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Reviews

Food intake and profession – principles of healthy food

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Abstract

Healthy nutrition is essential for maintaining workers' health and enhancing work productivity. This paper explores the principles of a healthy nutrition, emphasizing the relationship between dietary requirements and occupational demands.

The daily energy requirement depends on the intensity of the physical activity, being double for forestry workers compared to office workers. The consumed energy during a professional activity can be estimated through metabolic equivalents (METs).

The protein intake maintains muscle mass and protects against certain occupational toxins. Ensuring the optimal energy support requires the avoidance of carbohydrates with a high glycemic index (which disrupt glycemic balance and decrease work capacity) and introduction of slow-absorbing carbohydrates. Lipids provide a concentrated caloric support, particularly useful for intense physical labour (miners, farmers).

Micronutrients (vitamins and minerals) support musculoskeletal integrity, cognitive function, and immune resilience, especially in occupations involving physical or neuropsychological stress. Proper hydration is equally crucial for maintaining physical and cognitive capacities, with water requirements depending on the caloric expenditure and environmental conditions.

This paper provides a new perspective regarding the dual relationship between nutrition and work: occupational demands influence dietary needs, while dietary quality impacts work capacity and health. Knowing and applying the basic principles of healthy eating according to the professional activity and exposure is essential for maximizing workplace performance and employee well-being.

Keywords: *occupation, nutrition, energy requirement*

Introduction

One of the factors that determine the work capacity of employees and that influences their workplace performance is their nutrition. The intake of nutrients that correspond to the physiological needs of an individual, involved in a professional activity, is one of the most important factors of sanogenesis. Adequate nutrition can increase a worker's productivity by up to 20% [1]. A healthy diet can reduce absenteeism, presenteeism (presence at work, but with reduced involvement), the prevalence of both acute and chronic diseases [2, 3]. Overweight also has consequences on workplace performance by increasing both absenteeism and presenteeism [4, 5]. So, there is every reason for employers, employees and health professionals to be interested in implementing and supporting healthy nutrition programs.

The science of nutrition establishes the energy and nutrient requirements necessary for growth and development, as well as for the optimal maintenance of the body's functions, taking into account age, sex, level of physical activity, environmental conditions, as well as the presence of health or illness [6]. All these aspects are related to occupational activity, involves the development of new skills, and contributes decisively to the daily energy consumption of the body.

Energy requirements

The caloric requirement of the human body has three essential components: the basal metabolism, the thermic effect of food and the energy expended for voluntary activities. While the energy required to support the basal metabolism is relatively well-defined, being around 25 kcal/kg/day, the energy needed for physical activity varies considerably. For those with light physical activity (office workers, priests, teachers, students, clerks), the total daily energy expenditure is around 35 kcal/kg/day. Individuals with moderate physical activity (salespeople, transport workers , housekeepers) need 40 kcal/kg/day, while people with heavy physical activity level (agricultural workers, construction workers, miners, wood cutters) need about 45 kcal/kg/day [7]. Of course, there are certain jobs with a particularly intense physical effort, which may require a much higher caloric intake.

Table 1. Energy requirements based on the physical activity level [7].

Physical Activity	Energy Requirement
At rest	25 kcal/kg/day (BMR)
Light	25 + 5 (10) = 30-35 kcal/kg/day (1.2-1.4 x BMR)
Moderate	25 + 10 (15) = 35-40 kcal/kg/day (1.4-1.6 x BMR)
Heavy	25 + 15 (20) = 40-45 kcal/kg/day (1.6-1.8 x BMR)

The recommended daily caloric intake varies, from 2000 kcal for a female and 2500 kcal for a male [8], applicable for the general population, predominantly sedentary, but it can go up to 3800 kcal for a construction worker or 4000 kcal for a miner [9, 10].

