# SOCIAL DETERMINANTS OF PHYSICAL DEVELOPMENT STATUS IN BOYS IN THE PUBERTY PERIOD

Alfreda **DENCIKOWSKA**

*Faculty of Physical Education, University of Rzeszow, Rzeszow, Poland*

**Keywords:**
- somatic traits,
- pupils,
- social determinants.

**Abstract:**
The study was aimed at determining the effect of social determinants on the physical development of boys in the puberty period. It covered 1706 pupils at the age of 13-15 years. They were subject to measurements of basic somatic traits. Data were additionally collected on the educational level of parents. Analyses of relations between somatic traits and the educational level of father or mother demonstrated that in the group of boys that social variable had a significant effect particularly on body height and body mass values. In observations made from low [L] to upper [U] social stratum, body height values were displaying the ascending trend. Results obtained in the study point to still existing differences in the somatic development of children between social strata.

## INTRODUCTION

In contemporary anthropological studies, issues referring to the impact of social structure on differences in the physical development of individuals and overall biological status of a population have been of great significance. It has been reflected in scientific research and ample manuscripts emphasizing the fact that social variables (educational and social status of parents) differentiate values of somatic traits, body height in particular [Radzka 1998, Charzewski, Bielicki 1990, Charzewski, Przewęda 1992, Charzewski i wsp.2003, Przewęda, Dobosz 2003, Syta 2005]. Results of those investigations demonstrate that mean body height of boys is decreasing along with a descending educational status of their parents. That regularity is manifested especially in the puberty period, i.e. at the age of 13-15 years in boys. Results of investigations carried out so far in Poland confirm the great impact of socio-economic factors in the course and rate of growth of children and adolescents. Those environmental differences are a phenomenon commonly recognized and confirmed by anthropologists in a number of countries [Desai 1998, Eveleth, Tanner 1976, Van Wieringen 1986].

The objective of the presented study was to investigate the effect of social determinants on the physical development of boys in the puberty period.

## STUDY MATERIAL AND RESEARCH METHODS

The experimental material were data referring to boys attending to primary schools and gymnasium in the city of Rzeszów. The study covered 1706 subjects at the age of 13-15 years. Detailed numbers of subjects in particular age categories were presented in Table 1.

**Table 1.** Detailed numbers of subjects in particular age categories

| Age | Detailed numbers | Percent |
|---|---|---|
| 13 | 654 | 38, 3 |
| 14 | 857 | 50,3 |
| 15 | 195 | 11,4 |
| Whole | 1706 | 100 |

All the pupils were subjected to measurements of body height and body mass. The values obtained were used to calculate the Body Mass Index (BMI) using the following formula: **body mass in kg / body height in m$^2$**.

Significance of differences between mean values obtained was computed using the Anova model [18] for the so-called „general tests"; once the result of the general test was significant at a level of $p<0.05$, pair comparisons were conducted between two groups using the Student's t-test [Netter, Wasserman, Kutner 1990]. Calculations were performed in Stata 7.0 software [Stata Statistical Software].

## RESULTS

### Educational status of parents vs. somatic development of the boys examined

As indicated by data presented in Table II, in the whole population of boys, irrespective of age category, **the educational status of fathers** was significantly correlated with body height values of their sons ($p< 0.0001$). This correlation refers in particular to the secondary and higher education as compared to the lower educational levels (p from 0.005 to 0.0001). Analyses conducted in age categories confirmed the significant effect of higher and secondary education of fathers on body height values of especially 14- and 15-year-old boys (except for the 13-year-olds). It means that the boys originating from families with higher or secondary educational status of father were taller by ca. 4 cm on average than their peers from families with the other educational levels of fathers (Fig. 1). Worthy of notice is also practically lack of differences in body height between sons of fathers with secondary and higher education.

