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ASSESSING BIOLOGICAL AGE AND ITS DETERMINANTS IN ADULT MEN

INTRODUCTION

The age-specific decline in physiological functions reveals a similar pattern in men, but the assessment of aging *per se* is particularly complicated. Among many difficulties of measuring aging one may found "opposite trends" of involutional changes, age-related functional decline of specific organ systems, lifestyle factors that are likely to blur aging and diseases linked with physiological aging [3, 8]. For these and many other reasons, the chronological age usually poorly predicts physiological aging. Therefore, the concept of biological age has been developed and included in examination of aging. There are many biomarkers of aging; most recently, new, genetic biomarkers have been proposed. The results of numerous studies suggest that some environmental factors (social position, life style) affect the status of biological age [6].

The main aim of this work was to estimate the effect of environmental factors on the biological age of adult men in young, middle and late stages of life.

METHODS

For the purpose of the present study, data from a cross-sectional survey conducted between 2000 and 2002 in Poznań and several other localities in western Poland were used. The study "Biological and social aspects of male ageing" was approved by the Bioethics Committee of the University of Medical Sciences in Poznań. The following items of the Andropause-Specific Quality of Life Questionnaire AQOL were examined: the respondent's chronological age (CA), marital status, education level, health condition, lifestyle behavior, symptoms of aging, and subjective perception of the quality of life. 11 variables were selected as indicators of biological age (BA), forming the basis for statistical calculations: 1. body mass index (BMI), 2. systolic blood pressure (SBP), 3. diastolic blood pressure (DBP), 4. pulse pressure (PP), 5. total cholesterol (TCH), 6. HDL, 7. LDL, 8. triglycerides (TRIG), symptoms of aging men (SAM), 9. physical PSAM and 10. emotional ESAM, and 11. subjective perception of the quality of life QoL using Campbell's proposal [4].

The biological age (BA) was calculated according to the method proposed by Borkan and Norris [1] as a composite z-score. Z-score was calculated separately for each of the variables using the following formula: [(observed value – median)/distance between the 25th and 75th percentiles]. Differences between z-scores for subgroups based on social status, and life style in three age groups were compared with the use of U Mann-Whitney test; differences between z-scores for BA markers in age groups with the use of Kruskal-Wallis test. Negative scores refer to lower biological age, and positive results to higher biological age. All calculations were made using Statistica 7.0 package software (StatSoft. Inc. 2005 Statistica for Windows). Statistical calculations were made with 5% probability of error.

RESULTS

The studied sample consisted of 2509 men whose age ranged from 30 to 97 years. They were divided into three age groups: "younger" (younger than 50 years – 50.4%), "middle-aged" (50-60 years – 33.7%), and "late-aged" (older than 60 years – 15.9%). The analysis took into consideration the subjects' education level (lower: primary and vocational, higher: secondary and academic), physical activity (passive leisure time with lack of exercises and high active leisure time with intensive exercises), and cigarette smoking (smoker and non smoker).

In the first stage of the analysis it was estimated whether z-scores for the analyzed BA biomarkers were different in age groups. All except for TCH, HDL LDL,

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TRIG and QoL were significantly differentiated by the chronological age (Kruskal-Wallis test results) (Fig. 1). In all of these, except for DBP and BMI, older BA was associated with older CA. It was interesting that BA calculated for DBP and BMI in the group men aged 50-60 was higher than in men older than 60.

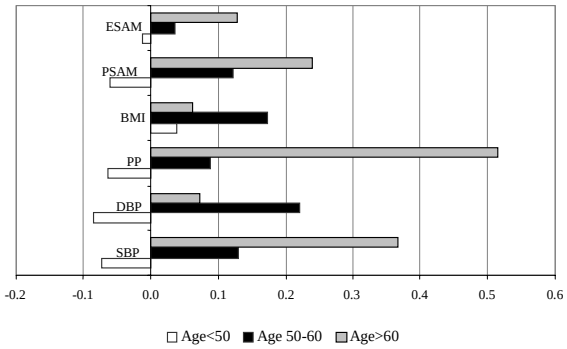

Figure 1. Z-scores for BA markers significantly differentiated by chronological age (Kruskal-Wallis test results, $p<0.05$)

