

APPLICATION OF EXPERT METHODS FOR FOOD QUALITY ASSESSMENT AND CONTROL IN CHILDREN'S DIET

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Abstract. *Food is one of the most important factors for improving and maintaining health and the prevention of various diseases. Not only is it important for body functions, but also for growth and development. The most important age-appropriate diet for children consists of carbohydrates, fats and proteins. The level of significance of certain types of food that we consume is not identical. Optimal benefit of food is achieved only if we consume different types of food.*

Expert methods used in food quality control can be subjective and objective. Quality control at multiple levels is an important basis in nutrition and health hygiene. It is especially important to apply the HACCP standard which is a legal obligation in our country, and also to respect the laws and regulations in certain areas. Environmental safety and food safety are achieved by the prevention of food contamination from water, air and land.

Key words: *health safety of food, expert methods, quality control, food chain*

1. INTRODUCTION

Food is one of the most important factors that are vital for preserving and improving human health and the prevention of various diseases. Food consists of protective substances, as well as energy and building materials.

The factors affecting the growth and development of the human body are: genetic factors, the influence of enzymes, nutrition, endocrine glands, climatic and geographical influences, the vegetative nervous system, socio-economic impacts, the impact of diseases, etc. Proper nutrition of children should involve all types of nutrients: proteins, fats, carbohydrates, vitamins, mineral salts and water. The nutrients can be ranged according to their significance for humans, especially to the most sensitive population - children. [7]

The methodology of food quality control is a combination of integration and complexity of certain types of control and their perception as a whole from several respects. Minimizing risk in food production and processing and maximizing safety is the most important task in applying expert methods as food quality indicators. [8]

Heavy metals and pesticides in soil, the air polluted from the industrial facilities and unhygienic water can greatly disrupt the ecosystem and affect the health of consumers. For this reason, there is an urgent need for various preventive measures and additional control of food and finished products at several levels.

2. DEFINITION OF NUTRITION AND FOOD QUALITY

By definition, nutrition is the sum of all the processes where the body accepts essential nutrients necessary to sustain life. Nutrition is a continuous dynamic process determined by the quantity and quality of food.

Modern food production involves the participation of experts from various fields such as technology, microbiology, physiology, chemistry, agronomy, environmental safety, etc. Food is usually considered from two aspects, from the aspect of quality and from the aspect of hygienic conditions. These two aspects are intertwined and supplemented, and together they represent a guarantee of product quality. In each country, quality is defined by regulations and standardization. Standardization is performed by examining the products by the same methodology and the same criteria.

Food is the most important factor in maintaining and promoting health, as well as in the prevention and protection against various illnesses. Nourishment is the provision, to cells and organisms, of the materials (in the form of food) necessary to support life. It is extremely important for the development and normal body functions in both adults and children. [11]

Man consumes food which has a variety of physiological and nutritional properties. The use of various additives and pesticides sometimes changes the characteristics of food. The greatest danger to the health of consumers is genetically modified food which is forbidden in our country. A great quantity of nutritive value is lost by various procedures of food processing. Application of laws and regulations in food quality control is necessary and recommended. There is a need for a multidisciplinary assessment of problems in food production and processing. [17]

Preschool collective meals play a key role in preschool children's diet. They should serve as a replacement for the part of a family meal or eventually compensate for the mistakes in family nutrition. Also, their educational role in physiological development helps children establish positive nutrition habits. A proper diet means that the food is adequate in terms of nutrition and its quantity. Children, in comparison to adults, require large amounts of food, especially proteins which are necessary for growth and development. [13]

