Education and adult women's anthropometry

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Background. The influence of educational factor on some anthropometrical parameters of adult woman's body was studied during the period 2001–2005 in Latvia.

Materials and methods. In the study, 873 women from 18 to 65 and 66+ years of age were investigated. All the anthropometrical measurements (body height, body weight, chest circumference) were carried out according to the methodical recommendations by R. Martin and K. Saller using Siber-Hegner and Co (Switzerland) instruments. Body mass index (BMI) was calculated. The data on education were estimated using a questionnaire which was divided into five groups: incomplete primary school, primary school, secondary school, professional (technical) school, higher educational institution. To describe the association of an individual's education by anthropometrical parameters two more factors (age and ethnicity) had to be added. The data analysis was performed using SPSS for Windows 10.0.

Results. The educational level of the women studied differed depending on their age. The groups of women with better education included a greater number of older than younger individuals. The values of some anthropometrical parameters varied between educational groups of adult women. Differences between educational groups showed, that the mean value of body height was greater for women with secondary school educational level than for women with other educations. Comparison of educational groups showed, that women with better educational levels had greater mean values for body weight, chest circumference and BMI. The level of education was statistically significant and positively associated with age. Factor analysis of regression showed associations of body height, body weight with age and ethnicity as well as associations between chest circumference, BMI and age. All the anthropometrical variables did not show any association with the educational factor.

Conclusions. The results of the present study support the idea that the educational factor has influence on the body build and could be used to investigate some associations of socioeconomic factors with women's physical development.

Key words: education, anthropometry, adult women

INTRODUCTION

Since at least the nineteenth century, the relationships between socioeconomic status, living conditions and body build have been subjects of more scientific studies. Education is a part of the socioeconomic status (SES), which additionally combines occupation and social prestige of a person or social group (1). SES is closely correlated with better health care. Today it is known from many studies of populations, that physical development is closely associated with social environment. Many differences and correlations between ethnic groups, education and body build are in various populations. Social factors often change, and it is quite difficult to find out borderlines between social groups and differences between them.

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The aim of this study was to examine the influence of the factor of adult women's education in Latvia on some of their anthropometrical parameters.

MATERIALS AND METHODS

This study was conducted in 2001–2005 in Latvia. The subjects involved in the study were women having different kinds of jobs (mostly employed women). A group of unemployed (students, seniors, unemployed women) as well as individuals with higher education or better professional position were also included into the study. The sample consisted of 873 women from 18 to 65 and 66+ years of age. All the anthropometric measurements were carried out according to the methodical recommendations by Martin and Saller (2) using Siber-Hegner and Co instruments (Switzerland). Three anthropometrical variables were studied: body height (cm), body weight (kg) and chest circumference (cm). The body height was measured using a metal anthropometer. For the evaluation of body weight, we used a portable scale with a 0.1 kg precision. The participants were weighed wearing light clothing and no shoes. Chest circumference was measured

with a flexible tape with a 0.1 cm precision. All the anthropometric measurements were measured by the author of this study together with the medical nurses of the Anthropology Unit of the Institute of Anatomy and Anthropology (IAA). Body mass index (BMI) was calculated as weight in kg / height in m^2 (3). All the women were divided into seven groups by age (18–20, 21–25, 26–35, 36–45, 46–55, 56–65, 66+) and into three groups by ethnicity (Latvians (n = 600), Russians (n = 201), others (n = 72)). The distribution of women by age and ethnic groups is presented in Table 1.

The education of the adult women studied also differed depending on their age (Table 2).

Education was estimated by a questionnaire which was evaluated on the basis of the level (years) of school completed according to the Latvian school system and was divided into five groups (0 – incomplete primary school, I – primary school, II – secondary school, III – professional (technical) school, IV – higher educational institution). Women having secondary (64.8%) or professional (technical) school (20.5%) education showed the largest prevalence compared to the women having high school (12.4%) education. In this study, only 2.3% women were with primary school education, and there were no women with incomplete primary school education.

To describe the association of the individual's education with anthropometrical parameters, two more factors (age and ethnicity) had to be added. Age and ethnic distribution were not equal in each educational group (Table 3). The groups of women with better education included a greater number of younger individuals than the older ones, more Latvians and Russians than others.