In the second stage of the analysis it was examined whether environmental factors determined differences in the same biological age indicators among men from the young, middle and late-age group. The results of the U Mann-Whitney test are presented in Table 1. Generally, considering separately the various functions of human body, it can be seen that pressure values, triglycerides, BMI, parameters of physical and emotional conditions seem to be influenced by physical activity, particularly in the group of younger men. Cigarette smoking and education level determine differences in biological age insignificantly and equally in all age groups. The most consistent for BA were QoL and the group of men under 50.

A detailed comparison between the subgroups carried out for education level, physical activity and cigarette smoking yielded similar results in all age groups: better educated, non-smoking and physically active men appeared to be biologically younger than their counterparts. One of these interactions is shown in Figure 2.

Table 1. U Mann-Whitney test results

BA markers	Z	p	Z	p	Z	p
	Age <50		Age 50-60		Age >60 lat	
Physical activity						
SBP	2.99	0.003				
DBP	2.52	0.012				
PP	2.15	0.030				
TRIGL	2.12	0.044				
BMI	5.58	0.000				
PSAM	3.34	0.001			2.20	0.028
ESAM	3.05	0.002				
QoL	6.02	0.000	3.99	0.000	2.47	0.014
Cigarette smoking						
SBP					-2.24	0.025
PSAM	-2.70	0.007				
ESAM	-3.53	0.000	-2.06	0.039		
QoL	-2.77	0.006	-2.01	0.044		
Education level						
BMI					2.34	0.019
PSAM					2.19	0.028
QoL	6.66	0.000	2.80	0.005		

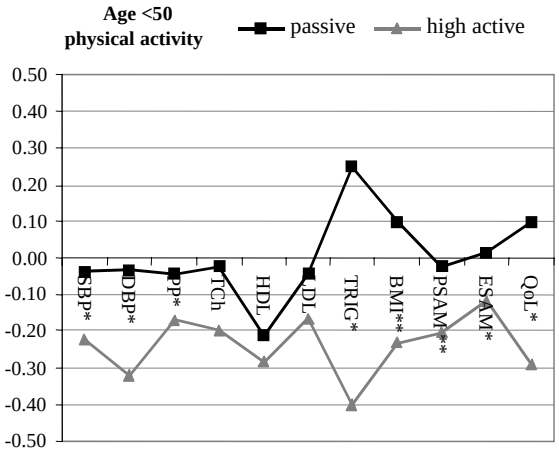

Figure 2. Influence of physical activity on biological age in males aged 50. Significant values of U Mann-Whitney test results are indicated by asterisks

DISCUSSION

In this study, according to the method proposed by Borkan and Norris, 11 selected variables were transformed into BA scores reflecting the influence of the social status and lifestyle of men on their chronological age. Of variables: education level, cigarette smoking, and physical activity, the latter seems

to have the greatest influence on the BA status. These results remain in accordance with the ones obtained by Borkan and Norris [1], Facchini et al. [2] and Karasik et al. [6]. Low social class or low education level are associated with increased morbidity and mortality in several epidemiological studies [7], but the significance of this dependence decreases with the chronological age over 50. This hypothesis can explain the results obtained in this study. The biological age calculated on different markers significantly depended on physical activity, education and smoking, particularly among men from the youngest group. In the group of middle-aged men, the social factors differentiated only their mental condition (ESAM, QoL); whereas in the oldest group – their physical condition (SBP, BMI, PSAM).

The statistical analysis showed that the middle-aged group of men was biologically older then the chronologically oldest group in DBP and BMI z-scores (Fig. 1). Involutional changes in the androgenic activity of the male body occur gradually, display high individual differences and, on average, may be pronounced at 50 years of age [5]. Hormonal changes play a key role in the whole body's aging process and affect physiological changes (e.g., blood pressure changes, overweight). Therefore, the worse biological status of men 50-60 could result from "andropausal" changes and unhealthy life style manifested by very low physical activity.

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