UP-TO-DATE DIET – WELL BALANCED NUTRITION - SPORT ACTIVITY (OPTIMIZAATION OF BODY MASS IN THE XXI CENTURY)

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Professional paper

Abstract

The paper deals with topics of up-to-date, with sport motion combined diet, helping in keeping the health, as well. In the last decades a lot of information were distributed concerning several viewpoints of bodyweight reduction and optimation. How should we know that it is useful and not unhealthy? A suitable Nutrition software (AOPNEI, Analysing and Optimation Program for Nourishment and Energy Intake) – developed at the Department of Food Chemistry and Nutrition of the Faculty of Food Science – can help.

Key words: adequate nutrition, bodyweight reduction, chemical composition, food, motion, software

INTRODUCTION

From point of view of healthy status of the organism and estetic appearance of the human body the bodymass should be rather close to the ideal (optimum) one. With high probability the optimum bodymass will have a favourable effect not only on the quality of life, but on the life-expectancy, as well. And in case of sport activity, the optimum body composition is one of the most important parameters, determining the performance level of the athletes. In this article we would like to give information about 2 topics:

- necessity of combination of the adequate nutrition and sport activity (eating, optimum body composition and physical load)
- computer sofware as Analysing and Optimation Program for Nourishment and Energy Intake (AOPNEI)

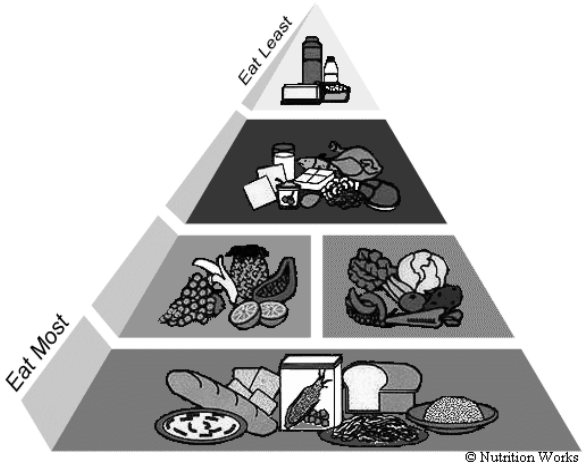
Let us mention a few useful books and papers, covering the field of adequate nutrition, bodyweight reduction, health and physical load (Inge and Brukner, 1989; Fogelholm, 1994; Williams and Devlin, 1996; Neumann, 2001; Miller et al., 2003; Oja and Borms, 2004; Bernardot, 2006; Fink et al., 2006; Manore at al., 2009). Even in the previous issues of this journal of kinesiology (SSPA) some interesting papers were published concerning the complex topics of nutrition and sport. Görner at al. (2009) were dealing with questions of physical activity, bodymass and body composition, in the paper of Sunje (2010) information was given about menus for athletes and Nasim (2011) paid attention to topic of effect of aerobic exercise in case of obese women.

UP-TO-DATE DIET – WELL BALANCED, ADEQUATE, MODERATED NOURISHMENT

Adequate nutrition means to eat not more and not less than the real physiological need of the organism. Of course the need is a function of many factors, e.g. gender, bodymass, age, type and duration of physical activity, body-composition, climate. To avoid the overweight and obesity we need moderated nourishment, not forgetting, that recently in developed countries (based on BMI determinations) appr. 30-40 % of adult population is in obesity state (BMI is over 30). Therefore the up-to-date diet – based on the newest achievements of nutrition science, as well – requires really moderated, but in the same time well-balanced nourishment. Well-balanced diet is adequate for all essential (biologically important) components of nourishment, e.g. for protein, indispensable fatty acids, macro- and microelements.

Fig. 1. shows the healthy diet pyramid (www.nutrition.com.sg). This is not a rigid prescription, but a general guide for normal human beings, that lets you choose a healthful diet that is right for you. Anyway, in case of top athletes we need some significant modifications (e.g. application of food supplements), because the pyramid was constructed not for top competitors. This type of pyramid has 5 different (basic) groups of food products.

Figure. 1. Healthy diet pyramid



The top level (small tip) of the pyramid shows fats, oils, sugar and salt. These are foods such cooking oils, butter, margarine, sugars, sweet desserts, seasonings and sauces. These foods provide dominantly calories (energy) and little else nutritionally. Most people should use them sparingly.

On the next level of the healthy diet pyramid are foods that come mostly from animals: meat like beef, lamb, mutton, pork, poultry, meat products, fish, eggs, milk, yogurt, cheese; nuts and seeds. These foods are mainly for protein, fat, calcium, iron, and zinc.

