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Menarche, Growth and Development in Hungary

By

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(1) Mean age at menarche in Hungary was 13.23 ± 0.021 years between 1959 and 1961.

(2) Values of growth and weight increment were higher in 1962 than in 1947.

(3) Normofunctional adolescent struma interferes with growth and gain in weight.

(4) Seasonal and geographical factors influence the age at menarche.

(5) The first menstrual flow occurred at an earlier age in 1962 than in 1947.

(6) The first menstrual flow occurred in the year following the highest rate of growth and weight increment.

(7) The standard deviation in respect of height was highest in the year preceding, in respect of body weight in that following, menarche.

(8) The earlier the menarche the taller the girl than the contemporaries. Since, however, the rate of growth becomes slower with the appearance of menarche (and growth stops altogether after some time), girls with early menarche remain persistently shorter in stature than those with later menarche.

(9) A crowded flat presupposes a worse socio-economic milieu and less favourable environmental factors, which hinder a girl's maturation. The socio-economic conditions of the family which are a function of the parents' occupation, influence the time of commencement of the adolescence in girls.

The growth of children is steady and gradual; even the accelerated rate of growth in adolescence fits smoothly into the process. Except birth and death, only the appearance of the first menstrual flow is associated with a single day of life. (It may, of course, happen that there is a longer interval between the first and the next menses or that the menstrual flow remains irregular for some time.)

The time of menarche has been widely studied, and Table I contains data in this respect from some European countries.

The first reference to the age at menarche in Hungary is in a study by SEMMELWEIS [22]. He wrote in 1864 that "In our climate the first menstrual discharge occurs between the 15th and 19th year". The first statistical compilation on a larger scale was done by DOCTOR [5] in 1891 who analysed the history of 9600 women "from the lower strata of the population".

TABLE I

Data for some European countries

Country	Author, year	Number of cases	Mean age at menarche, yrs	Note
Czechoslovakia	Valšik, 1953		13.5	
	Prokopec, 1953—1957	5702	12.7	
	Drobna and Cecer, 1960—1962	623	13.35—13.45	
	Smirak and Klementa, 1963	259	13.3	
	Valšik and Bernatova, 1963—1964	1886	14.32	
Yugoslavia	Kralj—Cercek, 1956	223	13.61	
	Davidovic, 1949—1963	2615	14.44	
Roumania	Necrasov et al., 1963		13.21	Data collected in different regions
	Necrasov et al., 1964	1270	13.63	
	Necrasov et al., 1965	615	13.0	
	Necrasov et al., 1965	558	13.76	
	Necrasov et al., 1965	581	14.43	
Poland	Kovalska et al., 1963	670	12.8	Data collected in different regions
	Kovalska et al., 1963	945	12.95	
	Kovalska et al., 1963	218	13.04	
	Kovalska et al., 1963	318	13.41	
	Kovalska et al., 1963	310	15.81	
	Kovalska et al., 1963	75	16.18	
	Jaczewski and Pyzuk, 1964	40	12.99	
	Zukowski et al., 1964	1621	12.6	
	Wich, 1965		13.29	
East Germany	Richter, 1944—1949	1948	11.1—13.1	
West Germany	Korbsch, 1959	1017	12.68	

While JANKOVICH [13], too, based his analyses mainly on case records, he used also statements made by a number of female industrial apprentices. Data from foreign countries are only mentioned in the Hungarian textbook of FEKETE and FARKAS [11a].

The first statistically evaluable data after World War II were compiled by the present author [29]; he collected his figures during the school-year 1947—1948 in a Transdanubian town. Evaluation were made throughout by the method of probit analysis.

