BALTIC JOURNAL OF HEALTH AND PHYSICAL ACTIVITY
© Gdansk University of Physical Education and Sport in Gdansk, Volume 4, No 1, 2012, 27-34

ORIGINAL ARTICLE

DOI: 10.2478/v10131-012-0004-1

Body Height of Adult Men Coming from the Pomerania Province in the Context of Gradients and Social Differences, Age and the Level of Physical Activity[1]

Ewa Wójtowicz

Gdansk University of Physical Education and Sport in Gdansk, Poland

Authors' Contribution:
A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
F – Literature Search
G – Funds Collection

Key words: *body height, adult men, social gradients, social differences, Pomerania*

Abstract

Background: *This paper attempts to answer the following question: are there any gradients and social differences in a group of adult men coming from Pomerania Province resulting from their biological condition – body height.*

Material/Methods: *Opinion polls were conducted in the years 2000–2007 in a group of 893 men aged 37-78 years. The subjects are fathers of first-year students of full-time studies at the Gdansk University of Physical Education and Sport (Poland). The questionnaire included open questions concerning the date and the place of birth, body height, education, performed job, social background and doing sport.*
Statistical analyses were conducted using Statistica 6.0 software. For continuous variables, the normality of distributions was verified using Shapiro-Wilk's test. In cases of abnormal distributions, medians were used and the differences between them were tested using the Mann-Whitney test or the Kruskal-Wallis test. The correlation link between quantitative variables was estimated calculating the Spearman rank-order correlation coefficient. Changes of specific values of the feature into an appropriate rank were made when the distribution of the variable did not have a normal character.

Results: *The correlation between the level of physical activity and body height in the adult age does not reach the level of statistical relevance. The highest values of body height are achieved by younger men coming from cities who have the intelligentsia background with higher education and perform intellectual jobs.*

Conclusions: *Differentiated body height is an anthropological reflection of still existing socio-economic inequalities and still can be one of the anthropological methods of following social inequalities in a group of adult men coming from the Pomerania Province.*

Word count: 3,738
Tables: 1
Figures: 0
References: 26

Received: January 2012
Accepted: February 2012
Published: March 2012

Corresponding author:
Ewa Wójtowicz, PhD.
Gdansk University of Physical Education and Sport in Gdansk,
80-336 Gdansk, Poland
Phone: +4858 5547257; E-mail: ewawoj14@wp.pl

[1] The research reported in this article has been funded by Gdansk University of Physical Education and Sport (statutory research).

Introduction

One of the anthropological methods of monitoring social inequality is an analysis of reasons and the state of social stratification of the population through an analysis of the population's biological condition. In societies with a high standard of life it is impossible to determine social stratification by anthropological methods [1, 2]. Poland still belongs to countries of a relatively low standard of life, which is why there still exist gradients and social differences of biological condition of the population [3, 4, 5]. Social gradients refer to differences in values of a given feature, for example body height, described by a several-degree scale observed among groups of the population of various social economic situations. However, the term "social differences" determines differentiation of a feature depending on a double-scale factor, for example city – countryside or physical work – intellectual work [6]. Unfortunately, an assessment of the economic situation by achieving reliable information from the subjects is very difficult. Therefore, the socio-economic situation is most often assessed indirectly, among others by means of such environmental features as the size of the place of residence, education, performed job, the type of performed work, the number of children in the family, living conditions, etc. [6]. Growing social differences are usually interpreted as a good measure of the inequality of living conditions existing in a given society. In families of a higher social-economic status, such conditions are better and at the same time they allow realizing the genetically determined developmental potential of an individual to a greater extent [7].

Since Poland still belongs to countries relatively low socio- economic status [3], this paper attempts to answer the following question: are there any gradients and social differences in a group of adult men coming from Pomerania Province resulting from their biological condition – body height. The additional aim of this research is to assess the differentiated influence of the socio-economic status, age and the level of physical activity on the body height of adult men coming from the Pomerania Province.

Material and Methods

Opinion polls were conducted in the years 2000–2007 in a group of 893 men aged 37–78 years. The subjects are fathers of first-year students of full-time studies at AWFiS (Gdansk University of Physical Education and Sport) in Gdansk. The questionnaire included open questions concerning the date and the place of birth, body height, education, performed job, social background and doing sport. The differences in the numbers of observations at different stages of the analysis result from the lack of respondents' consent to use the information contained in the questionnaire for research purposes. The relationships between the socio-economic status, age and the level of physical activity and the body height of adult men from the Pomerania Province were analysed.

