Organic and Conventional Food—Selected Properties †

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Abstract: This paper defines the concept of organic and conventional agriculture and presents the differences in the quality of produced food resulting from the farming system. The test materials were the same groups of food products from certified organic and conventional production. As a result, the dry matter content, water activity and the content of potassium, iron, copper, manganese and lead were compared. The obtained results showed that food from organic farming is characterized by higher dry matter content and lower water activity. Conventional products are characterized by higher content of the examined elements, which is due to, among others, geochemical background, the use of mineral fertilizers, and the development of industry and transport. Ecological management influences the increase in the quality of consumed food by limiting the migration of nutrients and other pollutants to the environment.

Keywords: organic farming; organic food; food contamination; environmental protection

1. Introduction

A consumer who buys a food product has certain expectations about its quality. It is also the final recipient who bears the entire risk of the health consequences connected with food consumption [1]. Therefore, more and more people, out of concern for their health, are introducing products from organic production to their menu. This is based on environmentally safe farming practices, which are characterized by properly selected crop rotation and the use of green and natural fertilizers and compost from their own farm. In the process of plant care, including weeding of crops, mechanical treatments are typically used, which do not require the use of forbidden chemicals [2]. All these treatments affect the sale and consumption of organic food, which is characterized by higher content of vitamins, minerals and other valuable ingredients than products obtained in a conventional way, i.e., one that is aimed at maximizing profit. Conventional farming contributes to environmental contamination, which endangers food quality. Products that come from this type of farm may contain compounds that are harmful to the human body [3]. Due to the growing consumer awareness regarding the quality of food and the state of the environment, research on issues related to food production is being conducted more and more often. It allows for the verification of the positive effects of consumed food products on health and the assessment of the impact of the agricultural production system on the surrounding environment.

2. Materials and Methods

The test materials were the same groups of food products from organic and conventional production (Table 1).
Table 1. The research material.

| Group of Tested Products | Products          |
|-------------------------|------------------|
| Fruits                  | Apples           |
|                         | Bananas          |
| Vegetables              | Potatoes         |
|                         | Cucumbers        |
| Dairy products          | Sour cream 18%   |
|                         | Kefir            |
| Cereal products         | Oatmeal          |
|                         | Millet groats    |

The aforementioned food products were subjected to laboratory analysis and selected physicochemical properties were determined, such as dry matter content using the drying method and water activity using the AquaLab apparatus. After mineralization of the samples, the potassium content was also examined with a flame photometer, along with the amounts of accumulated metals, such as iron, copper, manganese and lead, using atomic absorption spectrometry.

3. Results

Based on the conducted research, there was information on the dry matter content, water activity and the amounts of selected elements in organic and conventional products obtained. (Tables 2 and 3).

Table 2. Dry matter content, water activity and the amount of potassium in selected products.

| Group of Tested Products | Products    | Type of Farm | Dry Matter [%] | Water Activity | K [mg/100 g]  |
|-------------------------|-------------|--------------|----------------|----------------|---------------|
| Fruits                  | Apples      | organic      | 15.8348        | 0.99           | 131.5893      |
|                         |             | conventional | 13.6297        | 0.99           | 186.6578      |
|                         | Bananas     | organic      | 28.1652        | 0.98           | 313.6483      |
|                         |             | conventional | 26.4407        | 0.98           | 412.4088      |
| Vegetables              | Potatoes    | organic      | 21.8190        | 0.99           | 448.7805      |
|                         |             | conventional | 13.9407        | 1.00           | 453.6213      |
|                         | Cucumbers   | organic      | 3.9796         | 0.99           | 137.7304      |
|                         |             | conventional | 2.8897         | 1.00           | 175.3353      |
| Dairy products          | Sour cream 18%| organic     | 24.9912        | 0.99           | 121.6224      |
|                         |             | conventional | 24.0022        | 1.00           | 125.3409      |
|                         | Kefir       | organic      | 18.1288        | 0.99           | 134.2274      |
|                         |             | conventional | 17.4132        | 0.99           | 144.9745      |
| Cereal products         | Oatmeal     | organic      | 90.3101        | 0.39           | 304.6074      |
|                         |             | conventional | 90.1639        | 0.47           | 352.4884      |
|                         | Millet groats| organic    | 88.3629        | 0.44           | 89.2719       |
|                         |             | conventional | 88.2000        | 0.50           | 93.0943       |
Table 3. The content of iron, copper, manganese and lead in selected products.

