigned the title of ‘Father of Nutrition’.

In the early nineteenth century three kinds of food materials were known: saccharides, oilseeds and albumin. The same elements later called carbohydrates, fats and protein. In the mid-nineteenth century, a more critical view study started and also research on how they were formed in the body, where they came from and whether they were or were not necessary in the diet.

The study on minerals (iron, calcium and phosphorus) began, as well as vitamins, whose history is probably the longest, even though it was the last group of nutrients studied.

Current time

Currently the health of populations is addressed through a new approach, it is Nutrition in Public Health, and nowadays is one of the major tasks of research and health policy in developed countries and it will probably continue to do so over the coming decades.

During the first two or three decades of the last century, the deficit and infectious diseases were the leading cause of mortality, but in the middle of the twentieth century chronic diseases took over. From this moment, diet had a role in maintaining health and reducing the risk of chronic diseases, such as heart disease and cancer, which formed the basis of most of the research being carried out. Subsequently diet was reaffirmed through clinical epidemiology and laboratory as one of the most important factors involved in the etiology of these diseases.

Dietary assessment methods are key tools to inform this area, among other dietary surveys, diet history and food frequency questionnaires.

Dietary surveys

They were first used in the 1930s, in studies aimed to describe the nutritional status of populations.

The “24 hours recall “ method was mentioned by Burke in 1938, presenting it as a basic method to teach mothers to collect dietary intake of their children. But since the results were not calculated in terms of energy and nutrients, Wiehl has often been cited as the first researcher who used this method in a study of dietary deficiencies among industrial workers in 1942. It has been one of the most common methods in national studies, among others countries like Canada, USA (NHANES I, II, III), Spain, Mexico and South and Central American countries.

Diet History

Diet history was first used in 1947 by Burke et al., to measure the usual intake. The technique was structured in 3 parts: 1. Interview about the usual pattern of intake of the individual respondent, estimating quantities by household measures. 2. A questionnaire on a detailed list of foods to clarify the overall pattern of intake and verify the information obtained in the first part (cross-check) and 3.- 3 days food record with estimates of portions consumed.

Food Frequency Questionnaires.

Wiehl developed in 1960 a short questionnaire for qualitative classification of dietary habits. The diet records used by Heady were intended to show that the frequency of food consumed was greater than the total weights of the same foods. It was based on a self-administered questionnaire strictly based on the frequency of food consumption.

Stephanik and Trulson found in 1963 that a food frequency questionnaire discriminated between groups defined by ethnicity, but it was not considered useful to calculate nutrient intake. Also in 1963, JH Abramson studied the limitations and possible uses of food frequency questionnaires concluding that “its use in epidemiological studies is useful as a simple and inexpensive tool, although not very accurate”. Marr in 1971 -1973 proposed various methods for assessing the intake.

In 1985, Walter Willett developed a food frequency questionnaire known as the “Harvard FFQ” that includes information on portion sizes as part of the description of the food, rather than a separate list.

Currently, there are new designs for food frequency questionnaires that address specific population groups, such as children or elderly. There are also questionnaires focused on the characterization of food or nutrients, such as calcium or zinc.

The need for further research and improve the methodology of individual questionnaires for the assessment of dietary intake deserves a renewed effort and maximum impetus.
Situation in Spain

Currently the main sources of information on food consumption in our country come from both knowledge of food availability, based on food balance sheets (FBS), and the analysis of nutritional data derived from the household budget surveys (HBS) and other surveys conducted nationwide.

If we make a historical tour from 1900 to date, we can notice how both the reliability of the data, and the standardization of studies have progressed, a necessary condition to compare changes over time. In the evolution of these sources of information, we can clearly distinguish two stages: pre- and post- 1940.

The first stage, from the late nineteenth century until 1940, is characterized by scarcity and poor homogeneity of the information available. Information sources are the Ministry of Agriculture and surveys at provincial or regional level. Some historians like Simpson and Cusso have analyzed these data conducting a retrospective reconstruction of those years.

Among the difficulties they found, the poor reliability of tithing in many areas after the Independence war, and the lack of a register or good information acreage. Production estimates are based on the ‘Censo de Frutos y Manufacturas’ and the Agricultural Advisory Board (JCA).

