"Program Prehrane 5.0" – Software for Designing A Balanced and Varied Menu

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ABSTRACTS

"Program Prehrane 5.0" ("Nutrition Plan") is software for menu planning based on the Food Pyramid conceptual model. It guides users in designing balanced and varied daily menus which means the principal food groups participate in adequate (recommended) portions.

In addition, the software calculates body mass index, waist-to-hip ratio and daily energy expenditure. If necessary, it suggests additional physical activity and changes in the daily energy intake. "Program Prehrane 5.0" also gives nutritive and energy values of different foods and meals, recommends macronutrient proportions of 22 different diets as well as energy ratios of meals in daily menus. "Program Prehrane 5.0" calculates the energy expenditures of various sport and non-sport activities which is helpful for athletes, people on slimming regimes or those who should intensify their physical activity because of health reasons.

Users could create and store menus and clients' data, track anthropometric changes, calculate menu prices, incorporate new foods into software, follow nutritive and energy data as well the numbers of principal food group servings.

The software "Program Prehrane 5,0" could be used at fitness centers, wellness centers, sport clubs, residences for elderly people, hospitals, schools, dormitories, restaurants etc.

Keywords: balanced and varied menus; energy and nutritive values; menu planning; principal food groups; software

INTRODUCTION

It is well recognised that lifestyle and eating habits play important roles in maintaining optimal health and nutrition. However, increased incidence of chronic diseases (such as obesity, heart disease, diabetes, gallstones, etc.) prompt decision-makers to take action, and introduce wide public health initiatives, with an aim to mobilize society as a whole to act in a positive direction in order to improve overall health. Optimal nutrients and energy intake are important in maintaining good eating habits and they also serve as practical and indispensible educational tools for those who have to make shifts in their lifestyle in order to achieve good health and long-term well-being.

Implementation of nutritional recommendations and guidelines for individuals as well as groups of consumers, is demanded for several reasons. First, menu planning is time consuming and therefore costly. It is one of the reasons why people with weight problem or improper eating habits do not seek nutritional advice. Secondly, many institutions (hospitals, prisons, boarding schools, etc.) do not employ nutritionists or dietitians which means that employees with limited knowledge in nutrition (e.g. nurses, teachers, housekeepers, etc.) are responsible for menu planning. Also, it is not unusual that some institutions with scarce finances cannot afford adequate presence of all principal food groups in their menu on a daily basis. Last, but not least, public health professionals will put great effort into education of the general population, before an average consumer accept even main aspects of balanced and varied diet.

Professionals, nutritionists and dietitians in the first place, who design menus for individuals, as well as consumers at various institutions, face many obstacles. Besides the need for menus to be balanced and varied, nutritionists have to take care of consumers' preferences, customs, traditions, seasonal fluctuations of food availability and above all, limited budgets at institutions.

Software for menu planning is a great help in the design of a balanced and varied diet. Development of first computer-based menu planners goes back to early 60s of last century. At first, they were employed to satisfy nutritional needs at limited cost (Balintfy, 1964). After that scientists were working on programs in order to increase palatability as well as other sensory characteristics of meals (Eckstein, 1967), incorporate

familiar recipees (Leung et al., 1995), and increase meals compatibility within daily menus (Lancester, 1992). Such software finds its place in the catering industry (Ganeshan, Farmer, 1995), menu planning for individuals (Marling et al., 1999) and institutions such as hospitals, prisons, boarding schools, etc.

In this paper, we introduce the software „Program Prehrane 5.0" („Nutrition Plan") for optimal menu planning with respect to national dietary recommendations Regulation (121/07, 2007; Regulation 46/11, 2011; Regulation 146/12, 2012) and international guidelines (USDA, 2005) as well as customs and tradition.

MATERIALS & METHODS

„Program Prehrane 5.0" is an interactive software designed which development started in 2007. There was a need for software which would allow users to design balanced and varied daily menus, based on an individual's energy need and health status. Moreover, the menus had to have adequate proportions of all principal food groups (cereals and substitutes, meats and substitutes, vegetables, fruits, milk and dairy fermented drinks, and fats) and they had to be done in a reasonable time period, as it was proposed by other authors as well (Koroušić Seljak, 2007).

„Program Prehrane 5.0" calculates daily energy expenditure according to formulas of Schofield (Schofield, 1985) and the UK Department of Health (Department of Health, 1991) .

Energy and nutrition values of food presented in the software are based on internationally recognized data (Royal Society of Chemistry, 2002; USDA, 2011; Whitney, Rolfes, 1999).

