Knowledge-oriented system of dietotherapy

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Abstract

The article describes the compilation of a structural and parametric model of nutrition. It consists of three main blocks: patient's physiological state; diet indicators; environmental factors. The approach of the knowledge organization in the form of a set of rules "IF ... THEN ..." is shown. Based on them, an assumption is made about the patient's nutrition system (high, moderate, low) with a certain degree of confidence. The article shows the calculation of the prognostic risk index, main energy exchange, actual energy expenditure based on patient's physiological parameters and indicators of external factors in order to determine patient's needs for proteins, fats and carbohydrates. The author considers the algorithm of diagnostics of health status allowing to find initial reasons of an abnormal condition of a patient. Based on the data obtained, the doctor prescribes the appropriate diet and dietary regime.

Keywords

knowledge base, structural-parametric matrices, nutrition

1. Introduction

When recommending a particular diet, a dietitian should use not only biochemistry data (protein, carbohydrate and lipid statuses, immune indicators, biochemical blood analysis), physiology data (body weight deficit/excess, activity factor, etc.), food hygiene (volume, weight, consistency and temperature of food), but also take into account individual parameters (age, anthropometric and caliperometric data) [1-2]. In this regard, the problem of dietotherapy can be solved with the help of the knowledge-oriented system of dietotherapy, which will help the doctor to quickly and accurately design a diet for the patient, taking into account the state of his/her nutrition, individual characteristics (gender, age, nutritional status, content of macro - and micronutrients), as well as many external factors.

2. Knowledge-oriented system

The development of the knowledge-oriented system is associated with the accumulation of a knowledge database containing basic concepts and relations between them: region of residence, activity factor, injury factor (surgeries, bone fractures, traumatic brain injuries), current nutritional status, anthropometric data, caliperometric indicators, indicators of trophological status, indicators of macro- and micronutrient status, indicators of vitamin status, as well as a database of chemical composition (protein, moisture, fat, carbohydrates, vitamins, minerals) [5], physiological properties, nutritional, biological and energy values and other characteristics of food products.

These data in the knowledge database are presented in the form of structural and parametric matrices of relations [6], combining three main blocks: patient's physiological state; diet indicators; environmental factors, as well as many relations within the blocks and between the blocks and groups. Each individual block has its own parameters and attributes. For example, the block "Patient's physiological state" includes age, gender, anthropometric data – body weight, height, body mass index, shoulder circumference; caliperometric indicators – fat content, skinfold thickness 2 centimeters above the umbilicus, skinfold thickness above the biceps, etc.

One of the most important functions of the dietotherapy system is associated with the accumulation of knowledge with the formalization of experience of a doctor specializing in dietotherapy. In the dietotherapy system, knowledge is organized in the form of a set of "IF....THEN"

rules. For example, IF 1) Body mass index is less than 17.5 kg / m3; 2) Shoulder circumference is less than 23 cm; 3) Skinfold thickness above the triceps is less than 8.4 mm; 4) Shoulder muscle circumference is less than 20.5 cm; 5) Albumin is less than 30 g/l; 6) Transferrin is less than 1.8 g/l; 7) Lymphocytes are less than 1.5 thousand, THEN it can be assumed (with a certain degree of confidence) that the patient has moderate malnutrition.

The algorithm for finding solutions in the knowledge-oriented dietotherapy system is associated with the diagnostics of human health, and includes a calculation based on patient's physiological parameters Xi, and indicators of external factors Xr: (a) prognostic risk index; (b) main energy exchange; (c) actual energy expenditure) in order to further determine patient's needs for proteins, fats and carbohydrates.

The diagnostic procedure consists in the search for deviations of health indicators from the FAO/WHO standards Δx_i; $i = (\overline{1,n})$ and formation of a structural and parametric situational model of the current state of human health by multiplying the deviation vector Δx_i by the relations matrix vl_{ij}; $i,j = (\overline{1,n})$.

Further, the diagnostic procedure is reduced to a cyclic process of moving along the diagonal of the situational matrix and comparing values of diagonal elements with the reference (standard) values. If there is a deviation Δx_k, the *k*-th line should be reviewed with the registration of direct causes $vl_{ij}\Delta x_k$; $i,j,k = \overline{1,n}$ of this deviation and formation of the contour of relations of elements included in the interaction trajectory.

Branches of the contour of relations are stored in a separate array representing numbers of elements that are included in the interaction trajectory. If at least two elements of the number array match, the last link of the contour of relations is artificially broken and the movement along the line continues until the identification of the final cause. After finding original causes of the abnormal condition of the patient, the doctor prescribes the appropriate diet and dietary regime aimed at minimizing the influence of original causes of the person's abnormal condition.

In general, the dietotherapy system is intended to serve as an assistant to a doctor (dietitian, gastroenterologist, etc.) who is not a narrow specialist in this subject area.

3. References

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