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ASSESSMENT OF DAILY ENERGY EXPENDITURE, PHYSICAL ACTIVITY AND ENERGY INTAKE OF AGED WOMEN LIVING IN THE NURSING HOME – A SHORT REPORT

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Key words: aged women, physical activity, energy intake

The aim of the study was to evaluate nutrition and total energy expenditure of aged women living in the nursing home. Twenty two women over 60 years of age participated in the study. Their nutritional habits were evaluated based on a seven-day menu. Total energy expenditure and physical activity were assessed using SenseWear Pro3 Armband. The caloric value of diet was correct, however it was observed that the women supplied too much fat and too little carbohydrates with their diet. An average daily energy expenditure was 1810±236 kcal, physical activity of the participants was low, whereas the average time of their physical activity (MET 3-6) was about one hour per day. The average number of steps was 3016±2528. None of the women reached the recommended level of 10000 number of steps/daily.

INTRODUCTION

Regular physical activity is necessary for maintaining health and reducing the risk of many chronic diseases. Unfortunately, most people in Europe (43-78%) and in the United States of America (60%) lead sedentary lifestyle [De Cocker *et al*., 2007]. Inactivity increases with age. By the age of 75, about one in tree men and one in two women do not engage in physical activity [Physical activity …, 1996]. Older people who are physically active are fit and maintain independence in daily activities [Konieczny & Wrzosek, 2002]. Moderate physical activity performed at 3 to 6 METs (equivalent to brisk walking at 3 to 4 miles per hour) is recommended for good health and optimal physical function in the elderly [Schutzer & Graves, 2004]. Moderate amount of activity can be obtained in a 30-min brisk walk, 30-min lawn mowing or raking leaves, and in a 15-min run [Physical activity …, 1996; De Cocker *et al*., 2007]. The level of physical activity can be measured by the number of steps maid during the day. A value of 10,000 steps/daily appears to be a reasonable estimate of daily activity for healthy adults and may bring health benefits [Tudor-Locke & Bassett, 2004]. Among adults aged 65 years and older walking and gardening or yard work are the most popular and good physical activities [Physical activity …, 1996; Konieczny & Wrzosek, 2002]. Those types of physical activity have a favourable influence on the respiratory system, the cardio-vascular system and improve oxygen transport in organs and tissues [Rudzik, 1998].

The indirect calorimetry is the preferred method of measuring the energy expenditure of an organism. Other types of portable measuring devices can also be used to monitor everyday physical activity (they can easily be used at night). Some studies already documented the usefulness of SenseWear Armand in the measurements of daily energy expenditure of people [Teller, 2004], and resting metabolic rate [Malabolti *et al*., 2007]. The SenseWear Armband was used in measuring daily energy expenditure in groups of patients suffering from chronic diseases [Cole *et al*., 2004; Cereda *et al*., 2007] as well as in obese people [De Cristofero *et al*., 2005]. Using this device it is possible to estimate: the time of physical activity and the level of physical activity, the number of steps, sleeping time, daily energy expenditure, and physical energy expenditure.

To maintain good physical condition it is necessary to keep a balance between daily energy expenditure of the body and energy intake. The aim of this study was to evaluate nutrition and total energy expenditure of aged women living in the nursing home.

MATERIAL AND METHODS

Twenty two women living in the nursing home participated in the study. The average age of the participants was 79.8±7.8.

Measurements of their body height were made with the accuracy of 0.1 cm. Measurements of their body mass were made with the accuracy of 0.1 kg. Body Mass Index (BMI) was calculated using the formula: BMI = body mass/ height^2 (kg/m^2).

The women were grouped according to their BMI values [WHO, 2003]: <18.5 kg/m^2 – underweight; 18.5–24.9 kg/m^2 – normal range; 25.0–29.9 kg/m^2 – pre-obese; and 30.0–34.9 kg/m^2 – obese class I.

