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Ocena sposobu żywienia osób pracujących w systemie zmianowym

Nutritional assessment of shift workers

Streszczenie

Wstęp. Praca w systemie zmianowym może przyczyniać się do zwiększenia ryzyka rozwoju wielu chorób i dolegliwości. Inny od naturalnego rozkład czasu pracy wpływa na wiele aspektów życia w tym na sposób odżywiania się.

Cel. Celem pracy była analiza wpływu pracy zmianowej na sposób żywienia.

Materiał i metody. W badaniu oceniono sposób żywienia 35 ratowników medycznych w wieku 19-60 lat, zatrudnionych w pogotowiu ratunkowym na terenie Warszawy i okolic. W analizie zmian sposobu żywienia po podjęciu pracy zmianowej wykorzystano kwestionariusz ankietowy, natomiast w ilościowej ocenie żywienia posłużono się 2-dniowymi zapisami żywieniowymi.

Wyniki. Analiza żywienia badanej grupy wykazała szereg nieprawidłowości. Diety ratowników medycznych charakteryzowały się zbyt dużą podażą nasyconych kwasów tłuszczowych oraz wysokim współczynnikiem aterogenności. Odnotowano także zbyt małą podaż błonnika pokarmowego oraz witamin z grupy B. W dietach kobiet stwierdzono ponadto niewystarczającą podaż potasu, żelaza oraz folianów. Głównymi czynnikami warunkującymi nieprawidłowe żywienie były: brak czasu oraz nieregularne pory posiłków.

Wnioski. Sposób żywienia badanych osób w istotny sposób odbiegał od zasad prawidłowego żywienia, a niekorzystne zmiany związane były z pracą w systemie zmianowym.

Słowa kluczowe: praca zmianowa, żywienie, nawyki żywieniowe, ratownik medyczny, styl życia.

Abstract

Introduction. Shift work may contribute to increased risk of developing many diseases and ailments. Different from normal work schedule affects many aspects of life, including nutritional pattern.

Aim. The aim of this study was to analyse the impact of shift work on nutrition.

Material and methods. The study group consisted of 35 emergency medical technicians at the age of 19-60, working in medical emergency departments in Warsaw and surrounding areas. A questionnaire was used to analyse nutritional changes while in the quantitative evaluation of nutrition a 2-day food record was used.

Results. Assessment of nutrition of the studied group showed a number of irregularities. Paramedics' diets were characterized by excessive consumption of saturated fatty acids and high atherogenic quotient. There was also insufficient intake of dietary fiber and B vitamins. In women's diets there was also an insufficient content of potassium, iron and foliate. The main determinants of inappropriate feeding were lack of time and irregular meals.

Conclusions. Nutrition patterns of the test group deviate significantly from the principles of proper nutrition, and they have been affected adversely by working in shifts.

Keywords: shift work, nutrition, nutritional habits, paramedic , life style.

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INTRODUCTION

Diet is one of the most important determinants of human health.Propereating habits and rationally balanced food rations positively affect human body. Whereas poorly balanced diet coupled with preserved, improper nutritional habits may give rise to many diet-related diseases, such as type 2 diabetes, cardiovascular disease, hypertension, stroke and some types of cancer [1,2]. Additionally, gastric and duodenal ulcers, reflux disease, cholelithiasis, hepatic steatosis, acute pancreatitis can originate from improper nutrition [3].

Apart from diet, a chosen lifestyle plays an important role in maintaining proper health, which includes, among other things: physical activity and the use of drugs – tobacco, alcohol. The dominance of positive or negative components in the lifestyle influences effectiveness of maintaining good health. It seems that people with medical education should be particularly caring for their health status and be more aware of risks arising from an unhealthy lifestyle. Shiftwork, especially night work hours, can lead to many disorders, mainly impairment of circadian rhythms, but also sleep disorders and gastrointestinal and cardiovascular disease. Additionally, it can aggravate existing ailments and cause disturbance of family and social life [4].

AIM

The objective of the presented study was to evaluate the nutrition of the emergency service shift workers and the influence of work on their nutrition. Additionally, an attempt to recognize factors hindering proper nutrition of shift workers was made.

