



ÉVA B. BODZSÁR, ANNAMÁRIA ZSÁKAI

RELATIONSHIP BETWEEN PHYSICAL AND PSYCHO-SOCIAL DEVELOPMENT IN PUBERTY

ABSTRACT: Puberty is a hormonally unstable period of life, with dramatic dimensional changes and fast rate of sexual development. Although basically biological processes, growth and maturation are intimately involved in mental development and socialization. These processes interact in the development of personality. To accept our morphological constellation as part of our gender, may prove a problem even to a child of average rate of maturation. Adult self-assessment, a never ceasing process, has its roots in pubertal development. Any disharmony perceived affects adult self-acceptance and sense of identity, our emotional, conative and social development as well as our cognition.

In view of these very complex and intricate interactions of pubertal development, the purpose of our study was to analyze (1) mental development in girls of the same age, but different maturity, (2) body image in relation to body composition, (3) the influence of late and early maturation on self-concept, (4) maturation-dependent concordance of the subject's and investigator's assessment of pubertal stage, (5) the effects of late and early maturation on social integration and interpersonal attitudes at school.

*The sample consisted of 487 healthy girls aged 10–14. Maturity status was estimated by Tanner's stages (1962) of breast and pubic hair, resp. pre- or postmenarcheal condition. To study self-rated maturity a form illustrating and shortly describing the stages had to be filled in. Fat percent was estimated by Siri's method. Mental performance was appraised by Raven test scores. Interpersonal relationships were studied by a 30-item questionnaire. Subgroup differences were analysed by the *t*- and chi-square tests at the 5% level.*

Results and conclusions: (1) Early maturers displayed better mental performance in Raven's intelligence test (2) Fat girls' body image tended to have more negative characters, while (3) only too rapid or too slow rates of maturation lead to a negative self-concept. (4) Concordance between self-assessment and objective stage of maturation was high in breast stages 1 and 5 and in all stages of pubic hair. (5) The distribution of high and low social prestige did not differ between early and late maturers, while social behaviour of the early maturers was more successful than that of the belated ones.

KEYWORDS: Physical maturation – Body composition – Mental development – Body image – Social prestige – Puberty

INTRODUCTION

Puberty is one of the critical phases of development. It is during this period that previously established structures become consolidated following transitory phases of more or less instability. The complexity of human ontogenesis embraces biological growth and maturation as well as mental, affective and conative progress, and adaptation to the requirements of society called socialization process.

All these spheres of development are intimately related in the formation of personality.

The main rules of maturation that govern the interrelations between hormonal, physiological and mental processes as well as the sequence of developmental stages are common and universal for our species. However, the rate of maturation can be very different and its inter- and intraindividual variability is most conspicuous in puberty.

The hypothesis that the developmental rate of some physical, respectively mental and emotional indices of maturation are mutually related, has been supported by a number of studies (Jones, Mussen 1958, Tanner 1961, 1962, Weatherley 1964, Kohen-Raz 1974, Weber 1976, Matsudo *et al.* 1994).

Relationship of mental and affective development to early and late maturation has been found to be closer in boys, while observations made in girls are rather contradictory (Stone, Barker 1937, 1939, Davidson, Gottlieb 1955, Jones 1957, Jones, Mussen 1958, Mussen, Jones 1957, Lindgren 1979, Duke *et al.* 1980, Bodzsár 1981, Bodzsár, Pápai 1992). This state of affairs may have several reasons, as physical traits can affect adolescent behaviour and personality in three aspects:

(1) relative maturity, size and body build get directly manifest in physical abilities;

(2) outward look and expressions of maturity are socially recognized values, so invoke immediate emotions and expectations of the social environment;

(3) congruence or incongruence between look and individual abilities and between these abilities and their social reception exert strong influence on our self-concept.

A boy whose growth rate is accelerated can excel his less fast developing peers in size, bulk, physical strength and sport performance for years. In males the effects of an out-of-step development can be demonstrated even in adulthood, since tall stature and physical strength are much valued attributes at every age. The social repercussions of a similar difference between early and late maturation are much less obvious in girls. Some studies have reported preferences for late maturers, some others have stated that early maturers enjoy more social advantage (Jones, Bayley 1950, Jones 1957, Shipman 1964, Kiernan 1977).