Among the studies after 1900, highlights that conducted by pharmacist J. Giral “Food supply from a hygienic and social view,” 1914, one of the classics of the nutrition transition in Spain. It is based on documents and works of the extra-parliamentary commission for transforming consumption tax, and provides information on the estimated calorie intake, albumin, carbohydrates and fat as well as the consumption of various food groups in 6 populations with different economic income. The differences, especially in protein for poor families were evident.

Carrasco Cadenas in the Department of Food Hygiene and Nutrition, National School of Health, conducted several studies to determine the average regular diet of Spaniards, from the quantities consumed of each food throughout the country, following methodology recommended by the International Committee of Experts in Geneva and Rome 1932 Committee. With the method of food survey highlights the work of pharmacists Francisco Jiménez and Manuel Jiménez, 1934, conducted in the province of Jaén. They studied 3592 cases in 70 villages, based on the familiar feeding cards following the methodology recommended by the Hygiene committee of the League of Nations. They recorded everyone ordinary food, in quantities of bread, meat, eggs, etc., as well as epidemiological and anthropometric data. Most animal protein intake was constant in middle and upper classes. Higher consumption of fish was observed in working classes, especially salted cod.

During the early years of the 1940s, Francisco Jiménez García and Francisco Grande Covian, from the National Institute of Food Hygiene, published in Spanish Clinical Journal a series of clinical studies about the deficiency diseases in the population of Madrid during the war and the period after the war. We can learn details about this decade through the study of nutrition in Madrid during the Spanish War, 1937 to 1939.

From 1940 onwards, in order to inform about eating habits of the Spanish population over a number of years, the most important contribution is the nutritional analysis of the data from household budget surveys, conducted in a collaboration between the National Institute Statistics and the National Institute of Nutrition for the years 1958, 1964 to 1965, 1980 to 1981 and 1991.

The first standardized data on food availability are the HBA, appearing since 1940 and continue up to date. The Food and Agriculture Organization, United Nations (FAO) and The Organization for Economic Co-operation and Development (OECD) produce these reports from data provided by the Ministry of Agriculture. The FBS provide information about the amount of food that enters the domestic market, available for consumption. The calculation of food availability is a synthesis in which data from numerous statistical sources are integrated.

More recently, Rodriguez Artalejo made the first systematic reconstruction of food and nutritional history of Spain in the last fifty years, re-analyzing data from the Ministry of Agriculture, from 1940 to 1988. These new FBS for Spain also incorporate the sources cited and information from the International Olive Oil Council, the Vertical Olivo Trade Union, the National Association of Fish Powder Producers and the National Wheat Service. The changes occurred especially since the sixties, coinciding with the acceleration of economic development.

Among the surveys from 1940, highlights that by G. Varela, 1961, based on data from the National Statistics Institute (INE). Subsequently nutritional analysis of data derived from household budget surveys (HBS) has provided information of food consumed per person per day in physical quantities of food purchased by households.

Since 1987 the Panel of Food Consumption in Spain was conducted by the Ministry of Agriculture, Food and Environment (MARM, former MAPA). From 1987 until 2005 published yearly, the volume “Food in Spain”.

Subsequently, the Ministry, under the Framework Cooperation Agreement signed with the Spanish Nutrition Foundation (FEN), followed a step further by deciding a more complete nutritional analysis of the data obtained, leading to the volume “Rating Spanish Diet According to the Food Consumption Panel”, from 2000 to 2006. The latest edition of 2012 valued data for the years 2007 and 2008. The figures refer to consumption within households, hotels/restaurants and institutions.

Finally, the ENKID Study can be mentioned among child population surveys conducted.
Applications of food consumption assessment methods.

Food consumption assessment methods are an essential tool in determining food intake in populations. They are useful for assessing and monitoring nutritional health, allowing to observe trends and changes in consumption patterns. This information will serve as a basis for the development of guidelines, recommendations and nutritional health plans and policies for the organization of agricultural prices and food and nutrition. Also, to execute actions for the prevention and control of non-communicable diseases and, sometimes, to regulate the advertising of industrialized foods.

