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## SKELETAL AGE IN GIPSY SCHOOL CHILDREN FROM THE EAST SLOVAKIAN REGION

**ABSTRACT** — *The authors present results of an investigation of skeletal maturation in 300 Gipsy school children from selected areas of the East Slovakian region. The skeletal age was assessed by the Tanner-Whitehouse method II from the skiagram of the left hand and forearm. The skeletal age of Gipsy children lags behind their chronological age by as much as one year. These differences were smaller in younger age groups. Comparison of skeletal maturity of Gipsy and non-Gipsy children from the same area revealed that Gipsy children lag behind non-Gipsy children by 0.6 to 1 year, whereby the differences are statistically significant, in particular in the older age groups. This is manifested also by retardation of the general score of Gipsy children as compared with non-Gipsy children and the English mean.*

**KEY WORDS:** *Gipsy children — Skeletal age — East Slovakia.*

Accurate assessment of the degree of maturation of the child is an important tool of the care of favourable development of the child population.

Maturation is a group of changes which take place in the human organism during childhood and adolescence.

The development of children is as a rule expressed by the calendar age. It was, however, revealed that the developmental level of different children, evaluated by calendar age provides only very approximate information and may vary within a relatively wide range. Calendar age is an inadequate criterium, in particular during adolescence, when we can observe a significant disproportion between morphological and physiological changes. Therefore indicators were sought which render more accurate assessment of the developmental stage of an individual possible. To this end the "biological" or "developmental" age was investigated. Biological age is the outcome of the ratio of the age of the statistical standard to the actual calendar age (Blecha, 1966). Developmental age, on the other hand, expresses the level of the maturation

process, i.e. which part of the pathway towards adulthood was covered by a given individual or how much still lies ahead of him (Kapalín and Picko, 1964).

This degree of development is assessed by means of new indicators such as e.g. the process of ossification, eruption of teeth, the development of secondary sex characters, hormonal changes, etc. In the assessment of the development of children the method of determination of the skeletal age has become one of the generally accepted and used criteria of development. It is based on the assessment of the stage of maturity of ossification centres.

Several authors in Czechoslovakia were concerned with research into the growth and development of Gipsy children (Suchý, 1972; 1975; Dokládál, 1974; Hamplová, 1974; Suchý and Malá, 1975; Malá, 1975; Malá and Suchý, 1976; Šimková and Mačura, 1979; Bernasovský et al., 1979, 1983). For the investigations mostly anthropometric methods were used. We are not aware of any work where for investigation of the degree of maturation in Gipsy children skeletal age was used. This is why we selected this problem.

## MATERIAL AND METHODS

The material of our investigation comprised 300 Gipsy children from selected areas of the East Slovakian region, incl. 142 boys and 158 girls aged 7 to 15 years where we assessed the skeletal age by the method of Tanner and Whitehouse (1975). This method is based on the assessment of the degree of maturity of ossification centres of 20 bones of the hand and forearm. The grouping of children by age was done in such a way that the median of the interval describes the group which comprises children within a range of  $\pm 6$  months from the median value. The chronological as well as skeletal age was expressed in the decimal system where 0.1 does not stand for one month but one tenth of a year. The data were processed on a MINSK 22 computer in the computing centre of the Šafárik University in Košice.

## RESULTS

The mean values of chronological and skeletal age of Gipsy boys and the statistical significance of differences are presented in table 1. The skeletal age, except for 7-year-old boys lags behind chronological age on average by 0.2–0.6 years. Only in the 12-year-old boys the difference amounts to one year.

