

MENARCHEAL AGE AND GROWTH IN JÁSZBERÉNY GIRLS

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Abstract: A subject material of similar physiological (maturation) age was studied longitudinally. The 97 girls were subdivided retrospectively into three groups. 29 girls were studied 3-6 months after menarche (leading group); 45 girls were studied within ± 3 months of menarche (middle group); and 23 girls were studied 3-6 months before it (lagging group). Body mass, lean body mass, fat per cent, six skinfolds, sitting height, stature and the height of the anterior superior iliac spine were measured in every group four times in yearly intervals of which three consecutive years were considered in the named groups. There were obvious changes in both fat and lean masses before as well as after menarche. During the year preceding it there was a decrease in body fat per cent whereas lean mass grew considerably. During the year following the menarche the rate of lean mass increase became comparatively slower and was associated with a more intense rate of fat deposition. The relative share of skinfolds diminished on the limbs and increased on the trunk in the observation period. In the premenarcheal year stature and length of the lower extremity grew fast while sitting height developed rather linearly both before and after menarche.

Key words: Body composition; Body dimensions; Growth; Menarche; Skinfold ratios; Jászberény girls.

Introduction

Growth and development of children of the same chronological age often diverge so their biological ages also differ. Developmental rate is generally expressed in the state reached by body dimensions (Mészáros and Mohácsi 1984), bone (Roche 1978) and tooth maturation (Demirjian 1978). In girls physiological maturation status can be characterized by the age of menarche as well (Bodzsár 1983, Yoneyama et al. 1988).

The aim of our investigations was to establish the manner in which body composition and the intensity of growth changed before and after menarche in the girls classified by their physiological-functional status.

Material and Methods

The investigation was carried out in Jászberény (a provincial town in Middle-Hungary). At the outset in 1979, all the subjects (N=147) were either 10.5 or 11.0 years old chronologically and all were in the premenarcheal phase. The measurements were repeated in the autumn of four consecutive years. Then the girls were subdivided retrospectively into three groups each studied four times. The girls that were still in their premenarcheal phase at the age of 13.5, and 14.0 years, respectively, were omitted from the study. Of the remaining girls, all of whom had been observed both before and after menarche, 97 were only retained who were studied for the second time within 6 months after menarche ("leading group", N=29), within 6 months before menarche ("lagging group", N=23) and within three months of their menarche ("middle group", N=45), respectively.

This paper reports on body height, sitting height, the height of the anterior superior iliac spine, body mass and six skinfolds. Body composition was estimated by using the body fat approximation method of Siri (1956) and obtaining body density by the formula of Durnin & Rahaman (1967).

Results and Discussion

Sitting height and lower limb length contributed equally to the rapid increase of stature in the middle group (Fig. 1). The decreasing rate of longitudinal growth was above all due to the slowing rate of increase in lower limb length as sitting height grew almost linearly even after menarche. In the leading group the contribution of iliac spine height to the postmenarcheal slowing of height increase was greater than that of sitting height though the latter also grew slower. In the lagging group the decrease in the rate of longitudinal growth was very slight after menarche and was again attributable to the reduced rate of iliac spine height increase. All these facts point to a change in the rate of growth around menarche, the more important factor in which is the growth rate of the lower limb which undergoes more marked changes than the increase in sitting height.

A fast increase in body mass was noted in the studied period (Fig. 2). The rate of mass apposition was maintained also after menarche by all groups except the leading one in which postmenarcheal weight increase became slightly slower. However, this apparently steady gain in mass was associated with dissimilar trends in the share of the factors of body composition. As shown in Figure 2, there was an intense gain in lean body mass (LBM) in all the three groups before menarche. The postmenarcheal rate of LBM increase became much slower as shown by the difference between the lagging group and the two other ones. Before menarche body fat percentage was found to decrease, in contrast to its markedly rising ratio after menarche. The phase shift between the groups was, nevertheless, quite apparent, the lagging and middle groups showing the larger decrease. Therefore, in interpreting the almost steady mass gain we have good evidence that there is a switch-over in the main contributors, lean body mass dominating before menarche and fat gain after it.

Since relative body fat had been estimated by using skinfolds, we became naturally interested in analyzing the trend of fat apposition in the respective regions of the body. Absolute skinfold dimensions followed of course the trend reflected by the percentage of body fat (Table 1). When, however, the relative shares in the sum of the six studied skinfolds were analyzed (as shown in Fig. 3 summarizing the behaviour of limb fat) a slight but steady decrease was noted. This decreasing share was more marked in the middle and lagging groups.