Of the intricate interactions of pubertal development in girls aged 10–14, the present paper focuses on:

- (1) mental development in girls of the same age, but different maturation stage,
- (2) the relationship of body image with body composition,
- (3) the influence of late and early maturation on self-concept,
- (4) maturation-dependent concordance of the subject's and investigator's assessment,
- (5) the effects of late and early maturation on social integration and interpersonal attitudes at school.

SUBJECTS AND METHODS

The sample consisted of 487 healthy girls aged 10–14 (Table 1).

Maturity status was estimated by Tanner's stages (1962) of breast and pubic hair, resp. by pre- or postmenarcheal condition. In the former respect, children being at least one stage more advanced in pubic hair and breast development than the median of an age group were considered early maturers, and conversely, those being at

TABLE 1. Distribution of subjects by age-groups.

Age (yr.)	N
10	99
11	94
12	101
13	97
14	96

least one stage behind it were designated as late maturing ones.

In calculating median ages at menarche, resp. at stages of pubic hair and breast development the "maximum likelihood" version of probit regression was used (Weber 1964).

Mental performance capacity was estimated by Raven's non-verbal test of intelligence (1938). The age-group mean \pm one SD served to classify children with higher and lower intelligence.

Raven scores were contrasted with menarcheal status, early and late maturation and body fat percent.

Fat percent was estimated by Siri's method (1956). Body density was estimated by the Durnin-Rahaman regression formula (1967).

To assess subjective perception of femininity Machover's self-portrait method was used, which among others assigns a score to negative self-image ranging between 1 and 20 points, and higher scores expressing a greater extent of refusing one's prevailing morphology. Every girl was given a sheet of white writing paper with the instruction: "Make a drawing of yourself! Nobody expects you to be an artist, we don't care about your dexterity and drawing skills. Do not bother if it is not perfect!"

Spontaneous expression of negative self-image scores were averaged for the late and early maturers in respect of

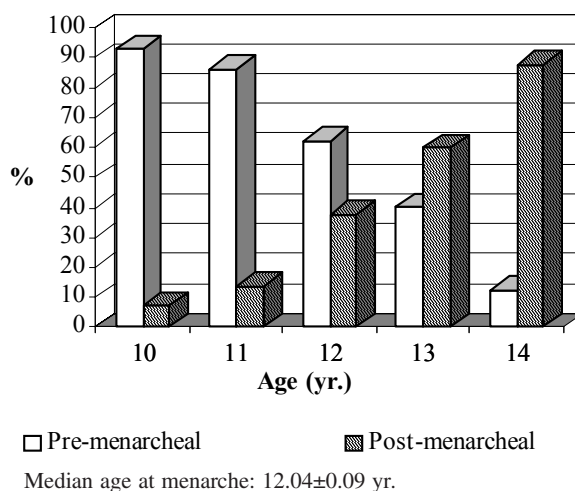


FIGURE 1. Age distribution of pre- and post-menarcheal girls.

the secondary sex characteristics. Interpersonal relationships were studied by a 30-item questionnaire.

Subgroup differences were analyzed by the t-test at the 5% level of random error.

RESULTS AND DISCUSSION

Sexual maturation

Figure 1 shows the age distribution of the studied pre-menarcheal and post-menarcheal girls. Menarcheal age has been estimated to be 12.04±0.09 years in this sample.

Median age estimates for stages 2 through 5 in pubic hair and breast development are reproduced in Figure 2. As perceivable, the respective stages of the two characters were found to have developed at practically the same rate.

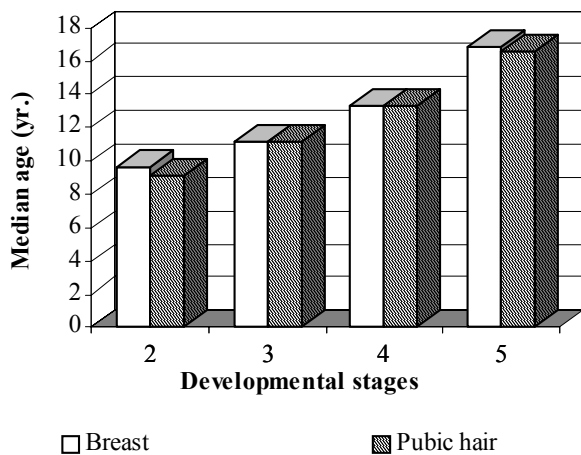


FIGURE 2. Age medians for the stages of breast and pubic hair development.