The lower level includes foods that come from plants, these are vegetables and fruits. Most people need to eat more of these foods for the vitamins, minerals, and fibre they supply.

At the base of the diet pyramid are rice and alternatives like noodles, breads, cereals, pasta - all foods from grains. In general your daily meals should include largest number of servings of these foods each day.

DETERMINATION OF THE OPTIMUM ENERGY INTAKE

If the person – e.g. an athlete with too high fat-ratio of the body – has overweight, the successful diet should be based on negative energy-balance. It means, that the energy-intake should be less, than the consumed energy by the body. The difference can be based on the mobilization of fat-depo. The determined daily energy intake is always individual, depending on the basal metabolic rate and other parameters.

To the sophisticated scientific literature in case of long-term weight-reduction the optimum daily energy-deficiency in general is not more than 500-600 kcal (2000-2500 kJ). For normal people – not top athletes – this is in general a daily diet with 1200-1500 kcal (5000-6300 kJ) for female, and 1400-1800 kcal (5900-7500 kJ) for male individuals. Let us see the ratio of components in the proposed low-energy, slimming (fat decreasing) diet!

ADEQUATE QUANTITY AND RATIO OF NOURISHMENTS

In case of adequate nutrition the energy % of protein should be appr. 15-20 %, about 1 g protein/kg bodymass. Protein is - the meaning is firstly important – an essential component of the diet, mainly used not as fuel, but for build up the muscles. The ratio of plant and animal origin protein can be appr. 50:50. Let us mention that to be a vegetarian is not healthy, there are some deficiency problems (e.g. protein, Fe, Ca, B-12).

Concerning the carbohydrates, the proposition is 55-60 %, which is 180-230 g daily. The amount of added sugar (saccharose) should not exceed 10 % of the total energy, it means that the dominant part of the carbohydrate consumption should be complex type (starch).

In case of fat and oil the daily quantity can be 40-60 g, which is less than 25-30 % of the total energy intake. We have to have a balance between the animal fat (high concentration of saturated fatty acids, SFA) and vegetable oil (high concetration of unsaturated fatty acids, MUFA and PUFA).
In case of cholesterol intake the daily maximum should not exceed 300 mg. And concerning the dietary fiber intake the amount should be minimium 25-30 g/day.

If the diet is well balanced and varied, this will cover in general the requirements of vitamins and minerals for untrained people. But in case of athletes the risk of deficiency of some components (e.g. Fe, Zn, folic acid, B-1 and B-6 vitamins) is high, for this reason the application of food supplements is a proposition. Partly for prevention of deficiency problems and partly for performance-increase (Shaw, 1998,1999) (Szabo, 2002, 2007, 2011). To our opinion it is better to apply special complex food supplements, containing different components.

DAILY ROUTINE OF NOURISHMENT INTAKE, PERIODIZATION OF MEALS

The proposition is 4-5 meals/day – in some cases even 6 meals: breakfast, second breakfast, lunch, high tea, supper and additional evening meal (e.g. cup of yogurt) before going to sleep – of course in moderated quantities, trying to keep the level of insuline almost constantly and

helping the decrease of the bodymass (Gibney et al., 1997).

VARIABILITY
The task is to create and apply a varied, many different foodstuffs containing, diverse diet which is in harmony with the individual tastes and habits. Of course one has to take into consideration the propositions of healthy diet pyramide, as well.

MOTION, PHYSICAL ACTIVITY, SPORT
Healthy life-style involves not only well-balanced nutrition, but physical activity, as well. Systematic and regular sport activity has a lot of favourable effects, beneficial advantages, because it is not only an effective help in keeping the normal bodyweight, but increases the muscle-ratio and decreases the fat-ratio of the body, improves the cardio-vascular ability of the organism, enhances the endurance, and based on these effects significantly decreases the risk of illnesses. In other woreds: effectively improves the quality of life.

It is proved, that the intensive motion slightly increaes also the BMR, the favourable effect is detectable after the training, as well, and the regular physical activity increases the fat-burning capability of the body, as well. Another positive advantage is the stress-decreasing effect, decreases also the pressure of eating and it is a pledge of a good and deep sleep. The question is the following: what should be the intensity of the motion? We can choose a high, or medium or low intensity sport activity.