Also **the educational status of mothers** appeared to exert a significant ($p< 0.0001$) effect on body height values of their sons, which was demonstrated both in the whole population of boys examined and in respective age categories. In contrast to the correlations observed in the case of the educational status of fathers, the impact of mothers was also significant in the youngest age category examined, i.e. in 13-year-olds, followed by groups of 14- and 15-year-old boys. Dependencies observed in that case indicated that sons of mothers with secondary and higher education were taller by 3.7cm in the group of 13-year-olds and by 5.2cm in the group of 15-year-old boys. The analysis of a linear trend demonstrated that the differences observed were linear in character and significant in the youngest age category assayed, i.e. in the boys at the age of 13 years.

In turn, Table III presents results of respective analyses made for differences between body mass values of the boys and the educational status of their fathers and mothers. The results show that the educational level of fathers was statistically significantly correlated with body mass values of their sons both in the whole population ($p=0.0008$) and in the youngest age category of 14-year-olds ($p=0.003$). In that age category, the difference between mean values of body mass accounted for 3.4kg between the extreme educational levels of fathers, i.e.: primary and higher one, which is depicted in Fig. 3.

In the case of correlations between body mass values and educational status of fathers, the linear trend test did not demonstrate any linear in character and significant differences neither in the whole population studied nor in particular age categories.

In contrast to fathers, **the educational status of mothers** was found to exert a greater influence on the **body mass** of their sons. Distinct correlations (statistically significant) were

observed both in the whole population of boys and in the selected age categories. Sons of mothers who had achieved lower educational levels were characterized by a lower body mass as compared to those whose mothers had secondary and higher education. It is worth noticing that the correlation between the educational status of mothers and body mass of the boys was especially tangible in the younger age categories, i.e. in boys at 13 and 14 years of age ($p=0.0025$; $p<0.0001$). The dependencies observed are manifested in differences between mean body mass values of the boys in particular educational strata of their mothers. The differences in body mass values between the extreme educational strata of mothers accounted for 4.6kg in the 13-year-old boys and 4.2kg in the 14-year-old boys (Fig.4). The observed dependencies between body mass values of the boys and educational levels achieved by their mothers were linear in character and significant only in the group of the 13-year-old boys.

As shown in Figures 5 and 6, dependencies between BMI values and educational levels of parents were less explicit than in the case of body height and body mass.

Results presented in Table IV demonstrated a lack of any correlation between the educational level of father and relative body mass of their sons as well as a significant effect of **the educational status of mothers** on BMI values in the whole population studied ($p=0.0001$) and in 13- and 14-year-old boys ($p=0.009$; $p=0.003$). It indicates than in the case of boys originating from families with primary and vocational education of mother **the BMI values** were lower in the younger age categories (13 and 14 years of age) by 0.9 to 1.4 units, on average, than in the case of boys with at least secondary or higher educational status of mothers. Results of the linear trend test were significant only for the educational status of mother in the group of 13-year-old boys.