Relationship between mental performance and the rate of sexual maturation

Scores attained in the Raven test were compared in both respects of sexual maturation. Post-menarcheal girls performed consistently better than their peer-age mates who were still in their pre-menarcheal condition. Only ages ten and fourteen failed to differ significantly (Figure 3).

When the Raven test performance was compared between the subgroups formed by the early and late maturers in the development of secondary sex characteristics, in both breast and pubic hair development consistent and significant differences were found in favour of the early maturers (Figures 4, 5 – see the definition at the bottom).

Body composition, sexual maturation and body image

Post-menarcheal girls were found to have significantly higher body fat content in comparison with girls of the same age but still in their pre-menarcheal state (Figure 6). Body fat content of the latter group was practically constant while early maturers displayed a decrease in relative fatness after age 12.

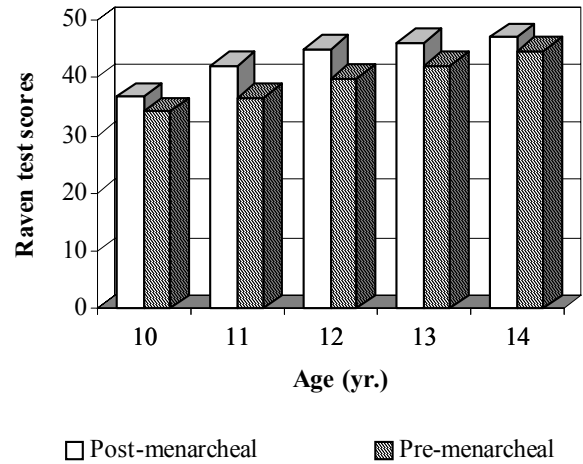


FIGURE 3. Performance differences in the Raven test between pre- and post-menarcheal girls.

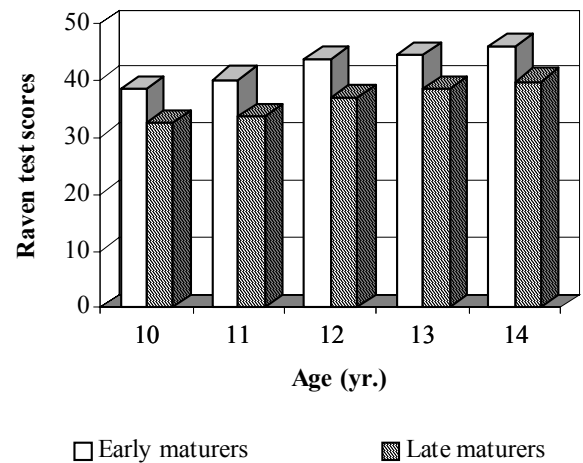


FIGURE 4. Performance differences in the Raven test between early and late maturing subgroups of breast development.

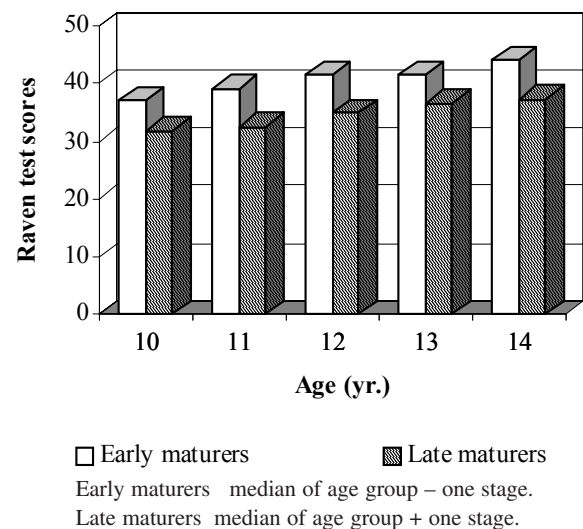


FIGURE 5. Performance differences in the Raven test between early and late maturing subgroups of pubic hair development.

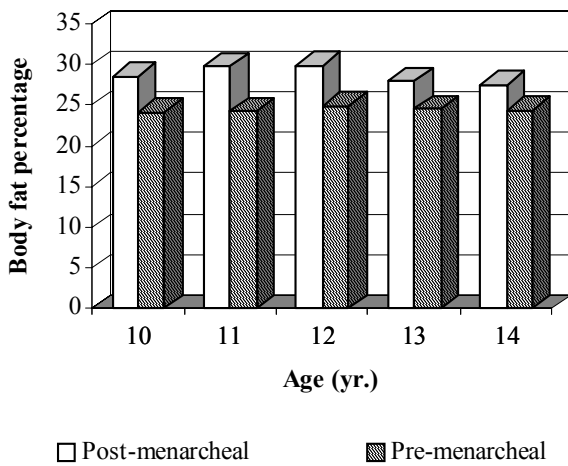


FIGURE 6. Body fat content (%) by age in pre- and post-menarcheal girls.

