ASSESSMENT OF FUNCTIONAL STATUS OF SLOVAK ADULTS ACCORDING TO THEIR SMOKING, PHYSICAL ACTIVITY AND MARITAL STATUS

Petra Lukáčiková[1], Ladislava Wsólová[2], Daniela Siváková[3]

[1, 3] Department of Anthropology, Faculty of Natural Sciences, Comenius University, Bratislava
[2] Slovak Medical University, Bratislava

Abstract

Biological age estimates the functional status of an individual (in comparison with the chronological peers). In this study we used a Borkan and Norris method (1980b) for assessment of biological age in adult Slovak women and men using bioimpedance, biochemical and anthropometrical parameters in the context of lifestyle behavior characteristics. Our findings revealed that „healthy life-style" such as sporting, no-smoking and living with partner may be associated with younger biological age.

Key words: *women, men, health, age related variables.*

Introduction

The study and estimate of biological age in adulthood is not easy because it is still unclear which body parameters can good measure the rate of aging, contrary of the childhood (Borkan, Norris, 1980a). The meaning of biological age is often explained as „the real overall state" of an aging organism, much more correct than chronological age and assessment of biological age is based on the selection of various age-dependent variables (Klemera, Doubal, 2006). The determination of biological age include a battery of biomarkers and the statistical method, whereby very commonly used is the multiple linear regression (Webster, Logie, 1976).

Aging causes general deterioration in many tissues and systems (loss of muscle mass, weakness, reduced sensory acuity, reductions in nervous system capabilities, reduced mobility, decline in reproductive capacity and many other changes) and thus aging limits life span (Goldsmith, 2008). That´s why assessment of biological age in adulthood is not simple.

In the light of health and „healthy aging" (healthy lifestyle aspects) a physical activity and no-smoking are very important. In general, it is known about regular physical activity that contributes to the primary and secondary prevention of several diseases and is associated with a reduced risk of premature death (Warburton et al., 2006). The smoke of cigarettes represents an important accelerator of the aging process. Non-smokers have a much higher life expectancy than smokers (Nicita-Mauro et al., 2008). Thus we can say that there exist a close relationship between these two factors and (biological) aging.

Also living alone is generally considered for more negative than living with partner. For example, married persons have significantly lower mortality rates than unmarried persons and this is established for men and women, but greater for men (Lillard, Panis, 1996). According to this, marital status may also take some character in the aging process and thus might influence the biological age.

Subjects and methods

Assessment of biological age was performed on the groups of Slovak males (N = 118) and females (N = 204) in age from 39 to 70 years (each group was processed independently). Data were collected in Slovakia between 2003 and 2008. This investigation focused on health status and lifestyle of Slovak people included many parameters: body composition (using a BIA 101 analyser, Akern S.r.l.), anthropometrical, biochemical parameters and others. For biological age assessment these characteristics (having a correlation with age) were included in the test battery:

In the group of women:

Cardiovascular: systolic and diastolic blood pressure (mmHg), pulse.

Anthropometric: weight (kg), height (cm), waist and hip circumferences (cm), chest saggital diameter (cm), waist hip ratio – WHR and conicity index – CI.

Biochemical: gamma-glutamyltransferase – GMT (μkat/l), creatinine – CREA (μmol/l), uric acid – UA (μmol/l) , apolipoprotein A1 and B – Apo A1 and B (g/l), total cholesterol – TCH (mmol/l), HDL and LDL cholesterol (mmol/l), triglycerides – TG (mmol/l) and glucose – GLU (mmol/l).

Bioelectrical impedance: fat free mass (%), fat mass (%), total body water (%), intracellular water (%), extracellular water (%), body cell mass (%), body cell mass index – BCMI, body mass index – BMI, muscle mass (kg), basal metabolic rate – BMR (kcal).

In the group of men:

Cardiovascular: systolic blood pressure (mmHg) and pulse.

Anthropometric: height (cm), waist circumference (cm), waist hip ratio – WHR and conicity index – CI.

Biochemical: gamma-glutamyltransferase – GMT (μkat/l), creatinine – CREA (μmol/l), apolipoprotein A1 and B – Apo A1 and B (g/l), HDL cholesterol (mmol/l) and sodium/potassium ratio – Na/K.

