Ways to reduce nitrate content in vegetables

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ABSTRACT

The article defines such concepts as nitrates and nitrites, reveals their role in the modern world. The problem of dependence of human health on the quality of agricultural products and nutrition is also considered. A brief description of nitrates, their origin and impact on plants and human health is given. The causes of nitrate accumulation in vegetables, as well as their distribution among plant parts are revealed. the norm of their content in the body is determined. At the end of the article, recommendations are given to reduce the content of nitrates in the human body

Keywords: nitraty, nitrity, noisemaker, ecotoxicant, toxic amino acids, bakchevaya culture.

Vegetables, due to the content of biologically active substances and antioxidants in them, have an important therapeutic and preventive value. They are the basis of a healthy diet and real springs of health. At the same time, they can also accumulate harmful substances. Nitrates are the most common ecotoxicants. The article presents information on the harmfulness of nitrates, the factors that cause their accumulation in plants, ways to prevent their intake and methods of reducing their content in vegetables.

In addition to substances useful for the human body, vegetables, due to violation of agricultural technology and environmental pollution, may contain harmful components in the form of toxic substances. These include some toxic amino acids included in protein, nitrites and nitrates, radionuclides, heavy metal salts and pesticides.

Nitrates (salts of nitric acid) are the main source of nitrogen nutrition for plants, the basis for the synthesis of protein compounds. Without them, the existence of a plant organism is impossible. With excessive intake into plants and weakening of the transition of mineral salts of nitric acid into organic compounds, nitrates accumulate in plants and contaminate products. 7080% of nitrates with vegetables and fruits enter the human body. Nitrates themselves are not dangerous and 6590% of them are excreted from the body in excess. However, 57% of them in vegetables and in the gastrointestinal tract can turn into nitrites (salts of nitrous acid), which have a harmful effect on humans.

The harmful effects of nitrates and nitrites are manifested in the following:

1. Once in the blood, nitrites oxidize ferrous iron into ferric iron, and methemoglobin is formed, which is unable to carry oxygen to tissues and organs. As a result, suffocation, a decrease in blood pressure, impaired liver function, and a decrease in physical and mental activity may be observed.
2. Nitrites and nitrates have a carcinogenic effect, since they form carcinogenic substances in the human body - nitrosoamines.

Children and the elderly, as well as people suffering from diseases of the cardiovascular and respiratory systems, are especially sensitive to the effects of nitrites and nitrates. In a number of countries, it is not recommended to give children some vegetables grown with the use of mineral fertilizers.

Nitrates are always present in plants and the environment, and there is no food that is

absolutely nitrate-free. It is necessary that the level of nitrate accumulation does not pose a risk to human health. Therefore, in order to improve product quality and ensure the safety of public health, a strict control system is needed to limit the nitrate content of vegetables. It has been established that the toxic dose of nitrates for an adult is 10 mg, and for children 45 mg per 1 kg of body weight.

The maximum available amount (MPC) of nitrate consumption per day for an adult is established: UN FAO - 500, for the CIS countries - 325 mg. The World Health Organization (WHO) sets the MPC separately for nitrates - 205 and nitrites - 15 mg.

Different countries have different nitrate limits for different vegetables. For the CIS countries, they are, mg/kg: potatoes - 250, early cabbage - 900, late cabbage - 600, early carrots - 400, late carrots - 250, tomatoes - 150, cucumbers - 150, table beets - 1400, onions - 80, onions - feathers - 600, melons - 90, watermelon - 60, sweet pepper - 200. For protected ground crops, these MPCs have been doubled.

In other countries, these MPCs are much higher. Thus, for all countries of the EEC, the standards are established only for leafy and salad vegetables (up to 25003000 mg/kg^{-}), and for baby food the requirements are stricter (200 mg/kg).

The nitrate content of vegetables depends on more than 20, half of which can be managed.