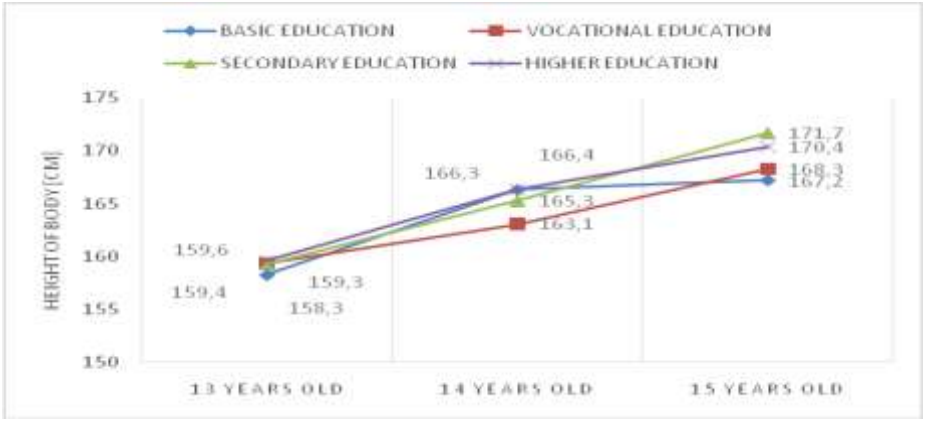


**Figure 1.** Average values of the heights of boys body in dependence from the level of the father education

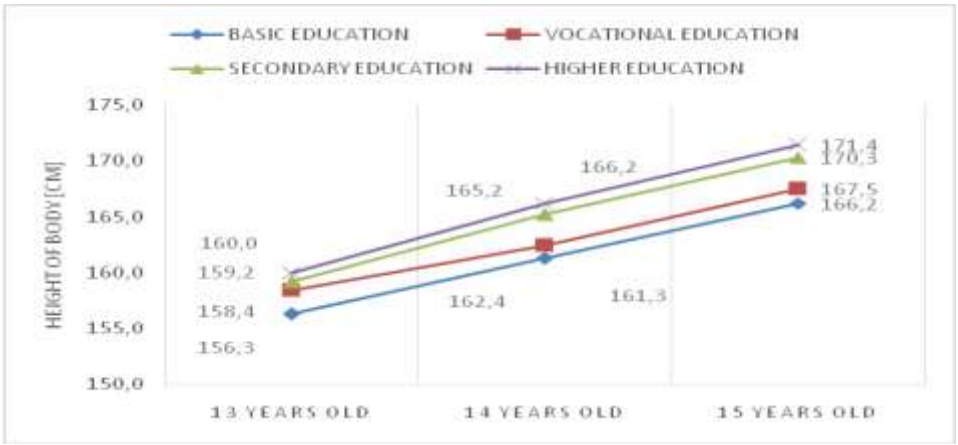


**Figure 2**. Average values of the heights of boys body in dependence from the level of the mother education

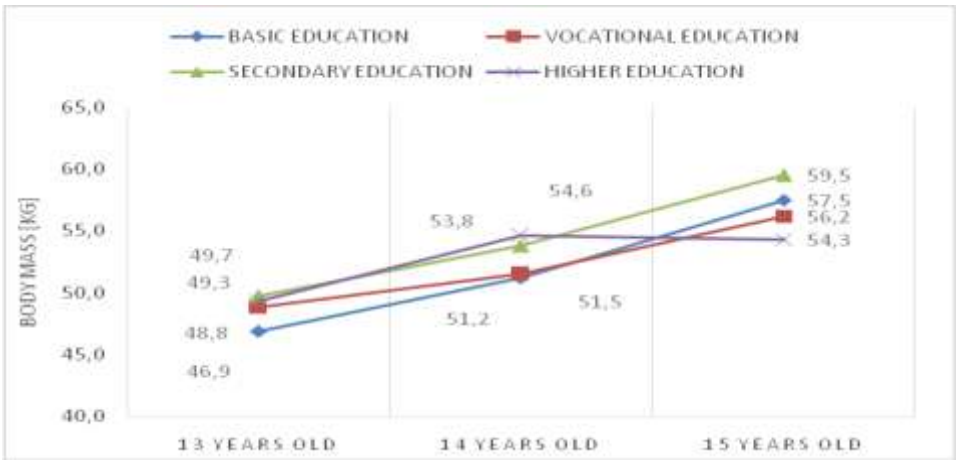


**Figure 3.** Average values of the mass of boys body in dependence from the level of the father education

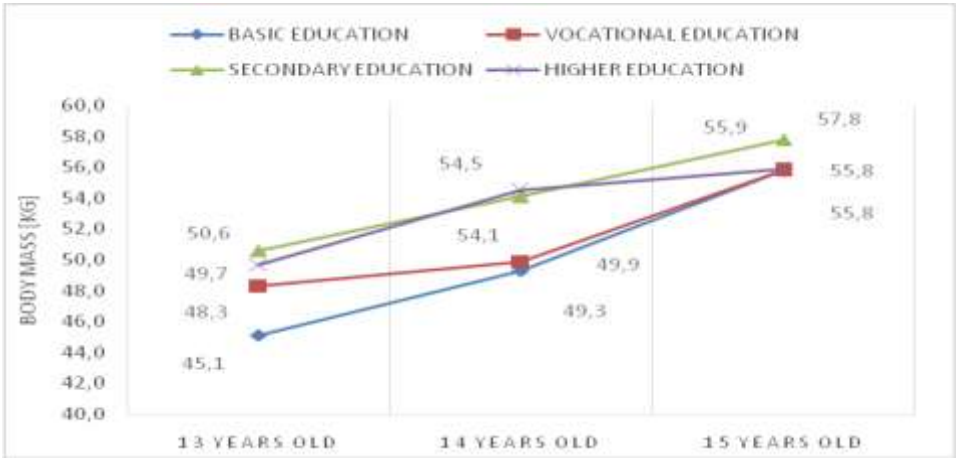