The energy expenditure during a professional activity can be estimated using metabolic equivalents (METs). Based on the fact that the basal metabolic rate (BMR) is approximated to be 1 kcal/kg/hour, we can compare the multiplier effect on energy expenditure of different activities, expressed as the metabolic equivalent for each specific activity. For example, cleaning results in an energy consumption of approximately 3 kcal/kg/hour, so METs = 3 for cleaning. Thus, a 70 kg adult will consume 210 kcal in one hour of cleaning. Below is a table listing different professional activities according to METs [11]:

Table 2. METs for different professional activities

Intensity	Activity	Metabolic Equivalent
Light < 3.0 METs	Office work	1,5 METs
	Slow walking	2 METs
	Store clerk	2,0-2,5 METs
Moderate 3.0-6.0 METs	Cleaning	3 METs
	Carpentry	3,6 METs
Intense > 6 METs	Shoveling (sand, coal etc.)	7 METs
	Carrying heavy loads (bricks etc.)	7,5 METs
	Digging	8,5 METs

One of the most energy-consuming activities is practiced by wood cutters, who require up to 12.7 kcal/min [12]. Therefore, the number of kcal needed for a day can be twice as high for individuals of the same age, height, weight, and sex, depending on their professional activity: a forestry worker may need to consume twice as many calories in a day as an office worker. This must be taken into account both when starting an intense musculoskeletal professional activity, as well as in cases of career change or retirement, when the significant reduction in physical activity combined with the habit of consuming a high-calorie diet can, in some cases, lead to the accumulation of adipose tissue and the onset of obesity [13].

Obesity causes multiple health complications, especially cardiovascular and metabolic ones, which will further reduce the work capacity. On the other hand, an insufficient caloric intake leads to malnutrition, which has as manifestations asthenia, apathy, fatigue, attention deficit, muscle cramps, etc., all of which with an impact on the workplace performance [7].

Therefore, a correctly performed professional anamnesis is vital when determining daily caloric needs, in order to categorize professional physical activity as light, moderate, intense, or very intense, and to adjust the caloric intake accordingly.

The energy needed by the body is provided by macronutrients. These are: proteins, carbohydrates and lipids.

Proteins

Proteins are organic compounds made from the aminoacids. Their composition mainly includes nitrogen, along with oxygen, hydrogen, and carbon. The main role of proteins is a structural one, they are the "bricks" that form the foundation of all tissues. Another important role is the functional one, as they are involved in various processes in the body in the form of enzymes, hormones, receptors etc. Secondarily, they also have an energetic role. Burning one gram of protein provides 4 kcal. The daily protein requirement is around 1g/kg. For a healthy individual, they should provide about 10-15% of the total caloric need [14].

A low protein intake can lead to a reduction of muscle mass, explained by the imbalance between the processes of protein anabolism and catabolism. In professions which predominately involve physical activity, it is necessary not only to maintain muscle mass, but also to develop it. Therefore, these activities usually require an increased protein intake to stimulate anabolism, tissue development and muscle

growth. In such situations, it is recommended to adjust the protein intake according to the intensity of the physical effort performed at work, as follows: 1.0 g of protein/kg for light physical activities, 1.3 g/kg for those of moderate intensity, and 1.6 g/kg for intense physical activities [15]. Maintaining a muscle mass corresponding to the intensity of physical effort is not only a prerequisite for effectively performing professional tasks, but also a protective factor for the osteo-articular system.

Proteins also have a protective role against some occupational toxins: lead, benzene, aniline, etc., especially against occupational toxins that damage the liver or the blood [16], as they are part of the enzymes that, in the case of lead, facilitate renal transport and elimination through the urine, while in the case of benzene and aniline, they help metabolize these substances to reduce their toxicity and aid their elimination from the body.

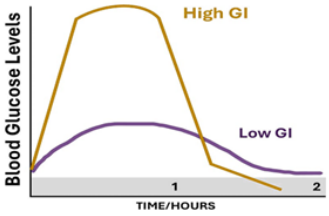
Carbohydrates

Carbohydrates are organic compounds made up of oxygen, hydrogen, and carbon. They represent the body's main "fuel," having mainly an energetic role. By burning one gram, 4 kcal are obtained. As part of a balanced diet, they should provide approximately 45-65% of the daily caloric intake [17]. For a total requirement of 2500 kcal/day, the intake should be around 300-350 g of carbohydrates per day.