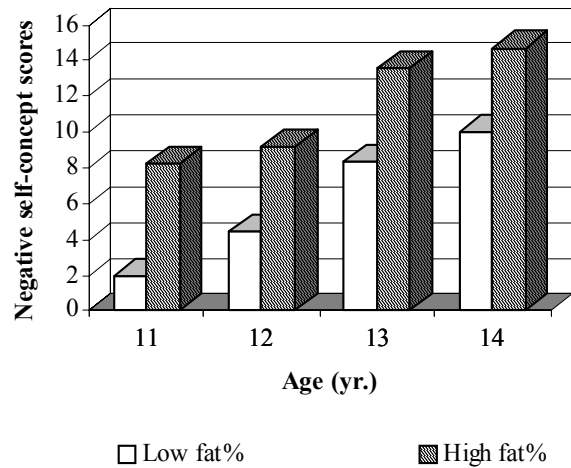


FIGURE 8. Negative self-concept scores related to fat percentage vs. age.

When fatness was used as a grouping criterion in analyzing Raven test scores, leaner girls were found to perform significantly better at all ages except age 14 (Figure 7).

Scores assigned to the negative statements in self-concept were also compared between the subgroups of lower and higher body fat content (Figure 8).

It could be stated that subjects of above average fat content assessed themselves more negatively in all age groups. It is noted that either extremes of body composition were more critical about their look at ages 13 and 14 than those aged 11 or 12. This kind of criticism increased steeper in the unusually lean ones, although it did not exceed the average score of ten.

When early and late maturers were compared in respect of the negative signs of self-concept (Figure 9), significant differences were only found at the ages of 11 and 14. Signs of rejecting one's shape in the self-portrait were more

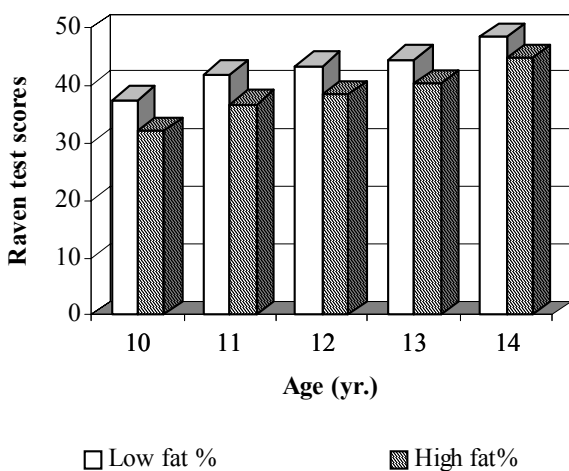


FIGURE 7. Differences by age in Raven scores between subgroups of body fat content.

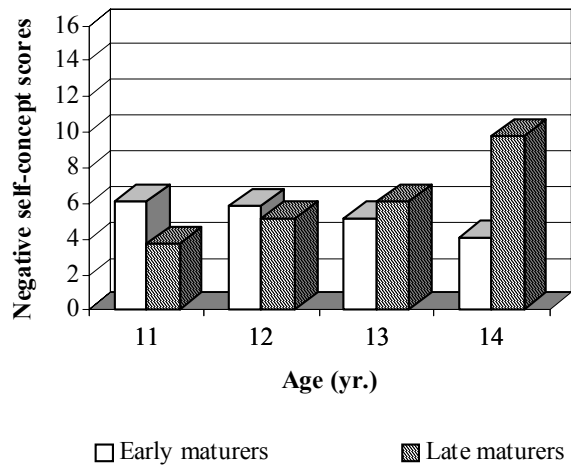


FIGURE 9. Negative scores in self-concept vs. maturation tempo.