Bioelectrical impedance: fat free mass (%), fat mass (%), total body water (l), intracellular water (%), extracellular water (%), body cell mass (kg), muscle mass (kg), basal metabolic rate – BMR (kcal).

Lifestyle aspects included in this study were: smoking (yes/no), physical activity – sporting (yes/no) and marital status (living alone/living in partnership).

Biological age was estimate extra for women and men. Biological age (BA) was computed as a composite z-score using the Borkan and Norris method (1980b). Individual z-score for a single variable were calculated and then these were converted to BA score by steps: 1) simple linear regression of each variable on age, 2) subtraction of the predicted score from the actual score of each individual, 3) standardization of residual scores using the z-transformation. At the end a conversion of data was done (negative sloped variables were multiplied by –1 to facilitate interpretation).

This procedure allows the transformation of age-related variables´ data into biological age scores (negative values of biological age reflect biologically younger persons, positive older persons).

BA profiles are plotted on a chart (subgroups are plotted by mean scores of the variables / abscissa-positive or negative values of biological age, ordinate-variables studied). For next analyze the Mann-Whitney test was performed. For a statistical data processing the statistical program SPSS, version 17 was used.

Results

The variables selected for biological age assessment (for women and men separately) are listed in Tables 1. and 2. (means and standard deviations). These tables are shown also watched lifestyle behaviour characteristics and marital status

of studied women and men with their sample size / percentage. As you can see, the majority of studied women and men were non-smokers and married/partnered. Approximately a 20–30% of probands were physically active. It is quite interesting that these poops look-alike in both groups.

The studied women were between 39 and 70 years of age with the mean age 55.86 years (SD 9.25), the studied men were between 40 and 70 years with mean age 59.20 years (SD 8.97).

The biological age profiles by smoking status in women and men are presented in Figure 1. As it is seen, smokers in both cases seem more to be biologically older than non-smokers, although there is no clearly association with younger biological age, especially in the case of women. Statistically significant differences between smoking and non-smoking women were found in total cholesterol ($p = 0.016$) and gamma-glutamyltransferase ($p = 0.038$). Non-smoking women were in these parameters significantly younger. In the group of men there were found more statistically significant differences in: waist circumference ($p = 0.021$), body cell mass ($p < 0.001$), muscle mass ($p < 0.001$), total body water ($p < 0.001$), extracellular water ($p = 0.040$), intracellular water ($p = 0.040$), basal metabolic rate ($p < 0.001$) and sodium/potassium ratio ($p = 0.041$). In all these parameters, except waist circumference, were non-smoking men statistically biologically younger than smoking men.

Figure 2. shows the profiles of biological age relating to physical activity (sporting). Generally, sporting persons were likely to be biologically younger than non-sporting individuals. In the group of women there were significant differences in chest saggital diameter ($p = 0.002$), waist circumference ($p = 0.028$), WHR ($p = 0.024$), CI (0.046), uric acid ($p = 0.008$), HDL cholesterol ($p = 0.014$), gamma-glutamyltransferase ($p = 0.004$), triglycerides ($p = 0.004$) and glucose ($p = 0.004$). In all this characteristics were sporting women biologically younger than non-sporting women. Similar situation was also in a group of men where active sporting men were significantly younger in waist circumference ($p = 0.025$), WHR ($p = 0.047$), CI ($p = 0.002$), fat free mass ($p = 0.033$), fat mass ($p = 0.033$), extracellular water ($p = 0.004$), intracellular water

