

PHYSICAL DEVELOPMENT AND MATURATION IN RELATION TO MENTAL PERFORMANCE IN GIRLS FROM AGE 10 TO 14

É. B. Bodzsár and J. Pápai

Department of Anthropology, Eötvös Loránd University, Budapest; Central School of Sports,
Budapest, Hungary

Abstract: Connection between indices of physical development, maturation and mental ability was studied in 354 girls aged between 10 and 14 years. Status of maturation was estimated by the stages of secondary sex characteristics and the onset of menarche. Mental performance was appraised by tests of non-verbal intelligence (Raven 1938) and creativity ("uncommon usage" and "the circles", Zétényi 1986).

The IQ and creativity measures were compared in the girls of different maturational and physical developmental status but of the same age. Early maturers were found to perform better than late maturers in the intelligence test as well as in every index of creative ability. For IQ this difference was significant at all ages. The intelligence test scores of the subgroups with high fat content were lower than those for the low-fat subgroups. The differences were not significant but consistent. Girls with a high IQ were taller and heavier than their low-IQ peers. The girls with a low IQ were significantly fatter than those with a high IQ.

The hypotheses that physically early maturers are superior to late maturers in mental tests and that children with a high IQ have larger body dimensions at the same chronological age have been confirmed by these results.

Key words: Adolescence; Early and late maturation; Physical development; IQ; Creativity; Body fat content.

Introduction

Conflicting results have been obtained by the studies the central problem of which was if the maturation rate of physical, respectively mental development was similar (Boas 1941, Davidson and Gottlies 1955, Stone and Barker 1937, Westin-Lindgren 1979). One of the possible sources of this conflict may be that usually physical development and mental performance have been compared in children of the same chronological age, disregarding that they may represent very dissimilar levels of either physical or mental development (Inhelder and Piaget 1958, Tanner 1961).

Not neglecting this aspect, we approached the relationship between physical development and mental performance from two directions. Our questions were as follows.

- What difference in mental test performance is there between children of different maturation and physical development but of the same age?
- What difference in body composition and main dimensions is there between children of different IQ but of the same age?

Material and Methods

The study comprised 354 urban girls aged between 10 and 14. The following subgroups were formed for each age group: (1) girls before and after menarche; (2) girls with early and late maturation of breast and pubic hair; (3) girls of low and high relative body fat content; and (4) girls of low and high IQ.

In assessing secondary sex characteristics Tanner's (1961) suggestions were followed. The median stage of maturation was based on the intra-age-group distribution of the development of breast and pubic hair. Those found at stages below the median were termed late maturers, those above it were classified as early maturers.

Physical development was described by body mass, height and composition. Body density was estimated by Durnin and Rahaman's formula (1967) while fat per cent by Siri's method (1956). Low-fat girls were those one standard deviation below the mean while those one standard deviation above it were termed the high-fat subgroups. IQ was estimated by the adult version of the Raven perceptive non-verbal test (1938). The originality, flexibility and fluency factors of creativity were estimated by the methods of "uncommon usage and "the circles" (Zétényi 1986).

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

Results and Discussion

Post-menarcheal girls were found to have a higher IQ in every age group (*Fig. 1*).

Early maturers in respect of breast and pubic hair development also scored significantly better in the Raven test (*Fig. 2*).

While early maturers had a higher score in all the three factors of creativity, only differences in originality and flexibility (estimated by the method of "the circles") were significant (*Table 1*).

Comparing the performance on the mental ability test of girls grouped on the basis of body fat percent, it was found that the Raven scores of the high-fat subgroups were consistently, though not significantly, lower than those of the low-fat ones (*Fig. 3*).

The second part of the study compared body height, mass and fat content as expressions of physical development in the low and high IQ subgroups of girls of similar age. The high-IQ subgroups were markedly taller and heavier (*Figs. 4 and 5*) except the 13-year-old ones' stature. Body fat content of the low-IQ subgroups was significantly higher, the only exception being the 12-year-old subgroup (*Fig. 6*).

Conclusions

This study of the relationship between physical and mental development has shown that physically earlier developing girls were also mentally more advanced. Conversely, the girls scoring higher in the mental tests had larger body dimensions and also their body composition differed. High-IQ girls had greater fat-free and smaller fat mass.

During the adolescent growth spurt the growth rate of LBM is known to increase whereas the accumulated fat does not change (Forbes 1978). So, a possible explanation of the obtained results can be that there is an association between faster mental development and earlier physical development and maturation.

