

FORMATION OF BASES OF A HEALTHY DIET IN NATURAL SCIENCE AND TECHNOLOGY EDUCATION AT THE UNIVERSITY LEVEL

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Abstract

A problem of education, aimed not only on preservation, but also on strengthening of health of younger generation, is particularly acute. Questions of the organization are actual, because the condition of nutrition is one of the major factors defining health of the individual and the nation in general.

Quantitative and qualitative value of nutrition defines extent of realization of genetic program of intellectual and physical development, including: cognitive ability, I.Q., working capacity, life expectancy, ability of an individual to reproduction, resistance to action of negative factors of environment, including stresses, weather climatic conditions, etc. At the same time researches of the actual nutrition of the population show great deviations of nature of nutrition from physiological standards. It plays an essential role in a wide dissemination in modern society of the so-called «diseases of civilization» (cardiovascular pathology, obesity, diabetes). We prepared an electron shell of a computer program for an assessment of the actual food «Analysis of a condition of nutrition», which based on of a complex of indicators: anthropometrical data (height, weight, waist/hip index); assessment of energy demand (general energy expenses of an organism, the energy value of a daily diet, the level of the basal metabolism, index of physical activity, working increase); assessment of nutritional status on the profile of food consumption (grain and products of its processing, beans, nuts, milk, dairy products, vegetables, fruit, berries and products of their processing, meat, meat products, fish, non-fish seafood, drinks and etc.); frequency of consumption; an assessment of nutritional status on the profile of nutrient consumption (the main macronutrients and micronutrients) which allows you to identify deviations in the diet and to optimize solutions of these problems.

This computer program will help students in receiving knowledge of healthy nutrition for a specific person;

it'll promote formation of healthy lifestyles and improve their states of health.

Key words: Nutrition, Health, Research, Analysis of a condition of nutrition, Computer program.

1. Introduction

The nutrients coming to a human body during a meal are a source of energy and material for the construction of body tissues, regulate a metabolic process and contribute to the formation of a human immunity. A food has to contain all necessary nutrients, specifically proteins, fats, carbohydrates, dietary fiber, vitamins, minerals and others, for implementation of all called functions.

Quantitative and qualitative value of nutrition defines extent of realization of genetic program of intellectual and physical development, including: cognitive ability, I. Q., working capacity, life expectancy, ability of an individual to reproduction, resistance to action of negative factors of environment, including stresses, weather climatic conditions, etc. (Ashwell [1], Diplock *et al.*, [2]).

The need of the person for energy and the amount of nutrients depends on many factors including: body weight, nature of its work, age, sex, and climate. A caloric content of a diet of the adult has to correspond to power expenditure of an organism. If this balance is disturbed, it comes to either obesity or exhaustion of the organism.

At the same time researches of the actual nutrition of the population show great deviations of nature of nutrition from physiological standards. It plays an essential role in a wide dissemination in modern society of the so-called «diseases of civilization» (cardiovascular pathology, obesity, diabetes).

We developed computer program that will help students in receiving knowledge of healthy nutrition for a specific person and to promote formation of healthy lifestyles and improve their states of health.

2. Materials and Methods

We prepared an electron shell of a computer program for an assessment of the actual food named "Analysis of a condition of nutrition", which based on of a complex of indicators:

1. Anthropometrical data (height, weight, waist/hip index, body mass index).
2. Assessment of energy demand (general energy expenses of an organism, the energy value of a daily diet, the level of the basal metabolism, index of physical activity, working increase).
3. Assessment of nutritional status on the profile of food consumption (grain and products of its processing, beans, nuts, milk, dairy products, fat products with a fat content of more than 50%, vegetables, fruit, berries and products of their processing, meat, meat products, fish, non-fish seafood, drinks, confectionery and etc.).
4. Frequency of consumption.
5. Assessment of nutritional status on the profile of nutrient consumption (the main macronutrients: proteins, fats, carbohydrates and micronutrients: vitamins, bio-elements, etc.) which allows you to identify deviations in the diet and to optimize solutions of these problems.