Table 1. *Selected characteristics of studied women (N 204)*

Characteristic	Mean	SD
Systolic blood pressure (mmHg)	129.42	17.75
Diastolic blood pressure (mmHg)	79.73	8.77
Pulse	72.48	12.85
Height (cm)	161.24	6.73
Weight (kg)	74.48	14.41
Waist circumference (cm)	91.55	13.00
Hip circumference (cm)	108.49	11.30
Chest saggital diameter (cm)	22.15	2.73
WHR (waist hip ratio)	0.84	0.07
CI (conicity index)	1.24	0.09
Fat free mass (%)	60.72	7.50
Total body water (%)	47.69	5.05
Extracellular water (%)	46.02	4.26
Intracellular water (%)	53.98	4.25
Body cell mass (%)	50.35	8.40
Fat mass (%)	39.18	7.45
Muscle mass (kg)	27.82	4.88
Basal metabolic rate (kcal)	1341.81	186.06
BMI (body mass index)	28.41	5.50
BCMI (body cell mass index)	8.25	1.86
Gamma-glutamyltransferase (μkat/l)	0.50	0.53
Creatinine (μmol/l)	74.62	14.95
Uric acid (μmol/l)	285.95	84.36
Apolipoprotein A1 (g/l)	1.65	0.28
Apolipoprotein B (g/l)	0.97	0.28
Total cholesterol (mmol/l)	5.59	1.08
Triglycerides (mmol/l) (mmol/l)	1.69	1.17
HDL cholesterol (mmol/l)	1.50	0.42
LDL cholesterol (mmol/l)	3.34	1.03
Glucose (mmol/l)	5.29	1.95
	N	**%**
Non-smoking women	165	80.9
Sporting women	39	19.1
Women living with partner, husband	127	62.3

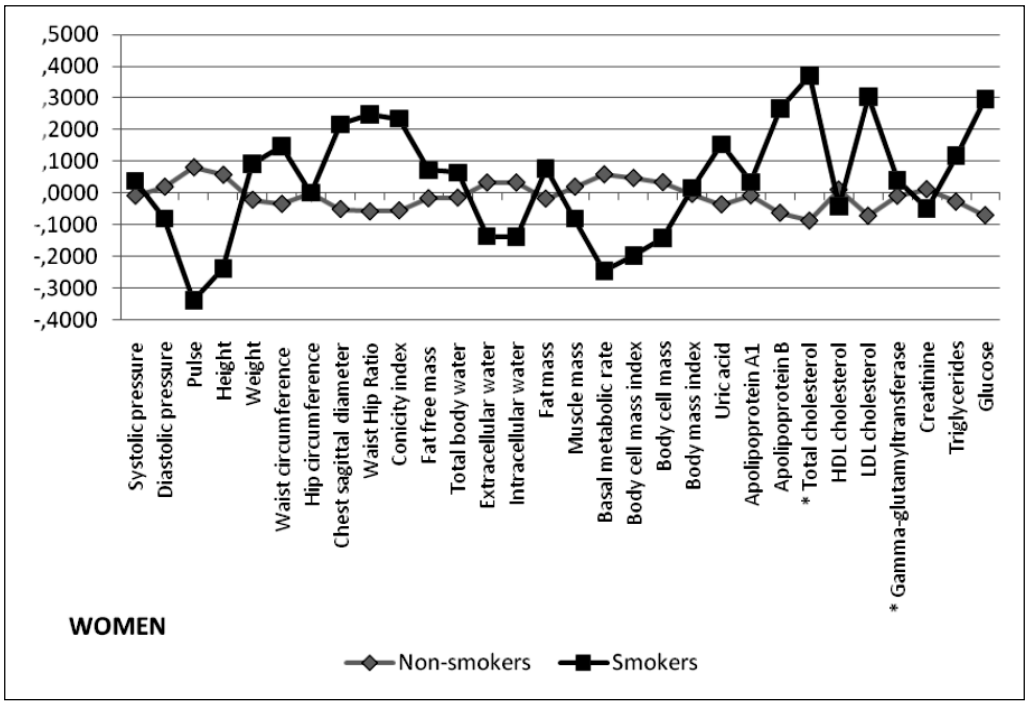
Table 2. *Selected characteristics of studied men (N 118)*

Characteristic	Mean	SD
Systolic blood pressure (mmHg)	135.47	16.62
Pulse	72.48	10.26
Height (cm)	173.01	7.25
Waist circumference (cm)	101.33	12.14
WHR (waist hip ratio)	0.96	0.07
CI (conicity index)	1.33	0.09
Fat free mass (%)	73.66	6.88
Total body water (l)	47.42	7.11
Extracellular water (%)	43.84	5.50
Intracellular water (%)	56.16	5.50
Body cell mass (kg)	31.04	5.52
Fat mass (%)	26.34	6.87
Muscle mass (kg)	38.39	6.50
Basal metabolic rate (kcal)	1597.96	255.88
Gamma-glutamyltransferase (μkat/l)	0.68	0.55
Creatinine (μmol/l)	88.04	15.37
Apolipoprotein A1 (g/l)	1.50	0.25
Apolipoprotein B (g/l)	1.04	0.31
HDL cholesterol (mmol/l)	1.24	0.35
Na/K (sodium potassium ratio)	1.03	0.17
	N	**%**
Non-smoking men	82	69.5
Sporting men	34	28.8
Men living with partner, wife	86	72.9

(p = 0.004) and basal metabolic rate (p = 0.015) than non-sporting men.