Recommended micro and macronutrients intakes and the presence of principal foods groups in daily menus, given in „Program Prehrane 5.0" follow national (Regulation 121/07, 2007; Regulation 46/11, 2011; Regulation 146/12, 2012) and international standards (USDA, 2005).

RESULTS & DISCUSSION

From a user's anthropometric data (body mass and height), the software „Program Prehrane 5.0" counts the body mass index (BMI). It also calculates their energy needs in accordance with anthropometric data, sex and age, as well as, intensity of physical activity at work and at leisure time (Bender, Bender, 1997) (illustration 1). Not rarely, the image of body mass index scale is an alarm which signals that the user has a problem with body weight (underweight or overweight) which has to be solved changing at the same time poor eating and lifestyle habits (Bosanac, Gašparović, 2014a).

If we talk about the general population, higher BMI values are connected with increased risk for high blood pressure, diabetes type II and cardiovascular diseases. Also, its significant increase in later life, increase incidence of myocardial ischemia. What is more, excessive weight is in a positive correlation with the presence of gallstones (Sachdeva et al., 2011), nonalcoholic fatty liver disease (Fabbriani et al., 2010) and post-surgery complications (Schwarzkopf et al., 2011). Obesity is connected with colon cancer (Sung et al., 2011), prostate cancer (Nunzio et al., 2013) in males, as well increases of breast (Sung et al., 2011), ovarian (Zhang et al., 2013) and uterine cancer (Jeong et al., 2010) in females.

The software „Program Prehrane 5.0" calculates waist to hip ratio, which indicates if the excess fat accumulates around waist or around hip. In the first case, there is an increased risk for diabetes type II and cardiovascular disease. Among females, this risk is higher when the waist circumferences are between 80 and 88 cm, and it is very high when the values are above 88 cm. Among males, this risk is higher when the waist circumferences are between 94 and 102 cm, and it is very high when the values are above 102 cm.
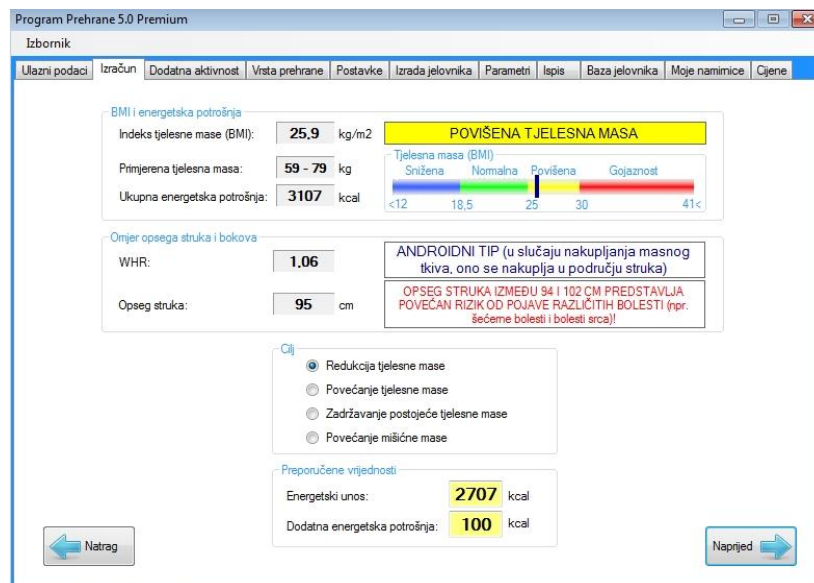
Illustration 1. Body mass index and appropriate energy intake estimation

Those who are physically inactive and/or have problems with weight, the software „Program Prehrane 5.0" recommends physical activity to be incorporated in their daily activities as it is an important link in health protection. The software gives energy costs of more than 400 various activities (Bosanac, Gašparović, 2014b; Montoye, 2000). Program Prehrane 5.0" shows energy and nutritive values of various fresh, cooked and frozen foods servings and well as ready dishes and food products.

While creating menus, this software allows users to take care of wide range of important aspects such as energy needs, taste preferences, culture, religion and customs, as well as seasonal availability of foods which, altogether, could certainly increase satisfaction and reduce plate waste. It takes into consideration clients' health status and gives guidelines for macronutrient intakes at various illnesses. Therefore „Program Prehrane 5.0" could be used in hospitals and similar institutions which were proposed by other authors (Petot et al., 1998).

Implementation of the software „Program Prehrane 5.0" in menu design results in balanced meals which means that it satisfies the clients' nutrient and energy needs and the principal food groups are present in adequate and recommended proportions (illustration 2).