Figure 4 shows the relative shares of the trunk skinfolds. The subscapular skinfold reflecting the subcutaneous fat layer of the upper trunk region showed a slight increase. On the other hand, the skinfolds of the lower region of the trunk displayed different tendencies. Starting from a relatively low level before menarche the growth rate of the abdominal skinfold was fast in all the three groups to become slower after menarche. The share of the iliac skinfold was, however, more or less steadily decreasing. It was a surprise, it is admitted, to observe differences in the rate of fat apposition within the same body region.

The findings indicate, therefore, that around menarche the pattern of fat deposition becomes rearranged: subcutaneous fat on the limbs grows comparatively less while on the trunk, particularly around the navel, a greater proportion of fat is deposited. This is clearly evidenced by the lagging group which had the largest proportion of fat on the limbs and the smallest one on the trunk at the time of the premenarcheal measurement

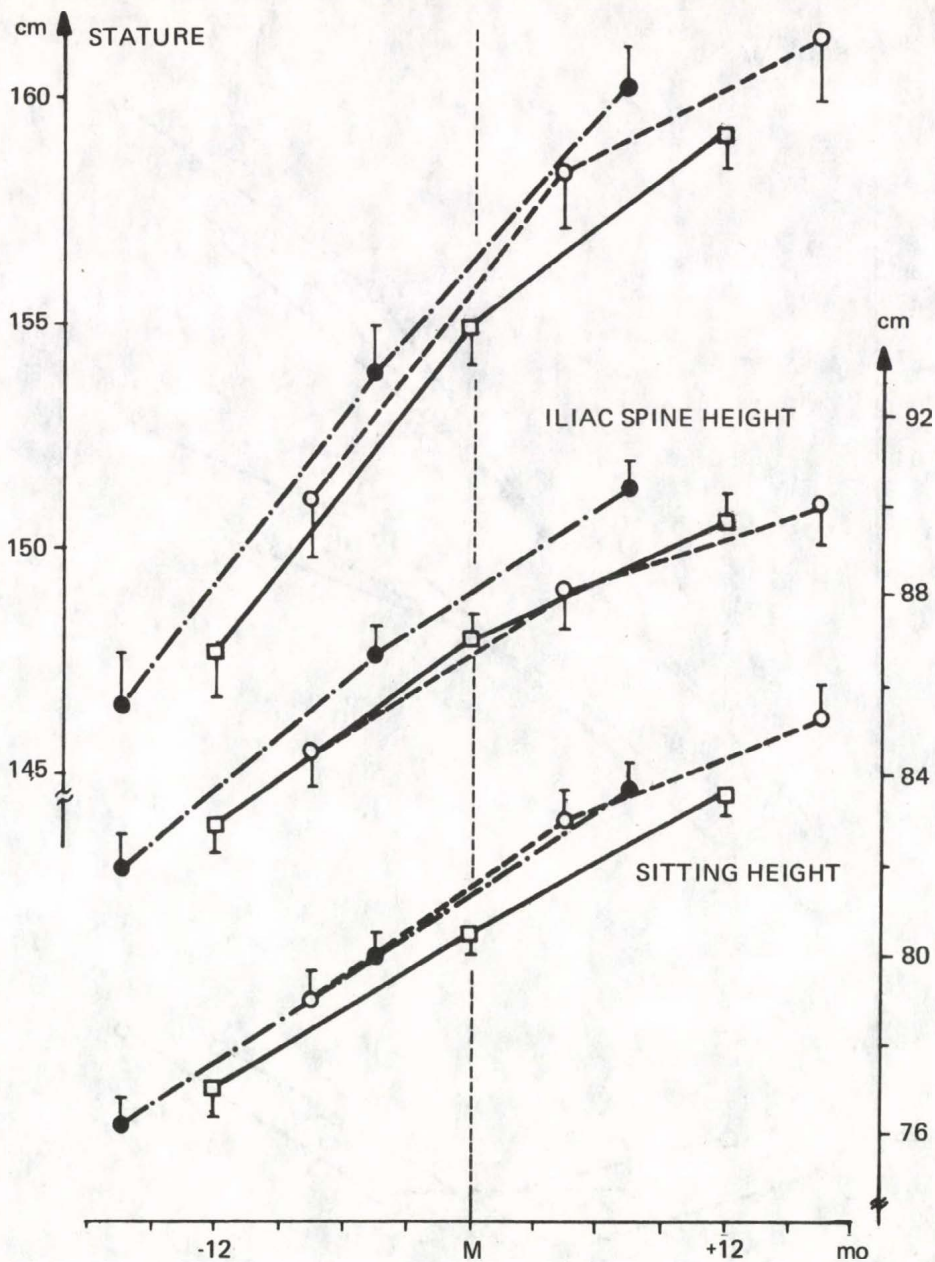


Fig. 1: Heights before and after menarche of the Jászberény girls (means \pm s.e.m.). On the abscissa the date of menarche is designated by M and the scale is in trimesters.