TABLE 1. Chronological and bone age in Gipsy boys. Means and standard deviations.

| Age group | Chronological age |      |      | Bone age |      |        |
|-----------|-------------------|------|------|----------|------|--------|
|           | n                 | Mean | SD   | Mean     | SD   | t      |
| 7         | 15                | 7.0  | 0.37 | 7.1      | 0.89 | 0.19   |
| 8         | 17                | 8.1  | 0.33 | 7.8      | 0.83 | 0.79   |
| 9         | 13                | 8.9  | 0.29 | 8.7      | 1.02 | 1.84   |
| 10        | 19                | 9.9  | 0.27 | 9.3      | 1.20 | 1.92   |
| 11        | 15                | 11.0 | 0.33 | 10.8     | 1.21 | 2.15*  |
| 12        | 18                | 12.2 | 0.33 | 11.2     | 1.19 | 3.38** |
| 13        | 25                | 12.9 | 0.33 | 12.7     | 1.43 | 2.30*  |
| 14        | 14                | 13.9 | 0.27 | 13.6     | 1.66 | 1.23   |
| 15        | 6                 | 14.7 | 0.25 | 14.2     | 0.89 | 1.14   |

\*\* P < 0.01 \* P < 0.95

TABLE 2. Chronological and bone age in Gipsy girls. Means and standard deviations.

| Age group | Chronological age |      |      | Bone age |      |       |
|-----------|-------------------|------|------|----------|------|-------|
|           | n                 | Mean | SD   | Mean     | SD   | t     |
| 7         | 28                | 7.0  | 0.20 | 7.3      | 0.75 | 0.51  |
| 8         | 22                | 8.0  | 0.32 | 8.4      | 1.13 | 1.28  |
| 9         | 18                | 8.9  | 0.28 | 8.5      | 1.13 | 1.78  |
| 10        | 13                | 9.9  | 0.42 | 9.7      | 1.43 | 0.99  |
| 11        | 14                | 10.9 | 0.32 | 10.9     | 1.15 | 0.62  |
| 12        | 14                | 12.0 | 0.32 | 11.8     | 1.10 | 1.18  |
| 13        | 19                | 13.0 | 0.29 | 13.0     | 1.38 | 1.50  |
| 14        | 17                | 13.9 | 0.26 | 13.1     | 1.19 | 2.70* |
| 15        | 13                | 14.9 | 0.33 | 14.5     | 1.18 | 1.54  |

\* P < 0.05

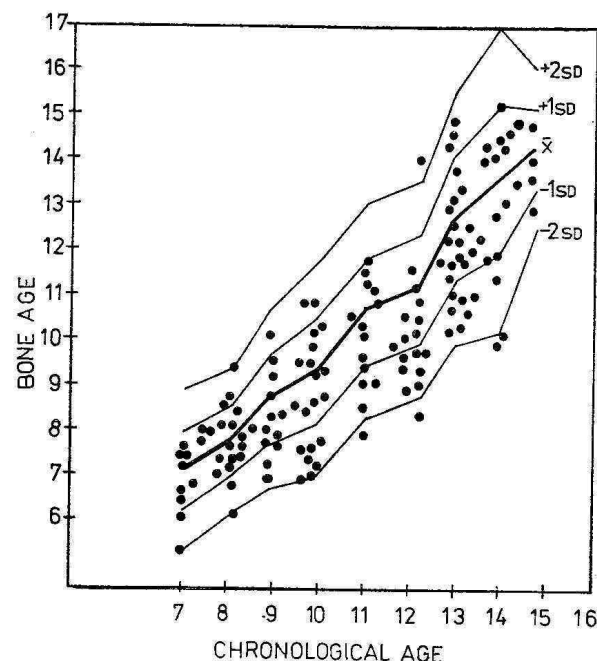


FIGURE 1. Absolute values of skeletal age of Gipsy boys.

The absolute values of skeletal age with standard deviations are illustrated in fig. 1. The majority of boys is in the ranges of  $\bar{x} - 1$  S.D. and  $\bar{x} - 2$  S.D. which provides evidence that skeletal age lags behind chronological age. The mean values of chronological and skeletal age of Gipsy girls are presented in table 2. The development of Gipsy girls differs as regards ossification from that in Gipsy boys. At the age of 7 and 8 years the girls have a higher skeletal age than chronological age. In boys this was the case only in 7-year-old ones. At the age of 9 to 12 years skeletal and chronological age are equal or skeletal age lags behind by 0.2–0.4 years. The greatest differences were recorded at the age of 14 and 15 years. Then skeletal age lags behind chronological age by 0.8–0.4 years.