Also, users could track nutritive and energy values of menus as the software compares these values with Croatian standards (illustration 3) which is in accordance with previous ideas (Gajdoš Kljusurić, Kurtanjek, 2002) and intentions of other innovators whose software helps in creating menus for individuals and groups with reference to official recommendations (Marling et al., 1999; Koroušić Seljak, 2007). This is especially important for professionals who create menus at various institutions so, during this process, they could replace one food with another, in order to satisfy consumers' energy and nutrients needs. Moreover, insight into energy and nutritive values of menus helps athletes to decide whether or not to take dietary supplements (Bosanac i Gašparović, 2014a).

If we talk about slimming diets, the most important fact in this process is the balanced relation between intake and expenditure on one side and an adequate proportion of nutrients and principal food groups on the other.
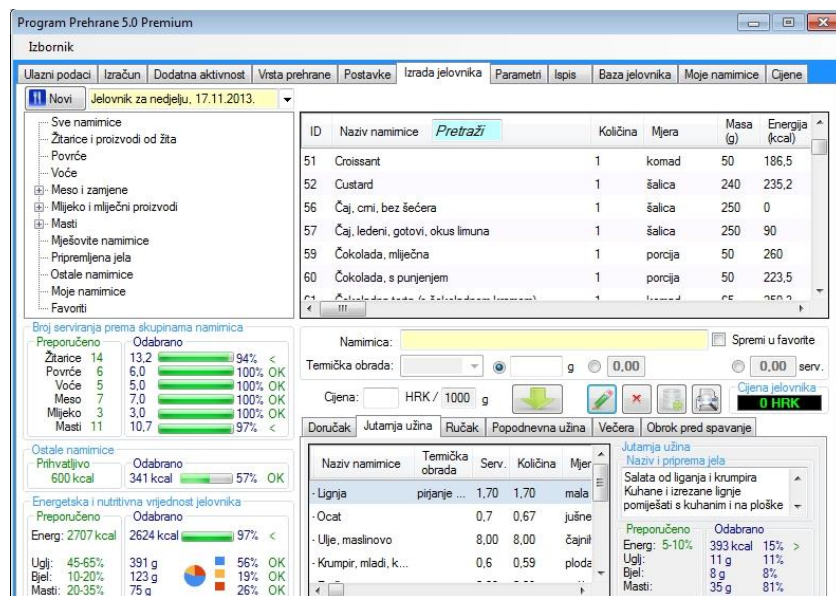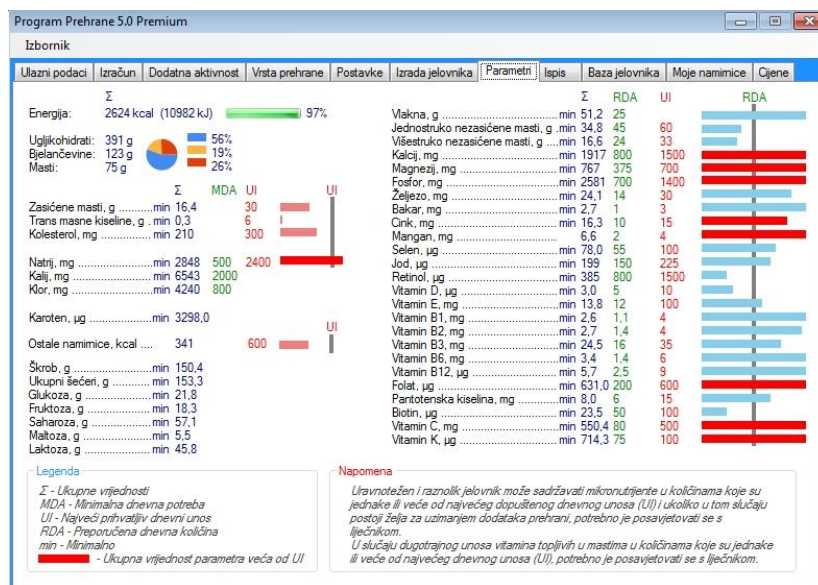
Illustration 2. Designing a menu

Illustration 3. Energy and nutritive values of menu

„Program Prehrane 5.0" helps users to change their poor eating habits and it encourages them to include physical activity in daily routine.

Users could create and store menus and data about clients or themselves, track anthropometric parameters (illustration 4), create price lists, print menus, etc.

