Research Article

Possibilities of Correction of Alimentary Status in the Era of Digitalisation

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Abstract. A balanced diet contributes to the prevention of nutritionallyrelated diseases. The purpose of this paperwas to demonstrate how tools of the digital economy could be used to help improve nutritional status, using the example of Microsoft Excel. To improve nutritional status, reliable digital information is needed on the content of macronutrients and micronutrients in raw materials and foodproducts. Then the correction of the diet or formulation of an individual product can be carried out. The database "Chemical composition of food raw materials and food products" was developed using Microsoft Excel; this database is a digital tool for quick and reliable information about the nutrient profile of Russian raw materials and food products. Itobtained official state registration under the number 2012620334. The database is a series of spreadsheets that are interconnected by common key fields. For each type of food raw material or food product, the database contains descriptors: the main chemical composition (mass fraction of water, protein, fat, saturated fatty acids, polyunsaturated fatty acids, cholesterol, mono- and disaccharides, starch, digestible carbohydrates, dietary fibre, ash, organic acids); minerals (sodium, potassium, calcium, magnesium, phosphorus, iron); vitamins (A, B_1, B_2, PP, C, beta-carotene, retinol equivalent, tocopherol equivalent, niacin equivalent); and energy value. Using the database can help to speed up and facilitate calculating individual and group diets and can assist in adjusting the nutritional status for healthier outcomes.

Keywords: healthy nutrition, nutritional status, chemical composition, database, digitalisation, Microsoft Excel

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1. Introduction

The world community has taken note that the food insecurity in the world is growing. The issues of ensuring healthy nutrition are raised in the "Political declaration of the high-level meeting of the UN General Assembly on the prevention and control of non-communicable diseases" (A/RES/66/2, January 24, 2011). The United Nations, in its Resolution of the General Assembly of December 13, 2018, calls for strengthening measures aimed at improving nutrition and raising the standard of living of the population

around the world as one of the key elements of strategies aimed at eliminating all forms of malnutrition.

Unhealthy diets and lack of physical activity are major health risks worldwide. According to theFood and Agriculture Organization(FAO), risk factors associated with diet due to inadequate physical activity cause 10% of cases of illness and disability. According to the World Health Organization (WHO), more than 60% of deaths in the world occur in non-communicable diseases (diabetes, oncology, heart disease, stroke, *etc.)*. Unhealthy diet is one of the key risk factors for premature mortality of people under 70 years of age from non-communicable diseases.

Studies of the interaction between the individual components of food and / or between the various ingredients of a mealplay a significant role and reinforces the importance of "food synergy" as a fundamental unit. This concept helps to understand the relationship between nutrition and health [1].

Malnutrition leads to changes in nutritional status, which contribute to the development of non-communicable diseases, which make up more than half of the causes of death of the population of Russia. It has been proved that the contribution of nutrition to the development of diseases of the cardiovascular system, diabetes, osteoporosis, obesity, some forms of malignant neoplasms is from 30 to 50%. The regularity of the influence of unbalanced nutrition of the population on the prevalence of neoplasms, diabetes mellitus, hypertensive disease with predominant heart damage, coronary heart disease, gastric and duodenal ulcer and a number of others have been established. A balanced diet, in turn, contributes to the prevention of a number of diseases [2].

Nowadays more than 2 billion people suffer from micronutrient deficiencies, especially vitamin A, iodine, iron, zinc and others. In all regions of the world, such phenomena as overweight and obesity among children and adults are rapidly growing. Strict adherence to unbalanced diets also leads to micronutrient deficiencies (Table 1).

When assessing the nutrient composition of the diets of Russians (1,435 people were examined), an imbalance in the intake of vitamins A, C, B_1, B_2, PP, as well as magnesium, iron and phosphorus was revealed in comparison with the norms. Clinical signs of mono-hypovitaminosis were found in 9.8% of people, poly-hypovitaminosis - in 18.8% of the examined participants. To assess the risk of the influence of the "nutritional factor" on the development of clinical manifestations of micronutrient deficiency, a factor analysis was applied, two hidden factors of micronutrient status ("hypovitamin" and "hymineral") were identified, which determine the variance of sufficiency of intake of studied nutrients in 48.2% and 14.9% of cases, which is equal to 63.1%. Identified multiple statistically

Table 1: Inadequate Intake of Micronutrients when Dieting [3].