A nutritionist is a person who offers advice on matters of food and nutrition impacts on health, and he or she is a part of the expert team in each institution (apart from a technologist, a sanitary technician, etc.) The physiological needs of children are defined by the Regulation on nutrition standards for preschool children. The standards are used to determine the proper application of essential nutrients and quantity of food, and these elements are determined according to several indicators. By respecting the physiological

norms in children's diet, we ensure the intake of all the necessary building, protective and energy substances. A quality diet and especially the quality of food make a complex system of indicators which can be viewed as a whole and individually. Diet quality is also defined, in a broad sense, as a product of adequate quality of production, technological processes, proper packaging, nutritional value and organoleptic-degustation properties. The organoleptic-degustation properties are the following: sight, smell, taste, colour, consistency, and so on. Quality is also one of the aspects of respecting the legal framework for human nutrition, especially among preschool children. [5]

3. THE SIGNIFICANCE OF NUTRIENTS IN CHILDREN'S DIET

The presence of nutrients in children's diet should be proportional. Essential nutrients in children are:

- protein,
- fat,
- carbohydrates,
- water,
- minerals and
- vitamins.

Daily recommended intake of protein ranges from 13% to 15%. The ratio of animal and vegetable proteins in the diet of preschool children should be 2:1. Proteins serve as building blocks for the maintenance, growth and development of an organism. Extremely valuable proteins are of animal origin (meat, fish, eggs, milk and dairy products). Less valuable proteins are vegetable protein (beans, peas, potatoes, etc.) Energy value of one gram of protein is 4.1 calories. [9]

Fats are divided into two groups: plant and animal fats. They play a significant role in the body since they dissolve vitamins (A, D, E and K). They are also important for the pleasant flavour of the dish. Vegetable fats are visible fats and they are added during food preparation, while animal fats are hidden and they can be found in food. One gram of fat provides 9.3 calories, and daily calorie intake should be 32% -35% of the total calorie intake.

Carbohydrates have an energy role and they can be found in plants. Carbohydrates from grains, flour, potatoes, fruits and vegetables have a special quality. Half of the carbohydrates are starchy carbohydrates, while the other half are the sugars. Also, they can be divided into: simple and complex, i.e. monosaccharides and disaccharides. The most important are carbohydrates from fruit and vegetables: fructose, glucose and sucrose.

Starch is one of the complex carbohydrates and they can be found in grains, potato and vegetable crops. Cellulose is found in plants such as: kale, tomatoes, cauliflower, spinach and zucchini, but unfortunately, there is no nutritional value in it. Each gram of carbohydrates provides 4.1 calories, so total calorie intake is around 50% -55% on a daily basis. [4]

Every living organism, especially children, need water. The percentage of water in the body of an adult man is 60% and 70% in children. Water can enter the body directly or through food, and it is necessary to maintain a constant body temperature and continual growth and development of children. It also serves as a means of discharge of harmful substances from the body. Daily needs of water are 100 ml per kg/tt for a child between the ages of 4 and 6.

A healthy diet for preschool children also involves the intake of minerals, such as: calcium, iron, phosphorus, sodium, potassium, sulfur, magnesium, chlorine, etc. They are needed for cell development, growth and the immune system. Daily needs for food intake for preschool children are: 720 ml - of which 9 ml are for iron, 720 mg for phosphorus, 1-3 grams for kitchen salt, 690-2092mg for potassium and 180mg for magnesium.

Vitamins are divided into two groups:

- fat-soluble vitamins (A, D, E and K)
- water-soluble vitamins (B and C).

Vitamins are organic compounds required as a vital nutrient in tiny amounts by an body. They are involved in most physiological processes and they protect the body from diseases.

4. THE LEVEL OF SIGNIFICANCE OF DIFFERENT FOOD GROUPS IN PRESCHOOL CHILDREN'S DIET

There are seven food groups used in children's diet:

- grains
- milk and dairy products
- meat, fish, eggs, etc.
- fats and oils
- vegetables
- fruit
- sugar and concentrates.

Grains are important due to a high content of carbohydrates (60%) and vegetable proteins (10%-15%). This group is an excellent energy source due to large amounts of bread. It contains vegetable proteins, mineral salts and B-group vitamins. [18] Milk and dairy products have a significant amount of proteins and they can usually be replaced with meat. They are a great source of potassium, which is well absorbed in the body and also contains milk fat.