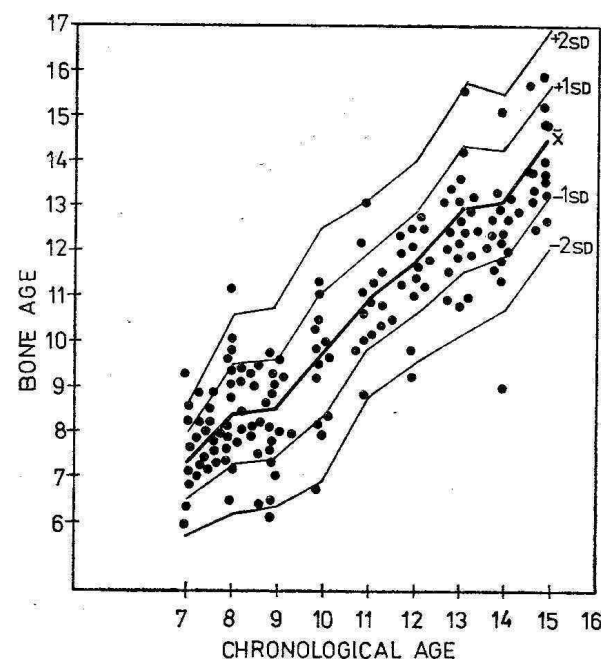


FIGURE 2. Absolute values of skeletal age of Gipsy girls.

Individual values of skeletal age in Gipsy girls are plotted in fig. 2. Contrary to boys, the values are concentrated more in the range of  $\bar{x} \pm 1$  S.D.

The relationship of skeletal age of Gipsy boys and Gipsy girls is given in table 3. Except for the groups of 9- and 14-year-old ones the skeletal age of Gipsy girls is higher in Gipsy girls than in Gipsy boys, although the differences are not statistically significant.

TABLE 3. Chronological and bone age in Gipsy boys and Gipsy girls. Means and standard deviations.

| Age group | Boys |      |      | Girls |      |      |      |
|-----------|------|------|------|-------|------|------|------|
|           | n    | Mean | SD   | n     | Mean | SD   | t    |
| 7         | 15   | 7.1  | 0.89 | 28    | 7.3  | 0.75 | 0.81 |
| 8         | 17   | 7.8  | 0.83 | 22    | 8.4  | 1.13 | 1.84 |
| 9         | 13   | 8.7  | 1.02 | 18    | 8.5  | 1.13 | 0.50 |
| 10        | 19   | 9.3  | 1.20 | 13    | 9.7  | 1.43 | 0.86 |
| 11        | 15   | 10.8 | 1.21 | 14    | 10.9 | 1.15 | 0.26 |
| 12        | 18   | 11.2 | 1.19 | 14    | 11.8 | 1.10 | 1.46 |
| 13        | 25   | 12.7 | 1.43 | 19    | 13.0 | 1.38 | 0.70 |
| 14        | 14   | 13.6 | 1.66 | 17    | 13.1 | 1.19 | 0.97 |
| 15        | 6    | 14.3 | 0.89 | 13    | 14.5 | 1.18 | 0.35 |

The mean values of skeletal age of Gipsy boys and Gipsy girls are illustrated in fig. 3.

In an attempt to assess to what extent the development of Gipsy children differs from that in non-Gipsy children studied by Bernasovská (1980),