Data analysis was performed using SPSS 10.0 for Windows method in the Institute of Anatomy and Anthropology and the Department of Physics of Riga Stradiņš University. Standard statistical methods were used to present mean values, standard deviations, significance of mean values and correlations of differences. To study the influence of education on body build a three-factor analysis of regression was used. Independent variables (factors) were: age, ethnicity and education. The statistical significance of differences between groups was tested using Student's t-test. Pearson's correlation coefficient (r) was used to determine the relationships between the dependent variables. The level of significance was set at $p < 0.01$; $p < 0.05$; $p < 0.001$.

Table 1. **The distribution of the adult women studied by age and ethnic groups**

Age group (years)	Latvians (n = 600)		Russians (n = 201)		Others (n = 72)	
	n	%	n	%	n	%
18–20	233	38.8	89	44.3	27	37.5
21–25	134	22.3	47	23.4	20	27.8
26–35	71	11.8	18	9.0	5	6.9
36–45	76	12.7	21	10.4	8	11.1
46–55	41	6.8	13	6.5	7	9.7
56–65	29	4.8	12	6.0	3	4.2
66+	16	2.7	1	0.5	2	2.8

n – number of persons.

Table 2. **The level of education of the adult women studied according to their age groups**

Age group (years) / Education	(18–20) n = 349		(21–25) n = 201		(26–35) n = 94		(36–45) n = 105		(46–55) n = 61		(56–65) n = 44		(66+) n = 19		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
Incomplete primary school	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Primary school	5	1.4	2	1.0	2	2.1	0	0	4	6.6	5	11.4	2	10.5	20
Secondary school	341	97.7	153	76.1	19	20.2	16	15.2	20	32.8	12	27.3	5	26.3	566
Professional (technical) school	2	0.6	28	13.9	44	46.8	66	62.9	17	27.9	14	31.8	8	42.1	179
Higher educational institution	1	0.3	18	9.0	29	30.9	23	21.9	20	32.8	13	29.5	4	21.1	108

n – number of persons.

Table 3. Mean age and frequency of ethnic groups according to different levels of education of the adult women studied

Education	Age			Ethnic groups					
				Latvians		Russians		Others	
	n	Mean	SD	n	%	n	%	n	%
Incomplete primary school	0	0	0	0	0	0	0	0	0
Primary school	20	42.02	20.3	14	70.0	4	20.0	2	10.0
Secondary school	566	23.15	10.14	380	67.1	140	24.7	46	8.1
Professional (technical) school	179	38.48	12.26	127	70.9	37	20.7	15	8.4
Higher educational institution	108	39.8	13.99	79	73.1	20	18.5	9	8.3

n – number of persons, SD – standard deviation.

Table 4. Values of the variables studied according to the age groups of adult women

Age group (years) Variable	(18–20) n = 349	(21–25) n = 201	(26–35) n = 94	(36–45) n = 105	(46–55) n = 61	(56–65) n = 44	(66+) n = 19	(Total)[1] n = 873
	x	x	x	x	x	x	x	x
Body height, cm	166.76	165.56	165.06	163.86	161.95	160.65	157.42	165.1
SD	6.37	6.23	6.35	6.5	6.56	5.2	5.93	6.62
Body weight, kg	59.91	59.51	64.31	70.40	72.18	73.16	73.55	63.38
SD	8.84	9.24	12.34	14.31	14.39	13.58	19.19	12.22
Chest circumference, cm	83.0	83.78	86.57	90.82	93.03	95.96	94.6	86.11
SD	5.36	5.74	8.34	9.74	7.54	8.35	11.4	8.09
Body mass index (BMI), kg/m^2	21.52	21.69	23.59	26.25	27.47	28.31	29.53	23.29
SD	2.82	3.17	4.27	5.35	4.92	4.94	6.94	4.58

x – mean value, SD – standard deviation, n – number of persons, 1 – mean value of all the women.

All the participants gave their written informed consent to participate in this study.

RESULTS

The mean age of the women studied was 28.78 ± 13.76 years. The mean and standard deviations of anthropometrical values and body mass index (BMI) according to age of the adult women in Latvia are presented in Table 4.

Body height. The mean body height was 165.1 ± 6.62 cm. The mean height reached maximum in the age group of 18–20 (Table 4). The body height showed a significant decrease with age ($p < 0.001$). Older women (age 66+) were shorter than younger women (age 18–20): reduction amounted to 5.6% (9.34 cm) of the height of younger women. The level of education showed body height increase after primary school level (Table 5).

This picture was rather clear, up to the secondary school level. The mean value of body height was greater of women with secondary school education than that of women with other education (D (difference) = I and II (+3.94 cm); D = II and IV (−1.41 cm); D = II and III (−2.84 cm)). Regression analysis (for all the subjects) did not show any association between the body height and education (Table 6).

