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Research Article

Development of the Nutritional Diet Information System for Athletes

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Abstract: The quality of diet for a sportsman will impact directly on the training effectiveness and playing condition. Based on now information technologies the nutritional diet information system would design the planning of nutritional implementation and diet recipes for the athletes according to the different sporting events. The system will manage, balance and rationalize the diet and nutrition for the athletes so as to improve training effect and reduce the physical injury. It will also helpful to manage sports training and improve the quality of sports training.

Keywords: Athletes, information system, nutritional diet

INTRODUCTION

A rational diet for the athletes not only helps to improve their athletic abilities and recover their body, but also a material basement which support the athletes to do physical training and keep in a good competition state (Li, 2012). The catering for the athletes is according to the Recommended Dietary Allowance (RDA) and the safe Upper Limit (UL) of the intake of various nutrients (Jun and Wenkun, 2010). Professional nutritionists and special computer software are needed in actual operations. There is a higher technical requirements for popularizing applications and is a heavier burden of work. Therefore, taking a full use of modern information technology to design and develop nutritious meal information systems is of great significance for simplifying and popularizing athletic nutritious meals, also contributes to improving logistics and quality of services. It is also an important measure to achieve a scientific, modern and normative management of physical training.

MATERIALS AND METHODS

The basic thinking of system designing and developing: The current situation of the nutrition catering for athletes. Currently, during the work of catering nutritious meals for athletes, the calculation, compilation, formulation of the nutritional recipes for athletes, the completion of the ordering tables, the computing and counting of the raw materials and so on, are mostly done by hand, which leads to a high-intense and low-efficiency work of the dietitian and staff and there also exist errors, food contamination and other issues during the operation. It is extremely difficult to achieve a scientific, nutritious, hygienic, accurate and thoughtful management.

The analysis of demand: With the deepening development of scientific exercise training, standardized management and the information technology, as well as an increasing competition in sports, the nutritional and dietary requirements for athletes seem to be more and more important. Proper nutrition supplies for athletes is an indispensable and important part of modern sports training, nutritious meals are formulated according to the features of the sports the athletes occupy and personal or physiological characteristics of the athletes, in order to meet the nutritional needs of the athletes in their training or competition under different circumstances (Quatromoni, 2008). Proper nutrition diet, does not only require a complete composition and a proper proportion of nutrients contained in the diet, but also requires color, smell, taste, shape and appearance to be good enough to enhance the athletes' appetite and improve the nutritional intake of athletes. Thus, making full use of modern information technology, developing and designing the intelligent "athlete-centered" nutritious meals systems, is of great meaning to promote the scientific and standardized management, improve training effectiveness and competitive level of athletes.

Goal: The nutritional quality of the diet reflect a direct or indirect impact on the athletes training effect and the management of nutritional quality is also part of the training campaign management. Proper nutrition for athletes helps to delay fatigue and speed recovery and improve training effectiveness and competitive level. For the athletes concerned, due to the difference of the characteristics of sports training and competition

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environment and periods, they have different needs for nutrition, it must supply the nutritional needs of different projects and different diets, so that both meet the nutritional needs of athletes and consistent athlete management and sanitary conditions of food, which is the goal of athlete nutrition and diet management. Development of nutrition catering system can effectively improve the nutritional status of athletes and solve the problems such as proper nutrition consistent, a balanced diet, an scientific catering, special dietary and nutritional management that cannot exist under artificial conditions, promoting the benefits of exercise training and improving the competition level of protection.

The mathematical model of nutritious meals:

Mathematical model: According to the requirements of a balanced diet of nutritional assessment, the following constraints and multi-objective model with realistic goals can be obtained:

$$AX = B \quad (X \geq 0) \tag{1}$$

$$\min Z = CX \quad \min Z = CX \tag{2}$$

Among them:

- Represents a set of constraints, including nutrient standards constraints meals heat distribution ratio limit, dietary quality constraints, each condition can turn into a standard equal form.
- Is the target function; A is the constraint coefficient matrix, X is the decision vector, B is the expected value of the vector, C is the target coefficient vector.