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Daily energy expenditure, time of physical activity and level of physical activity, number of steps, lying time, sleeping time were collected using SenseWear Pro3 Armband made by BodyMedia Pittsburgh, USA. The armband has 4 sensors: 2 axis accelerometer, skin temperature, heat flux and galvanic skin response. The armband was worn on the back side of the upper right arm (the triceps muscle), touching the skin. It was worn without cease for the minimum period of 24 h. The women were asked to have normal physical activity over the measurement period. The level of physical activity was calculated based on the metabolic equivalent (MET). One MET was defined as energy expenditure while sitting quietly, which, for an average adult approximates 3.5 mL of oxygen uptake per kilogram of body weight per minute [Fletcher *et al*., 2001]. The physical activity was defined as a sedentary life style for METs below 3.0; as a moderate physical activity for METs between 3.0 and 6.0; as a vigorous physical activity for METs between 6.0 and 9.0, and as a very vigorous activity for METs higher than 9.0.

Physical activity was classified according to the number of steps and according to the classification proposed by Tudor-Lucke & Bassett [2004]. For healthy adults: <5000 steps/day indicated persons with sedentary lifestyle; 5000-7499 steps/day indicated persons with low activity; 7500-9999 steps/day indicated somewhat active persons; ≥10,000 steps/day indicated active persons, and more than 12,500 steps/day indicated highly active persons.

The women were also asked to answer a few questions about their physical activity.

Diet energy value and contents of proteins, fats and carbohydrates in the women's diet were calculated based on a 7-day menu in the nursing home. The software – "Dietetyk 2" and "Food composition tables" database [Kunachowicz *et al*., 2005] were used.

A statistical analysis of the result obtained was carried out using Statgraphics Plus ver. 4.1 software. Mean values were compared with the Student's t-test after having checked normal distribution.

All of the protocols were approved by the Bioethical Commission of Regional Medical Chamber in Warsaw.

TABLE 1. Age, height, body mass and BMI of the aged women.

Parameter		Aged women N= 22
Age	$\bar{x}$±s.d. (min -max)	79.8±7.8 (60-94)
Height (cm)	$\bar{x}$±s.d. (min -max)	152.9±4.1 (145-160)
Body mass (kg)	$\bar{x}$±s.d. (min -max)	62.7±11.9 (45-91)
BMI (kg/m^2)	$\bar{x}$±s.d. (min -max)	26.8±4.9 (20.0-37.9)

$\bar{x}$ – mean, s.d. – standard deviation

TABLE 2. Energy expenditure and physical activity of the aged women per day.

Parameter		Aged women N= 22
Total energy expenditure (kcal)	$\bar{x}$±s.d. (min -max)	1811±236 (1302-2169)
Number of steps	$\bar{x}$±s.d. (min -max)	3016±2528 (51-8756)
Lying down duration (min)	$\bar{x}$±s.d. (min -max)	544±118 (334-717)
Sleep duration (min)	$\bar{x}$±s.d. (min -max)	429±78 (230-546)
Sedentary physical activity (MET<3.0) (min)[a]	Me (min -max)	1374 (1165-1440)
Moderate physical activity (MET 3.0-5.9) (min)	$\bar{x}$±s.d. (min -max)	52±39 (0-162)
Vigorous physical activity (MET 6.0-8.9) (min)[a]	Me (min -max)	2 (0-25)
Very vigorous physical activity (MET≥9.0) (min)	$\bar{x}$±s.d. (min -max)	0

MET – metabolic equivalent, $\bar{x}$ – mean, s.d. – standard deviation, Me – median, [a] – variable dose not normal distribution.

RESULTS AND DISCUSSION

The average BMI value for the group of women was 26.8±4.9 (Table 1). Nine women (40.9%) were characterized by a good nutritional status, whereas the others were obese. The average daily energy expenditure was 1811±236 kcal. According to the recorded physical activity, three persons led only a sedentary lifestyle. Moderate physical activity (that lasted on average for 52±39 min/day) was recorded in 19 women (86.4%), (Table 1). Vigorous physical activity was recorded in the case of 67% of the women but the duration of this activity was usually only a few minutes.