Diet	Excluded Foods	The lack of vitamins and minerals
partially vegetarian	red meat, milk, cheese, yogurt	iron, calcium, vitamins B_2, B_{12}
lacto-ovo-vegetarian (vegetarian diet including milk and eggs)	red meat, poultry, fish	iron, vitamin B_{12}
lacto-vegetarian	red meat, poultry, fish, eggs	iron, vitamins D, B_{12}
vegan	red meat, poultry, fish, eggs, milk, cheese, yogurt, honey	fat-soluble vitamins, vitamin B_2, B_{12}, calcium, iron, zinc
low-calorie	high-calorie foods	all vitamins

significant correlations between micronutrient status and prevalence of clinical signs of micronutrient deficiency require measures to optimise nutrition [4].

On a regular basis, the state statistics bodies of Russia analyse the level of food consumption by the population on the basis of a sample survey; 47,800 households were included in the sample. According to state reports from the Federal Service for the Supervision of Consumer Rights Protection and Human Welfare (2018-2019), and according to the degree of influence on indicators of the state of the population's health in the Russian Federation, lifestyle factors in order of importance are as follows: unbalanced diet, alcohol consumption and smoking. The results of the studies on the nutritional status of various adult groups in 1994-2012 indicate an increase in fat intake, with a significant part of it coming from animal products. The average intake of vitamins with a diet provides 65-80% of the body's needs. Similar values are characteristic for calcium intake among the entire population and iron among women. Over 30% of the adult population suffer from osteoporosis, the main reason for the development of which is associated with a lack of calcium in the diet due to insufficient consumption of milk and dairy products. Inadequate intake of iron is the main cause of the prevalence of anaemia in pregnant women. According to the Russian Ministry of Health, up to 70% of the country's population are deficient in iodine. When analysing the nutrition of 4 thousand people, the majority of those examined showed an excessive consumption of cholesterol, saturated fatty acids against the background of insufficient dietary content of polyunsaturated fatty acids of the omega-3 family, dietary fibre vitamins A, B1, B2, PP, calcium and magnesium. The diet noted an excess of added sugar, sodium and insufficient - dietary fibre [5].

An unanimous opinion on the principles of developing a balanced diet, rational norms for the consumption of macro- and micro-elements, and theoretical foundations for improving food products has been reached in the world of foodscience [6-10]. The next step is the creation - on the basis of these principles – of products with a set of predefined characteristics, which is impossible without the use of the modern digital economy, without the use of computers and specialised software [11-15]. An analysis of modern approaches to the development of balanced recipes using the tools of the digital economy is given in the works of Russian and foreign authors [16-24].

The purpose of this article is to demonstrate the possibilities of correcting nutritional status using the tools of the digital economy using the widely used office program Microsoft Excel as an example.

2. Results and Discussions

First of all, to correct the nutritional status of a consumer group or an individual, one should have information about the existing problems of this status. Such studies are usually carried out by state organisations. In Russia, such large-scale studies are officially conducted by Rospotrebnadzor (Russian Agency for Health and Consumer Rights), as well as the Federal Research Centre for Nutrition, Biotechnology and Food Safety, and a number of other federal state institutions. Further, for the correction of nutritional status, one should have reliable digital information on the content of macronutrients and micronutrients in food raw materials and products. And only then should we begin to correct the diet or the formulation of an individual product.

Sources of data on the nutrient profile of raw materials and food products are databases. In the twentieth century, such databases were books (handbooks) published in paper form, later digitised books appeared (in the pdf format).

Such reference books are periodically published in Russia under the editorship of academician V.A. Tutelyan, academician A.A. Pokrovsky, professor I.M. Skurikhin*et al*. [25]. The world-famous handbookofMcCance and Widdowson has been published in Russian [26].

In the digital age, databases on the nutrient profile of raw materials and food products appeared in an online format, in the form of Microsoft Access or Microsoft Excel files.

As a digital tool that allows us to quickly calculate nutritional ratios and formulations of individual products, we developed and registered the database "Chemical composition of food raw materials and food products" [27]. The database includes original systema-tised reference data on the chemical composition of raw materials and food products.

The materials placed in the proposed manner in the database make it possible to quickly analyse and select from the raw materials and food products available in Russia that have the desired characteristics, and make up a recipe or a ration balanced for the specified characteristics.

The database is intended for the accumulation, storage, analysis and issue of reference information on the chemical composition of a wide range of food raw materials and food products. As a database management system (DBMS), Microsoft Excel was selected as the one that most fully met the goals of creating this particular database.