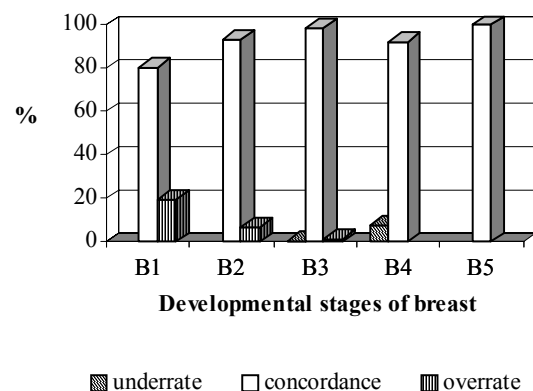


FIGURE 10. Relative distribution of self-rating in breast development related to investigator's assessment.

abundant in the relatively too early maturing 11-year-old girls and in the 14-year-old late maturers. The opposite trends in the body image of early and late maturers are a clear indication of the state expected by society.

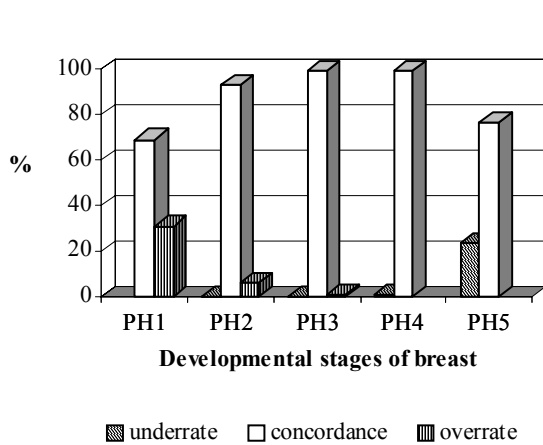


FIGURE 11. Relative distribution of self-rating in pubic hair development related to investigator's assessment.

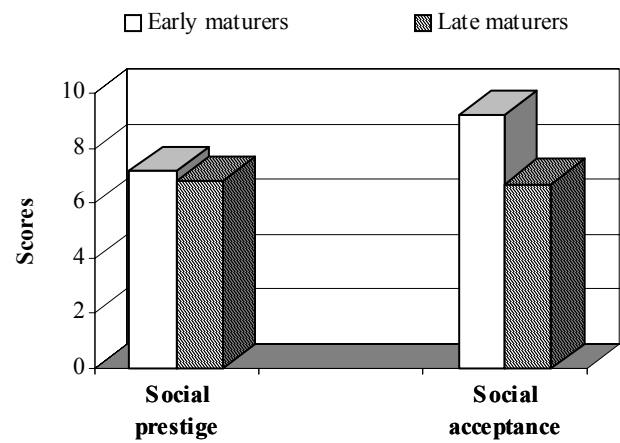


FIGURE 12. Interpersonal relationship vs. maturation rate.

Stage-dependent concordance of assessed maturity between subjects and investigator

By asking the subjects to self-rate the developmental stage of their secondary sexual characters and then comparing this irrespective of age with the investigator's assessment, close agreement was found in stages 2 and 5 of breast development (Figure 10) and in stages 2 to 4 of pubic hair development (Figure 11). A not negligible part of the girls was inclined to overrate their pre-adolescent breast and pubic hair by one stage. On the other hand, when the pubic hair was in stage 5, a part of the girls rated it as being one stage less.

Since there was no opportunity in this study to interview the children about the motives, the reasons for the discrepancy can only be settled by surveys designed accordingly. The overall inference was nevertheless that children of this age range are able to rate their developmental stage acceptably.

The effects of late and early maturation on social acceptance and prestige among mates

The last point studied was whether a relationship existed between maturation rate and social reception. Both prestige and social acceptance were studied by questionnaires of 15 items each, and evaluated by scoring every item as one unit. Thus the maximum attainable score in either respect was 15.

Social prestige among mates was analyzed only for early and late maturation, irrespective of age. No significant differences were found between early and late maturers. However, early maturers scored higher in social acceptance, they were more easily accepted than late maturers (Figure 12).

CONCLUSIONS

In studying the differences in mental performance, self-concept, social impact of the personality, fat content and

body image between the early and late subgroups of sexual maturation, the main inferences of the study were:

(1) Accelerated physical maturation was accompanied by faster mental development, that is, the latter was largely parallel to bodily development. This observation corroborates other studies (Stone, Barker 1937, Douglas, Ross 1964, Lindgren 1979, Bodzsár 1981, 1996).