The profiles of biological age in relation to marital status are presented in Figure 3. According to this we can say that persons living with partner/mate are biologically much more younger than people living alone. In the case of women statistically significant differences were found in HDL cholesterol (p = 0.007) and apolipoprotein A1 (p = 0.015), for account of biologically younger age of women living in partnership. In the event of men more differences that confirmed a not-alone living men younger biological age were found: body cell mass (p = 0.002), muscle mass (p = 0.003), total body water (p = 0.046), extracellular water (p = 0.011), intracellular water (p = 0.011), basal metabolic rate (p = 0.005) and HDL cholesterol (p = 0.001). Exception was only pulse (p = 0.015) in which the partnered men were biologically older.

Figure 1. *Profiles of biological age in women and men by smoking status*



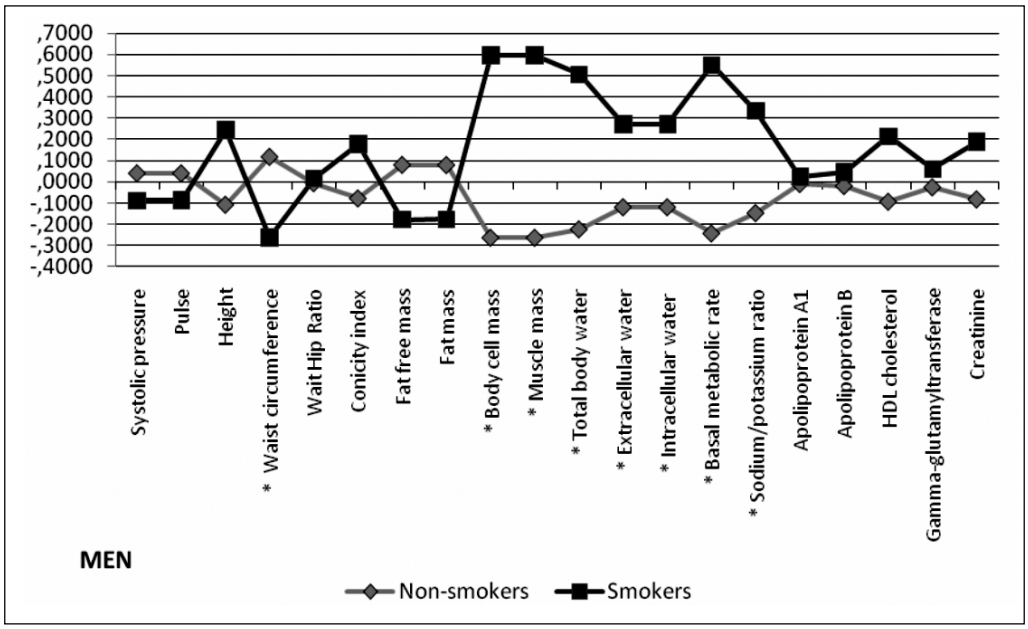
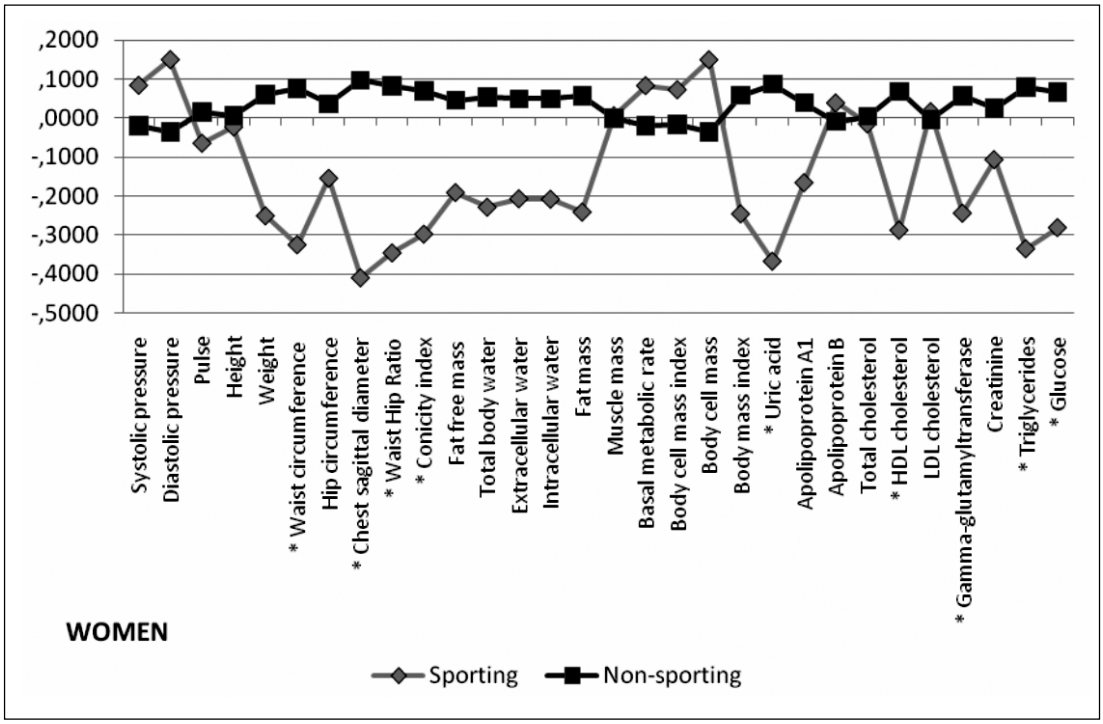