Symbols: lagging group (n=45) ● ———●; middle group (n=45) □ ———□; leading group n=29: ○ - - - - ○

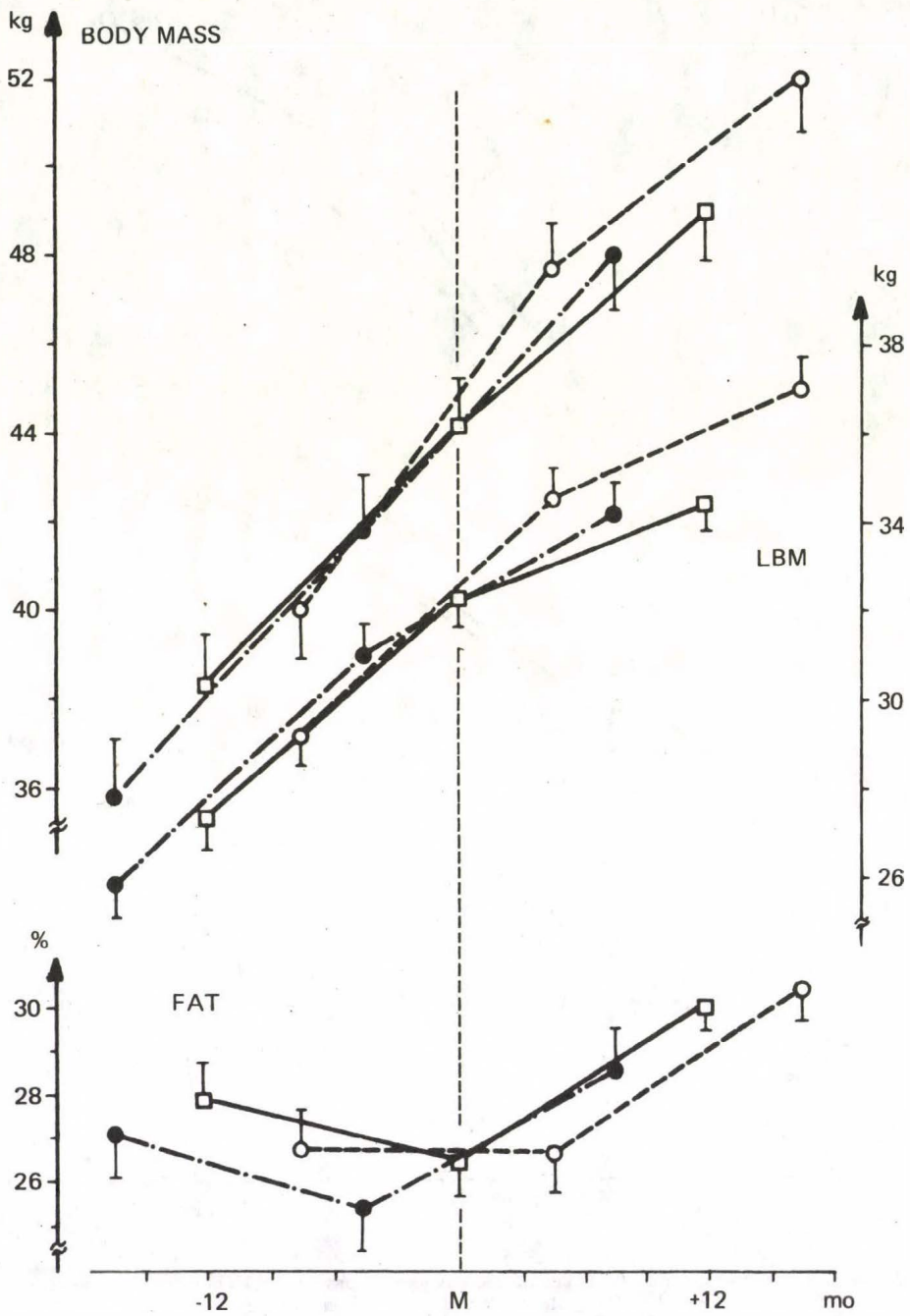


Fig. 2: Body composition before and after menarche. Symbols and marks as in Fig. 1.