The database is a series of spreadsheets that are interconnected by common key fields and provide information on the basic nutrientcomposition, content of minerals, vitamins and energy value of food raw materials and food products from the list:

Grain and products of its processing (bread, flour confectionery), legumes, nuts, oilseeds and products of their processing

Meat and meat products, poultry, eggs and melange

Fish, non-fishseafood, products from them

Dairy products, fermented milk product, cheeses

Fat products (fats, oils, margarines, mayonnaises)

Vegetables, mushrooms, products of their processing

Fruits, berries, products of their processing, jam, confiture, jelly

Confectionery, confectionery raw materials

Beverages (juices, nectars, soft drinks, mineral table water, alcoholic drinks)

The presented forms of the materials contained in the database "Chemical composition of food raw materials and food products" are shown in Figure1 in the form of screenshots.

The principles of systematisation of the materials contained in the database, allowing to find and process these data by computer, are as follows. For each specifictype of food raw material or food product, the database contains descriptors:

basic nutrientcomposition (mass fraction of water, protein, fat, saturated fatty acids, polyunsaturated fatty acids, cholesterol, mono- and disaccharides, starch, digestible carbohydrates, dietary fibre, ash, organic acids);

minerals (sodium, potassium, calcium, magnesium, phosphorus, iron);

vitamins (A, B_1, B_2, PP, C, beta-carotene, retinol equivalent, tocopherol equivalent, niacin equivalent);

energy value.
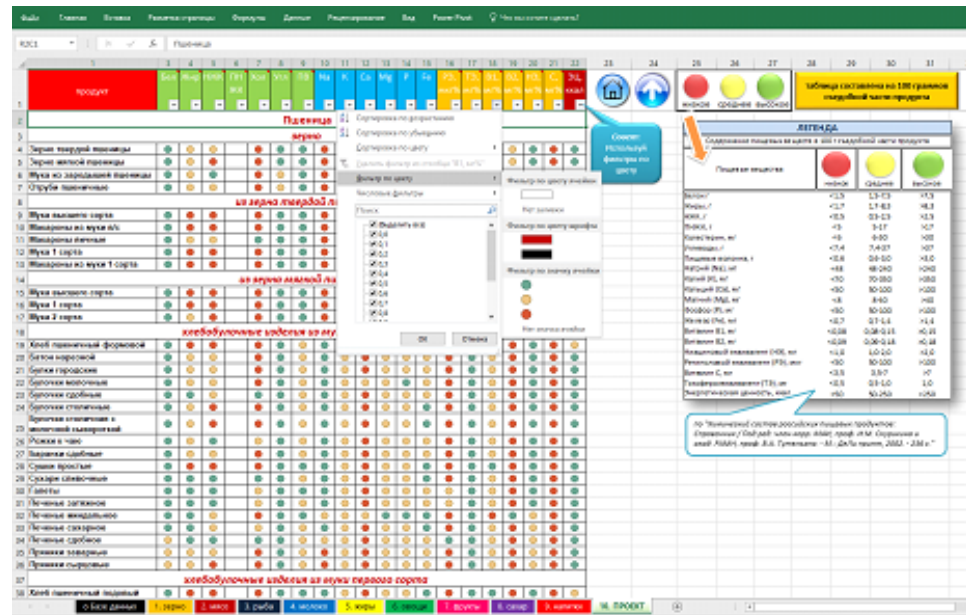
Figure 1: Screenshot of the Database "Chemical Composition of Food Raw Materials and Foodstuffs" (Authors' own work).

Finding data in the database is possible for each descriptor separately, as well as for a combination of descriptors.

Digital data on the chemical composition of raw materials and food products are based on information from officially published reference book [25].

The database is equipped with a navigation system that allows users to quickly move to the up of the sheet, what is convenient for working with large tables, as well as instantly go to the start page with the list of tables (table of contents of the database).

The technical capabilities of processing the data contained in the database "Chemical composition of food raw materials and food products" are related to the capabilities of Microsoft Office Excel.

3. Conclusion

As a digital tool that allows you to receive quickly reliable information about the nutrient profile of raw materials and food products, the database "Chemical composition of food raw materials and food products" has been developed on the basis of Microsoft Excel. The database was officially state registered under the number 2012620334. Using the database will speed up and facilitate the work on calculating individual and group diets and adjust the nutritional status in the desired direction.

4. Acknowledgments

5. Conflicts of interest

There are no conflicts of interest.

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