This software could be used in fitness and wellness centers, sport clubs, residences for elderly, prisons, etc. „Program Prehrane 5.0" is a useful tool in balanced menu design at schools and boarding schools as it follows national guidelines (NN146/2012) which is in accordance with earlier studies (Balintfy et al., 1978).
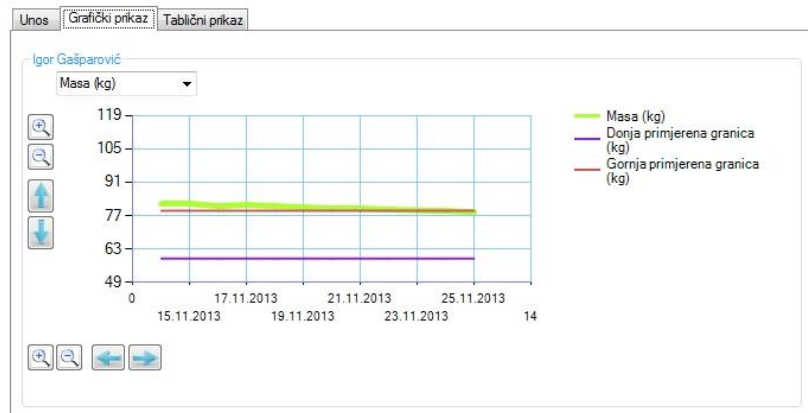
Illustration 4. Tracking client's anthropometric data; graph

Also, it is helpful in analyzing energy and nutritive values of various dishes recipees and therefore could be used in restaurants and hotels which serve *healthy* dishes, in order to attract more guests. This idea was well elaborated in previous papers (Ganeshan, Farmer, 1995; Hinrichs, 1992; Koroušić Seljak, 2007).

„Program Prehrane 5.0" could be used, beside dietitians, by other health workers, as it is the case with a software designed in Malaysia. There, nutritionists and dietitians invented a software to help health workers in rural areas to analyze the eating habits and nutrients intake of people living in remote villages as well as to create new nutritious menus (Noah et al., 2004). There is a guide how to use „Program Prehrane 5.0" so dietitians and nutritionists should have no problem in implementing it in their daily work routine. However, some institutions (houses for elderly, hospitals, boarding schools, etc.) employ registered nurses who solve many tasks, one of which is menu planning. In this case, the application of „Program Prehrane 5.0" undoubtedly requires some professional training in menu planning skills, but will have the proven benefits of better and more efficient nutrition (Bosanac, 2012) at lower cost. This is in accordance with earlier studies which show costs reductions between 10 and 30 % (Balintfy et al., 1978).

The software „Program Prehrane 5.0" is registered at The Croatian Copyright Agency, Zagreb (Innovation 05-3613/14) (Bosanac, Gašparović, 2014b).

CONCLUSION

The software „Program Prehrane 5.0" is an invention which helps to create balanced and varied menus for individuals and groups of consumers according to, among others, their energy and nutrients needs, health, customs, tradition and preferences. Manus consist of appropriate proportion of principal foods groups. Energy and nutrient recommendations are based on national and international standards. This software encourages people to incorporate appropriate physical activity in everyday life. „Program Prehrane 5.0" could be used at hospitals, schools, boarding schools, homes for elderly, sports clubs, wellness centers, etc.

It is believed that the consumers would benefit from this software, as the *healthy* diet is an essential link in maintaining good health and longevity.

REFERENCES

Balintfy J.L. 1964. Menu planning by computer. Communications of the ACM 7, 255-259.

Balintfy J.L., Ross G.T., Sinha P., Zoltners A.A. 1978. A mathematical programming system for preference and compatibility maximized menu planning and scheduling. Mathematical Programming 15, 63-76.

Bender D.A., Bender A.E. 1997. Nutrition, a reference handbook, Oxford University Press, Oxford, New York, Melbourne, Toronto.

Bosanac V. 2012. Optimization of menu planning for students living at secondary school dormitories according to conceptual model (dissertation). Faculty of Food Technology and Biotechnology, University of Zagreb

Bosanac V., Gašparović I. 2014a. Program Prehrane 5.0. Medicus 23(1), 71-74.

Bosanac V., Gašparović I. 2014b. Program Prehrane 5.0. The Croatian Copyright Agency, Zagreb, Inovation 05-3613/14

Department of Health, HMSO 1991. Dietary Reference Values for Food Energy and Nutrients for the United Kingdom no. 41. London.

Eckstein E.F. 1967. Menu planning by computer: the random approach. Journal of American Dietetic Association 51, 529-533.

Fabbriani E., Sullivan S., Klein S. 2010. Obesity and nonalcocholic fatty liver disease: Biochemical, metabolic, and clinical implications. Hepatology 51(2), 679-689.

