

The production and processing of organic food

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Abstract

Food is not only failing to fulfill its purpose of nourishing and, therefore, of generating health, but also, from more and more broad scientific sectors, it has begun to denounce that food as the cause of modern degenerative diseases (obesity, cardiovascular diseases, cancer, etc.). In addition to the healthy nutrition, there are an increasing sensitivity of public opinion to the negative consequences of agricultural activity on the environment, so that the production of quality food, through respectful techniques is the alternative to obtain food for a sustainable future. Food based on agroecological products, much healthier and with less environmental impact, is an alternative to conventional (industry or chemical) food.

The bromatological value of food is variable and depends on different factors, including production techniques. In addition, the different methods and products used in the post-harvest and processing can be important and decisive in the composition and final quality of the food.

The comparative results show that the nutraceutical quality of organic food is greater, providing nutrients and bioactive substances in sufficient quantities and making a nutritional contribution according to compensated foods in their right quality.

Key words: nutrients, food, agroecology, vitamins, minerals, antioxidant.

1. Introduction

Food is closely linked to the evolution of humanity in its process of civilization. In the exceptional cases where gathering and hunting practices still subsist, eating patterns have not changed or have changed very little. In general, food standards are evolving as the interactions between human beings and the environment where they carry out their activity increase.

As a consequence of the green revolution and the growth of industrialized agriculture, there have been substantial variations in food production systems, processing, storage and consumption. The most drastic differences have occurred in just a few decades, where there have been important changes in food sources, moving from diets rich in fiber and complex carbohydrates formulated based on cereals and legumes, to diets high in animal fats and refined carbohydrates. The data show that one third of the energy provided in the diet of "northern countries" comes from foods of animal origin, observing that while the proportion of calories obtained from plant sources has decreased by 30%, those obtained from animal meat has increased by 33% (1).

During the last 25 years, several studies have consistently established the implication of nutrition in the etiology of several of the main causes of morbidity and mortality, contributing to a greater predisposition to infections and chronic diseases associated with aging, which decreases the quality of life of the human collective. Some social and scientific sectors denounce that modern industrial agriculture and food processing are the cause of the appearance of some of the modern degenerative diseases (obesity, cardiovascular diseases, cancer, etc.). In this way, food can have negative effects due to its influence on the generation of diseases, or positive because they act as preventive. As an example, the intake of high-fat foods seems to have a strong influence on the incidence of diseases (2), while the intake of vegetables rich in antioxidants and fibers tends to reduce the incidence of cancer (3).

The human body is not prepared to metabolize, unfold or eliminate many of the chemicals or heavy metals that are part of the products used in the industrial production of food. Foodborne diseases are one of the most widespread public health problems, with a tendency towards the appearance of new or recently identified pathologies of this nature,

which may be biological or chemical. This has evolved in the synthesis of new drugs to combat the effects generated by food, leaving them to fulfill their healing function against diseases, causing a spiral of nonsense without equal, and where only the same multinationals that produce industrial foods and medicines in the same way to cure what they generate win. The repercussions, apart from on health, are also direct on the economy, since all the well-being that food does not generate is contrasted on the basis of health costs, which far from having an impact on the most local economies, influence the economic, social and environmental budgets of a country.

Faced with the growing pollution caused by the abusive use of synthetic products and other aggressive practices for the agricultural environment, in order to produce food, theoretically, cheap (if the externalities produced are not counted), there is a protection tool that consists of controlling what is consumed, monitoring the origin, the production system, nutritional composition, etc. Knowing what we eat, how it is produced and the impact on the body is important, but it is no less important to know what we inhale and what we absorb through the skin or breath. This can also affect digestion and other metabolic functions. This transition goes through the consumption of organic food, obtained by technological innovation, organizational innovation and changes in consumption patterns, respecting the principles of the global balance of the system, which has as its main objectives to have a series of values such as the commitment to biodiversity, the optimization of resources, the proper care of animals, the respectful extraction of fish, respect for cultural values and social equity, the reduction of economic costs (but not at any price, and taking into account the standard of living of producers), the care of the planet and its inhabitants in short, and the impact of all this on the health and well-being of people.

Among the underlying principles for organic farming, one of them is the principle of health. In a holistic definition of sustainability, supported by the principles of health, ecology, impartiality, equity and care. Under this umbrella of health, reference must be made to the general concept of sustainable food, and in particular organic food, obtained through techniques that respect the landscape and the maintenance of ecosystem services, such as fertile soils and clean water, while ensuring a fair income for producers and consumers, and an equitable distribution of the wealth generated. In addition, agroecological production is characterised by respectful processing and contribution to climate change mitigation and adaptation, as well as increased biodiversity, while producing healthy and high-quality food (4).

In this sense, health must be presented as a broad definition, covering terms such as the health of soils, ecosystems and people, from that perspective of sustainability.