Different crops have different ability to accumulate nitrates. A large amount of nitrates (1200-5000 mg/kg) is accumulated by green ones - head lettuce, spinach, dill, kohlrabi, rhubarb, rhubarb, radish, table beets, squash and pumpkins. The average position (100-1000 mg/kg) is occupied by eggplants, melons, cabbage, carrots, cucumbers, parsley, celery, garlic, beans. The smallest amount of them (60-90 mg/kg) is accumulated by watermelons, green peas, potatoes, onions, peppers, tomatoes. Large fluctuations in the nitrate content between varieties of the same crop have been established. According to the Uzbek Research Institute of Vegetable and Melon Crops and Potatoes, the nitrate content varies especially strongly depending on the variety in dill, lettuce, parsley, coriander and cauliflower.

In all vegetable crops, varieties with a short growing season accumulate more nitrates than varieties with a long growing season.

As our studies have shown, tomato varieties that form small, elongated, small-sized fruits are characterized by a lower accumulation of nitrates. Varieties prone to nitrate accumulation are those that form large, multi-chambered fruits with a rounded and rounded-flat shape. Of the varieties zoned in Uzbekistan, the varieties Novinka of Transnistria, UzMASH1, and Progressive are resistant to the accumulation of nitrates. Cucumbers with a lower accumulation of zoned cucumbers are characterized by the Early 645 variety, and Omad and Competitor are characterized by a higher one. In table beets, the Bordeaux 237 variety accumulates nitrates much less than the zoned Dutch hybrids, of which Boro F1 is the most prone to nitrate accumulation. In cauliflower, the zoned Russian variety Otechestvennaya accumulates nitrates less than zoned hybrids.

Numerous studies have found that varieties with intense color and thicker root crops accumulate less nitrates in carrots than varieties with less intense coloration and thin root crops. Curly-leaved varieties of salag accumulate more nitrates than smooth-leaved ones. The difference in the ability of varieties to nitrate accumulation indicates that during breeding work and conducting variety tests, it is necessary to evaluate variety samples by the level of nitrate accumulation.

The accumulation of nitrates is significantly influenced by the conditions and technology of cultivation. Vegetables grown in protected ground with less light and a higher nitrogen content in the soil accumulate nitrates 2 times more than in the open field.

The level of nitrogen nutrition has the strongest effect on the accumulation of nitrates. It is generally recognized that the unilateral application of nitrogen fertilizers, the application of nitrogen in high doses, as well as the application of nitrogen during the formation of food organs contributes to an increase in the accumulation of nitrates. Studies of UzNIIOBKiK have established that in potatoes, onions, carrots, cabbage and melon, the nitrate content is directly related to the doses of nitrogen

fertilizers applied1, and in tomatoes and cucumbers, nitrates do not accumulate in large quantities regardless of the doses of nitrogen application.

With late application of nitrogen fertilizers, nitrate nitrogen penetrates directly into the food organs. As established by UzNIIOBKiK, melon reacts especially strongly to late application of nitrogen fertilizers. There is evidence that the application of nitrogen fertilizers is not bound at the level of nitrate accumulation if they are applied together with organic fertilizers, phosphorus and potassium. Best Ratio: N; P; K-1: 1, 5: 1. 2.

When cultivated on organic-poor soil, nitrates accumulate less than on rich soils. At the same time, in Germany and Lithuania, there are no differences in the nitrate content in traditional and biological farming systems. In the conditions of Uzbekistan, UzNIIOBKiK recommends using organic fertilizers to obtain environmentally friendly products, such as vermicompost (a product of thermal processing of manure), vermigum (a product of processing organic matter by red California worms), liphoshum (produced by the Institute of the Academy of Sciences of Uzbekistan), chlorella, green manure (fodder peas, sorghum).

The reduction of nitrate content in vegetables is facilitated by the use of slow-acting nitrogen fertilizers, the use of nitrification inhibitors, which are chemicals that selectively suppress the activity of nitrifying microflora. They are applied together with nitrogen fertilizers in a dose of 0.5-2.0% of the nitrogen content. By conserving nitrogen in ammonium form, they reduce the accumulation of nitrates in plants.

Other environmental factors also have a noticeable effect on the accumulation of nitrates in vegetables. The GNR found that vegetables of the summer harvest contain 5 times less nitrates than early vegetables. In our studies, the Bordeaux 237 table beet variety accumulated nitrates in an average of two years during early spring sowing and harvesting in June – 145 mg/kg; and Boro hybrids – F1, -211 and – 203, Pablo F1 – 210 and 183, Vodan F1 – 203 and 182 mg/kg.