Body weight. The mean body weight was 63.38 ± 12.22 kg. The lower mean values of body weight were at age groups 18–20 and 21–25 (Table 4). The body weight increase started after the age of 25. Older women were heavier than younger women ($p < 0.001$). The body weight reached a maximum value at the age group of 66+: increase of 22.8% of the weight of younger women (age 18–20). The body weight was the highest among the women with primary school level of education (D = I and II (+8.64 kg); D = I and III (+3.19 kg); D = I and IV (+2.4 kg)). Women with secondary school education showed minimal body weight compared with other education groups (Table 5). After secondary school, the body weight of women started increasing (D = II and III (+5.45 kg); D = II and IV (+6.24 kg); D = III and IV (+0.79 kg)). Regression analysis (for all the subjects) did not show any association between the body weight and education (Table 7).

Chest circumference. The mean value of the circumference was 86.11 ± 8.09 cm (Table 4). The mean values of the circumference increased significantly with age ($p < 0.001$). The highest increase of the circumference started after the age of 35. All the mean values of the circumference were higher for the oldest women compared with the youngest ones. Chest circumference value increased among women with secondary education and de-

Table 5. **Values of the variables studied according to education groups of adult women**

Education Variable	Primary school (I) n = 20	Secondary school (II) n = 566	Professional (technical) school (III) n = 179	Higher educational institution (IV) n = 108
	x	x	x	x
Body height, cm	162.01	165.95	163.11	164.54
SD	6.32	6.68	6.28	5.94
Body weight, kg	69.93	61.29	66.74	67.53
SD	14.02	10.91	14.12	12.42
Chest circumference, cm	90.17	84.44	88.92	89.45
SD	11.78	6.81	9.95	7.52
Body mass index (BMI), kg/m^2	26.72	22.27	25.12	24.95
SD	5.73	3.95	5.3	4.45

x – mean value, SD – standard deviation, n – number of persons.

Table 6. **Body height and education (regression analysis)**

Model	Unstand. Coeff.		Stand. Coeff.	t	Sig.
	B	Std. Error	Beta		
Constant	170.501	1.119		152.4	.000
Age	−.163	.017	−.338	−9.58	.000
Ethnicity	−1.500	.331	−.144	−4.54	.000
Education	.402	.318	.045	1.26	.207

Table 7. **Body weight and education (regression analysis)**

Model	Unstand. Coeff.		Stand. Coeff.	t	Sig.
	B	Std. Error	Beta		
Constant	55.467	2.012		27.57	.000
Age	.359	.031	.405	11.77	.000
Ethnicity	−1.561	.594	−.081	−2.63	.009
Education	−7.36E−02	.572	−.004	−.13	.898

creased among those with primary school education (D = I and II (–5.73 cm); D = I and III (–1.25 cm); D = I and IV (–0.72 cm); D = II and III (+4.48 cm); D = II and IV (+5.01 cm); D = III and IV (+0.53 cm)). Women with better education levels after secondary school had greater mean values for chest circumference (Table 5). Regression analysis (for all the subjects) did not show any association between chest circumference and education (Table 8).

Body mass index (BMI). The mean BMI was 23.29 ± 4.58 kg/m^2 (Table 4). The mean BMI increased significantly with age (p < 0.001). The mean values of the BMI ranged normal till the age of 35. After that all the mean values of the BMI showed overweight. The maximal mean BMI was in the age group 66+. Body mass index had a positive association with the level of education after secondary school and the negative one after primary school and professional (technical) school (D = I and II (–4.45 kg/m^2); D = I and III (–1.6^{2}kg/m^2); D = I and IV (–1.77 kg/m^2); D = II and III (+2.85 kg/m^2); D = II and IV (+2.68 kg/m^2); D = III and IV (–0.17 kg/m^2)). Women with primary school education and better levels of education had greater mean values of BMI (Table 5). Regression analysis (for all the subjects) did

not show any association between the body mass index (BMI) and education (Table 9).

Correlations. Regression analysis of all the anthropometrical variables (body height, body weight, chest circumference, body mass index (BMI)) of all the adult women showed no statistically significant associations with the level of education. While comparing different educational groups, anthropometrical variables showed statistically significant differences. Body height and body weight depended mostly on age and ethnicity. Chest circumference and body mass index (BMI) values depended only on age. The level of education was statistically significant and positively associated with age (p < 0.01; r = 0.579).