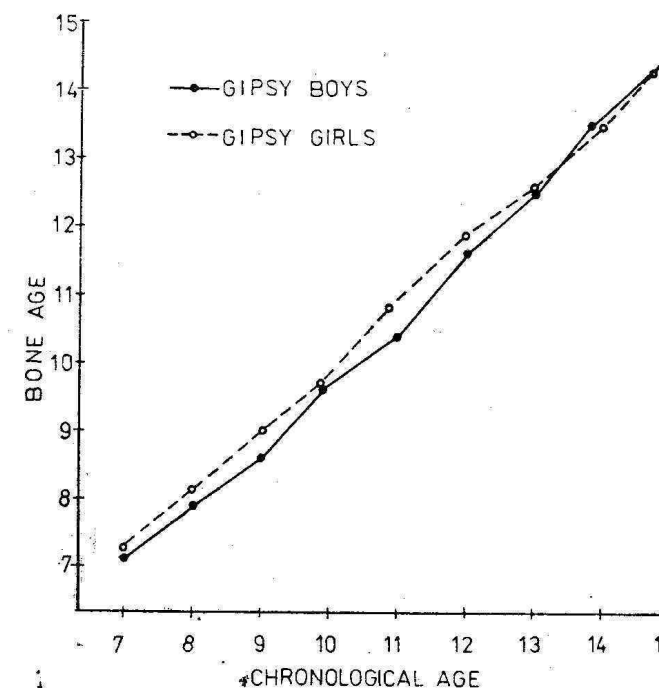


FIGURE 3. Skeletal age of Gipsy boys and girls.

we compared their skeletal age. The mean values of skeletal age of Gipsy and non-Gipsy boys are illustrated in fig. 4. The skeletal age of non-Gipsy boys except the 7-year-old ones is higher than in Gipsy boys. A statistically significant difference was recorded in the group of 12-year-old boys.

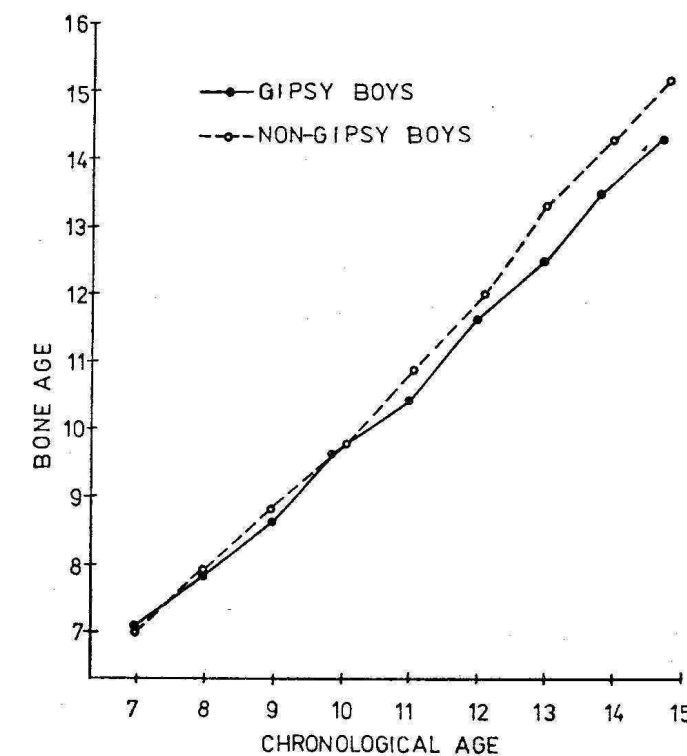


FIGURE 4. Skeletal age of Gipsy and non-Gipsy boys.

In girls (fig. 5) the position is similar. In the age groups of 7- and 8-year-old ones the Gipsy girls have higher skeletal age than non-Gipsy girls; in older age groups the position is reverse. Statistically significant differences were recorded in 13- and 14-year-old girls.