The statistical analysis of the results was conducted using Statistica 6.0 software. For the continuous variables, the normality of distributions was verified using Shapiro-Wilk's test. In cases of abnormal distributions, medians were used and the differences between them were tested using the Mann-Whitney test or the Kruskal-Wallis test. The correlation link between quantitative variables was estimated calculating the Spearman rank-order correlation coefficient. Changes of specific values of the feature into an appropriate rank were made when the distribution of a variable did not have a normal character. The Spearman rank-order correlation has a great advantage – it eliminates a negative influence of points coming off. The following variables and their categories were considered during the study:

1) independent variables:
- education (po = elementary, z = vocational (basic), s = secondary, w = higher),
- the subject's calendar age (years),
- social background (c = peasant, r = working class, I = intelligentsia),
- type of job (f = physical, u = intellectual),
- place of birth (m = city, w = village),
- physical activity (w = the subject has never participated regularly in any recreational or competitive extracurricular sports activities for at least a year; n = the subject has regularly

participated in recreational or competitive extracurricular sports activities for at least a year; k = the subject used to participate regularly in at least lasting one year sport activities that were not included in the teaching programme, of a recreational or professional character);

2) dependent variables – body height (cm).

Results

Descriptive statistics of body height in the categories of the analyzed factors and the results of Spearman's rank order correlation (between body height and the analyzed factors) and Mann-Whitney and Kruskal-Wallis tests are presented in Table 1. Statistically significant correlation relations ($p \leq 0.05$) have been noted between the body height and the place of birth, social background, education, the type of job and the calendar age of the subject. However, the correlation relation between the body height and the physical activity level (doing sport) does not achieve a level of statistical significance. The subjects' calendar age correlates the strongest with the body height, next with social background, the place of birth, education and the type of job (Tab. 1).

For the analysed variables of a continuous character (body height and calendar age) the normality of distributions was checked by applying the Shapiro-Wilk test. Both body height ($W = 0.99$; $p = 0.00023$) and calendar age ($W = 0.94$; $p = 0.0000$) did not have normal layouts. In this connection, medians and differences between them were used for analysis, and the differences between them were tested by the Mann-Whitney or Kruskal-Wallis tests (Tab. 1).

Among the analysed variables the subjects' calendar age correlates the strongest with the body height (Tab. 1). In the indicated age categories of men, body height increases achieving the highest values in the youngest age group. The non-parametric equivalent of a uni-factor analysis of variance (Shapiro-Wilk test) for the calendar age and body height achieves the level of statistical relevance (Tab. 1). The difference in body height between the extreme age categories was 7.5 cm that is around 2 cm between neighbouring age categories (decades) (Tab. 1).

Besides calendar age, also a differentiating influence of social background upon body height of the tested men was observed in the study. The correlation relation and differences in medians achieve the level of statistical relevance. The men declaring intelligentsia background are the tallest, followed by working class, while men of peasant background are the shortest (Tab. 1).

In the researched group there are also clearly marked differences in the body height between men of the urban and rural background. Men coming from cities are on average 2 cm taller than men of the rural background. The correlation relation ($p = 0.0001$) and differentiation ($p = 0.0002$) achieve the level of statistical relevance.

Body height is also relevantly correlated with the level of subjects' education. The higher the level of education, the higher the values of body height. The men with higher education are the tallest. The difference of body height between the subjects with higher education and the primary education equals 3 cm (Tab. 1). The level of education is relevantly correlated also with the type of performed job ($R = 0.32$; $p = 0.0000$). The men performing intellectual work are relevantly taller (by 2 cm) than men whose job is of a physical character (Tab. 1).

The declared level of physical activity, in contrast to the described before relevant dependencies between the analysed factors and body height, is not relevantly correlated with the body height, and medians of body height in particular categories of the physical activity level do not differ essentially. Nevertheless, certain dependencies are observed. Men who have never participated in extra sport classes that were not included in the teaching syllabus are the shortest (Me = 176 cm), while those who formerly (mainly in school years or during studies) participated in such classes are the tallest (Me = 180 cm).