*

Paper presented at the Fifth International Symposium of Human Biology, Keszthely, Hungary, June 1991; Received 1 August, 1991.

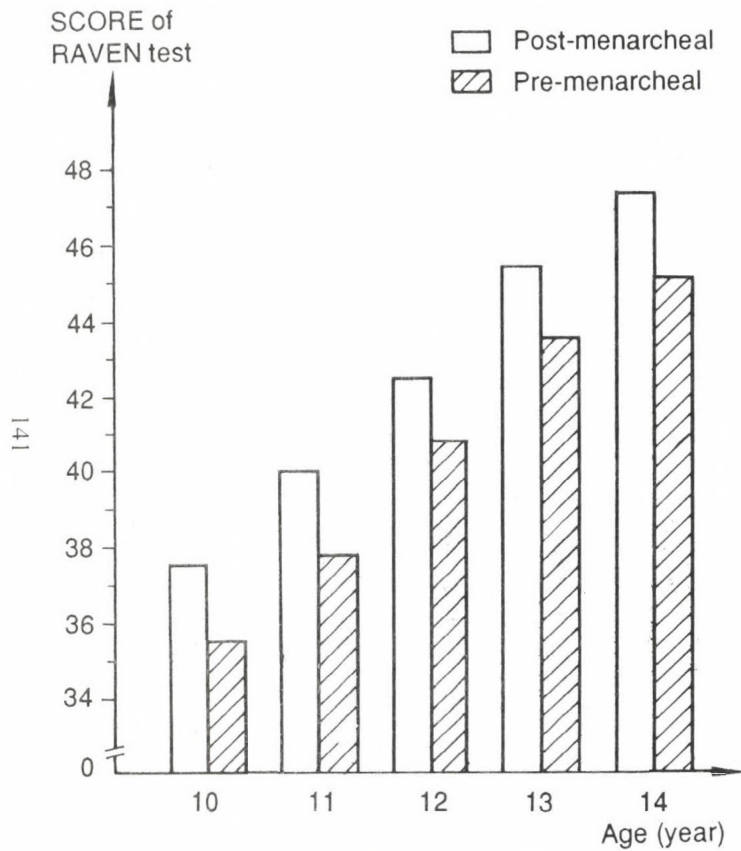


Fig. 1: Scores of Raven test in post- and pre-menarcheal girls

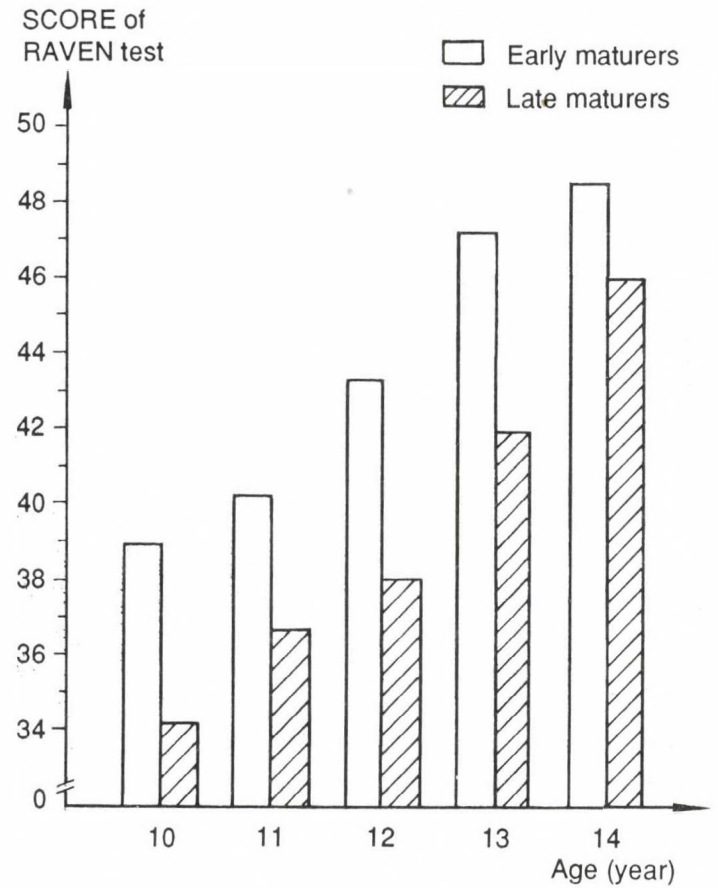


Fig. 2: Scores of Raven test in early and late maturers

Table 1. Parameters of factors of creative ability

Flexibility		Late maturers Fluency		Originality		Age (year)	Flexibility		Early maturers Fluency		Originality	
\bar{x}	s	\bar{x}	s	\bar{x}	s		\bar{x}	s	\bar{x}	s	\bar{x}	s
<i>The method of the uncommon usage</i>												
4.13	1.91	4.00	1.52	1.78	0.98	10	4.42	2.01	4.21	1.73	2.11	1.13
4.51	2.03	4.10	1.34	1.85	1.01	11	4.81	1.97	4.42	1.52	2.01	0.98
4.47	1.89	4.15	1.51	1.90	0.85	12	4.78	2.12	4.58	1.48	2.53	1.41
4.56	2.01	4.20	1.49	2.07	1.16	13	5.17	2.31	4.65	1.67	2.69	1.35
4.78	2.50	4.31	1.62	2.18	1.24	14	5.51	2.54	4.83	2.12	2.99	1.78
<i>The method of the circles</i>												
7.90	3.75	7.40	2.57	3.30	1.94	10	8.51*	3.01	7.70	1.87	4.85*	1.81
8.01	4.01	7.67	2.41	3.75	1.86	11	9.38*	2.87	8.01	2.01	5.01*	1.76
8.37	3.99	7.90	2.77	4.01	2.15	12	11.51*	2.96	8.40	1.94	5.50*	1.99
8.45	4.17	8.11	2.88	4.15	2.05	13	12.00*	2.79	8.90	1.83	5.87*	1.84
8.60	4.45	8.25	3.14	4.23	2.31	14	12.65*	2.86	9.11	1.95	6.02*	1.79