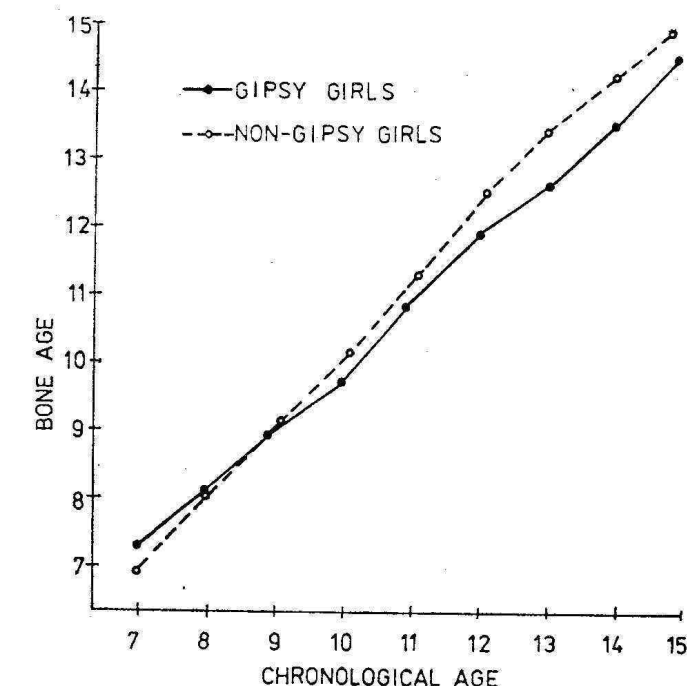


FIGURE 5. Skeletal age of Gipsy and non-Gipsy girls.

From the above values we calculated the mean values of the score according to tables of the Tanner-Whitehouse atlas, separately for boys and girls and compared them with data from non-Gipsy children and the English standard. The mean values of the score between Gipsy and non-Gipsy children are



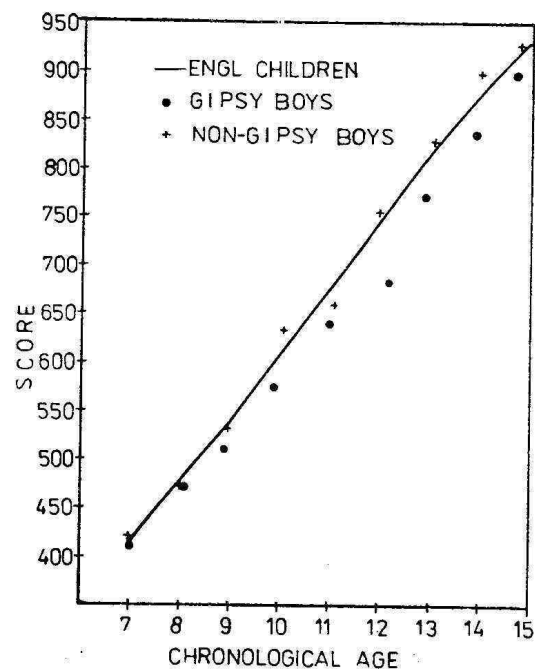


FIGURE 6. Mean values of the score in Gipsy and non-Gipsy boys.

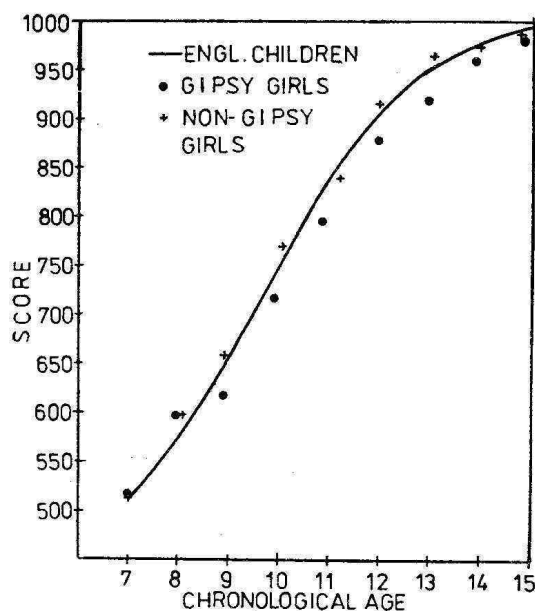


FIGURE 7. Mean values of the score in Gipsy and non-Gipsy girls.

illustrated in figs. 6 and 7, which show also the curves of the score of English children (Tanner et al., 1975). From the figure it is apparent that the mean values of the score of non-Gipsy children vary near the English mean, while Gipsy children lag behind the English standard, except for 7- and 8-year old girls.