Figure 2. *Profiles of biological age in women and men by sporting status*



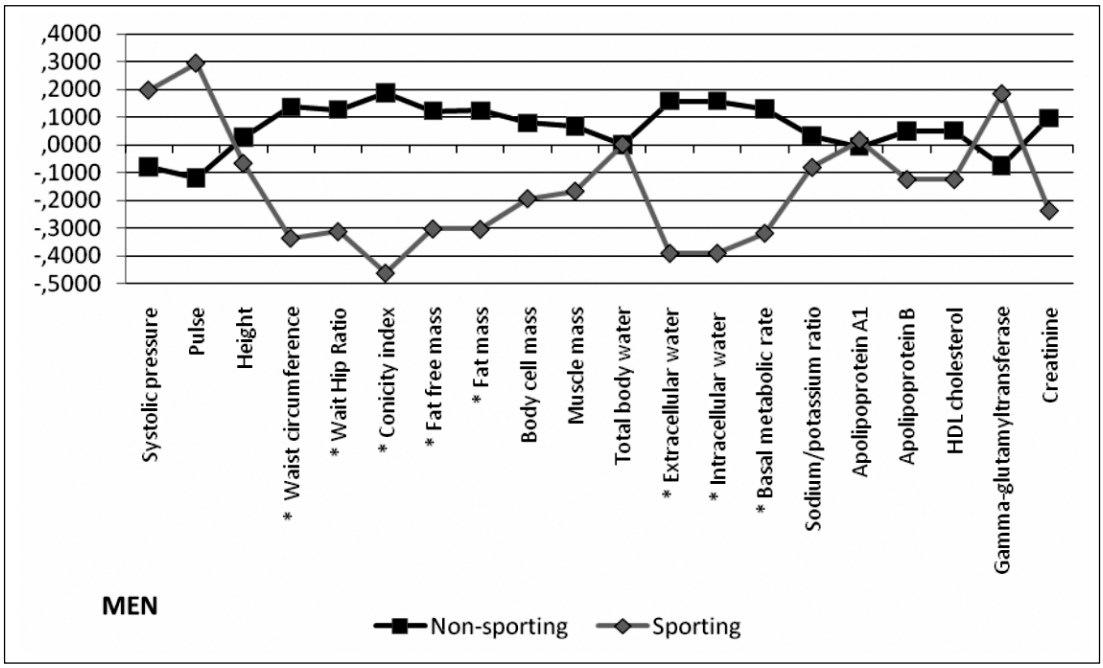