Meat, fish and eggs are of great significance for child growth and development. They are also a great source of vitamins and minerals, especially potassium, iron and B-group vitamins, while fish is a rich source of vitamins A and D. Fats and oils are the major energy source, while only oils have a biological value. Vegetables are a great source of vitamins and minerals, especially those rich in potassium, iron and cellulose. [19]

Fruit contains mineral salts and vitamins, simple sugars, fruit acids and aromatic compounds. Walnuts, almonds and hazelnuts contain a lot of fat and proteins. Sugars contain carbohydrates, but no other nutrients.

The combination of the above-mentioned groups of food helps us achieve goals in children's diet regarding their nutrition, health and hygiene, and meet energy and nutrients needs.

A representative review of the daily physiological needs of children aged between 4 and 6 has been given in the following tables. [3.9]

4.1. Daily physiological needs of children aged between 4 and 6

The total daily needs of children between 4 and 6 years of age are 1600Kcal = 6720 KJ (75% of this amount is 1200Kcal = 5040 KJ).

Table 1. A daily meal should include the following food groups

Breakfast	25%	400 kcal = 1680 KJ
First snack	5%	80 kcal = 336 KJ
unch	35%	560 kcal = 2352 KJ
Second snack	10%	160 kcal = 672 KJ

Table 2. The ratio of nutrient content (in grams and calories) to the total energy value of a meal

	%	kcal
1. Grain (corn, flour, bread, pastry)	30%	360 kcal
2. Meat, fish, eggs	10%	120 kcal
3. Milk and dairy products	20%	240 kcal
4. Fats (visible fats and oils from animals and plants)	10%	120 kcal
5. Vegetables	10%	120 kcal
6. Fruits	10%	120 kcal
7. Sugars (sugar, jam, chocolate, cake)	10%	120 kcal
Total	100%	kcal

Table 3. Overview of nutrition

Proteins	10%	29 g	120 kcal
Fats	30%	39 g	360 kcal
Carbohydrates	60%	176 g	720 kcal
Total	100%	–	1200 kcal

Menus in preschool institutions are prepared depending on the seasons (spring, summer, autumn and winter) and for this reason they have a seasonal character. They are conditioned by the food supply, which is oriented towards aesthetic and physiological targets of proper nutrition. Sometimes, there are deviations from the planned menu due to the inability of the procurement of certain types of food or lack of technological conditions of production. For this reason, certain food is replaced by another type of food from the same group, with the purpose of respecting the structure of the meal. Each type of food has its place in the food chain of the human population, especially for the most vulnerable population - children.

5. EXPERT METHODS FOR FOOD QUALITY CONTROL

Health disorders due to inadequate nutrition can be defined in two ways:

- insufficient nutrition diseases
- over-eating diseases.

The control of health safety is carried out to ensure that a certain type of food is suitable for human consumption and does not represent a health risk to consumers. Sampling of food is important because food is sensitive and it needs proper treatment; therefore, the best option is to use a camp refrigerator. The samples must be kept in the original and adequate packaging. A person who is collecting samples must be qualified and he must complete the record and answer the following questions about who, when and where performed the sampling. When the data are not coherent, there is a need for further analysis- a superanalysis [12].

The laboratories for testing can be internal and external (accredited), or even both. Health and hygienic conditions are expertly controlled through the following examinations:

- chemical
- microbiological
- sensory (organoleptic and tasting).

Chemical examination involves biological value and the content of additives and contaminants. Biological value is determined by the Regulation on product quality and labeling.

The declaration (labeling) includes the following information:

- a product name
- a producer name and an address
- product composition
- additives
- the date of packaging
- expiration date.

The declaration must be in accordance with the manufacturer's specifications. The manufacturer's specification must be in accordance with the Food quality regulation act, and if there are any alterations, they must be clearly stated.