According to the requirements of a balanced diet of nutritional assessment, nutritious meals model equations can be generated: According to "intake of various nutrients supply should meet the standard of 90 to 110%", you can get a group of nutrient equations; according to requirements that meals heat distribution ratio should reach 3:4:3, you can get heat distribution ratio equations; you can generate a set of equations based on the nutritional quality of dietary quality requirements; target cost equation can be constructed based on user requests the target cost. All the equations above constitute a plurality of target equations nutritious meals multi-objective mathematical models.

The generation of the attainable function: The general form of the attainable function: $a = \{g1(c, p), \cdots, gk(c, p)\}$, is divided into k priorities. Order of priority can be selected according to the actual situation. In the diet catering multi-target model, the priorities of the target cost of energy, protein, carbohydrate, fat, meals heat proportion can be set by users. Different priorities of catering are able to get corresponding optimal results. Reasonable design priority can get a more realistic ideal catering.

The system design:

The main functions of the system: The athlete nutrition catering information system includes functions such as smart nutrition, catering, restaurant management, food analysis, nutrition consulting, systems maintenance and so on (Fig. 1) and also armed with professional experience and ability of nutritionists, especially making sports nutrition and clinical nutrition management by computer, networking, systematic and popularity come true.

The basic statistics of nutritious catering: The module can strictly follow the "food pagoda", the proportion of intake "three substances" requirements and the intake of important nutrients and proportion requirements then realizes an automatic catering, ensuring diversity and importance of food.

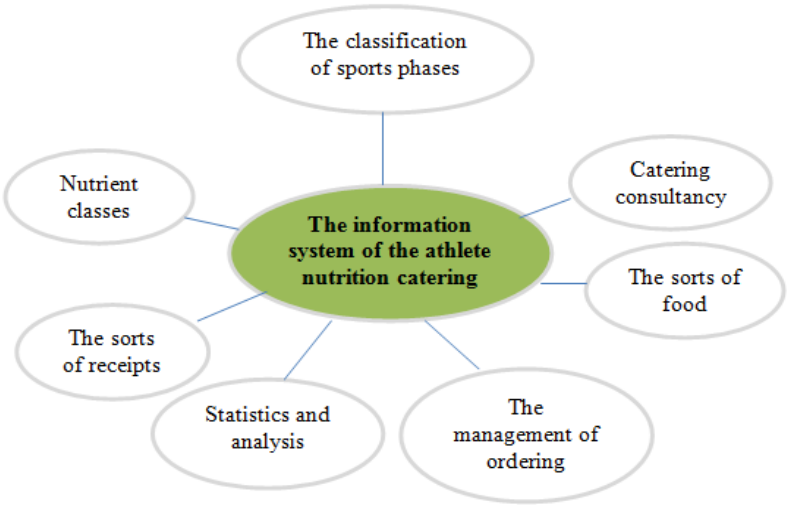

Fig. 1: The basic model of athlete's nutrition catering information system

Food data: The content lists of nutrients, amino acids, cholesterol, fatty acids, folic acid for nearly 2,000 kinds of common food and a variety of dishes with plenty of cooking methods taboos and data are contained in the system, easy to find reasonably related to food catering.

Sports nutrition demand data: The system is equipped with the sprint, long-distance running, cycling, team sports, gymnastics, swimming, weightlifting and power projects hander sports, weight sub-level sport, the nutritional needs of skating and cross-country skiing and other sports, features, implement nutrition programs and other sorts of data. Nutritional requirements includes the need for heat, the need for protein, fat on the need, the need for carbohydrates, dietary fiber needs, the need for vitamins, minerals need, the need for water and the like. Nutrition implement includes different training phase diet program, diet programs, diet before and after the game, etc. Moreover the system is also incorporated into the diet plan athletes may need during special times, such as weight control period, sports injury recovery period, nutritional supplement during race and the period preparing for future race and sedative sleep promotion meal programs and so on.

Recipe data create new categories of self-renewal and improvement of catering platform to build up a personalized diet and nutrition knowledge, in accordance with dishes, soups, porridge, milk and other categories, aiming at the operator's personal habits and personal recipes material.