The present author's work was followed by a number of studies presenting data from various parts of Hungary [7, 9, 10, 11, 14, 15, 24]. These studies contained the results of local or regional measurements; in order to make a general survey of the whole country, a team was formed which recorded data regarding the time of menarche in 14 areas of Hungary. The members of the team used identical methods and worked accord-

TABLE II

Frequency of menstruation according to age groups (1947—1948)

Age (years)	Number of cases	Number of menstruating girls	Percentage of menstruating girls	Mean age at menarche
11	169	0	0	0
12	161	5	3.10	3.10
13	175	36	20.57	17.47
14	147	91	61.90	41.33
15	111	94	84.68	22.78
16	74	70	94.60	9.91
17	55	54	98.18	3.59
18	54	54	100.0	1.82

n: 946. Mean (probit) 13.9 years

ing to a uniform plan [1]. The average age of menarche for Hungary was found to be 13.23 ± 0.021 years. The homogeneity of the material and the reliability of the data are well illustrated by the fact that the difference between the lowest and highest mean recorded in 14 areas was not more than 9 months.

The mean of 12.98 years obtained at Kaposvár (Transdanubia) in 1960—1961 was nearly a year less than that recorded in the same town in 1947—1948. It is doubtful whether the later value should be regarded as indicating acceleration of the earlier as indicating retardation [1, 28].

The appearance of menarche shows two seasonal peaks, one at the end of summer and one in winter [9, 10, 27].

It can be seen that the winter peak is higher in the data of FARKAS and the summer peak in those of VÉLI [29]. According to the figures of FARKAS from Pécs [11] the peak is in August which coincides with the highest frequency found at Kaposvár; both of these towns are in southern Transdanubia, while the other data of FARKAS [9, 10] show conditions in the Great Hungarian Plain, a phenomenon pointing to the significance of geographic factors.

According to EIBEN's data [8] collected in western Hungary in 15,229 girls (age 11.5—16.0) the mean age at menarche was 13.13 ± 0.01 years. EIBEN analysed the effect of different genetic and demographic factors and found that a genetically given factor was the girl's position among her siblings. The later the girls was born, the later appeared the menarche; in first-born girls at 12.96 years, in second-born at 13.19, in third-born at 13.23, in eighth-born at 13.43 and in the 9th—14th-born, at 13.46 years.

The number of family members is a significant socio-economic factor. The age at menarche grew parallel with the size of the family.

Connected with this is the number of family members per room. Menarche set in earliest in those girls who lived in one room alone or with another person, at 12.90 years. The age of those who lived three in a room was 13.18 years; of those who lived 4 or 5 in a room, 13.22 years; and if 6 or more persons lived in the same room, 13.41 years.

According to the father's profession, the age at menarche of daughters of professional office workers and salaried families was 12.74 and 12.91 years, respectively; of light physical