The basis of the developed program was formed by definition of the whole complex of indicators, one of which is anthropometrical data. Anthropometrical indexes, in particular, a body mass index (BMI - the ratio of weight to height squared) are epidemiologically important indicators for risk from diseases.

Clinical classification of body mass index values, which was developed by the National Institute of Health and was approved by the WHO, has been used in the developed program. In Table 1 are presented clinical classification of BMI values. In Table 2 is presented the normal index value depending on age.

The widespread use of the body mass index is caused by simplicity and availability of the measurements. Numerous researches showed that the deviation from the normal range of BMI is associated with increased risk of morbidity and mortality. At patients with obesity, the body mass index is recommended to be considered as the fifth main vital signs of life, along with blood pressure, heart rate, frequency of respiration and body temperature. However, the individual level BMI does not always adequately reflect the degree of fat deposition. The use of BMI in diagnostics of obesity and other

violations of the trophic status possesses low diagnostic sensitivity - about 50% Janssen *et al.*, [3], Segal *et al.*, [4].

An example of an incompetence of the individual assessment of the degree of fat deposition based on BMI is illustrated in Figure 1, which shows the two individuals with an identical length and body weight.

It is subjectively clear that one of them has obesity, while another express hypertrophy of a muscle tissue. But they have the identical BMI, so both of them shall be classified as having one obesity (I degree). In this regard, other indicators were used to assess the actual effective power.

Table 1. Clinical classification of BMI values

BMI, kg/m ²	Classification	Risk of incidence
Less 18.5	Deficiency of the body weight (attrition)	Raised
18.5 - 24.9	Normal body weight	Minimum
25.0 - 29.9	Overweight	Raised
30.0 - 34.9	Obesity I degree	High
35.0 - 39.9	Obesity II degree	Very high
Over 40	Obesity III degree	Excessively high

Table 2. The normal index value depending on age

Age group	Normal values of an index
19 - 24 years	< 20
25 - 34 years	20- 25
35 - 44 years	21 - 26
45 - 54 years	22 - 27
55 - 64 years	23 - 28
> 65 years	24 - 29

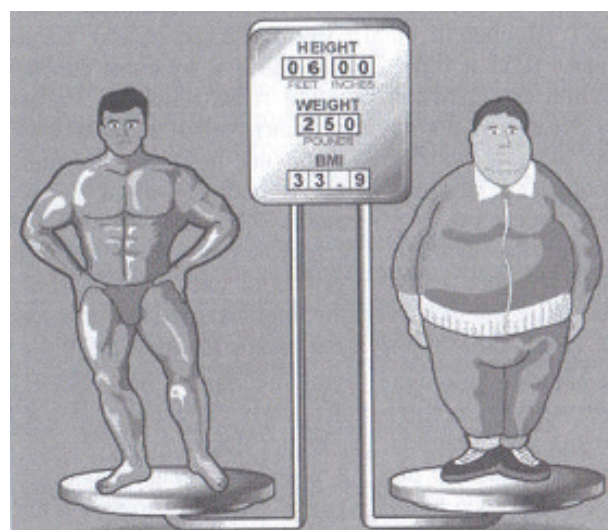


Figure 1. The example of the two individuals with different degree of fat deposition, having identical BMI

During creation of an electron shell of a computer program, physiological norms of body's need for nutrients were used from Sanitary standards and rules "Requirements to the food of the population: regulations of physiological needs for energy and nutrition for different groups of the population of Republic of Belarus" [5], which were developed and approved by the Ministry of Health of the Republic of Belarus. Physiological norms of nutrition are the average values, which reflect the optimum requirements of specific groups of the population in the major nutrients and energy. It is necessary to consider data on height, weight, age, and also specific features of work and life, when you determine individual requirements.

These Sanitary standards and rules are used in the planning of production and consumption of food, an assessment of food reserves, the development of measures of social protection, planning nutrition in organized collectives, the development of average daily sets of food, an assessment of the actual nutrition of the population and another. The values, which contained in these sanitary standards and rules, apply to the groups of children's and adult population having identical characteristics: age, sex, body weight, coefficient of physical activity (for adult able-bodied population). Coefficient of physical activity (CFA) - a ratio between the total energy expenditure on all types of activity and the value of basal metabolism, which is the objective physiological criterion determining amount of energy, adequate for specific groups, are norms established in Resolution of Ministry of Health of Republic of Belarus of November 16, 2015, No.111, and act only on the territory of the Republic of Belarus [5].