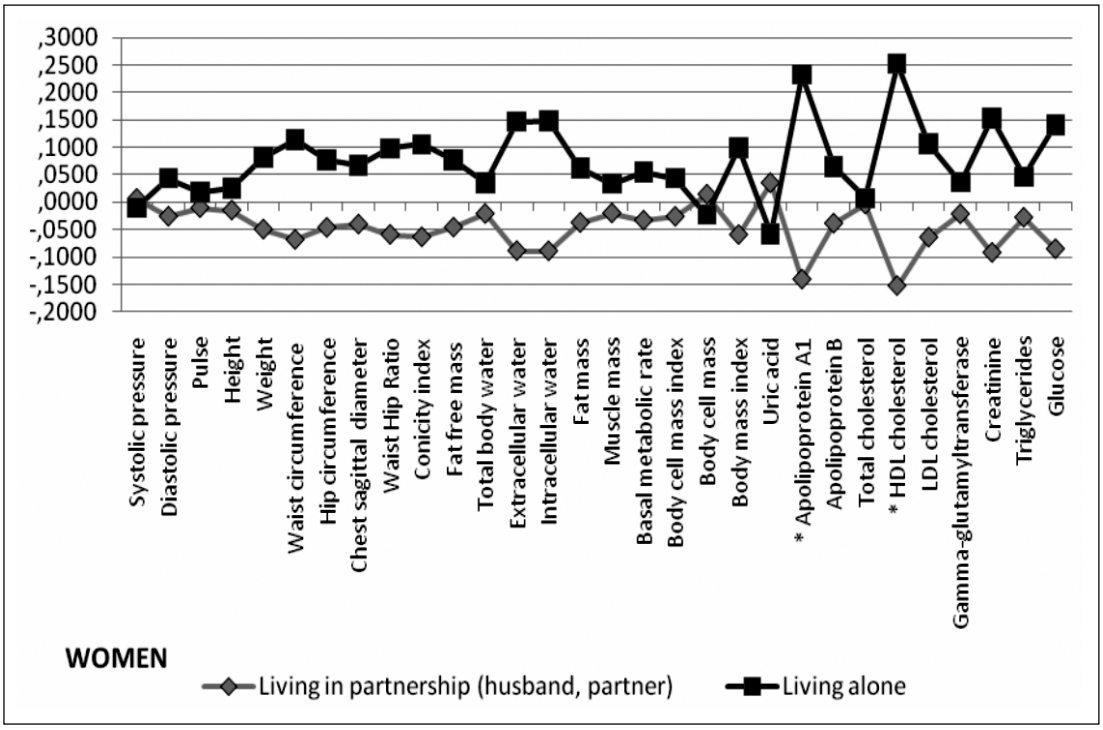
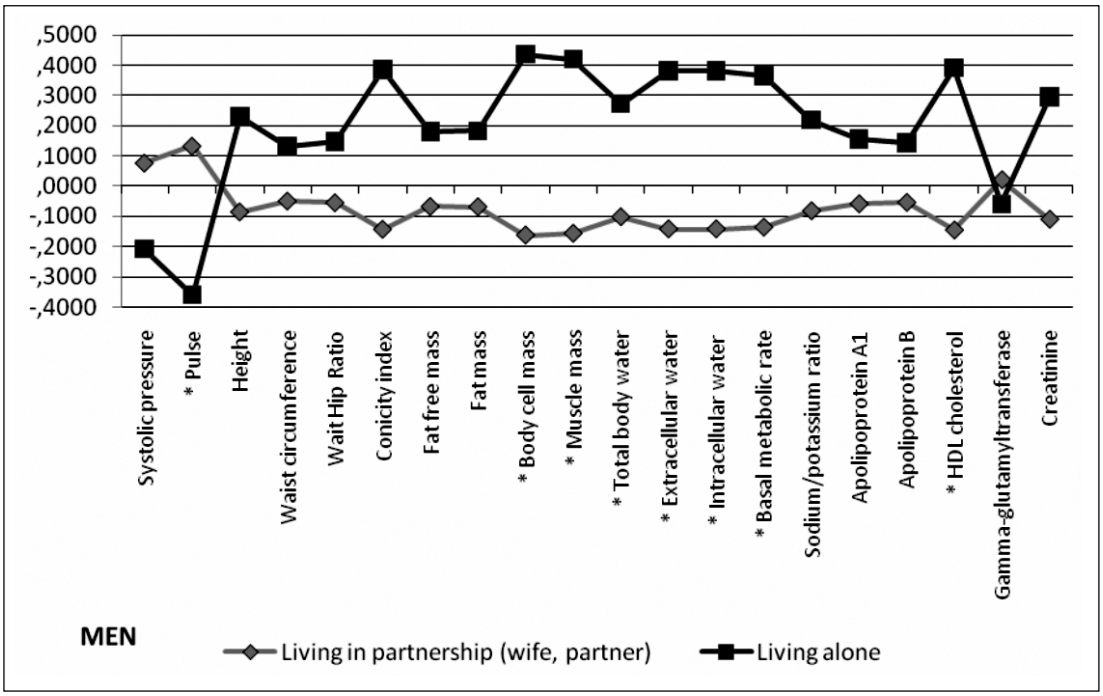