(2) The observed relationship of body composition and body image reflects that in children older than 13 excess fat contributes markedly to an accumulation of negative scores in self-concept as well as to a rejection of fat in others. In this way, – despite its high prevalence – neither adults, nor children regard fatness as a preferable trait. This may also be motivated by experience since obese children were found to score poorer in IQ tests (cf. Rumpel, Harris 1994, Bodzsár, Pápai 1991). The outcome of this negative self-concept coupled with the environmental attitude is that such children become socially isolated (Wardle, Beales 1986, Wing, Greeno 1994).

(3) The effect on the development of a negative self-concept exerted by the rate of sexual maturation depended on age and was demonstrable in the too early or too late maturers. It has to be noted that in the studied age range a lack of feminine body shape has yet no dominant role, thus it would not disturb identification with one's own body scheme. Provided that it only arose from the rate of maturation, negative attitude to body shape in the early maturers fades soon. In the late maturers this may take longer.

(4) The concordance found between the stages of the subject's and investigator's assessment of secondary sex characteristics gives further support to the suggestion (Duke *et al.* 1980, Lerner *et al.* 1991) that self-rating is an acceptable substitute for direct examination when the latter is unfeasible. Self-rating may be used to monitor the rate of pubertal progression in a given group (but not that of an individual) or to estimate the overall duration of puberty.

(5) Results concerning the interpersonal attitudes of early and late maturing girls seemed to indicate that social

acceptance depended little on sexual maturation status in the studied age interval. It is noted, however, that the influence of rapid and slow maturation on the interpersonal attitudes in the reference group does depend on age (Bodzsár 1996): among the girls of 11 and younger early maturers were rated much lower in social prestige, but progressively higher than their late maturing peers as age advanced.

FINAL REMARKS

Some attributes of the affective response in puberty have their roots in the physiological and hormonal processes. Psychologists have deemed the ages between 12 and 14 the most difficult phase of emotional development. It would be a mistake, however, to reduce pubertal emotional responses merely to hormonal effects. These responses depend on and become modified by social interactions and breeding. Adolescents are much concerned about their body and look. Interest in one's self and body is quite naturally aroused by the experienced change in body shape and sexual maturation.

One important factor in self-concept arises from the perceived social roles, another two are body image and identification with one's physical properties. Fast physical growth and maturation induces fast changes in body image, so it is small wonder that adolescents usually have a negative perception of their physical development. The degree of self-acceptance has a strong impact on behaviour. It is a far from easy task to gain social acceptance and to arrive at a sound degree of self-acceptance even for adolescents who are attractive or nice, and a much more difficult one for those obviously farther away from the "average" or "norm" or the socially desirable one. In them accepting one's body image and developing a positive self-concept may only be achieved by a rearrangement of values. In the more fortunate cases this may involve a higher priority of mental abilities before physical ones. In the less fortunate ones it may lead to a rejection of social norms. Basing on a previous study (Bodzsár 1996) it may be stated that in late maturing girls a higher intellect may help accepting "lacking" femininity while a lower one cannot compensate for it, so identity with one's body scheme becomes distorted.

During puberty also qualitative changes develop in mental activity. Between the age of 12 and 15 thinking undergoes structural changes until reflective thinking develops (Piaget 1972). As mental processes become more intricate, also emotions and behaviour are bound to reshape. A good number of studies have provided evidence that whenever possible physical and mental development proceeds in parallel (see above). Optimum conditions for physical development promote mental exfoliation, in turn spiritual maturation aids correct self-assessment and efficient social adaptation. Thus — although it may appear as oversimplification — an undisturbed course of physical

development has an important part in the evolution of personality and mental health.

ACKNOWLEDGEMENTS

This paper was funded by the Hungarian National Foundation for Scientific Research (OTKA grant No T 34872).