Gajdoš Kljusurić J., Kurtanjek Ž. 2002. Statistical Modelling of Anthropometric Characteristics Evaluated on Nutritional Status. Proceedings of ITI, Zagreb, Croatia, June 2002. 168-169.

Ganeshan K., Farmer J. 1995. Menu planning system for a large catering corporation. Proceedings of the Third International Conference on the Practical Application of Prolog, Paris, France, April 1995. 262-265.

Hinrichs T. 1992. Problem solving in open worlds: A case study in design. Lawrence Erlbaum Associates, Hillsdale.

Jeong N.H., Lee J.M., Lee J.K., Kim Cho C.H., Kim S.M., Seo S.S., Park C.Y., Kim K.T., Lee J. 2010. Role of body mass index as a risk and prognostic factor of endometrioid uterine cancer in Korean women, Gynecology Oncology, 118(1), 24-28.

Koroušić Seljak B. 2007. Computer-based dietary menu planning. Journal of Food Composition and Analysis 22, 414-420.

Lancester L.M. 1992. The evolution of the diet model in managing food systems. Interfaces 22, 59-68. Leung P., Wanitprapha K., Quinn L.A. 1995. A recipe-based, diet-planning modelling system. British Journal of Nutrition 74, 151-162.

Marling C.R., Petot G.J., Sterling L. 1999. Integrating Case-Based and Rule-Based Reasioning to Meet Multiple Design Constraints. Computer Inteligence 5, 308-332.

Montoye H.J. 2000. Energy Costs of Exercise and Sport. In Nutrition in Sport. Maughan R.J. (Ed.) Blackwell Science, Oxford.

Noah S.A., Abdullah S.N., Shahar S., Abdul-Hamid H., Khairudin N., Yusoff M., Ghazali R., Mohd-Yusoff N., Shafii N.S., Abdul-Manaf Z. 2004. DietPal: A Web-Based Dietary Menu-Generating and Management System. Journal Medical Internet Research 6, e4.

Nunzio C., Albisinni S., Freedland S.J., Miano L., Cindolo L., Finazzi Agro E., Autorino R., Sio M., Schips L., Tubaro A. 2013. Amdominal obesity as risk factor for prostate cancer diagnosis and high grade disease: A prospective multicenter Italian cohort study. Urology Oncology: seminars and Original Investigations 31(7), 997-1002.

Petot G.J., Marling C., Sterling L. 1998. An artificial intelligence system for computer-assisted menu planning. Journal of American Dietetic Association 98, 1009-1014.

Regulation 121/2007 2007. Odluka o standardu prehrane bolesnika u bolnicama. Official Gazette of the Republic of Croatia No. 121/2007.

Regulation 146/2012 2012. Normativi za prehranu učenika u osnovnoj školi. Official Gazette of the Republic of Croatia No. 146/2012.

Regulation 46/2011 2011. Pravilnik o dodacima prehrani. Official Gazette of the Republic of Croatia No. 46/2011.

Royal Society of Chemistry – Food Standard Agency 2002. McCance and Widdowson's The Composition of Foods, Royal Society of Chemistry – Food Standard Agency, Cambridge.

Sachdeva S., Khun Z., Ansari M.A., Khalique N., Anees A. 2011. Lifestyle and Gallstone Disease: Scope for Primary Prevention. Indian Journal of Community Medicine 36(4), 263-267.

Schofield W.N. 1985. Predicting basal metabolic rate, new standards and review of previous work. Human Nutrition - Clinical Nutrition 39(S1), 5-41.

Schwarzkopf R., Thompson S.L., Adwar S.L., Liublinska V., Slover J.D. 2012. Postoperative Complication Rates in the "Super-Obese" Hip and Knee Arthroplasty Population. The Journal of Arthroplasty 27(3), 397-401.

Sung M.K., Yeon J.Y., Park S.Y., Park J.H., Choi M.S. 2011 Obesity-induced metabolic stresses in breast and colon cancer. Annals of the New York Academy of Science 1229, 61-68.

USDA–United States Department of Agriculture 2005. My Pyramid Food Intake Patterns. http://www.mypiramid.gov.

USDA – United States Department of Agriculture 2011. USDA National Nutrient Database for Standard Reference. http://www.ndb.nal.usda.gov.

Whitney E.N., Rolfes S.R. 1999. Understanding Nutrition. West Wadsworth, London.

Zhang Y., Solley T., Nowicka A., Klopp A. 2013. Obesity promotes growth of ovarian cancer through adipose steam cells. Clinical Cancer Research 19(S19), A67.