MATERIAL AND METHODS

The study involved 90 paramedics and nurses of the emergency service stations across Warsaw and its suburbs. The analysis was based on the questionnaires connected with food record. Due to a very low return rate of the distributed surveys (about 38%) only data received from 35 people (7 women and 28 men) have been examined.

Nutritional assessment was based on the 2-day food record and author's questionnaire survey consisting of inquiries concerning the current diet (meals planning, fast-food eating frequency, sweet and salty snacks and drinks), influence of work in the emergency service on the diet change, physical activity connected with performed work and smoking. The analysis of the dietary records was carried out with the use of the computer program "Dietetyk" and Polish food composition tables [5]. The diet was evaluated according to the energetic value, nutrient content: proteins, fat, carbohydrates in general, saturated fatty acids (SFA), monounsaturated fatty acids (MUFA), polyunsaturated fatty acids (PUFA), amount of cholesterol, dietary fiber and selectedminerals and vitamins (potassium, calcium, magnesium, iron, vitamins: A, C, E, B1, B2, B6, B12 and folic acid). Furthermore, percentage of energy from proteins, fat and carbohydrates and Keys' atherogenic quotient was calculated. The quotient was obtained with the following formula:

Keys' rate = 1.35 · (2 · % energy from SFA - % energy from PSFA) + 1.5 · sqrt (digestive cholesterol (mg)/1000 (kcal)).

Acquired results were compared with the recommendations for women of 60 kg body weight and moderate physical activity and for men of 70 kg body weight and moderate physical activity [6].

Body height and mass information obtained from surveys were used to calculate body mass index (BMI), according to formula BMI=body mass/body height (kg/m^2).

The statistical analysis was performed with MS Excel 2007 computer program.

RESULTS

Characteristics of the studied group

The average age of research subjects was 28.4 years. For more than half of the respondents (n=20), the calculated BMI indicated an excess body weight (BMI>24.9 kg/m^2), including 3 for which there was an indication of a first degree obesity. The average BMI for women was 24.8 kg/m^2, for men 26,0 kg/m^2.(Table 1.)

TABLE 1. Characteristics of age and anthropometric indices of the test group (n=35).

Analyzed parameters	Women n=7		Men n=28	
	$\bar{X}$	SD	$\bar{X}$	SD
Age (years)	36.0	6.71	26.54	4.22
Height (cm)	169.29	5.99	180.04	5.71
Body weight (kg)	71.43	18.48	84.25	10.37
BMI (kg/m^2)	24.8	5.29	26.0	2.73

n - number of studied subjects, X - average, SD - standard deviation

Eating habits and diet changes in the studied group

Twenty nine (29) out of 35 study subjects stated, that their diet had deteriorated after starting work for the emergency service, including 14 respondents that described changes as significant. The most common of the listed changes in nutrition related to the performed work were: irregular meals (n=20) and eating in a hurry (n=18) attributed to the lack of time, described by the shift workers also as nervousness and greediness in eating meals. The third change was the increased frequency of fast-food consumption (n=13). Other changes were mentioned, such as night eating (n=7), inability to satisfy hunger at the moment of its occurrence, increased share of cold meals in the diet, consumption of meals reheated multiple times, lack of diversity, monotonous diet and increased consumption of caffeinated beverages.

Majority of the respondents (n=32) admitted to eating fast-food during their shift, thirteen of them in most or all shifts in a month. Out of 33 people, which stated eating sweets/sweet or salty snacks during work, twelve admitted to eating them when feeling hungry, instead of meals.

More than half of the group (n=18) planned in advance meals later consumed in work, mainly through their earlier preparation. Most often, subjects took from home meals of the following types: main course – for reheating in work, sandwiches, soups and lettuce or fruit salads. Additional positive fact was that nearly all of the surveyed (n=34) reported eating hot meals in work. Twenty people ate at least one such meal during an average shift, while 10 at least 2 hot

meals. Confirming to the main, declared by the respondents, change in nutrition after taking the job in the emergency service, most of them admitted to eating their meals at work in a hurry.