DISCUSSION

Studying the variability of anthropometrical parameters of adult women in connection with the influence of various factors is one of all the current issues in modern anthropology. Special interest in this respect is devoted to the characteristics of some anthropometrical parameters, including the influence of the

Table 8. **Chest circumference and education (regression analysis)**

Model	Unstand. Coeff.		Stand. Coeff.	t	Sig.
	B	Std. Error	Beta		
Constant	78.235	1.257		62.26	.000
Age	.299	.019	.509	15.69	.000
Ethnicity	−.455	.371	−.036	−1.23	.220
Education	−3.03E−02	.358	−.003	−.09	.933

Table 9. **Body mass index (BMI) and education (regression analysis)**

Model	Unstand. Coeff.		Stand. Coeff.	t	Sig.
	B	Std. Error	Beta		
Constant	18.850	.697		27.05	.000
Age	.184	.011	.553	17.41	.000
Ethnicity	−.143	.206	−.020	−.7	.486
Education	−.193	.198	−.031	−.97	.330

educational factor. At present, some authors show that children and adults with greater body build are more frequently associated with a higher educational level than with the lower one (4). Different social levels are characteristic of Latvia's population, like in other European countries. Such a phenomenon is present in many countries, and the main objective of this study was to analyse the possible influence of education on adult women's bodies. This problem may also affect two additional factors, age and ethnicity. Our findings showed some differences among the women measured in various educational groups.

Body height and body weight are essential indicators of physical growth (5). These parameters are considered to be sensitive and undergo variations. Body height is the most stable parameter describing the condition of plastic processes in one's organism. The women with secondary school education showed higher values of body height.

It has been determined that weight parameter of a body is hereditary enough, reflecting genetic and environmental influences and used as one of the parameters describing a somatic type (6). Women with higher levels of education showed greater values of body weight. The lower body weight values of women with secondary school education were probably the result of keeping their calorie intake low in order to be fashionably slimmer. Some comparative studies of girls in private and public schools confirm this hypothesis (7).

Chest circumference characterizes the size of the thorax of a person and indirectly characterizes functionalities of cardiorespiratory system of that person. Women with higher levels of education had greater chest circumference values. The differences in chest circumference among educational groups can be associated with the changes in chest size or with fat adiposity around the chest, which in our study increased in women with higher education.

BMI is widely used in general medicine around the world as an indicator expressing the level of obesity. The values of BMI increased together with better education. Another problem was observed in women with complete primary school education. They were rather overweight. In our work, the body height, body

weight, chest circumference and BMI were associated with age. It is well known that some anthropometrical parameters increase or decrease with the age of individuals (8).

In this study, the level of education was associated with age. The higher educational groups consisted of a greater number of older women than the lower educational groups – it appeared that together with better education the age of women increased.

Many differences between educational groups may also result due to ethnicity. Our findings showed, that body height and body weight were associated with ethnicity. Currently, in research of the influence of socioeconomic factors on the size of a body, special attention is devoted to women's education. According to some authors, differences between ethnic groups may have their origins in socioeconomic status (9, 10). Direct dependence on the educational level of women and the economic status of a family is marked. The women from families with better socioeconomic status have better physical development (11, 12). Certainly, they come from better socioeconomic conditions, and it can be expected, that they receive better nutrition. So, better nutrition together with stressful style of life may lead to the so-called civilization diseases, which are usually characterized by higher body weight and BMI values. Some results show that better educated women take better care of their health status and usually reduce body weight and BMI (13).

According to our results, the tendencies of some anthropometrical parameters between educational groups were found; however in this study, regression analysis did not show any association of anthropometrical variables with the educational factor. Therefore, some anthropometrical parameters of adult women's bodies and their variability in connection with the influence of different factors will be studied in greater detail in our future works.

CONCLUSIONS

In each educational group, age and ethnic distribution was different. The values of some anthropometrical parameters varied between educational groups of adult women. Interpretation of

the results showed the influence of education on body build; however, for all the subjects it was not statistically significant. Comparison of educational groups showed a tendency that taller women had a higher educational status than shorter women. Women with a better level of education had greater mean values of body weight, chest circumference and BMI. The values of body height and body weight were associated with age and ethnicity; however, the values of chest circumference and body mass index (BMI) were associated only with age. The results of the present study support the idea that the educational factor has influence on the body build and could be used to investigate some associations of socioeconomic factors with women's physical development.

The results of the present study support the idea that the influence of the educational factor on the body build could be used in investigating the associations of some socioeconomic factors with the women's physical development.

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