Tab. 1. Descriptive statistics of body height in the categories of the analyzed factors and the results of Spearman's rank order correlation (R) (between body height and the analyzed factors) and Mann-Whitney (T M-W) and Kruskal-Wallis (T K-W) tests.

Variables and their categories	N	%	M	SD	Q25	Me	Q75	R	T M-W	T K-W
Place of birth										
w	124	13.95	175.94	6.65	171.5	176	180	R=-0.13	Z=3.78	
m	764	85.94	178.21	6.32	174	178	182	p=0.0001	p=0.0002	
Social background										
c	90	10.24	175.8	6.77	171	176	180	R=-0.14		χ^2=1.53
r	488	55.52	177.598	6.46	174	177	182	p=0.00004		p=0.0002
i	301	34.24	178.94	6.08	175	179	183			
Education										
po	21	2.35	175.38	6.84	172	175	180			
z	178	19.96	176.38	7.01	172	176	180	R=-0.12		χ^2=10.73
s	446	50.00	178.18	6.21	174	178	182	p=0.0004		p=0.01
w	247	27.69	178.599	6.12	175	178	182			
Type of job										
f	209	23.48	177.34	6.48	172	176	178	R=-0.095	Z=2.17	
u	315	35.39	178.44	6.01	175	178	178	p=0.029	p=0.03	
another	366	41.12								
Calendar age (categories)*										
30-39 years	5	0.56	180	6.78	176	180	182			
40-49 years	532	59.64	178.91	6.52	175	178	183	R=-0.196		χ^2=18.35
50-59 years	326	36.55	176.48	5.92	172	176	180	p=0.00000		p=0.001
60-69 years	25	2.80	174.36	5.76	169	174	179			
70-79 years	4	0.45	172	6.48	167	172.5	177			
Physical activity										
w	20	24.096	177.10	6.24	176	176	181.5	R=0.13		χ^2=1.53
k	37	44.58	178.41	6.74	175	180	182	p=0.25		p=0.5
n	26	31.33	180.62	7.13	176	178	187			
Calendar age (year)										
Calendar age (year)	1255		48.78	4.83	46	48	51	R=-0.24 p=0.00000		
Body height (cm)										
Body height (cm)	893		177.86	6.42	174	178	182			

Variables and their categories are described in experimental procedures, p = significance level
** Given the small number of observations in the category of 30-39 years and 70-79 years, R and χ^2 statistics were calculated only for the categories: 40-49 years, 50-59 years, 60-69 years.*

Discussion

Body height as a morphological feature is recognised as a good measure of a general level of biological development of the population; in the group of tested men there is essential statistical differentiation in the majority of the analysed factors. Adults' body height is the effect of two processes: a secular trend of younger generations and systematically progressing ageing of an organism [8, 9, 10, 11]. A clear decrease in body height in the following age groups (in the direction from younger to older age groups) that has been noted is a phenomenon also observed by other authors [9, 10, 11]. Research conducted by Jopkiewicz [9] in the years 1982–1983 in the Kielce region among 18-65-year-old men also indicates an essential relation of the body height with the subjects' calendar age. Explaining the reason for achieving smaller values of body height by elder generations, the author writes "it is most probably rather an effect of secular changes than involution". Also Szopa [11], testing men of 19–62 years of age who come from Cracow, observed a clear decrease in body height in the consecutive (increasingly older) age groups.The author explains this tendency by an evident result of a secular trend phenomenon, since involution changes of the body height do not start earlier than after 40th year of age [12]. The author estimated the

intensity of secular changes as approx. 1.5 cm per 10 years. Nowicki [10], however, who tested men at the age of 21–65, coming from the Torun, Bydgoszcz and Wloclawek provinces, estimated the intensity of secular changes as 1.3 cm per decade. This author also perceives the main reason for these changes in the phenomenon of a secular trend. In our research the difference of body height amounted to about 2 cm per decade. Probably also in this case it is mainly an effect of a secular trend, but involution changes due to the subjects' age (37–38 years) also play a certain role. Research explaining these dependencies is continued.