REFERENCES

- BODZSÁR B. É., 1981: Relationship between physical and mental development. *Collegium Antropologicum (Suppl.)* 5: 21.
- BODZSÁR B. É., 1996: Sexual maturation, intelligence and self-assessment. *Anthropologiai Közlemények* 37: 24–31.
- BODZSÁR B. É., PÁPAI J., 1991: Physical development and maturation in relation to mental performance in girls from age 10 to 14. *Anthropologiai Közlemények* 33: 139–145.
- BODZSÁR B. É., PÁPAI J., 1992: Physical development and maturation in relation to mental performance in girls from age 10 to 14. *Anthropologiai Közlemények* 34: 7–11.
- DAVIDSON H. H., GOTTLIEB L. S., 1955: The emotional maturity of pre- and post-menarcheal girls. *J. Genet. Psychol.* 86: 261–267.
- DOUGLAS J. V. B., ROSS J. M., 1964: Age of puberty related to educational ability, attainment and school leaving age. *J. of Child Psychology and Psychiatry* 5: 185–196.
- DUKE P. M., LITT I. F., GROSS R. T., 1980: Adolescent's self assessment and sexual maturation. *Pediatrics* 66: 918–920.
- DURNIN J. V. G. A., RAHAMAN M. A., 1967: The assessment of the amount of body fat in the human body from measurement of skinfold thickness. *Br. J. Nutr.* 21: 681–685.
- JONES M. C., 1957: The later carriers of boys who were early or late maturing. *Child Development* 28: 114–128.
- JONES M. C., BAYLEY N., 1950: Physical maturing among boys as related to behaviour. *J. of Educational Psychology* 41: 129–148.
- JONES M. C., MUSSEN P. H., 1958: Self conception, motivation and interpersonal attitudes of early and late maturing girls. *Child Development* 29: 491–502.
- KIERNAN K. E., 1977: Age at puberty in relation to age at marriage and parenthood. A national longitudinal study. *Annals of Human Biology* 4: 301–308.
- KOHEN-RAZ R., 1974: Physiological maturation and mental growth at preadolescence and puberty. *J. of Child Psychology and Psychiatry* 15: 199–213.
- LERNER R. M., PETERSEN A. C., BROOKS-GUNN J. (Eds.), 1991: *The Encyclopaedia of Adolescence*. New York: Garland Publishing Company.
- LINDGREN G., 1979: *Physical and mental development in Swedish urban schoolchildren*. Studies in Education and Psychology 5, Stockholm.
- MATSUDO S. M. M., MATSUDO V. K. R., 1994: Self assessment and physician assessment of sexual maturation in Brazilian boys and girls: Concordance and reproducibility. *Amer. J. of Hum. Biol.* 6: 451–455.
- MORRIS N. M., UDRY J. R., 1980: Validation of a self administered instrument to assess stage of adolescent development. *J. of Youth and Adolescents* 9: 271–280.
- MUSSEN P. H., JONES M. C., 1957: The self-conceptions, motivations and interpersonal attitudes of late- and early-maturing boys. *Child Development* 26: 243–256.

- PIAGET J., 1972: Intellectual evolution from adolescence to adulthood. *Human Development* 15: 1–12.
- RAVEN J. C., 1938: Standardisation of progressive matrices, 1938. *Br. J. Med. Psych.* XIX(1): 137–150.
- RUMPEL C., HARRIS T., 1994: The influence of weight on adolescent self-esteem. *J. Psychosomatic Res.* 38: 547–556.
- SHIPMAN W. G., 1964: Age at menarche and adult personality. *Archives of General Psychiatr.* 19: 155–159.
- SIRIWE E., 1956: *Body Composition from Fluid Spaces and Density*. MS UCRL 3349. California; Donner Lab University of California.
- STONE C. P., BARKER R. G., 1937: Aspects of personality and intelligence in post-menarcheal girls and pre-menarcheal girls of the same chronological ages. *J. Comp. Physiol. Psychol.* 23: 439.
- STONE C. P., BARKER R. G., 1939: The attitudes and interests of pre-menarcheal and post-menarcheal girls. *J. Genet. Psychol.* 54: 27.
- TANNER J. M., 1961: *Education and Physical Growth*. University of London, London. 144 pp.
- TANNER J. M., 1962: *Growth at Adolescence*. Blackwell, Oxford.
- WARDLE J., BEALES S., 1986: Restraint, body image and food attitudes in children from 12–18 years. *Appetite* 7: 209–217.
- WEATHERLEY D., 1964: Self perceive rate of physical maturation and personality in late adolescence. *Child Development* 35: 1197–1210.
- WEBER D. P., 1976: Sex differences in cognition: A function of maturation rate? *Science* 192: 572–573.
- WEBER E., 1964: *Grundriss der biologischen Statistik*. 5. Aufl. Fischer, Jena.
- WING R. R., GREENO C. G., 1994: Behavioural and psychosocial aspects of obesity and its treatment. *Baillieres Clin. Endocrinol. Metab.* 8: 689–703.

Éva B. Bodzsár, Annamária Zsákai
Department of Biological Anthropology
Eötvös Loránd University
Pázmány Péter sétány 1/c
H-1117 Budapest, Hungary
E-mail: bodzsar@ludens.elte.hu