Additives are added to food to achieve a certain effect (to preserve flavour or enhance its taste and appearance) and they can be divided into several groups: preservatives, antioxidants, colour retention agents, flavourings, emulsifiers, stabilizers, etc. There are harmful substances that can be found in food and they are: pesticides, toxic metals, hormones, histamines, mycotoxins, radionuclides, etc. [14].

Microbiological examination is performed according to the Regulation on microbiological food safety (aseptic conditions are mandatory).

Sensory evaluations are performed through the senses. Organoleptic and tasting tests are used to control the colour, the appearance, the smell, the taste, the consistency, the impurities, the packaging, etc. In certain situations, when the food is obviously in improper condition, it is sufficient to perform only an organoleptic examination. [9]

The safety of food in terms of a complete analysis includes: appropriate sensory characteristics without mechanical impurities, lack of pathogenic microorganisms with a minimal amount of harmful substances in the regulation of prohibited substances without the appropriate packaging and with the correct declaration. [16]

All of the above mentioned features are approved by professional teams to maximize food safety and minimize the risk to children's health.

Expert control is performed at several levels:

- internal expert control
- inspection control
- control by the Institute of Public Health
- control by HACCP standards.

All these types of controls reduce the risk of food contamination to a minimum. The application of HACCP safety control standards (Hazard Analysis and Critical Control Points) is particularly important. The HACCP system is a management system in which food safety is addressed through the analysis and control of various hazards. This system represents a form of refinement, control and monitoring products that are being prepared. It is the basis for defining the critical points as well as their control and compliance with critical limits. Since 2011, this standard has been a legal requirement for all the industries involved in food production and distribution. [10.15]

By applying expert methods of control of nutritional properties and food safety, it is mandatory to achieve strict compliance with statutory laws and regulations in the area. The aspect of product safety and the environmental aspect are also significant because they are not reduced to protection against water, soil and air contamination, but they are significant in terms of prevention from product toxicity. [1.2]

6. CONCLUSION

Improper food quality is a risk to children's health not only in our country, but also all over the world. Therefore, nutritional properties and health - hygiene conformity in children's diet must be respected. Nutrient adequacy represents the basis for a safe and healthy consumption of food in preschool children's diet. It is necessary to know the food groups and the norms – recommended daily food intake in terms of children's optimal needs.

The expert methods that are used are extremely significant regarding the safety of the final product. A special significance is the application of the HACCP standard which is the final step in the control of the technological process and the distribution of food to the end consumer. Food safety is achieved by preventive measures in food production, with the aim of avoiding the contamination of food from the land, water and air.

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PRIMENA EKSPERTNIH METODA ZA VREDNOVANJE I KONTROLU KVALITETA ŽIVOTNIH NAMIRNICA U ISHRANI DECE

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Hrana predstavlja jedan od najvažnijih faktora za unapređenje i očuvanje zdravlja i prevenciju raznih bolesti. Važna je za funkcije organizma a takođe za rast i razvoj.

Najznačajnije materije u ishrani dece su ugljeni hidrati, masti i belančevine. Stepem značajnosti određenih grupa namirnica koje se unose u organizam nije indentičan. Optimalno dejstvo namirnica se postiže isključivo u unosu različitih vrsta istih.

Ekspertske metode koje se koriste u kontroli kvaliteta su subjektivne i objektivne. Kontrola kvaliteta na više nivoa predstavlja značajan bedem u nutritivnom i zdravstveno higijenskom smislu. Posebno je značajna primena HACCP standarda koji je i zakonska obaveza u našoj zemlji, kao i poštovanje zakona i pravilnika u određenim oblastima. Aspekt zaštite životne sredine i bezbednost namirnica se vrši i prevencijom zagađenja samih namirnica iz vode, vazduha i zemljišta.

Ključne reči: *zdravstvena bezbednost hrane, ekspertne metode, kontrola kvaliteta, lanac ishrane*