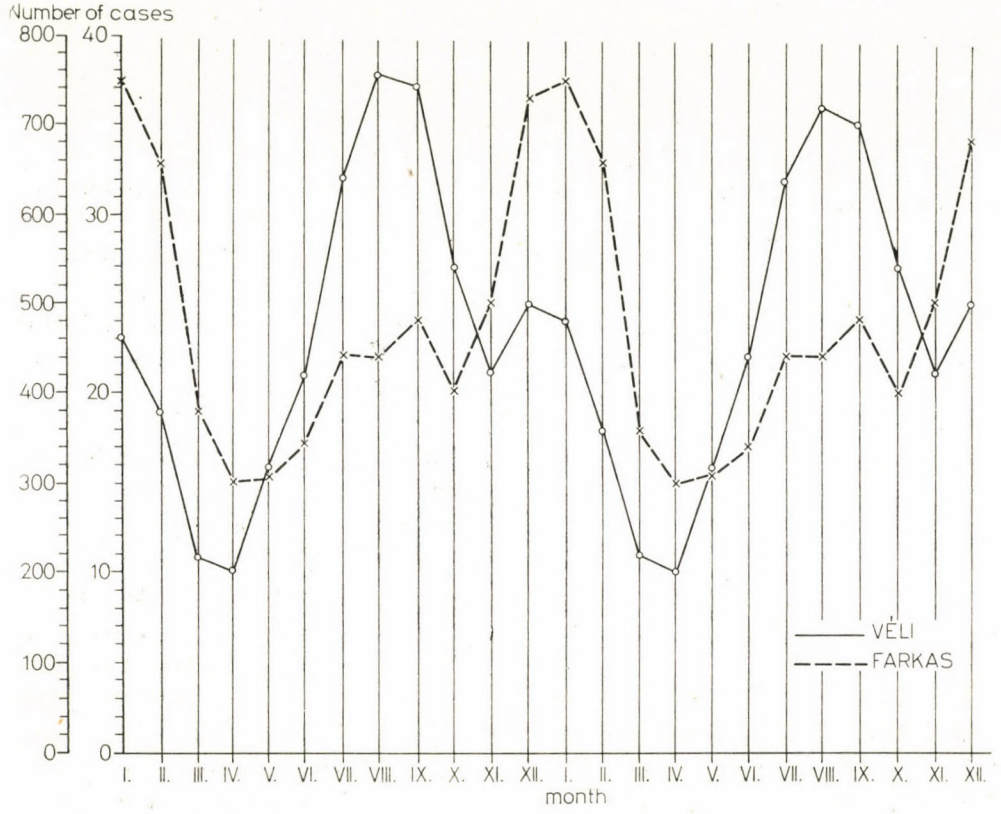

FIG. 1. Appearance of menarche plotted per 3-month moving averages

TABLE

Appearance of menarche according to months (seasons) (Data

	Month	January	February	March	April	May	June	July
Farkas	Number of cases	1051	527	381	222	269	404	345
	%	18.74	9.40	6.43	4.00	4.79	7.23	6.15
	Three-month moving average	740.7	653.0	376.7	290.7	298.3	339.3	438.3
Véli	Number of cases	35	14	8	10	13	23	27
	%	12.68	5.07	2.90	3.62	4.71	8.33	9.78
	Three month moving average	22.7	19.0	10.7	10.3	15.3	21.0	33.0

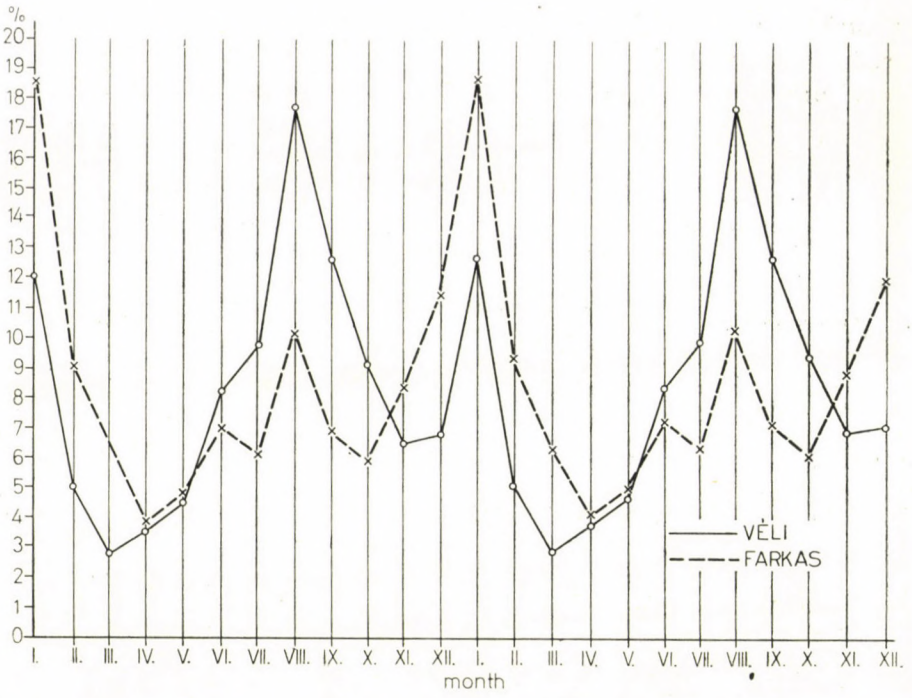

FIG. 2. Appearance of menarche illustrated by monthly percentages

workers, 13.10; of heavy physical workers, 13.26; and for the daughters of peasants, 13.34 years. Grouping according to the mother's occupation yielded similar data.