**Figure 4.** Average values of the mass of boys body in dependence from the level of the mother education

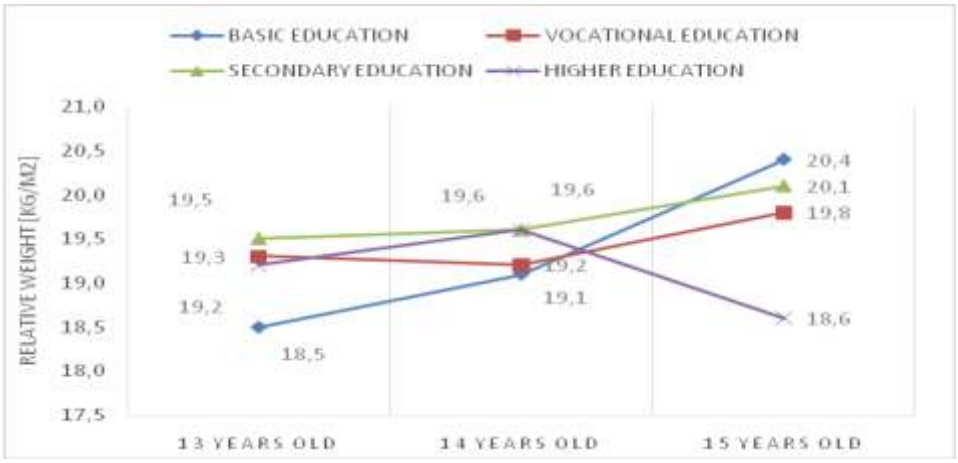


**Figure 5**. Average values of the relative mass [BMI] of boys body in dependence from the level of the father education.

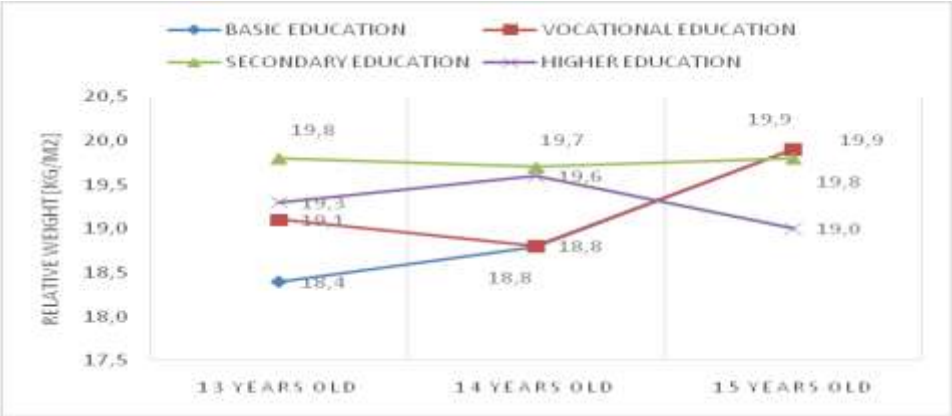


**Figure 6**. Average values of the relative mass [BMI] of boys body in dependence from the level of the mother education.