Improving diet, lifestyles and food processing is crucial for the prevention of certain diseases. Food based on organic products, much healthier and with less environmental impact, is an alternative to conventional food, minimizing the impacts on the health of consumers, and physical and biological erosion on ecosystems. Therefore, food must move to the new conception of nutraceutical value.

The term nutraceutical comes from the interception of two terminologies: nutrition and pharmaceutical, that is, a food or part of a food that provides medicinal or health benefits, including the prevention and/or treatment of diseases (5), in addition to its function on basic nutrition. In general, it can be said that nutraceuticals are products of natural origin with active biological properties, beneficial to health and with defined preventive and/or therapeutic capacity.

The characteristics that nutraceutical substances must meet are that they have a natural origin, that the extraction and purification methods are non-denaturing, that they provide temporal stability, that their beneficial effects for health are the improvement of physiological functions, preventive and / or curative action and improvement of quality of life, that provide reproducibility, quality, safety and efficacy, and that the studies where their benefits are tested are reproducible and achievable, and that guarantee non-toxicity.

Nutraceutical substances can be classified according to the properties of biological activity that they present (which is directly related to their chemical structure) in two categories: that of substances that respond to nutrient typing, and that of other substances of different chemical nature.

- Nutrients: Formed by a group of chemical substances that in addition to their ability as a nutrient is assigned some extraordinary benefit on health, this group belongs to some fatty acids constituent of lipids, some vitamins and minerals.
- Other chemical compounds: Forming part of this group are polyphenolic antioxidants such as phenolic acids, anthocyanins or flavonoids, carotenes, dietary fiber, isothiocyanates, phytosterols, phytoestrogens and sulfides among others.

The alarming situation requires innovation and structural change in production models because increasingly, the consumer is demanding when it comes to demanding balanced and healthy food that is produced using techniques that respect the planet and those who inhabit it; Therefore, it is essential to publicize the factors that influence food safety, with the ultimate goal of being able to choose, among the wide variety of foods, those that offer more guarantees of global quality, and thus be able to appreciate the differences between foods produced by ecological techniques and by unsustainable industrial methods.

The main objective of this work is to show a list of studies where nutrient concentrations are presented in organic and conventional foods, in order to evaluate their nutraceutical capacity.

2. Materials and Methods

To meet the objective, the results of nutritional composition have been collected, obtained from research carried out in parallel, under certified organic production systems and conventional production systems, in climatic conditions of the Mediterranean area, controlling the various factors that influence the composition of food (soil type, varieties, irrigation, light hours, etc.), and the productive system being the dependent influential variable on the nutritional composition. The nutritional composition analyses have been carried out according to the official methods for each specific element (6). Where appropriate, data were subjected to analysis of variance, using statistical software Statgraphics® (V16.2.04). The goodness of fit with respect to the experimental values was evaluated with single-factor ANOVA, standard error of estimation and the smallest significant difference of the Fisher test (F-test) and the derived p-value as described by Ott (7). The results are considered significant when $p \leq 0.05$.

Complementary studies are also reported on the evidence of the benefits of organic production that complement the nutritional composition studies, and others that support the benefits at the environmental and social level.

3. Results and Discussion

The quality of a food can be expressed by means of evaluation criteria. In the case of fresh products, and especially in the case of fruits and vegetables, these quality criteria can be concentrated in four distinct groups:

- Internal quality criteria: which include the attributes of taste, smell, texture, and other parameters related to its chemical composition (nutrients and anti-nutritional compounds, unwanted), which have a very direct influence on the organoleptic characteristics.
- Appearance criteria: where the attributes of color, size, shape, presence or absence of defects, and other parameters that influence the external appearance of the food are introduced.
- Technological/commercial criteria: related to packaging attributes, palletizing, useful commercial life, level of rotting at destination, market diseases, etc.

- Social and environmental criteria: linked to the preference towards food from proximity, equity and mutual support, and produced using environmentally friendly techniques.

In the course of the last 25 years the composition of fruits and vegetables has suffered considerable losses in the content of vitamins and minerals ranging from 12% in calcium for bananas, to 87% of vitamin C in strawberries, the main causes of these losses are the impoverishment of soils, the use of certain commercial varieties, the harvesting of food without its proper point of maturity, storage for a long time, transport and the use of chemical treatments (8), almost all related or fruit of the Green Revolution.

Since the industrial green revolution, conventional agriculture based on the use of chemical-synthetic inputs has been proposed as an agricultural practice accepted as a generalized norm. This industrialized agriculture based on the mechanization of labor, the search for productivity and maximum profitability, monocultures and genetically modified organisms requires respectful alternatives, because in recent years global problems linked to the agriculture-food relationship are manifesting, such as scarcity, hunger, malnutrition, insecurity, surplus supply and additional costs, food contamination, in addition to poverty, climate change and the financial crisis (9). Organic farming has become the sustainable alternative to the serious problems of pollution from industrial agriculture, and increasingly obtains greater importance in the world either by the increase in consumption, as by the increase in production areas in the world. However, there is an opposition between the two production systems that has led to long confrontations (10), despite certain positions that seek their integration (11).