The average number of steps in the group examined was 3016±2518 (Table 2). Eighteen women made less then 5000 steps daily. Three women were characterized by a low physical activity (number of steps between 5000-7499) and only 1 person was somewhat active (8700 steps/day). None of the women reached the level of the recommended 10,000 steps/day [Tudor-Locke & Bassett, 2004]. Shwatz *et al.* [2007] recorded 3939±232 steps/day in a group of older adults, and majority of individuals (73%) took less than 5000 steps/day, 47% of the group took less than 3000 steps/day, and 28% of the group took less than 2000 steps/day. In another study, older women suffering from chronic diseases recorded fewer than 5000 steps/day [Strycker *et al*., 2007].

The sedentary type of physical activity in the group lasted 1374 minutes (median). The average daily time of lying down was 544 ±118 min, and sleeping time – 429±78 min (Table 2). At the same time almost all of the women had breaks during the sleep at night, and more than 45% person had naps during the day.

In our study, 68% of the woman assessed their physical activity as sedentary, 27% – as moderate, only one person assessed her physical activity as vigorous. Investigations of other authors show that the group of adult people living in Warsaw and in suburbs assessed their physical activity as higher, *i.e*. 41% of people declared moderate physical activity and 11% vigorous one [Kołłajtis-Dołowy & Tyski, 2004].

The group of women who declared higher physical activity had indeed higher daily energy expenditure, longer dura-

TABLE 3. Daily physical activity of the aged women.

Parameter	Declared physical activity		p (Student's t-test)
	Small (n=15)	High (n=7)	
	$\bar{x}$±s.d.		
Total energy expenditure (kcal)	1746±249	1948±129	0.05
Time of physical activity (MET 3-6) (min)	35±27	87±38	0.001
Active energy expenditure MET>3 (min)	167±151	422±112	0.0008
Number of steps	2015±1968	5163±2336	0.003

TABLE 4. Energy and nutrients in a daily diet of the aged women.

Parameter			Value
Energy	(kcal)	x±s.d. (min -max)	2104±306 (1698-2514)
Energy	(kJ)	x±s.d. (min -max)	8824±1281 (7127-10540)
Carbohydrates (g)		x±s.d. (min -max)	258±15.6 (236-284)
Proteins (g)		x±s.d. (min -max)	86.2±13.3 (59.8-103.0)
Fats (g)		x±s.d. (min -max)	88.9±32.7 (53.1-136.5)

tion of moderate physical activity and made more steps daily (5163±2336) than the group of women who declared low physical activity (2015±1968) (Table 3).

The average energy value of a seven-day diet in the nursing home was 2104±306 kcal (Table 4). The highest energy expenditure recorded in the group of women was 2169 kcal. It means that energy from food was enough to satisfy the energy needs of the women. The results showed that daily energy intake among the aged women was insufficient in respect of the recommended values. The caloric value of diets satisfied the energy needs in 86% [Duda *et al*., 2000].

The study demonstrated that the women supplied too much fat and protein and too little carbohydrates with their diet. Proteins constituted 15% of energy in diet, fats 37% and carbohydrates 48%. In other study, the results were similar, namely in the daily diet of aged women the per cent of energy from fat was also high and that from carbohydrates was low [Szponar & Rychlik, 2002]. The analysis of the nutritional habits of elderly people in Warsaw showed that the consumption of calories from fat was excessive. Fats delivered 36% of energy in the daily diet of the studied subjects [Chwojnowska *et al*., 1993].

CONCLUSIONS

The caloric value of the diet was adequate to total energy expenditure of the aged women examined. However, in their daily diet the content of fat was high, while that of carbohydrates was low.

The physical activity of the group was low and lower than that recommended for adults.

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