Almost half of the surveyed (n=17) smoked (in average 22.5±8.3 items per shift). Ten of them admitted that there had been situations in which they smoked to deaden the hunger during the shift.

Respondents asked about the level of physical activity related to their work in the emergency service evaluated it as moderate (n=18), high (n=11) and low (n=6). Additionally, it has been noted that people attending more shifts per month have higher body mass.

Quantitative assessment of the shift workers' diets

Energy supply in the men's diet was oscillating around norm, while diets of the women were not supplying sufficient amount of energy (79.91% of the recommended standard). For more than half of the respondents (n=18) large differences in calorific value between two days of recording were found, exceeding 500 kcal. Percentage of energy coming from individual macro components in men's diets deviated from the recommendations – proteins supplied 16.73% of energy, fat 41.43%, while carbohydrates only 42.20% of energy. The energy structure of the women's diets was correct.

The excessive amount of fat in the men's diets was accompanied by improper structure of fatty acids consumption. Saturated fatty acids supplied 14.92% of overall energy, monounsaturated fatty acids 18.30%, and only polyunsaturated fatty acids constituted an appropriate percentage of the diet's energy. An improper pattern of fatty acids consumption was also observed among women. In their diets, saturated fatty acids supplied 14.56% of overall energy, monounsaturated fatty acids 11.62% and polyunsaturated fatty acids only 4.39% of energy.

An excessive supply of cholesterol (in average 375.73 mg), accompanied by an insufficient consumption of dietary fiber – in average 17 g/day (56.01% of the recommended intake) was observed among men. Women's diets were characterized by proper amount of cholesterol (in average 179.19 mg) and, similar to men, insufficient supply of dietary fiber – in average 15 g/day (49.52% of recommended intake). The average value of Key's atherogenic quotient was 49 for men and 48 for women.

Supply of minerals and vitamins did not differ much from recommendations for men. Only for vitamins B1 and B2 an insufficient supply was observed, accordingly 84.59% and 80.635% of the norm.

For women the deficient components were: potassium (86.92% of the norm), iron (61.09% of the norm), vitamins from the B group: (55.22% of the demand), B2 (80.29% of the demand), B6 (83.87% of the norm), and folians (87.43% of the norm). The average consumption of minerals and vitamins is shown in Table 2.

DISCUSSION

There are more factors in shift work that negatively affect the health than in day-only operation. In some cases, however, such work system is unavoidable, mainly in health service, particularly in hospitals and emergency service. The work of a paramedic is specific – it requires cold blood in stressful situations, ability to make quick decisions, emotional detachment and, simultaneously, high commitment and empathy. Both a paramedic and a nurse carry out a profession based on the principle of providing professional help, therefore their job is often perceived as stressful. Stress and emotional tension may cause irritated bowel syndrome, which manifests itself, for instance, with stomach pain, flatulence, nausea, discomfort in the abdomen, and bowel dysfunction (diarrhea, constipation) [7]. The results of the study showed, that the diet of surveyed paramedics did not contribute to elimination of the symptoms mentioned above, or even encouraged their formation.

Due to the character of the performed work, mainly due to its unpredictability and requirement of constant availability, it was very hard for the studied workers to plan even an indicative diet for the whole day. The study showed that most subjects ate breakfast only at work or had their first meal around noon. This is consistent with the research performed for nurses, which did not have breakfast at all, or had it only just at work [8,9]. The varying time of breakfast was accompanied by a general irregularity in eating. Despite the fact that the number of meals during day was sufficient, it has

TABLE 2. Average intake of minerals and vitamins of the test group.