HIGH INTENSITY SPORT ACTIVITY
In this case the duration of the exercises (e.g. sprint, weightlifting) is short. This type of training does not influence the fat-mobilization of the body, but increases the muscle-strength. Because of intensive protein-biosynthesis the protein-need is higher. Of course we should control also the carbohydrate-intake, surely if the muscles do not contain enough carbohydrate the organism gets quickly exhausted. Anyway, this type of training can be also a useful (supplementary) part of the slimming diet program, because the bigger quantity of muscles gives the possibility to burn more fat.

MEDIUM INTENSITY SPORT ACTIVITY
The duration of the exercises (e.g. running, tennis, swimming) is longer, this type of training increases the endurance. Such exercises and trainings increase the fat-burning, but protect the muscle-mass. 3-5 minutes after the beginning of the motions the fat-stream from the fat-depo of the organism into the blood is measurable, but the fat still does not burn, because for this we need much longer time. To the newest knowledge of the specialists the biggest amount of fat will be burnt at medium intensity sport activity between the 30 and 90 minutes of the training. We mention that this type of training is the most effective tool on the reduction of fat layer thickness on the waist.

LOW INTENSITY SPORT ACTIVITY
The low intensity exercises (e.g. walking, jogging) stimulate the release of fat from fat cells. Because of the rather low level energy consumption of the organism the carbohydrate consumption is also very moderated, the need is mainly covered by the sugar in the blood. The concentration of fatty acids in the blood is the highest in case of these type of training, becase the fat-burning is limited. Increasing the intensity, incerasing the energy consumption the concentration of fatty acids reduces step by step, because the burning of free fatty acids has the highest level in case of moderated intensity range.

FOR WHAT TO APPLY THE PULS-CONTROL?
The heart-frequency is in close correlation with the physical load. The effective fat-burning needs an optimum range of puls during the training. It is wellknown that the energy production– performed during the training or competition – is based on the anaerobic (phosphagen and lactic acid) and aerobic energy systems. The most important characteristics of these energy systems are shown in table 1. Of course all energy systems are used simultaneously at the onset of maximum exercise, but with the energy system mentioned in the table being dominant.

Table 1. Energy systems of the body

parameter	energy system		
	anaerobic		aerobic
	phosphagen	lactic acid	
rate of energy production	very rapid	fast	slow
substrate used	ATP	muscle glycogen	fat, carbohydrate
duration of maximum exertion	4-8 seconds	1-2 minutes	hours
examples of activity	jumping, throwing sprint	400-800 m running 100-200 m swimming	long distance running, cycling

So in case of a training in the first seconds the anaerobic phosphagen system (ATP) is the dominant energy producer, and later the energy production is based mainly on carbohydrate. The fat burning – aerobic energy production from dominantly fat – will be significant only after 30-40 minutes of training if the puls is in optimum range (appr. 120-140 beats/minute). So we need a medium level load (not too high and not too low intensity) to have an effective fat-burning, and as a result a better body-composition and lower fat%. So the regular puls-control can help not only in establishment of appropriate training method and performance development, but to achieve the optimum bodyweight and body-composition, as well.

ANALYSING and OPTIMATION PROGRAM for NOURISHMENT and ENERGY INTAKE

At the Department of Food Chemistry and Nutrition of the Food Science Faculty of Corvinus University, Budapest a special, interactive software – computer program for planning of nourishment – was developed (AOPNEI), which is suitable for planning and control of the nutrition of various people, including even top competitors, as well.

The software is composed on 4 Excel files, which operate statistically evaluated and fitted algoritms, representing the model as a logical system. With help of the AOPNEI software the propositions (real energy and nourishment demand) are determined based on the following parameters: gender, age, bodymass, height, level of physical activity and other anthropometrial - shoulder, hip, waist, wrist, elbow, skin caliper at biceps, triceps, breast, back, front (belly), inside and outside thigh (leg) - and physiological - body temperature, bodyfat %, BMI, puls (heart frequency) after wake up – characteristics. It is possible to take into account the differences in the metabolism of the investigated persons, as well. The databank of the software contains 90 chemical composition parameters (e.g. starch, fat, dietary fibre, water soluble vitamins, essential macroelements) for more than 1000 basic food, foodstuffs and diets, so the calculations are based on more than 90 thousand data. Using this database it is possible to create special recipes for the individuals.

Based on the results of the previous measurements (input data) and the databank the process for optimation of bodyweight can be performed. For effective and appropriate calculation we should put still the following information into the computer: measure of the bodymass change (kg) and the planned time interval to reach the wanted (or optimum) bodymass. The sofware will calculate also the individual puls rate interval, which is useful for effective fat-burning. The parameters, evaluated and calculated in the program are shown in table 2.