Figure 3. *Profiles of biological age in women and men by marital status*





Discussion

Our results of biological age in adult women and men associated with selected lifestyle characteristics shows that physical activity (active sporting) and living with partner seem to be associated with younger biological status. Also smoking might be in conjunction with younger biological age, but it is not so apparent as in the case of sporting and marital status profiles.

Younger biological status in context of living with partner could be expect. Living alone appears to be associated with higher risks for health problems (for example poor health, worse memory and mood, lower physical activity, poorer diet, risk for social isolation, smoking and alcohol using and others) (Kharicha et al., 2007). Marriage may have a protective effect on health by reducing risky behavior and by economies of scale in nutrition and caretaking thus marriage improves health status (and so reduces mortality risks) (Lillard, Panis, 1996) and this positive effect manifests till the oldest age (Goldman et al., 1995). Our study confirmed a positive influence of partner coexistence in biological aging, in both women and men. To same results come also Polish study of Kaczmarek and Lasik (2006).

It seems that there exist a graded linear relation between the volume of physical activity and health status (most physically active people are at the lowest risk) (Warburton et al., 2006). A long-term Swedish study on 7142 men aged 47 to 55 years demonstrates independent protective effect of leisure time physical activity on death and confirms that increasing physical activity during middle age could have important public health implications (Rosengren, Wilhelmsen, 1997). The results of our study, which demonstrate an association of younger biological age in women and men in context of active sporting are in agreement with Borkan and Norris (1980b).

Smoking is an important risk factor for cancer, cardiovascular and respiratory diseases (main causes of death in the industrialized countries) but it may play a controversary role in Alzheimer and Parkinson diseases (Nicita-Mauro et al., 2008). We found that non-smoking seems to be associated with younger biological age, mainly in men´s group. Our findings correspond with Bulpitt et al. (1994).

In summary, we suggest that physical activity and partnered living may be closely associated with younger biological status. Also non-smoke appears to be in relationship with younger biological age. This support the opinion that „healthy" lifestyle and content partnership may leads to healthy aging and longevity.

Souhrn

Biologický vek vyjadruje funkčný status jedinca (v porovnaní s jeho chronologickými vrstovníkmi). Pre odhad biologického veku dospelých jedincov zo Slovenska sme v tejto štúdii aplikovali metódu Borkana a Norrisa (1980b). Použité boli antropometrické, bioimpedančné a biochemické parametre. Pri analýze bol zohľadnený životný štýl probandov. Výsledky našej štúdie ukázali, že „zdravý životný štýl" ako športovanie a nefajčenie a rovnako aj partnerský život môžu byť asociované s nižším biologickým vekom. Záverom môžeme konštatovať, že fyzická aktivita a partnerský život môžu byť asociované s mladším biologickým statusom. Rovnako nefajčenie by mohlo mať súvis s nižším biologickým vekom. Naše zistenia potvrdzujú všeobecný názor, že „zdravý" životný štýl a spolužitie s partnerom sa môžu pozitívne odzrkadľovať v procese starnutia.

Kľúčové slová: *ženy, muži, zdravie, vekové zvláštnosti.*

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