An important characteristic of carbohydrates, which can affect the professional performance, is the glycemic index. This index indicates the speed of digestion and absorption of a certain food and its ability to produce hyperglycemia. The glycemic index uses as reference the absorption of glucose. Foods rich in fiber (wholemeal bread, whole grains, vegetables), or those in which the proportion of proteins and lipids and their degree of mixture with carbohydrates are high, have a low glycemic index and are preferable. These carbohydrates are absorbed slowly, over a longer period of time, and thus provide an optimal and constant supply of "fuel" for the body, without causing significant increases in blood sugar and hyperinsulinemia.

On the other hand, foods with a high glycemic index, such as highly processed foods (white bread, pretzels, sweets etc.), are digested and absorbed quickly into the bloodstream, early postprandial, leading to rapid increases in blood sugar, with an inappropriate response of insulin secretion. Under the action of insulin, the excess of carbohydrates are transformed and stored as fat, and blood sugar levels will drop sharply, often below preprandial values, which can result in a state of neuroglycopenia and the stimulation of the vegetative sympathetic and parasympathetic autonomic nervous system [6]. These changes will be clinically expressed through the appearance of hunger, fatigue, headaches, decreased attention, irritability, decreased physical and, above all, intellectual performance [18], negatively influencing the professional activity of employees.

Glycemic variations between a high glycemic index food (yellow) and a low glycemic index food (purple) [19]:



Lipids

Lipids are a group of compounds that are soluble in organic solvents but insoluble in water. Members of this group are triglycerides, fatty acids, phospholipids, cholesterol, etc. Lipids have structural roles (e.g.: in the cell membrane) and functional roles (being part of enzymes, hormones) in the body, as well as an important energetic role: they are a concentrated form of energy and serve as the body's stored energy. One gram of lipids contains 9 kcal. Lipids should provide 20–30% of the daily caloric intake [20].

For sedentary professions (programmers, engineers, students, office workers, etc.) it is preferable to have a lower intake of lipids. The diet should focus on lean meats (chicken, fish), low-fat dairy products and vegetable oils, rich in unsaturated fatty acids. In professions requiring intense physical activity (construction workers, forestry workers, etc.), a higher intake of saturated and unsaturated fats can be accepted, as they provide a concentrated caloric support corresponding to the high energy consumption of the activity performed [21]. For example, the calories provided by bacon, a food commonly consumed by agricultural workers in Romania for its high caloric content (approximately 600 kcal per 100 g), will be burned almost entirely to support the intense agricultural work performed, without the reappearance of the sensation of hunger for a long period.

One of the issues with workplace nutrition in the last decades, is the increasing consumption by

employees of snacks containing trans-unsaturated fats (from pastries, fast foods, etc.), which are easy to purchase and consume at the workplace, but involve a significant risk for the cardiovascular health. Most of these foods contain fatty acids with 18 carbon atoms, the most important being the elaidic acid. The recommendation is that the caloric intake from trans-unsaturated fatty acids should be less than 1% of the total caloric intake, i.e. less than 2.2 g per day for a daily intake of 2000 kcal [22]. Occupational medicine professionals should discourage employees from consuming such foods, providing examples of healthy alternatives to them [23].

Water

Water is essential for the body, it represents 50-75% of the body weight and is involved in almost all body functions. Therefore, in order to maintain an optimal work capacity, it is very important to ensure a proper hydration.

An individual's water requirement depends on several factors such as: sex, age, physical activity level, environmental conditions, etc. As a general recommendation, about 3.7 liters of fluids per day are needed for a man and 2.7 liters per day for a woman, with sources including water, other beverages and food [24]. A more accurate estimate of the total fluid requirement is based on the energy requirement: 1-1.5 ml/kcal/day [6]. For example, for a construction worker that has a daily caloric requirement of 4,000 kcal, the total fluid intake should be around 4-6 liters/day. Thus, for intense physical work, it is recommended to increase fluid intake in proportion to the increased caloric needs.

Water helps regulate the body's temperature. In certain professional climate conditions, it is necessary to adjust the fluid intake. For example, O.U.G. no. 99/2000, issued by the government of Romania, stipulates that at high temperatures, above +37°C, employers must provide employees with mineral water in the amount of 2-4 liters/person/shift. On the other hand, at low temperatures, hot tea should be provided in quantities of 0.5-1 liter/person/shift [25]. OSHA recommends consuming 250 ml fluids every 20 minutes during work at high temperatures [26]. In cases of exposure to air currents, water intake should be increased to compensate the loss due to evaporation from the body surface.