*Significant level between two groups: $p < 0.05$

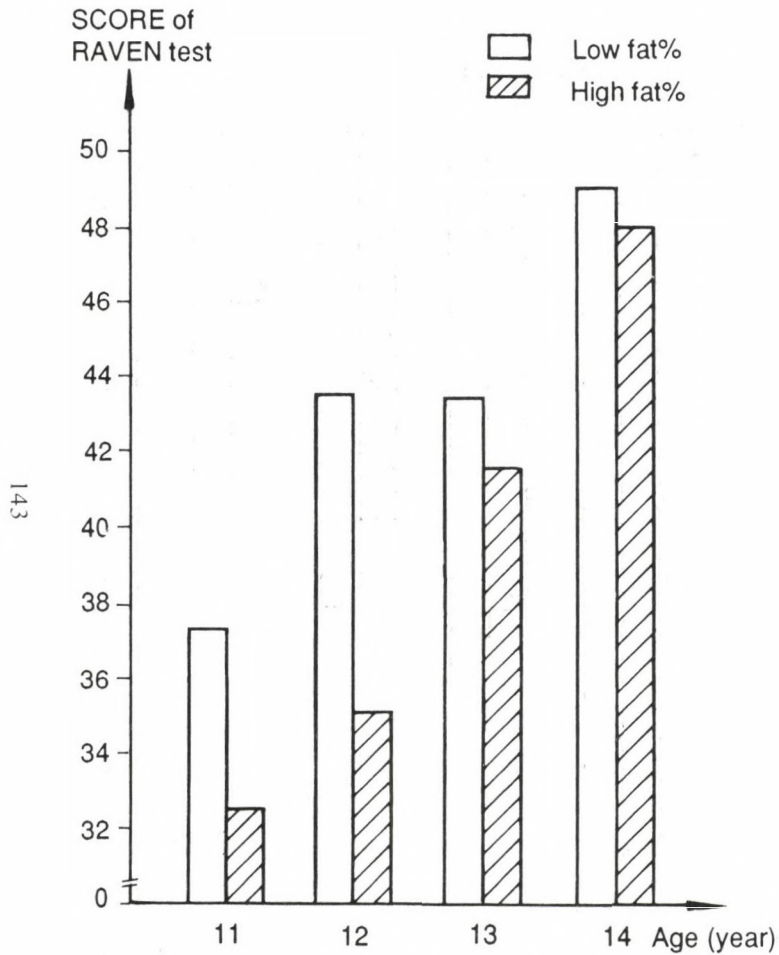


Fig. 3: Scores of Raven test in girls with low and high fat percent

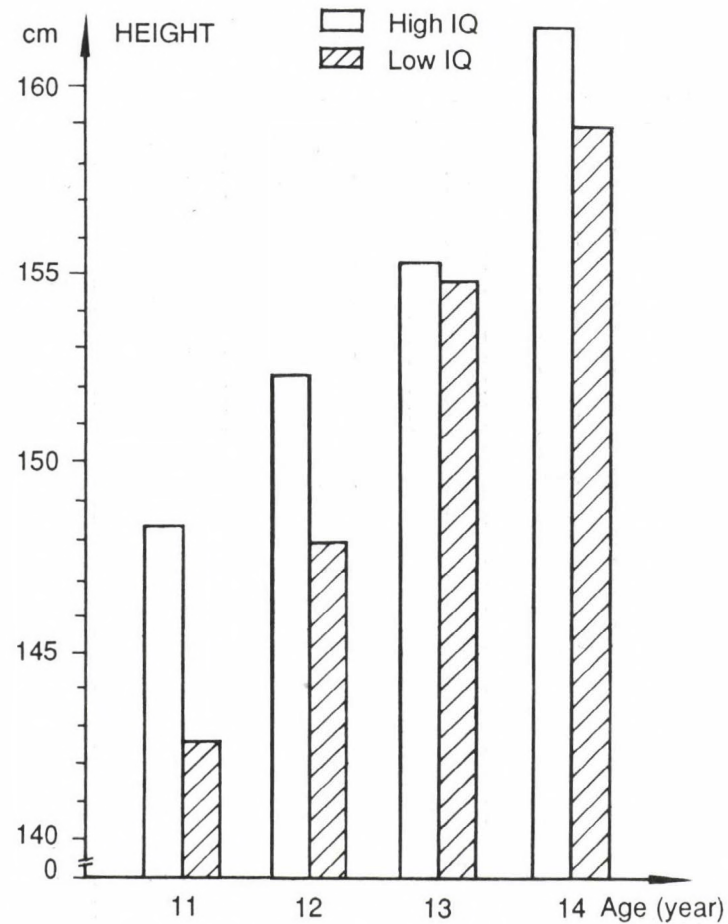


Fig. 4: Height in girls with high and low IQ

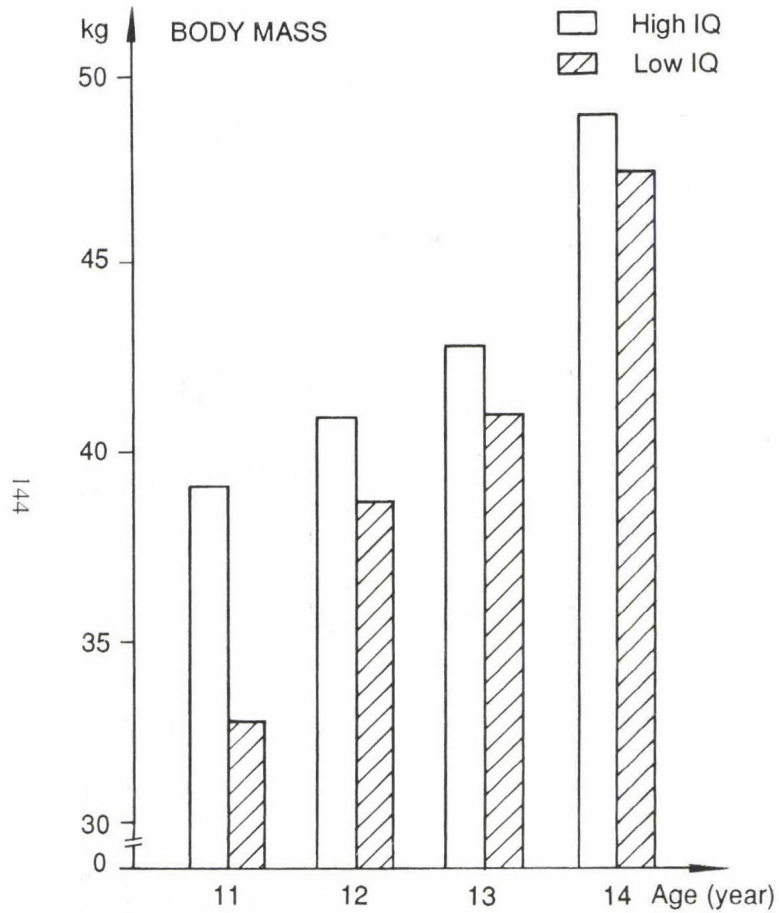


Fig. 5: Body mass in girls with high and low IQ

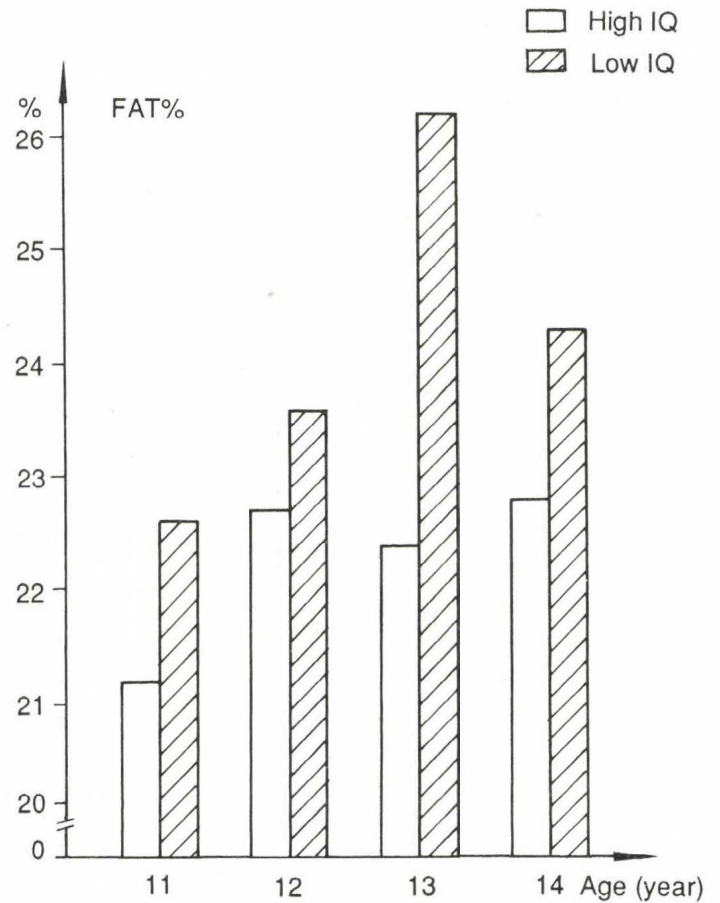


Fig. 6: Percent body fat in girls with high and low IQ

References

- Boas F (1941) The relation between physical and mental development. — *Science*, 93; 339.
- Davidson HH, and Gottlieb LS (1955) The emotional maturity of pre- and post-menarcheal girls. — *J. Genet. Psychol.*, 86; 261.