Social background should be connected with the level of education and professional work performed by parents of the studied men. It finds its reflection in achieving higher values of body height by people of intelligentsia background in comparison with people of working class or peasant background (Tab. 1). Relations between body height of children and their parents' education and professional work are known. Higher education of the family and parents' intellectual work have an influence on a better development of physical features of family members in contrast to family members of a lower level of education and professional work of a physical character [2, 6, 7, 13].

Men with higher education achieve higher values of body height than less educated men (Tab. 1). Similar remarks were noted by Kaczmarek [5]. The author running continuous research on cohorts of children born in 1980 from Poznan describes the phenomenon of social stratification expressed in social gradients of heights and parents' body mass of the tested children. Parents with higher education were on the average taller than those less educated, and the difference of average values of body height between people with higher education and elementary education equalled to 2.7 cm. A similar difference (3.22 cm) was noted in the group of tested men from the Pomerania Province (Tab. 1).

It is generally known that rational nutrition has an essential meaning for the correct growth and development of a man. A better economic level of a family should have an influence on better nutrition. However, as Wolański [13] states, it has been indicated that middle-class people with a higher level of education indicate a better way of nutrition in contrast to well earning working class families. Researching various regions of Poland (cities of Warszawa, Łódź, Bialystok, Zambrów, Lublin, Olkusz, Strzemieszyce, and Bełchatów and villages of the Lublin Coal Region as well as from the Suwałki region), Wolański noted in all of them essential correlations of body height with education of the tested people, but the correlations of the body height with income have not achieved the level of statistical relevance in any of the researched regions [14]. In Poland there is still a lack of clear interdependence between the level of education and the level of income. Such public sectors as health care or the educational system employ a higher percentage of well-educated people, but at the same time they are badly paid [3]. Not always an educated parent can provide his/her family and himself with a high economic standard. So why are better-educated people taller than those who have a lower level of education? (Tab. 1). Considering a relevant correlation of the subjects' education with their social background ($R = 0.39$; $p = 0.0000$) and at the same time with education and professional work of their parents, it seems rational to agree with Łaska–Mierzejewska's opinion on this matter [6]. The author presents results of research in which the amount of payment of engineers who do not perform managerial functions and of workers of the same factory did not differ relevantly. The engineers' offspring were taller. The engineers could not offer their children a high economic standard but they could offer them knowledge and at the same time proper distribution of money, rational nutrition, a better level of hygiene and health care [6].

The type of performed professional work is closely connected with the level of education. In the tested group of adult men from the Pomerania Province, a correlation relation between the level of education and the type of performed professional work is statistically relevant ($R = 0.32$; $p = 0.0000$). Probably that is why higher values of body height of men whose professional work has an intellectual character were noted at this work (Tab. 1). Also Szopa [11], testing adult inhabitants of Kraków, while considering the type of performed professional work, indicates the presence of a big differentiation of the level of somatic features. With respect to body height, intellectual workers were taller than physical workers by 0.5 standard deviation [11]. After World War 2 very intensive cultural and socio-economic transformations of the Polish village took place. They resulted from industrialisation and the urban development and sociological processes. In spite of

this, differences in the body build between the inhabitants of towns and villages are still observed [13, 15]. Adult men coming from cities of the Pomerania Province are taller by 2 cm than those coming from villages of the Pomerania Province (Tab.1). It seems that reasons for such a dependence should be found, among others, in the fact that the place of residence (city–village) relevantly correlates with the social background of the tested men (R=0.29; p=0.0000). Among men of the urban background, the proportional participation of particular categories of social background is as follows: intelligentsia (37.07%), working class (57.56%), and peasants (5.37%). However, among men of the rural background proportional participation of particular categories of social background is as follows: intelligentsia (13.39%), working class (47.24%), and peasants (39.37%). Also Bielicki et al. [4], assessing the influence of the urbanisation level of the place of living upon the body height of conscripts, describe a gradual increase in body height including the degree of urbanisation. Inhabitants of villages were the shortest (169.8 cm – year 1965, 174.0 cm – year 1986, 175.7 cm – year 1995) and inhabitants of cities with a population over 500,000 people were the tallest (172.7 cm – 1965 year, 176.9 cm – 1986 year, 178 cm – 1995 year).