Nutrient	Women n=7			Man n=28		
	$\bar{x}$	SD	recommendation	$\bar{x}$	SD	recommendation
Potassium (mg)	3042.27	1250.64	3500.0	3153.80	1189.82	3500.0
Calcium (mg)	752.33	500.66	900.0	1220.75	754.29	900.0-1200.0
Magnesium (mg)	285.97	112.16	300.0	336.69	107.24	370.0
Iron (mg)	8.55	2.29	18.0	11.88	3.40	15.0
Vitamin A (μg)	1038.47	1617.56	800.0	1004.53	876.37	1000.0
Vitamin E (mg)	8.74	4.36	9.0	15.45	7.56	10.0
Vitamin B1 (mg)	0.94	0.39	1.9	1.52	0.64	2.0
Vitamin B2 (mg)	1.28	0.50	1.8	1.94	0.69	2.6
Vitamin B6 (mg)	1.51	1.00	2.0	2.06	0.99	2.4
Folate (μg)	209.84	80.58	290	282.97	108.24	300.0
Vitamin B12 (μg)	3.20	2.93	3.0	4.68	2.64	3.0
Vitamin C (mg)	90.04	110.88	70.0	101.65	147.45	70.0

to be stated that they were often separated by very long or very short time periods. This prevents correct assimilation of nutrients and causes fluctuations of the glucose level, which is one of the factors determining adjustment of the hunger and satiety center [10]. High irregularity of eating among the workers of the health service was also shown in the research performed by Sokołowska et al. When analyzing the diet of nurses, they found out that even as much as 76.3% of the subjects nourished irregularly. It was also determined, that the main reason for this was the shift work and lack of time caused by excess duties [8].

The inability of predicting the course of a day, related to the performed work, probably inclined workers to eat portions of food bigger than necessary, or to eat when they were not hungry (eating "for the future" or in stressful situations). The shift work also compelled night eating. These factors, combined with smoking and irregularity of meals, can cause homeostasis of gastrointestinal disorder and can be also the cause of symptoms of indigestion, constipation and diarrhea. In longer perspective, they can contribute to development of gastric and duodenal ulcers.

A wide range and availability of highly processed products, inexpensive and with attractive taste supports their overconsumption. Some of the fast-food restaurants are opened during night, which facilitates shift workers to consume the mentioned products. Frequent consumption of fast-food was observed among paramedics. Eating these products could be a reason for improper energetic structure of studied diets. Furthermore, these products are the source of saturated fatty acids, the increased consumption of which contributes to the increased risk of incidence of cardiovascular disease. Additionally, fast-food, pastry, popcorn, instant soups and sauces – also popular among paramedics – are sources of partially hydrogenated trans fats, high consumption of which predisposes to heart disease, atherosclerosis and type 2 diabetes. Consumption of trans isomers increased to 2% of energy raises the risk of coronary heart disease by 23% [11].

It can be assumed that the improper structure of macro components consumption and energy structure of diets – eating too much fat instead of carbohydrates – especially among men, contributed to the occurrence of overweight for more than half of the examined shift workers. Similar results for the diet energy content was obtained in the WOBASZ programme for men in Małopolska Voivodship [12]. Diets of women were characterized by insufficient energy supply and low supply of most of the minerals and vitamins. Similar results were obtained in the WOBASZ programme for women in Opole and Małopolska Voivodships [12]. Likewise percentage of energy from individual macrocomponents in the group of women was reported by Ilow et al., who studied the diets of 40-year-olds from the Lower Silesia Voivodship [13]. In the presented research, similarly to the WOBASZ programme, a high content of saturated fatty acids in diet and higher than correct atherogenic rate was found [12].

In the group of studied men, consumption of vitamin E was higher than average consumption for Polish population and higher than the highest recorded for Opole Voivodship. For women it was equal to the average consumption for Polish population. Vitamin B1 intake of men and women reached the same value as average intake for Polish population in the WOBASZ programme [12]. Consumption of calcium was higher, for both men and women, than average for Polish population. For the magnesium it was close to the values obtained in the WOBASZ programme for men in the Małopolska Voivodship, while for women it was higher by 35 mg than the highest intake of this element recorded in the Lublin Voivodship. Similar results for women – for intake of potassium, magnesium, vitamin B6, vitamin C – and for men – for intake of magnesium and vitamin B6 – were obtained by Ilow et al. [13].

The deficiencies of vitamins, especially those from the B group, observed for the studied group of shift workers may lead to: changes in the nervous cardiovascular systems, cracking of the lips, glossitis and dermatitis, anaemia, ocular pathology and susceptibility of cells to tumour. In animal studies occurrence of atherosclerotic lesions, fatty liver and decrease in insulin synthesis were also observed. The deficiencies of some of these vitamins are more probable for, among others, people exposed to stress [14].