In this section we review some of these basic documents in the field of Public Health, such as Recommendations and Guidelines, the development of Health Plans and actions on the Disease-Related Malnutrition

Recommendations and Guidelines

Documents dating from the 40s to the 60s of 20th century are known and they are the precursors of current dietary guidelines; but not until 1970 guidelines appeared, some of them in a pyramid shape, published by the competent authorities and state agencies in each country. The first one was published in Sweden in 1974. In the United States, the first guidelines were published in 1980 (Food Based Dietary Guidelines) and they are reviewed every five years. In January 2005, some of the foundations of the new pyramid are specified; the latest revision is from 2010 and the next, currently under development, will be published in 2015. Perhaps the best known is the 1992 United States Department of Agriculture version revised and updated in 2005 and called ‘My Pyramid’, where the importance of exercise is reflected and which was later replaced by ‘My Plate’ in 2011.

FAO and WHO during the Rome meeting in 1992, made a statement in which they urged all countries to adopt strategies to promote health through food and make dietary guidelines to guide the population. In 1996 they developed a report describing the methodology for setting standards and proper use of these guidelines based on food consumption.

The Spanish Society of Community Nutrition (SENC) sponsored by the World Health Organization made a document in the shape of a pyramid and pioneer in our country, where the nutritional status of the population is reviewed, nutritional goals are defined and food guidelines for the population are disclosed. The Food Guideline, published in 1992, follows the model promoted by the National Nutrient Database for Standard Reference (USDA), which reflected the latest nutritional science. Until the publication of the new pyramid, the Food Guideline was the only nutrition guide for consumers. In subsequent years a spread work of the food pyramid was made, being used by many institutions and agencies at national, regional and local level and it was included in nutrition publications and textbooks. Later in 2001, following the 4th Congress of the SENC in Bilbao, the 2nd edition of the Dietary Guidelines was published, incorporating recommendations for different population groups and diseases. In 2004 the SENC publishes the “Guideline for Healthy Eating” in collaboration with the “Spanish Agency of Consumer Affairs, Food Security and Nutrition” (AECOSAN).

In addition to the Food Pyramid other graphic resources for nutrition education of the population have been suggested, as the Food Wheel, an educational resource that was widely used in the 70s and 80s promoted in Spain by the EDALNU program of the Ministry of Health and involved health professionals and education professionals. In 2005 the Spanish Society of Diетetics and Food Science (SEDCA) retook this symbol and updated it with the collaboration of the Alfonso X el Sabio University of Madrid and the Madrid regional government.

More recent data on the Spanish diet should be kept in mind when planning future action on Nutrition.

Health Plans

At the International Conference on Nutrition (ICN) held in December 1992, 159 countries unanimously adopted a World Declaration and Plan of Action for Nutrition where the strong commitment of all participating governments was to eliminate hunger and all forms of malnutrition before the end of the twentieth century. The new global statement CIN and Plan of Action for Nutrition, adopts new targets to combat malnutrition by 2000 as nutritional predicting and detecting short-term or acute problems; specify populations groups for short term SOS campaigns; long-term programs development; close monitoring of changes in the situation; to organize programs and evaluate the impact of the interventions and development programs.

In the past few years a comprehensive plan for mother and child, infant and child nutrition has been developed, it was voted and adopted by the 194 member countries of WHO in 2012, during the 65th World Health Assembly. This plan includes six goals related to nutrition to be achieved by 2025. In June 2014 the World Health Organization (WHO) published its proposed Action Plan on Food and Nutrition for the period 2015-2020.

At the last International Conference on Nutrition of FAO in Rome in November 2014 a framework is proposed with 60 objectives to be achieved by 2025 which compliance will be monitored every two years by FAO and WHO. The program advocates, among other challenges, to reduce by 40% the number of children under 5 suffering from stunting, 50% the number of anemias suffered by women in reproductive age and...
by 30% the number of babies born weighing less than healthy\textsuperscript{23}. It also sets as objectives, a 50% increase in rates of breastfeeding in the first six months of life and a 30% decrease in the consumption of salt, sugar, animal fats and trans fats.