It is generally known that physical activity, appropriate to the biological condition and the age of organism, has a beneficial influence on the state of health. Limited activity, however, is one of the threats connected with appearance of civilisation diseases (among others, the cardiovascular system disease, diabetes, obesity) [16, 17, 18, 19]. From tests by Żarów et al. [20], it results that as many as 63.3% of adult men do not take up any physical activity in leisure time, and in the tests done by Drygas [21] as many as 70% of the tested men. In the tested group of adult men coming from the Pomerania Province, the percentage of men who currently do not do any sport in their leisure time equals to 68.67% (Tab. 1). The condition of engagement of the Polish society in sport and its physical activity is slight (Tab. 1) [16, 17, 18, 19, 22, 23]. The reasons adults give for not doing any sport are most often: tiredness after work, willingness for passive rest, lack of time, lack of a sport club in the neighbourhood [23]. In the presented study, certain dependencies between the body height of adult men and the level of their physical activity are given, but they do not reach the level of statistical relevance (Tab. 1). The greatest values of body height are achieved by men who still or previously did professional or recreational sport (Tab. 1). However, the men who currently do not do any sport are the shortest. A similar phenomenon was also observed by Nowakowska et al. [22]. The men tested by the author who previously did sport are characterised by greater body height. In the tests by Żarów et al. [24], men of a low level of motor fitness in their adulthood during the whole period of tests (7–32 years) were usually shorter of all subjects. Similarly, in the tests by Panka et al., subjects presenting a low level of fitness are characterised by lesser body height [25]. One of the reasons for such dependencies between the level of physical activity and body height may be the fact that organised, rational, directed movement, considering the individual's age, development, condition of health, physical fitness and psychological predispositions, acts as a stimulus for the organism accelerating a growth of the muscular and bone system. Such movement also has a beneficial influence on the circulatory, respiratory, nervous and endocrine systems. Motor exercises prolong the period of forming bases and delay the ossification of the epiphysial cartilage thus prolonging the period of its production and at the same time allowing greater values of body height achieved by the organism [26].

Summing up, it may be stated (on the basis of the present research and a review of literature) that the factors conditioning a development of organism create an unusually complicated network of mutual dependencies, and the considered elements of socio-vocational status (social background, the type of place of residence, education, the type of professional work) and physical activity and calendar age of the subjects find its reflection in the level of development of the considered somatic feature – body height. The highest values of body height are achieved by younger men coming from cities who are of the intelligentsia background, have higher education and perform intellectual job. Also men who did or do sport professionally or recreationally are taller. The dependency, however, between the level of physical activity and body height in the adult age does not reach the level of statistical relevance. Strategies of development, realised by the genotype in the interaction with defined environmental factors lead to the differentiation of values of body height so that in better conditions they are higher on average. To illustrate this phenomenon, from among

the tested men, two groups differing by extreme ("the best ones – the worst ones") categories of the considered factors were selected. Due to a small number, while selecting the most possible uniform groups considering all the analysed independent variables, only social background, education and the type of the performed job were chosen:

- group I: intelligentsia background, higher education, intellectual professional work (body height – median = 178 cm);
- group II: peasant background, elementary education, physical professional work (body height – median = 173.5 cm).

It is interesting that in group II raising the level of education from elementary to secondary with final exams results in increasing the body height value by 2 cm. Hence, men of peasant background, performing physical work but with secondary education achieve half-way, between group I and II, values of the body height – median 175.5 cm.

Conclusions

Factors conditioning the development of the organism create an unusually complicated network of mutual dependencies.

Differentiated body height is an anthropological reflection of still existing social economic inequalities and still can be one of the anthropological methods of following social inequalities in a group of adult men coming from the Pomerania Province.

Strategies of development, realised by the genotype in the interaction with defined environmental factors lead to differentiation of values of body height so that in better conditions they are higher on average.

In all social groups, one should take up all possible activities, which will encourage and create possibilities of deepening biological knowledge and improving qualifications by achieving increasingly higher levels of education, which will flourish by getting wider knowledge concerning the biological development of a man and factors modifying this development. The achieved knowledge will certainly help in proper distribution of funds, which will enable introducing rational nutrition, and greater health care in the family and at the same time it will increase the level of physical activity, which, in consequence, will enable realising the genetically programmed information about the biological condition of organism to a better and fuller extent.

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