#### DISCUSSION

In the world literature there are relatively few publications concerned with investigations of skeletal maturity from the ethnic aspect. The skeletal age in Negro children was investigated by Kelly and Reynolds

(1947), Bass (1960), Massé and Hunt (1963), Carayon (1969) and Roche et al. (1975). Skeletal maturation in the yellow race was studied by Greulich (1957), Bass (1960) and Lee (1971).

Various authors studied this problem in the Caucasian population. The method of the so-called scoring system according to Tanner et al. (1962) was used in Danish children by Andersen (1968) who found that skeletal age was on average two months ahead of chronological age. In children from central Italy also higher values of skeletal age were observed as compared with English children (Nicoletti et al., 1976). Similar conclusions were reached by Karlberg et al. (1976) who assessed skeletal development in a group of 212 urban Swedish children followed up in a longitudinal survey. They found that as compared with English children skeletal maturation of Swedish children was faster in all age groups. The other most widely used guide for assessment of skeletal age is the atlas compiled by Greulich and Pyle (1950) derived from investigations of children in Cleveland USA in the thirties. These children developed more rapidly than English children in the fifties from which the standards of the TW 2 system were derived. Sutov and Ohwada (1953) found that Japanese children are as regards their skeletal development retarded as compared with the standards in the Greulich-Pyle atlas. On the other hand it was observed that a group of Japanese children born in the USA was closer as to the degree of skeletal maturation to their white peers who lived under similar conditions, than to Japanese children of the same age living in their home country. Based on these findings Greulich (1957) assumes that the cause of retardation in Japanese children are not racial differences but a more restricted diet and other less favourable conditions of living environment. However, there are also publications which confirmed racial differences in skeletal maturation of North American Negroes and white children (Roche et al., 1975) and African Negroes (Massé, 1969; Carayon, 1969).

Hamidou et al. (1978) investigated in Algerian children the skeletal age by means of the Greulich-Pyle atlas in 7- to 12-year-old school children. The results were compared with a group of children in the USA and data for Czech children assembled by Kapalín (1967). In Algerian children a marked retardation of skeletal maturation was observed as compared with the other groups except for 7- and 8-year-old boys who had a similar skeletal age as Czech children.

Skeletal maturation, similarly as growth, is the result of interaction of genetic and external factors. The results of the anthropometric investigation of Gipsy children indicate that it is not possible to use equal criteria for evaluation of physical development of Gipsy children and Slovak or Czech children. The development of Gipsy children has some peculiar features. Investigations of the physical development of Gipsy children living in childrens homes indicate that these children retain some genetically conditioned characters and differ from Czech and Slovak children living under the same conditons (Suchý and Malá, 1973). In the literature so far data on the skeletal

development of Gipsy children are lacking. Therefore we selected this problem for our investigation.

The sexual dimorphism is manifested also in the skeletal age of Gipsy children where the skeletal age of Gipsy girls is higher than in boys of the same age except for the group of 9- and 14-year-old ones, and in some Gipsy girls ossification is completed at the age of 13, while in boys it is not terminated even at the age of 15 years.

Investigations of the relationship between chronological and skeletal age in Gipsy children revealed retardation of skeletal age behind chronological age by as much as one year. These differences were smaller in younger age groups.

Comparison of skeletal maturity of Gipsy and non-Gipsy children revealed that Gipsy children lag behind as regards skeletal age by 0.6–1 year, the differences being more marked in the older age groups. This is manifested also in the retardation of the general score which is in Gipsy boys on average by 40 lower and in girls by 30. The greatest differences were recorded in 12- and 14-year-old boys and 10 and 11-year-old girls. The retarded skeletal maturation of Gipsy children can be ascribed to poorer socio-economic factors and to the genetic factors, as the Gipsy population still forms a fairly isolated social group. The assembled results show that it is inevitable to elaborate standards of skeletal age for gipsy children which will render it possible to evaluate more accurately their biological maturity.

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