Estimated norms of consumption, which are based on the main provisions of the concept of a balanced diet, suggest the following principles:

A caloric content of a diet of the adult has to correspond to power expenditure of an organism.

The values of consumption of essential nutrients - proteins, fats and carbohydrates have to be in limits of physiologically necessary ratios between them.

- The optimum ratio of proteins, fats and carbohydrates (by mass) makes 1:1:4 (in a daily diet of children over 1 year and adults);

- Physiologically required amount of animal protein (essential amino acids sources) has to be provided;

- The quantities of consumption of vitamins have to cover optimum needs of an organism for them. At the same time needs for vitamins have to be satisfied as much as possible due to their content in natural products.

- The content of the major minerals in the diet has to be provided according to their physiological requirements.

In determining the need for essential nutrients and energy for different groups of the adult able-bodied population are particularly important differences in energy expenditure connected with the peculiarities of work. Physiological requirements for persons at the age of 18 - 60 years are this on five groups differentiated depending on the sizes of energy expenditure:

- Group I - workers mainly mental work, very easy physical activity (research associates, students of the humanitarian specialties, programmers, controllers, teachers, dispatchers, operators of control panels and others);

- Group II - the workers occupied with easy physical work, easy physical activity (drivers of trams, trolleybuses, weighers, stackers packers, seamstresses, working trades of electronics, agronomists, nurses, orderlies, working communications, consumer services, sales of non-food goods and others);

- Group III - workers of moderately severe physical labor, the average physical activity (mechanics, servicemen, adjusters, machine operators, drillers, bus drivers, doctors-surgeons, sellers of foodstuff, operating textile trades, shoemakers, workers professions of railway transport, water transport, bureaucrats, blast furnace workers, chemical manufacturing, and others);

- Group IV - workers of heavy physical labor, high physical activity (workers construction, assembly and repair construction works, an assistant driller, sinker, machine operators and workers of plant growing, animal husbandry, milkmen, vegetable growers, workers of woodworking production, metallurgical production, founders and others);

- Group V - the workers especially of hard physical work, very high physical activity (machine operators and workers of plant growing during the sowing and harvest periods, fellers, concrete workers, bricklayers, excavators, loaders and other non-mechanized labor and others) (Resolution of Ministry of Health of Republic of Belarus [5]).

In these sanitary standards and rules, physiological requirements for persons at the age of 18 - 60 years for women has four groups and five groups for men.

Using the recommended quantities of nutrients and energy consumption allows to determine the need of various population groups in the basic food factors with greater degree of accuracy and expands the possibilities of creation of a balanced diet.

3. Results and Discussion

We prepared a product, which give a comprehensive assessment of nutritional status on the profile of food consumption taking into account the frequency of their

consumption. In the suggested electron shell foodstuff is divided into the following functional groups:

1. Grain and products of its processing (grain, cereal, flour products);
2. Bean, nuts and seeds;
3. Confectionery (confectionery raw materials and products);
4. Milk and dairy products;
5. Eggs and egg products;
6. Fat products (oils and fats)
7. Vegetables, mushrooms and products of its processing (vegetables, dried vegetables, canned vegetables, mushrooms);
8. Fruit, berries and products of their processing (melons, citrus fruits, dried fruit, canned);
9. Drinks (water, juice, fruit drinks);
10. Meat and meat products;
11. Fish, non-fish seafood and products of their processing;
12. Auxiliary nutrients and flavor enhancers (spices, seasonings).

The program allows users to assess the nutritional status not only on the profile of food consumption, but also on a profile of the consumed dishes. In addition users have the ability to add own dishes to the database, which not originally envisaged. The program automatically calculates the main content of nutrients, as well as macro and micronutrients in the dish.