The content of nitrates depends on the degree of ripeness, young fruits contain more of them than mature ones. The highest nitrate content within the day in vegetables is observed in the period from 5 to 9 hours and from 21 to 24 hours. Studies in different countries have proven that insufficient intensity and duration of illumination, low soil moisture, cold, cloudy, humid weather, overheating contribute to an increase in the accumulation of nitrates in vegetables. This is also facilitated by other conditions that cause a weakening of the formation of carbohydrates and other organic substances (damage to plants by diseases and pests, lack of trace elements, premature drying of leaves, aging of plants, etc.).

In our studies, the sparse placement of cauliflower plants of the Otechestvennaya variety contributed to an increase in the nitrate content in the heads. Thus, on average, for three years, it was 236, 0.175 m2-299, 0.210 m2 - 334, 0.245 m2 - 362 mg/kg.

To activate the synthesis of organic substances and to reduce the accumulation of nitrates in vegetables, UzNIIOBKiK recommends the use of such physiologically active substances as gibbersib - 25 mg/l, bisol - 10 mg/l, rosalin - 10 mg/l, tetranil - 10 mg/l with liquid consumption when spraying plants 600 l/ha.

Taking all this into account, in order to obtain products with a low nitrate content, it is proposed: to use varieties that poorly accumulate nitrates, to strictly follow the recommended scientifically based cultivation technology. Do not apply nitrogen fertilizers in large doses and at a late date, apply ammonium and slow-acting nitrogen fertilizers, use nitrification inhibitors, use organic fertilizers, select rational doses and ratios of fertilizers, conduct timely and effective pest and disease control, prevent premature death of leaves and aging of plants, apply the correct irrigation regime, harvest vegetables at full maturity and harvest on clear days, At the beginning of the afternoon, observe the rotation of crops, apply the recommended microfertilizers and growth stimulants.

To reduce the nitrate content in vegetable products, it is important to use for food and for processing those parts and organs of plants that accumulate little nitrates and to reject plant parts with a high accumulation of them.

Different parts of plants contain different amounts of nitrates. There are more of them in those parts in which there are more xylem and vacuoles are well developed in the cells, i.e. in the parts that ensure the transport of nutrients from the soil to plants, namely: in roots, petioles and veins of leaves, stems. There are less nitrates in the pulp of the leaves and fruits. The highest nitrate content in vegetable crops was noted in the following parts: white cabbage - the upper leaves of the head of cabbage and cabbage; cucumber, zucchini - at the base and in the skin; watermelons and melons - in the rind and the adjacent unripe part; beets, radish, turnips, radishes - in root crops, especially in their lower part; carrots - in the core of the root crop, especially in its lower part; green leafy - in leaf petioles and stems.

For this purpose, vegetables, especially leafy vegetables, should be transported and stacked loosely, in a layer of up to 20 cm, preferably in open packages; leafy vegetables rich in nitrates should be processed immediately after harvesting, frozen vegetables should be consumed in the hour after defrosting and should not be refrozen; open canned vegetables should be consumed immediately after opening the jar, do not leave the open jar for a long time; Dishes from vegetables rich in nitrates should be consumed immediately after cooking.

The nitrate content of vegetables decreases as a result of washing, blanching, canning and cooking. The nitrate content is sharply reduced already during washing and blanching vegetables. Sliced blanched carrots lose more nitrates than whole carrots during the cooking process. It has been proven that aluminum is an active catalyst for the transition of nitrates into nitrites. Therefore, vegetables with a high nitrate content should not be cooked in aluminum dishes.

Nitrate reduction is facilitated by storing vegetables at low positive temperatures, as well as soaking for several hours, salting, pickling, pickling. Vegetables with a high nitrate content should not be used for the preparation of juices, because nitrates pass into juice in the amount of 5070%. Drying and boiling increases the nitrate content. Therefore, you cannot take vegetables with a high nitrate content for drying and making jam.

Literature

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