As can be seen, the objectives are aimed for people to obtain a correct nutritional status, in situations of abundance and scarcity. Another innovation is the creation of a website as a teaching tool about the proper food intake and dietary guidelines, and trying to unify the messages made by nutritional educators, which sometimes can be confusing\textsuperscript{23, 30}. This nutrition web currently has a collection of dietary guidelines from more than 100 countries, including Spain.

**Disease-Related Malnutrition (DRM)**

All references made so far refer to guidelines or protocols facing the population understood as healthy; but one of the issues that most concern in recent decades is related to the Disease-Related Malnutrition (DRM) because it constitutes a health problem of high prevalence and high costs. It affects about 30 million people in Europe. In this aspect, the Spanish Society of Parenteral and Enteral Nutrition (SENPE) is the one who has taken the initiative and lead the studies on this issue, as being part of the European Society for Clinical Nutrition and Metabolism (ESPEN), endorses the recommendations of the European Nutrition for Health Alliance (ENHA) on Nutritional Risk Assessment in Europe.

Malnutrition is a common problem at all levels of healthcare, from primary to specialized care and also in geriatric care centers. Its incidence in hospitals is 40% and in nursing homes exceeds 60%. Malnutrition increases morbidity, mortality, hospital admissions and length of stay. These high numbers logically imply an increased use of health care resources. According to (ENHA) in Europe there are 20 million people suffering from malnutrition. This is a universal problem, which was recognized by the European Council in 2003.

The +Nutridos Project is a Strategic Plan, or “Action Plan to Combat Malnutrition in Spain” which includes the following points: Training in nutrition; assessment of disease-related malnutrition; Nutritional therapy in primary care centers, hospitals and nursing homes defining degrees of intervention; nutritional care monitoring and treatment; registration of diagnosed patients with disease-related malnutrition; Evaluation of results in health\textsuperscript{30, 31}. One approach of the project is “to invest in early nutritional care, is investing in health” and at the same time, saving costs.

The 2008-2013 Strategy “Together for Health” raised in the European Parliament urges Member States to develop, together with regional and local authorities, initiatives in the field of education to the population, specific training, research and good clinical practice. The ENHA has promoted the “Optimal Nutritional Care for All” (ONCA), strategy debated in Brussels in 2014 by several delegations of member countries, which takes over from the previous and on which will work from now on.

These strategic lines continue the recommendations proposed by the European Council in the “Resolution on Food and Nutritional Care in Hospitals “, released in 2003 and other initiatives such as the “Prague Declaration” of June 2009.

In 2011 the “Consensus on Multidisciplinary Approach of Malnutrition in Spain’ appeared at the Ministry of Health signed by representatives of more than 35,000 healthcare professionals represented in 22 scientific associations, the Spanish Foundation for Nutrition and The Patient Forum. With all these strategies, they pretend DRM to be a priority of the health system, as similar strategies have been made before for obesity.

The Swedish physician Arvid Wretlind, by 1961 said: “Malnutrition in the villages is a sign of poverty, in hospitals is a sign of ignorance.”

**Conclusions**

Consumption quantification and eating habits has awaken interest from the time of Hippocrates and been related to the individual health.

Since the 30s and 40s of the twentieth century this effort by collecting food consumption data begins to be standardized in the form of questionnaires, in a time when the deficit and infectious diseases were the leading cause of mortality.

With the relief brought about by the chronic diseases from the mid-twentieth century, the methods to evaluate dietary intake take a position better oriented to health maintenance and to reduce the risk of chronic diseases.

Currently, they constitute an essential tool in determining food intake in populations groups. They are useful for assessing and monitoring the nutritional health of the population allowing to observe trends and changes in consumption patterns, this information serves as a basis for the development of guidelines, recommendations and nutritional health plans, and for the organization of agricultural price policies and food and nutrition. They are also useful to measure the prevention and control of no communicable diseases and sometimes regulating propaganda of industrialized food.

However, more research and the improvement of the methodology of individual questionnaires are needed for their faithful applicability to the realities of food consumption.

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