III

collected by Farkas [10] and Véli [28])

August	September	October	November	December
566	400	326	473	644.
10.09	7.13	5.81	8.43	11.49
437.0	464.0	399.7	481.0	722.7
49	35	25	18	19
17.75	12.68	9.06	6.52	6.88
37.0	36.3	26.0	20.7	24.0

Correlation between menarche and development was studied in connection with measurements made in 1947 and 1967 [29].

The only facts registered in 1947 were whether the girls were already menstruating and whether or not they had a goitre. It was found that the average weight and height of 13-year old girls who had already menstruated approximated the value $\bar{x} + s$, while the same parameters of 15-year old girls who had had no menses approximated the value $\bar{x} - s$. Thirteen-year old menstruating girls were 4 cm higher and weighed 4.5 kg more

than girls who, although two years older, had not yet had their menses. It was further found that goitrous girls were in both groups about 0.5 s behind the non-goitrous ones. (The goitre belonged in most cases to the normofunctional adolescent type) (Table IV, Figs 3, 4).

TABLE IV

Height and weight of 13-year old menstruating girls and 15-year old non-menstruating girls

Measurements	Total number of 13-year old girls		Menstruating 13-year old girls 20.57%		
				Healthy	Goitrous
	$\bar{x}$	$\bar{x}+s$	$\bar{x}$	$\bar{x}$	$\bar{x}$
Height (cm)	147.8	155.2	153.5	154.2	152.7
Weight (kg)	40.00	46.90	47.85	49.00	46.36
	Total number of 15-year old girls		Still not menstruating 15 year old girls 15,32%		
				Healthy	Goitrous
	$\bar{x}$	$\bar{x}-s$	$\bar{x}$	$\bar{x}$	x
Height (cm)	156.2	150.2	149.5	151.2	143.6
Weight (kg)	49.00	42.70	43.25	45.66	41.94

Data regarding menarche were recorded once more in 1962, when 1342 girls of 10 to 18 years were examined. The parameters determined were height, body weight, and of the pelvic dimensions the distance of the cristae (Martin 2), and that of the spines (Martin 5). Circumference of the chest was not measured, because it cannot be done reliably. Correct determination of the chest circumference requires its measurement in three positions (quiet breathing, deepest inspiration, deepest expiration); besides, the vital capacity too has to be established. Errors due to the diversity of the form and the development of breasts, especially marked in adolescence, are thus avoided. Dimensions of the pelvis are more uniform. We determined the distance of the cristae in the first place. The distance of the spines was measured in one of the schools: this parameter can be determined with greater accuracy since the fat pad interferes less with the result [29].

It is evident from Table V that the values for height and body weight obtained in 1962 were higher in all