- Durnin JVA, and Rahaman MN (1967) The assessment of the amount of fat in the human body from measurements of skinfold thickness. — *Brit. J. Nutr.*, 21; 681.
- Forbes GB (1978) Body composition in adolescence. — In Falkner, F, and Tanner, JM (Eds): *Human Growth. II Postnatal Growth* pp. 239—272. — Plenum Press, New York — London.
- Inhelder B, and Piaget J (1958) *The Growth of Logical Thinking from Childhood to Adolescence*. — Univ. of London Press, London.
- Raven JC (1938) *Progressive Matrices*. — HK Lewis, London.
- Siri WE (1956) *Body composition from fluid spaces and density*. — MS UCRL 3349. Donner Lab., University of California.
- Stone CP, and Barker RG (1937) On the relationship between menarcheal age and certain measurements of physique in girls of the ages 9 to 16 years. — *Hum. Biol.*, 9; 1.
- Tanner JM (1955) *Growth at Adolescence*. — Blackwell, Oxford.
- Tanner JM (1961) *Education and Physical Growth*. — University of London Press, London.
- Westin-Lindgren G (1979) *Physical and mental development in Swedish urban schoolchildren*. — Studies in Education and Psychology 5. Stockholm Institute of Education, Stockholm.
- Zétényi T (1986) *A kreativitás tesztek* (Creativity tests, in Hung.). MLKT vol. 18. Munkaügyi Kutatóintézet, Budapest

Mailing address: Dr Bodzsár Éva
Department of Anthropology ELTE
H-1088 Budapest, Puskin u. 3.
Hungary