**Table 2.** Relationship of the height of body with the total level of the father or mother education

| p | Whole | 13 years | 14 years | 15 years |
|---|---|---|---|---|
| The education of father | <0.0001 | 0.44 | 0.0002 | 0.048 |
| basic vs principal professional | 0.60 | ns | 0.91 | 0.68 |
| basic vs average | 0.005 | ns | 0.19 | 0.041 |
| basic vs higher | 0.006 | ns | 0.056 | 0.023 |
| principal professional. vs average | <0.0001 | ns | 0.003 | 0.011 |
| principal professional. vs higher | 0.0001 | ns | <0.0001 | 0.20 |
| average vs. higher | 0.90 | ns | 0.17 | 0.41 |
| The test on the linear trend | 0.36 | 0.12 | 0.24 | 0.29 |
| The education of mother | <0.0001 | 0.03 | <0.0001 | 0.028 |
| basic vs principal professional | 0.09 | 0.11 | 0.39 | 0.61 |
| basic vs average | <0.0001 | 0.013 | 0.0017 | 0.035 |
| basic vs higher | <0.0001 | 0.004 | 0.0001 | 0.032 |
| principal professional. vs average | <0.0001 | 0.34 | 0.0004 | 0.055 |
| principal professional. vs higher | <0.0001 | 0.11 | <0.0001 | 0.035 |
| average vs. higher | 0.14 | 0.38 | 0.15 | 0.41 |
| The test on the linear trend | 0.74 | 0.004 | 0.95 | 0.21 |

Received the horizontal significance: p <0.05; the level of significance wa lowered In comparisions between two groups to the correction Bonferroniego to 0.01 according.

**Table 3.** Realtionship of the mass of boys body with the level of the father Or mother education.

| p | Whole | 13 years | 14 years | 15 years |
|---|---|---|---|---|
| The education of father | 0.0008 | 0.29 | 0.003 | 0.19 |
| basic vs principal professional | 0.23 | ns | 0.96 | ns |
| basic vs average | 0.005 | ns | 0.22 | ns |
| basic vs higher | 0.007 | ns | 0.075 | ns |
| principal professional. vs average | 0.002 | ns | 0.012 | ns |
| principal professional. vs higher | 0.011 | ns | 0.0006 | ns |
| average vs. higher | 0.64 | ns | 0.34 | ns |
| The test on the linear trend | 0.47 | 0.14 | 0.16 | 0.22 |
| The education of mother | <0.0001 | 0.0025 | <0.0001 | 0.67 |
| basic vs principal professional | 0.10 | 0.055 | 0.64 | ns |
| basic vs average | <0.0001 | 0.0005 | 0.002 | ns |
| basic vs higher | <0.0001 | 0.0028 | 0.0006 | ns |
| principal professional. vs average | <0.0001 | 0.039 | <0.0001 | ns |
| principal professional. vs higher | <0.0001 | 0.19 | <0.0001 | ns |
| average vs. higher | 0.68 | 0.49 | 0.60 | ns |
| The test on the linear trend | 0.41 | 0.003 | 0.26 | 0.66 |

Received the horizontal significance: p <0.05; the level of significance wa lowered In comparisions between two groups to the correction Bonferroniego to 0.01 according.

**Table 4.** The relationship of the relative mass of body (coefficient BMI) with the level of the father or mother education.

| P | Ogółem | 13 lat | 14 lat | 15 lat |
|---|---|---|---|---|
| The education of father | 0.20 | 0.25 | 0.30 | 0.14 |
| The test on the linear trend | 0.72 | 0.33 | 0.27 | 0.39 |
| The education of mother | 0.0001 | 0.009 | 0.003 | 0.40 |
| basic vs principal professional | 0.30 | 0.13 | 0.99 | ns |
| basic vs average | 0.0006 | 0.0024 | 0.043 | ns |
| basic vs higher | 0.015 | 0.04 | 0.063 | ns |
| principal professional. vs average | 0.0004 | 0.03 | 0.0014 | ns |
| principal professional. vs higher | 0.052 | 0.50 | 0.005 | ns |
| average vs. higher | 0.10 | 0.14 | 0.75 | ns |
| The test on the linear trend | 0.17 | 0.036 | 0.11 | 0.82 |

Received the horizontal significance: $p < 0.05$; the level of significance wa lowered In comparisions between two groups to the correction Bonferroniego to 0.01 according.