The consumption of agroecological foods brings together many of the fundamental aspects that lead consumers to decide on this type of food, such as the concern about the presence of residues of phytosanitary products, antibiotics and / or metabolites of medicines, as well as the desire to contribute and support the existence of sustainable agricultural systems, or the knowledge that organic food can contribute to a better understanding of what is eaten and how it impacts on social improvement, health, safety, nutrition and palatability (12).

In this sense, organic production techniques are favorable for producing foods of high nutritional and organoleptic concentration, in the natural food groups that make up the shopping basket, from the most basic to processed foods (13).

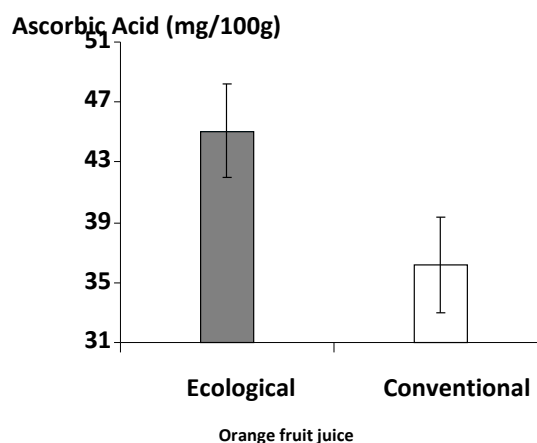
In the case of vitamins: they are essential organic nutrients that do not provide energy to the body, which are required in small amounts in the diet, but which are essential to regulate certain processes of the body, such as growth, reproduction, and maintenance of tissues, they are also necessary to prevent certain symptoms in the body and that it needs as

catalysts for vital processes. The vitamin with the greatest presence and therefore the most studied in fruits and vegetables is vitamin C.

Juice from organic orange fruits contains 20% more vitamin C than juice from conventional fruits (Figure 1) (14, 15). These differences highlight the importance on health, since if the recommended daily dose of vitamin C is estimated at 60 mg, only 135 g of juice from organic orange fruits would be needed to reach the daily dose of this nutrient, which is equivalent to the use of two medium-sized fruits for the preparation of the juice. While with conventional orange fruits it would require more than 162 g of juice to reach the same dose of vitamin, which would raise to a portion of three units of fruit to reach the recommended daily dose, these high amounts of fruit, normal are not consumed, so it would produce deficiency in this nutrient. While with organic fruits, reasonable amounts of the feed provide sufficient doses of vitamin, without the fear of nutritional deficiencies.

According to Mozafar (16), nitrogen fertilizers, especially in high doses, decrease the concentration of vitamin C in various fruits such as citrus fruits, and in vegetables such as potatoes and tomatoes. One of the consequences of the abuse of nitrogen fertilizers in conventional agriculture is the increase in the concentration of nitrate ions in plants, and simultaneously the decrease of ascorbic acid (inhibitor in the formation of carcinogenic nitrous compounds). The balance of nitrogen fertilization is one of the causes of the synthesis of vitamin C is adequate in fruits and vegetables and consequently manifests itself in higher concentration in these foods, as other authors have also shown (17).

Fig. 1. Vitamin C content (mg / 100 g of orange juice) depending on the production system (organic or conventional).



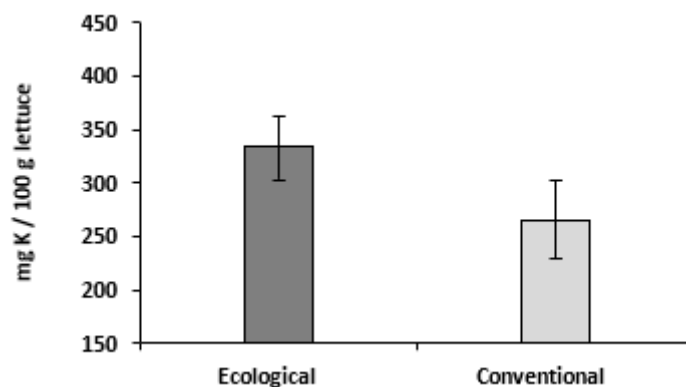
In the case of minerals: they are the inorganic components of food. Like vitamins, they do not provide energy, but they intervene in countless structural and regulatory functions, related to growth and metabolism. Minerals have both plant and animal origin and the bioavailability of

each of them is influenced by interactions with other minerals, vitamins, and other components such as fiber, phylates, oxalates and tannins. These elements of mineral origin are eliminated by the body on a regular basis and therefore, their losses must be replenished through food, they are therefore essential and indispensable nutrients.