Adequate water intake is also very important in exposure to certain occupational toxins (heavy metals, benzene, etc.) to facilitate their elimination through diuresis and sweating. In order to prevent kidney damage through toxic accumulation, in these cases a good diuresis facilitates the transport and elimination of harmful substances [27].

A negative fluid balance, where fluid intake is lower than necessary, will result in a water deficit, a state of dehydration. This will lead to decreased physical and intellectual performance and the appearance of the following symptoms: asthenia, fatigue, headache, vertigo, syncope, etc. Studies show that a water deficit greater than 2% of the body weight negatively impacts performance during aerobic effort, prolonged orthostatic tolerance, and cognitive function [28], affecting work productivity.

A good and easy-to-apply indicator at the workplace, to regulate fluid intake, is the color of urine. A pale yellow or transparent yellow shade indicates good hydration levels. A slightly deeper yellow shade indicates that more fluids are needed. The darker the shade, the greater the water deficit [29].

Vitamins and minerals

Micronutrients are organic and inorganic compounds needed in small amounts for the proper functioning of the body. This group consists of vitamins and minerals. Micronutrient deficiencies affects more than 2 billion people worldwide [30], having consequences on the physical and mental health and implicitly on the work capacity. In particular, iron deficiency, leading to iron-deficiency anemia, results in in reduced physical work capacity and impaired performance in repetitive tasks [31].

In certain occupational contexts that involve overwork and exposure to harmful agents, it is vital to ensure the adequate intake of vitamins and minerals to protect the workers' health. In intense physical efforts (e.g. agricultural/forestry/ construction workers, etc.) it is necessary to ensure enough Calcium and vitamin D to repair and strengthen the bone and muscle structures, which have suffered micro-injuries during physical exertion [32]. Additionally, in these intense physical efforts, the intake of iron of animal origin and vitamin C (to increase iron absorption) will prevent the development of iron-deficiency anemia, a condition that decreases the effort capacity of the muscular system. Iron deficiency also increases the absorption of toxic metals, such as cadmium and lead, which may be present in certain occupational environments [33].

An adequate intake of B vitamin complexs, vitamin

C and minerals such as magnesium and zinc is important for the proper functioning of the nervous system during intense neuropsychologically efforts [34]. Supplementation with vitamins C and D and Zinc may be considered for strengthening the immune system in workers with exposure to biological agents, particularly those with respiratory transmission (teachers, medical staff, etc.) [35].

In the case of professions that overwork the visual analyzer (e.g.: work in front of screens) it is recommended to meet the requirements of vitamin A, C and E [36]. Vitamin A also has a beneficial effect in the case of exposure to toxins that affect the lung (e.g.: miners) for its role in restoring the pulmonary epithelium [37]. In the case of professional exposure to chemical toxins that affect the liver and increase the oxidative stress, it is recommended to consume foods rich in the vitamins C and E, for their antioxidant role.

In order to maintain the osmotic balance, during intense physically work and in a hot, unfavorable microclimate, it is necessary to supplement the intake of Na with 0.5-1 g of NaCl for every liter of water consumed, in order to prevent the occurrence of hypo-osmolarity and hyponatremia [38].

To meet the micronutrient needs, a diverse and varied diet containing the appropriate proportions of macronutrients and micronutrients in sufficient amounts is the ideal option. Vitamin and mineral supplements are only necessary for individuals who are deficient in a particular nutrient. Fortified foods (e.g. with: Iron, B vitamins, Iodine, etc.) may be considered for individuals with diets poor in these micronutrients (e.g.: vegetarian workers). A balanced diet is the best solution as it provides, in addition to proteins, carbohydrates, fats, vitamins, and minerals, other substances necessary for the body, such as antioxidants, bioflavonoids, salicylates, etc. [39].

Conclusion

There is a two-way relationship between an individual's diet and their workplace. In order to correctly establish the caloric and nutrient needs of an individual, it is important to understand the characteristics of their work and occupational exposure. On the other hand, the quality of an individual's diet will influence his work capacity. It is in the interest of the employers, employees and health professionals to encourage a healthy diet, which takes into account the occupational activity and contributes to maintaining the best state of health, in order to achieve the best professional performance.

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