Table 2. Evaluated parameters of the program

BMI index, bodyfat %, proposed optimum bodymass (kg)
physical activity factor, ideal puls rate interval for fatburning
energy requirement of basal metabolism (BMR), energy requirement of real (working) metabolism, need of energy balance (kcal, kJ)
energy intake, energy deficiency or energy excess (kcal, kJ)
protein requirement, total protein intake, intake of protein of animal origin, protein deficiency or protein excess (g)
proposed carbohydrate intake, real carbohydrate intake, added saccharose intake, deficiency or excess of carbohydrate, glicaemic index for different meals (%), glucose load of the different meals (g)
fat requirement, total fat intake, vegetable oil intake, deficiency or excess of fat (g)
dietary fibre requirement, intake of dietary fiber, deficiency or excess of dietary fiber (g)
water requirement, water intake, deficiency or excess of water (l)
maximum tolerable alcohol intake, real alcohol intake, alcohol excess (g)
sodium intake, sodium excess (mg)
potassium requirement, potassium intake, deficiency or excess of potassium (mg)
calcium requirement, calcium intake, deficiency or excess of calcium (mg)
magnesium requirement, magnesium intake, deficiency or excess of magnesium (mg)
ratio of (Na+Ca)/(K+Mg), ratio of Ca/P
iron requirement, iron intake, deficiency or excess of iron (mg)
quantities of intakes of different food groups shown in table 3 (dkg)
energy intake from different food groups (kcal, kJ)
percentage (%) of the diffrent meals from the total daily energy consumption
percentage (%) of the food components of the total energy intake
energy utilization based on the different physical loads (e.g. sport activity) of the body (kcal, kJ)
protein, fat, carbohydrate, dietary fiber, Na, K, Ca, Mg, Fe intake from different food groups (g or mg)
estimation of need, intake, deficiency and excess of vitamins A, D, E, C, B-1, B-2, B-3, B-6, B-9 B-12 (mg)
estimation of need, intake, deficiency and excess of Cu, Zn, Mn, Cr (mg)

Table 3 shows the different groups of food products. To our classification 15 different groups of foodsuffs were constructed and evaluated, significantly more than shown in the diet pyramid.

Table 3. Groups of food products
(Food groups in the AOPNEI software)

milk
milk products
meat, fish, meat products
egg
bread products
other cereals (e.g. rice)
vegetables, greens
fruits
nuts, oil-containing seeds
confectionary products, sweets
fats, oils
non-alcoholic drinks
alcoholic drinks
food supplements
other products (e.g. added sugar)

Concerning the level of physical activity – e.g. recreational level activity or high load in top sport – 2 versions were elaborated. The first one is a simple model for normal, everyday, recreational level physical activity (e.g. 30 minutes jogging/per day), the second one is more complicated. This version needs the planned or performed physical activity precisely for 24 hours of each day. On the base of information about the physical activity (sport branch, level of intensity, duration) the program will determine the physical activity factor and the energy requirement for the performed sport activity, as an additional need. Taking into consideration also this additional need, the program will have a proposition for the daily nourishment. With this program we can plan, calculate and control the daily nourishment for long period or even evaluate our previosly applied diet.

CONCLUSIONS

The real (adequate) energy and nourishment requirement of the human body depends also on the physical activity of the individuals. So, in case of determination of physiological need of the organism we should take into account the physical activity factor, as well. The up-to-date diet is always well-balanced, moderated and varied, based on many different foodstuffs. Of course in case of weight-reduction (e.g. too high

fat% of the athlete) the successful diet is based on negative energy-balance. But the long-term fat-content decreasae of the body should not exceed 50 g daily, whis is appr. 1.5 kg kg/month. So for 10 kg real bodyweight-reduction (not water, but fat should be removed) we need 6-7 months period as a minimum.

Applying the developed AOPNEI software we can plan and control the daily nutrition of persons, as a function of many parameters. The software is able to recognise the incorrect input data (e.g. significant difference in metabolism) showing the mistakes. Information is given also about the fault in that cases, when the planned slimming cure is too drastic and the risk of malnutrition is too high. The program involvs the application possibility of puls control, as well, helping effectively in fat-burning during the physical activity.

The application of the program is suitable not only for control the nutrition, but can help in modification of life style, way of life, in prevention and treatment of deficiency diseases, too. In other words to produce better quality of life and healthy status. And for athletes additionally a higher performance level.

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Received: 22. August 2012
Accepted: 23. December 2012