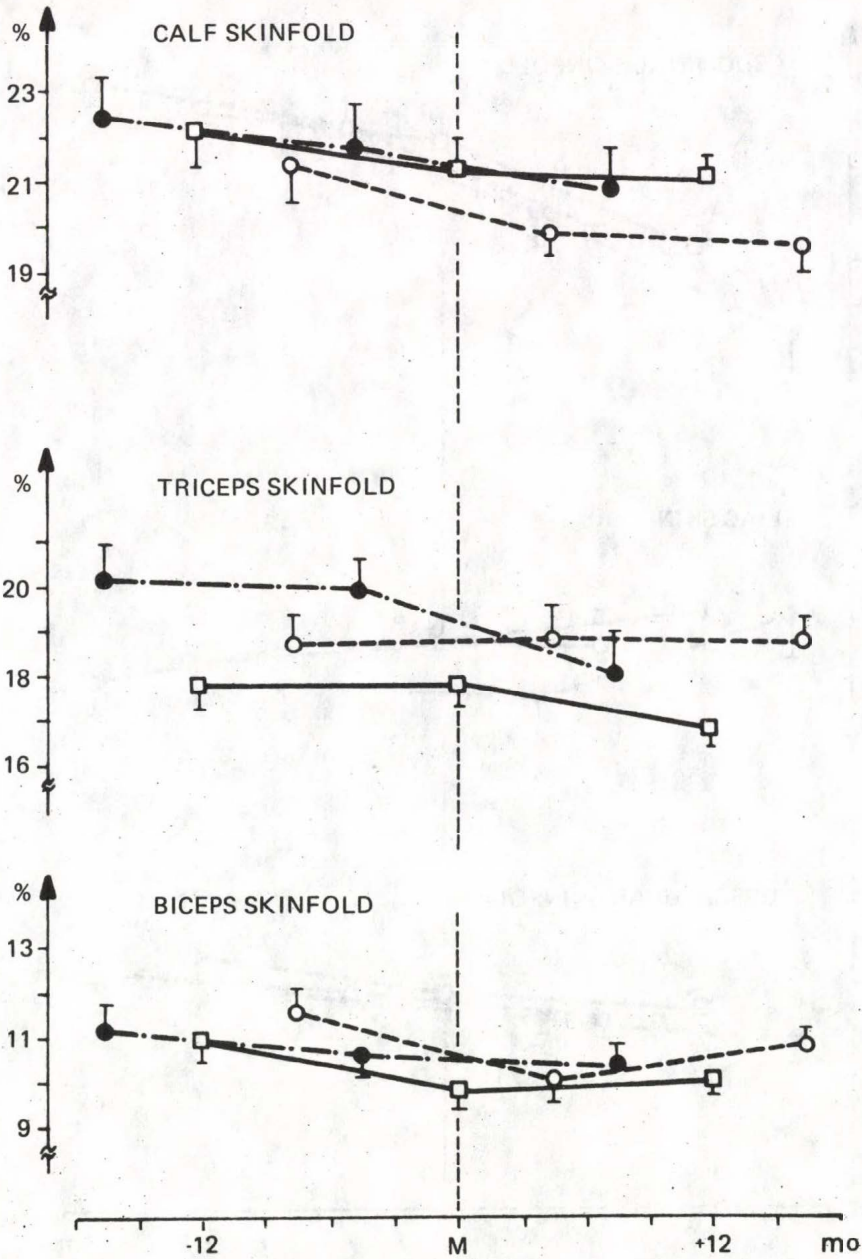


Fig. 3: Skinfolts on the limbs before and after menarche. Symbols and marks as in Fig. 1.