This computer program allows users to determine visually quantity of the consumed products in mass expression, without using additional supportive applications. For this purpose, users have an opportunity to utilize "An album of photos of products and dishes", which is the important instrument in researches on an assessment of the actual consumption. This album allows you to provide a reliable assessment of quantity of the consumed products and dishes. With the help of these pictures, users have an opportunity to estimate

the portions consumed by them. In this case, a reference point for determining the size of the portions, are unified tableware and equipment (spoons, plates glasses, etc.). Examples of the used photos are shown in the Figures 2 and 3.

The authors prepared all photos included in an album, using digital technology. For each product presented three options of the sizes of portions - small, medium and large. Serving sizes for each product selected individually and are ranged from 5 to 600 grams.

Assessment of nutritional status on the profile of nutrient consumption (the main macronutrients: proteins, fats, carbohydrates and micronutrients: vitamins, bio-elements, etc.), which can also be received by using this program, allows to reveal not compliance in diet of different age groups of the population to physiological regulations, and to determine solutions of these problems [5]. The reference tables of content of the main nutrients and energy value of food Skurikhin and Volgareva [6] were used as reference data.

The condition of nutrition is one of the most important factors determining a human health of the specific person. For this reason, the organization and control of a condition of nutrition of youth are important objects of researches. In modern conditions among of a research methods of human body composition drew particular attention to the method of bioimpedance analysis, which allows to study the features of the body structure, to evaluate the physical and hormonal development, extent of development of muscles, the presence of adipose tissue, basal metabolism, the volume of the total liquid and intracellular liquid for each individual, which is important for maintaining health and preventing diseases [7]. The bioimpedance analysis is a good example of interdisciplinary research, including a contact method of measuring of the electrical conductivity of biological tissues (physics), a diagnostic method of morphological and functional characteristics of body composition (medicine), which allows you to investigate the level of basal metabolism, the percentage of fat and "lean" mass, level intracellular



Figure 2. Example of food photography (millet cereal)

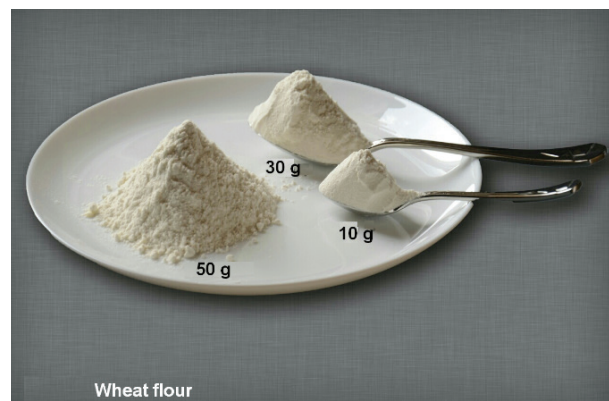


Figure 3. Example of food photography (wheat flour)

and extracellular liquid (biology) to optimize the actual nutrition (alimentary technologies).

However, the use of modern information technology, non-invasive techniques represent a balance between the traditional classical techniques and modern technologies to maintain proper quality of education, and also to obtain rather reliable data necessary for improvement of the actual nutrition. A prominent representative of such technologies is computer program for an assessment of the actual nutrition "Analysis of a condition of nutrition".

The direct participation of students in studying of their own diet and determination of parameters of a body, using this program, lays the foundation for formation of ideas of basic provisions of the concept of a balanced diet.

4. Conclusions

- As a result, an electron shell of a computer program for an assessment of the actual food "Analysis of a condition of nutrition", which based on of a complex of indicators: anthropometrical data (height, weight, waist/hip index); assessment of energy demand (general energy expenses of an organism, the energy value of a daily diet, the level of the basal metabolism, index of physical activity, working increase); assessment of nutritional status on the profile of food consumption (grain and products of its processing, beans, nuts, milk, dairy products, vegetables, fruit, berries and products of their processing, meat, meat products, fish, non-fish seafood, drinks and etc.); frequency of consumption; an assessment of nutritional status on the profile of nutrient consumption (the main macronutrients and micronutrients), allows users to identify deviations in the diet and to optimize solutions of these problems.

- The use of modern information technology, non-invasive procedures in the conditions of active participation of students in the study of actual nutrition and determining parameters of the body, lays the foundation for the formation of ideas and skills of good nutrition and healthy lifestyles.

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