Inadequate quantities of potassium and iron, observed in the diets of women, may manifest as: impairment of the nervous system, constipation – as the result of impairment of muscle function, arrhythmias, atrophic changes in the oral cavity and anaemia. The hypoxia leads mainly to the lower tolerance for physical activity, sleep disorders, decrease in psychophysical activity and immunity [15].

The most common cause of hospitalization in Poland is cardiovascular disease, which is also responsible for 46% of deaths [15]. An important role in the aetiology of cardiovascular disease is played by factors related to the improper lifestyle, such as low physical activity, improper nutrition, smoking – which lead to the increase of blood pressure, lipid profile and carbohydrate metabolism disorders and obesity [16]. These factors affect a large part of the Polish population, including the studied group of shift workers. Due to the nature of their job, they are exposed additionally to other risk factors of cardiovascular disease like stress or fatigue resulting from sleep disorders.

The results of presented study show how big is the threat of health problems arising from an improper diet of shift workers, especially men. We are dealing here with an accumulation of several negative dietary factors. They are mainly excessive general consumption of fat and improper structure of consumption of fatty acids with dominant share of unsaturated fatty acids. One should add to that list an excessive intake of cholesterol and insufficient consumption of dietary fiber, which is the factor decreasing of cholesterol blood level. These abnormalities are reflected by the obtained high atherogenic factor of the diet. More factors include insufficient vitamin B6 consumption (for women below normal, for men verging on the normal) which, in connection with a diet with excessive amount of proteins, can cause increase of homocystein synthesis, of which high concentration in blood is a risk factor for development of atherosclerosis [14]. The positive was, however, the fact of supplying body with a sufficient quantity of antioxidant vitamins. No deficit of any of those vitamins was observed. Vitamin C slows down the changes caused by peroxidation in the body, helps its detoxication and increases immunity. Due to the fact that itreduces quantity of nitrosoamines created

in the gastrointestinal tract it is recognized as a vitamin inhibiting the cancerogenesis. Vitamin C is also important for lipids metabolism and in the prevention of ischemic heart disease. Vitamin A also helps preventing tumors and is necessary in: vision, building of epithelium and skin, synthesis of hormones and erythrocytes. Additionally, it participates in immune reactions. Vitamin E, as a natural antioxidant, eliminates radicals generated by metabolic processes in the body, prevents polyunsaturated fatty acids and vitamin A from oxidating and is also recognized as a compound reducing the risk of cancerogenesis [15].

It seems that despite the difficulties, there are a few rules for which compliance would help minimize ailments and postpone occurrence of more serious illnesses. First of all, shift workers should attempt to maintain as big diversity of their meals as possible, not overeat, avoid fat food – especially at night – consume meals of high quality – resign from fast-food and remember about eating breakfast. It would also be advised to pay more attention to the consumption of the main meal in the middle of a day, not in the middle of a shift. In the night, however, it would be recommended to eat light meals during the shift and consume not very plentiful breakfast in the morning - this way paramedics would not be very hungry during sleep and simultaneously would avoid discomfort associated with digestion of a too hearty meal. Additionally, consumption of large quantities of beverages, mainly water (minimum 1.5 l), composing diet of vegetables, fruits, fish, dairy products, poultry, lean meat and cereal products (preferably whole wheat) is recommended. Shift workers should also limit the amount of consumed salt, carbonated beverages, sweets and caffeine – the last one especially in night, at least 5 hours before planned sleep [17].

As can be seen, rules that shift workers should obey during their work in principle do not differ from general rules of healthy nutrition. Observing them plays a key role in prevention of diet-related diseases, as well as in proper work efficiency.

CONCLUSIONS

1. The diet of shift workers significantly diverged from rational nutrition recommendations.
2. More dietary errors were observed for women.
3. The improper diet was related with the shift work.
4. The main factors causing the improper diet were lack of time and irregular meals schedule.

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