The management of ordering:

Includes catering, restaurant, meals processing functions: Catering will firstly collect the athletes' sex, age, weight, engage in projects, exercise level and other basic information, the system can calculate the day recommended nutrient intake and body mass index of the athletes and automatically calculate a variety of foods, recipes intake volume. The process is quick and accurate, providing a complete proportional contribution results, various recipes for plenty of nutrients and scientific and comprehensive references for the preparation of catering.

Ordering staff use systems to analyze the different nutrients based on athletes actual situation and suggest supplementation should be added, providing tips such as recommended food intake amount, added amount of food, emphasis added food and diet tips and offer the athletes nutritional programs or recipes that meet the specific circumstances of individual.

Meals recipes ordering processing system calculate the meals ordered by the athletes according to the type, quantity and price.

Dietary analysis: After a detailed analysis of the relationship between athletes balanced diet, an excel spreadsheet will be automatically generate, providing a easy version to compare and print.

In the process of catering, often there will be a maximum of a nutrient content of the day's higher than acceptable daily, athletes does not only lose nutrients, but also have a negative impact. This eye-catching "color warning system" in this software is for the maximum tolerated dose of daily nutrients to the red mark, catering to prevent errors caused by excess nutrients, so that the actual amount of the recommended amount of nutrients do when catering immediate control, the operator can edge compare with watching all day actual amount of nutrients, demand and maximum tolerated dose did glance. The tolerable Upper intake Level (UL) database built inside it makes the catering operation become more flexible, simple, safe and reliable.

The analysis of nutrients curve: The staff is recommended to select one or more nutrients, the system will automatically add a graph analysis of nutrients and take the actual amount of the recommended amount of nutrients intake cycle catering athletes to a comparative analysis and conduct various fast processing for different types of nutrition therapy nutritionally balanced diets and collect information of the athletes once in the system and optimize the information processing automatically.

The analysis of intake: According to the data analysis of intake ordering athletes do during morning, afternoon and evening, it provides a flexible query embodiment nutrition for athletes and nutrient management.

The maintenance and management of systems:

Entry and copy: The system has the feature of entry and copy any dishes and a dish can be copied from one category to another category which significantly improve the ability to classify and organize dishes.

Open data interface: Users can manage (add, modify, delete) nutrient database and dietary program design according to the actual dining center. This mode allows system users to easily select their favorite foods diet program that contains the same nutrients in foods which are not so different.

The function of print and output: It can be convenient to print and output all sorts of diet statistics analysis journal sheets.

The backup and recovery of data: The system take full account into the security of the data, not only for data backup, recovery and made user-friendly design, but also on the performance data of the maintenance done careful design.

THE REALIZATION OF SYSTEMS

About the data the user enters nutritious meals, such as: sports, body type, food, priority mode. According to the model nutritious meals, nutrition data from the table and supply the standard data tables found in the relevant data, generate catering multi-objective model equations. Call multi-objective equation solver module, find the best catering, catering to the data stored in the recipe table. Also calls for comprehensive evaluation of nutritional assessment module, the output module output print evaluation results. Users can also manually invoke catering function, enter the relevant information through the man-machine interface catering, with a comprehensive evaluation of the evaluation module, the evaluation results show, according to the results to adjust catering data. Suitable formulations can be stored in the recipe library catering to save.

Nutritious meals system supports single objective and multi-objective planning, decision-making process:

- Input various parameters and user information through the session screen.
- According to the data corresponding to the user information extracted from the database, automatically generate the target programming equation.
- Start-objective optimization module, the optimal solution is stored in the recipe library.
- Calls a comprehensive assessment and output modules catering to obtain nutritional evaluation result, the output evaluation report.

CONCLUSION

Nutritious meals for athletes to improve athletic efficiency is a very important job, it can be based on different sports, athlete features, from a nutritional point of view to better meet the coaches training, improve training effectiveness. The implementation of the system, can greatly improve the work efficiency and simplify the work of sports nutritionists, sports health and management staff to make exercise training more standardized and more scientific. Therefore, in the rapid development of technology today, faced with increasingly sophisticated sports training and athletic increasingly fierce trend of competition, scientific and intelligent management will become an important tool nutritious meals to promote athletes' proper nutrition, exercise recovery, delay their fatigue and regulate nutrition.

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