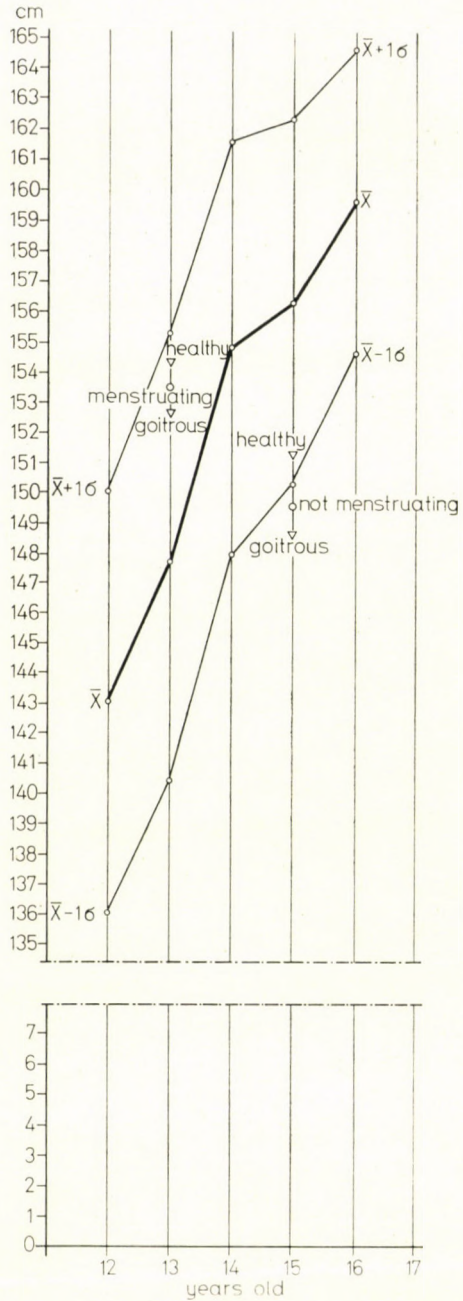

FIG. 3. Height of 13-year old menstruating and 15-year old still not menstruating girls

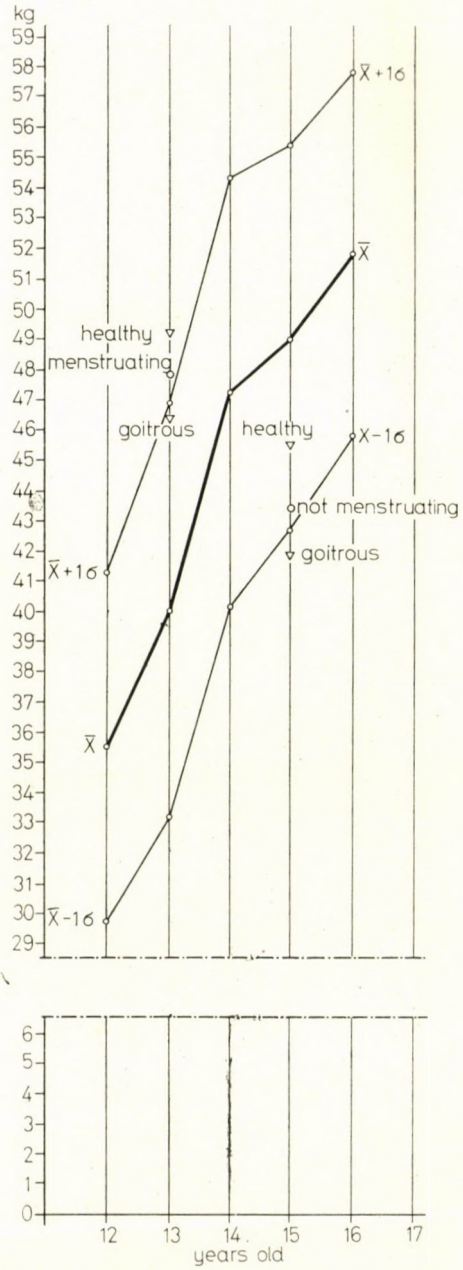

FIG. 4. Body weight of 13-year old menstruating and 15-year old still not menstruating girls

TABLE V

Height and body weight of 10 to 16-year old girls and the percentage of menstruating girls in 1947 and 1962

Age years	Height, cm		Body weight, kg		Percentage menstruation	
	1947	1962	1947	1962	1947	1962
10	132.2	140.06	28.40	32.60	00.0	00.0
11	137.3	142.00	32.03	34.83	00.00	00.0
12	143.0	148.07	35.50	39.72	03.10	23.20
13	147.8	153,61	39,97	44.66	20.57	54.10
14	154.7	157.04	47.23	48.55	61.90	83.00
15	156.2	160.77	49.03	53.08	84.68	91.30
16	159.5	160.00	51.77	53.81	94.60	98.66

age groups than those obtained in 1947, and that the proportion of menstruating girls was also significantly higher at the second census.