## DISCUSSION

Analyses conducted in the reported study were focused on the biological effects of social stratification in boys at the age of 13 to 15 years. Educational status of father and mother, affiliation to a respective social stratum, were adopted as factors stratifying the population examined. In addition, detailed description was provided for the social determinants of a few biological characteristics analyzed (somatic traits, physiological maturation).

The analyses enabled explicit documentation of a strong dependency between the educational status of father and mother and the development of somatic traits. A higher educational level of the parents was observed to significantly diversify body height and body mass values of the boys. Mean values of body height of the boys were decreasing along with a descending educational status of their parents. The results obtained confirmed findings of other authors [Charzewski, Bielicki 1990, Hulanicka 1990, Charzewski i wsp. 2003, Przewęda, Dobosz 2003, Syta 2005]. The above observation is consistent with results of a study by Hulanicka et al. [Hulanicka i wsp. 1990] referring to pupils from the city of Wrocław as well as with results achieved by Chabros [Chabros 1998] for the population of boys from Warsaw originating from families with extreme educational levels of parents in the free market period (i.e. in the years 1990-1991).

Out of the environmental factors that exert a significant impact on the physical development of an individual, and consequently on the final body height, well documented in contemporary population is the coupled effect of the educational status of father and mother in the form of the discriminated social strata. It turned out that the boys originating from families in which both parents had higher education were taller, on average, than their peers whose parents had lower educational status. Similar dependencies occurred in a study by Charzewski et al. [Charzewski I wsp. 2003] both in respect of differentiation of children originating from small-town environment as well as those from the „upper social classes" living in Warsaw. The assessment of the extent of that effect was also demonstrated in results achieved by Charzewski and Bielecki [Charzewski, Bielicki 1990] referring to a population of boys from Warsaw, in results reported by Syta [Syta 2005] referring to boys from Jędrzejowo as well as in findings of other authors [Stelmach 1996, Kołodziej, Kozieł 1998, Radzka 1998, Przewęda, Dobosz 2003].

The lower body mass values in respect of body height appropriate to age occurred with greater intensity in the boys from the lower stratum when compared to their peers from the upper stratum, which confirms results achieved by other authors [Charzewski 1984, Krzemień 1997, Lipowicz 1999, Saczuk, Tarasiuk 1996]. Similar conclusions were drawn by Datar et al.

[Datar i wsp. 2004] who reported a beneficial influence of the higher educational status of mothers on BMI values of their children.

Summarizing the occurrence of differences in the somatic traits it was confirmed that social factors determined the proper growth and physical development of boys in the puberty period. Observations made in the reported study confirm results reported earlier in Polish and international surveys [Eiben, Mascie-Taylor 2003, Komlos, Kriwy 2002].

## SUMMARY AND CONCLUSIONS

In summary, worthy of noticing are the following results reported in the group of boys from Rzeszów being in the pubescence period:

- the analysis of results proved that the social variable of the educational status of either father or mother had a strong impact on the body height and body mass of the boys examined. Sons of fathers and mothers with a higher educational status were characterized by up to 5.2cm greater body height values (in the oldest group examined) and by up to 5.2kg greater body mass values (in the younger age categories) as compared to their peers from the lower educational strata.
- analyses showed no linear trend between body height and body mass values and the educational status of either father or mother;
- it seems interesting in the case of BMI values the linear trend was not significant when affected by the onefold educational status of parents.

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