They are classified into majority and trace elements, according to the contents necessary in the diet or present in the body. The majority minerals include those whose needs are greater than 100 mg per day or that are present in the body in amounts greater than 0.01% of body weight, such as sodium, potassium, calcium, magnesium, chlorine, sulfur and phosphorus. Trace elements or trace elements are those whose needs are equal to or less than 100 mg per day or that are present in the body in amounts equal to or less than 0.01% of body weight, such as chromium, cobalt, fluorine, copper, iodine, iron, manganese, molybdenum, selenium and zinc.

Organic vegetables have presented higher mineral concentration, such as 25% more potassium in lettuce (figure 2), 14% more calcium in fennel stalks, the iron contents in the bean-grain from conventional cultivation are approximately 6 mg per 100 g, while those of organic production are 7.12 mg, these data show that organic bean grains provide 15.7% more of this trace element (18).

Fig. 2. Potassium content (mg K/100 g of fresh lettuce matter) depending on the production system (organic or conventional).



These results show that the amounts recommended daily in an adult of Fe, Na, K and Ca can be achieved with the consumption of 500 g of fresh organic chard, without affecting apparent risk to health, by not exceeding the acceptable daily intake of nitrates. The same amounts of nutritional elements could be consumed with the intake of approximately 550 g of fresh conventional chard, although with this the number of nitrates consumed would double, appearing health risk (19).

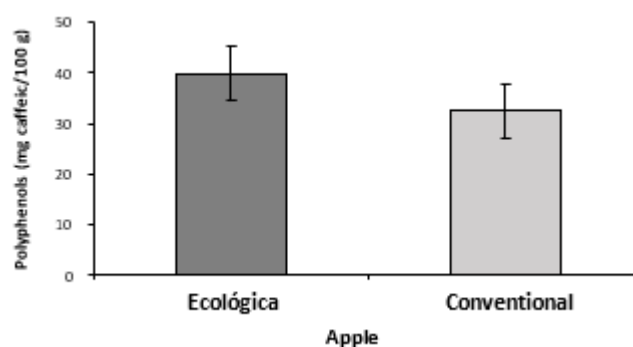
Organic plant foods are produced respecting the balances of the soil, ensuring that in any case, the soil presents an adequate biological

fertility, capable of providing an adequate environment for plant nutrition. This translates into an adequate mineral concentration in the vegetative parts of the plant and therefore in the fraction of food serves, providing plants with a higher content of essential elements for the human diet such as iron and phosphorus. Studies carried out by Rembialkowska (20) corroborate the presence of mineral elements in foods of plant origin.

Vegetables provide almost all of the essential vitamins and minerals, in addition to a significant number of health-promoting phytochemicals, mostly secondary plant metabolites, polyphenolic in nature. Polyphenolic substances have a high complexity and are increasingly interested in their action on degenerative processes such as the delay of aging or the reduction of the risk of contracting different diseases such as cancer, heart disease, hypertension, cataracts, osteoporosis or urinary tract infections, enzyme regulators, detoxifiers, immune system stimulators, regulators of the hormonal system and activity Antibacterial and antiviral drugs have been extensively studied (21). Some of these polyphenolic substances are produced in plants in response to external stress (both biotic and abiotic), such as the presence of pests or fungal disease, cultivar or variety, maturity, light or temperature.

These polyphenolic substances are found in higher concentrations in fruits and vegetables of organic origin, for example, in strawberries (26%), blackberry (40%), apple (15%) (Figure 3), pepper (17%), eggplant or onion (22, 23).

Fig. 3. Concentration in polyphenols (mg of caffeine / 100 mL of apple juice) from fruits of organic and conventional farming.



As a consequence of the greater use of old or local varieties, the respect for the harvests that have as a criterion the optimal moment of maturation and the greater conditions of stress in organic farming, many authors (24, 25, 26, 27, 28, 29) have agreed that foods obtained by organic practices have a higher concentration of phytochemical substances of polyphenolic nature.

4. Conclusions

Changes in well-being depend on changes in habits and consumption; Therefore, if health is related to physical, psychological and social well-being, higher levels of health will be reached based on agroecological production models and the consumption of organic food.

There is an upward trend in the consumption of organic foods due to the greater awareness and knowledge of the nutritional composition of these foods, and the repercussions of their production on health and other values of environmental or social sustainability.

The double attractiveness of the intake of organic foods is due, on the one hand, to the fact that they are foods that are not systematically and voluntarily exposed to toxic substances from biocides and nitrates, used in conventional or industrial agriculture. And on the other hand, because the composition of substances of nutraceutical nature in organic foods is high and more balanced, providing nutrients in the most natural way possible, in sufficient quantities at the recommended doses and making a nutritional contribution according to compensated foods in their right measure.

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