| Group of Tested Products | Products | Type of Farm | Fe [mg/100 g] | Cu [mg/100 g] | Mn [mg/100 g] | Pb [mg/100 g] |
|-------------------------|----------|--------------|--------------|--------------|--------------|--------------|
| Fruits                  | Apples   | organic      | 0.1831       | 0.0981       | 0.1831       | 0.0000       |
|                         |          | conventional | 0.2334       | 0.1659       | 0.2731       | 0.2559       |
|                         | Bananas  | organic      | 0.0000       | 0.2588       | 0.5109       | 0.0000       |
|                         |          | conventional | 0.2218       | 0.3773       | 0.5249       | 0.0886       |
| Vegetables              | Potatoes | organic      | 3.1322       | 0.3273       | 0.3851       | 0.0000       |
|                         |          | conventional | 1.4231       | 0.6417       | 0.3240       | 0.2414       |
|                         | Cucumbers| organic      | 0.2635       | 0.3330       | 0.1536       | 0.1154       |
|                         |          | conventional | 0.3929       | 0.4056       | 0.3467       | 0.1269       |
| Dairy products          | Sour cream 18% | organic | 0.0000       | 0.1067       | 0.0000       | 0.0000       |
|                         |          | conventional | 0.0000       | 0.2860       | 0.0000       | 0.4656       |
|                         | Kefir    | organic      | 0.0000       | 0.2438       | 0.0000       | 0.2408       |
|                         |          | conventional | 0.0000       | 0.4290       | 0.0000       | 0.4020       |
| Cereal products         | Oatmeal  | conventional | 3.3752       | 0.2986       | 2.9656       | 0.0000       |
|                         | Millet   | organic      | 3.5594       | 0.4543       | 5.1228       | 0.1363       |
|                         | groats   | conventional | 0.5155       | 0.3125       | 0.3415       | 0.2287       |
|                         |          |              | 4.7776       | 1.2450       | 0.4349       | 0.6607       |

4. Summary

The main difference between the organic farming system and the conventional one, from the consumer’s point of view, is the exclusion of various chemical compounds aimed at optimizing yields. Therefore, the final properties of food products show significant differences depending on the type of crop they come from.

Water activity is a key parameter in the course of biological processes, which primarily affects the development of microorganisms. On the basis of the conducted research, it was found that products belonging to groups such as fruit, vegetables and dairy products are characterized by water activity above 0.98, which suggests a lack of microbiological stability. Food classified as processed cereals has the values of the analyzed parameter below 0.5. The water level in the material determines the activity of water. Therefore, there is a clear correlation between significantly lower dry matter content of products belonging to the first three mentioned groups compared to cereal products and an increased value of water activity. It was found that all the tested organic products have a higher dry matter content, and thus lower water activity, compared to their conventional counterparts. The given dependence results from the greater susceptibility of water accumulation in the tissues of plants from conventional crops as a result of the use of mineral fertilizers, which have a regressive effect on the amount of dry matter and bioactive ingredients, which is a different situation with regard to plants from organic farms [4].

In order to determine the differences in the chemical properties of the tested products, potassium, iron, copper, manganese and lead were determined. Total potassium is abundant in soil, but the content of its mobile forms that are available to plants is often too low. Therefore, farmers are forced to fertilize with this component. The effects of this phenomenon are noticeable in the conducted research. Food from conventional crops, in which the use of artificial fertilizers is allowed, has a higher content of the element in question compared to organic food [5].

The content of iron, zinc and manganese is higher in most of the food products from conventional crops compared to products from organic farming. The content of these components depends, among others, on the geochemical background, plant variety, breeding method, fertilization and location. Moreover, on the basis of the conducted research, it was found that conventional food has higher Pb content. This is related to the use of mineral fertilizers and the development of industry and transport. Heavy metals are classified as chemical hazards present in food products, the level of which largely depends on the management system [6].
The conducted research shows that the tested ecological and conventional products are characterized by different properties, and the ecological way of farming contributed to the improvement of the quality of consumed food. Organic food is a basic way to provide the body with high-quality products that are free of pollutants. Therefore, the producers of organic food aim to create a product that is safe for the consumer and pro-health activities by caring for the natural environment.

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