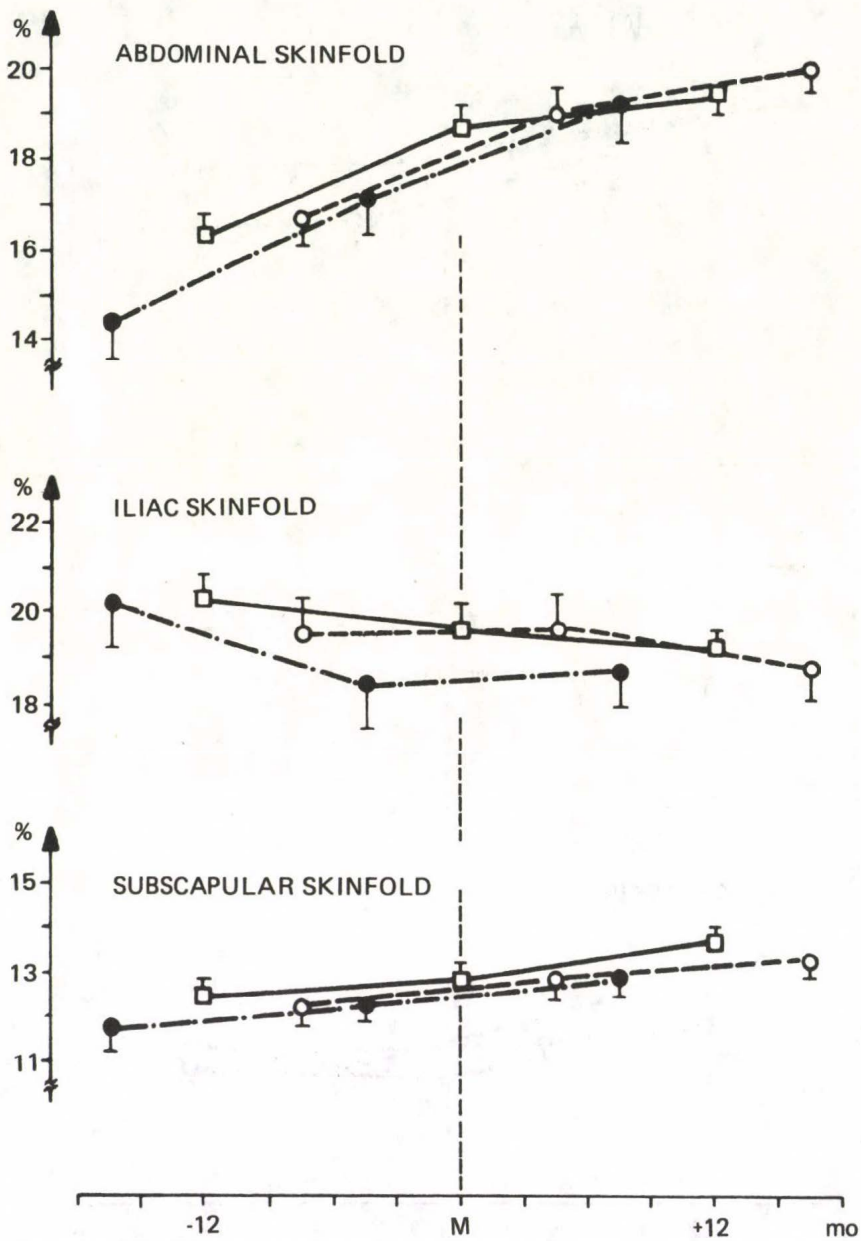


Fig. 4: Skinfolts on the trunk before and after menarche. Symbols and marks as in Fig. 1.

Table 1. Absolute skinfold measurements of Jászberény girls (mm, $\bar{x} \pm s.e.$)

Skinfolds	Leading group			Middle group			Lagging group		
	before	after menarche	after	before	at menarche	after	before	before menarche	after
Biceps	9.3 ± 1.0	7.9 ± 0.7	11.4 ± 0.8	9.9 ± 0.8	7.9 ± 0.6	10.8 ± 0.7	8.6 ± 0.8	7.4 ± 0.7	9.7 ± 0.9
Triceps	14.1 ± 0.9	14.2 ± 0.8	18.1 ± 0.9	14.7 ± 0.8	13.3 ± 0.6	17.4 ± 0.8	14.9 ± 0.9	13.2 ± 0.8	16.1 ± 1.1
Calf	16.5 ± 1.3	15.0 ± 1.0	20.1 ± 1.0	18.8 ± 1.2	15.9 ± 0.8	21.5 ± 0.9	16.7 ± 1.2	14.2 ± 0.7	18.3 ± 1.0
Subscapular	9.2 ± 0.7	9.9 ± 0.7	14.1 ± 0.9	11.6 ± 0.9	10.3 ± 0.8	14.4 ± 0.9	9.6 ± 1.3	8.5 ± 0.8	11.9 ± 0.9
Iliac	15.9 ± 1.7	15.8 ± 1.5	20.3 ± 1.7	19.2 ± 1.8	16.0 ± 1.2	20.3 ± 1.2	16.9 ± 2.2	13.2 ± 1.6	17.7 ± 1.6
Abdominal	13.4 ± 1.3	14.8 ± 1.1	21.1 ± 1.3	15.3 ± 1.4	14.9 ± 1.0	20.4 ± 1.1	12.2 ± 1.7	12.2 ± 1.4	17.9 ± 1.5

and which lined up with the other two groups after menarche. A more detailed study is thought necessary to clarify the particulars of this process as well as the time needed until the regional proportions of subcutaneous fat grow stable.

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