Results in respect of the correlations between menarche and the rate of annual growth and weight increment are illustrated in Table VI and Fig. 5.

It is evident that there exist correlations of this kind. The first menstrual flow occurs at the deceleration following the year of the most rapid growth. This correlation is less pronounced in respect of the weight increment. In 1947 the annual growth of 13-year old girls amounted to 6.86 cm, their increase in weight to 7.26 kg. The corresponding figures for the next year, when the girls had reached their 14th year, were 1.5 cm and 1.8 kg. Mean age at menarche was 13.6 years.

In 1962 the most intensive growth was found among 11-year old girls; it amounted to 6.07 cm, while the gain in body weight was 4.89 kg. The corresponding figures were 5.54 cm and 4.94 kg for 12-year old girls, and 3.43 cm and 3.89 kg for the 13-year old ones. Mean age at menarche was 12.8 years.

We examined moreover the effect of the age at which menarche had occurred on the further course of growth and body weight. Values for height, body weight and pelvic dimensions from the first to the eighth year after the menarche, as measured in 1962, are listed in Table VII. Values marked with an asterisk were

TABLE VI

Annual growth and weight increment measured in 1947 and 1962 at Kaposvár (Transdanubia)

Age years	Annual growth cm		Annual increase in weight, kg	
	1947	1962	1947	1962
10—11	5.07	1.96	3.63	2.23
11—12	5.70	6.07	3.47	4.89
12—13	4.84	5.54	4.47	4.94
13—14	6.86	3.45	7.26	3.89
14—15	1.5	3.73	1.80	4.53
15—16	3.3	—	2.74	0.73

used for the computation of mean age, while group averages were not calculated owing to the small number of cases.

are indicated on the x line. The horizontal lines serve better orientation. Points to the right of the $\bar{x}$ line (connected therewith by dotted lines)

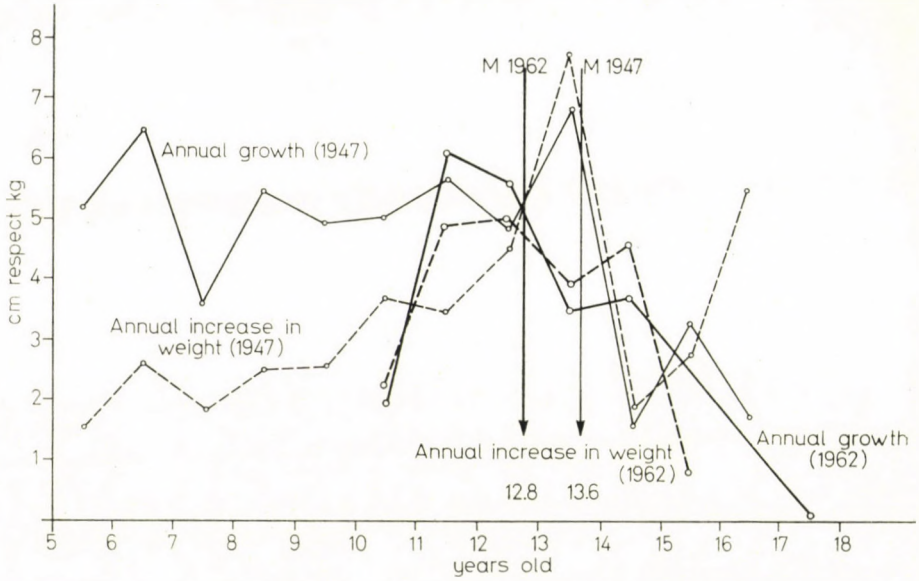

FIG. 5. Annual growth and weight increment measured in 1947 and 1962 at Kaposvár (Transdanubia)

A clearer picture is obtained by studying Figs 6 and 7. Mean height and weight of 12—16-year-old girls indicate height and weight of girls before the menarche, those to the left show the corresponding values of girls who had been menstruating for 0 to 6 years. The lines of trend, values of which are shown in Table VIII, were drawn for clarity's sake.

TABLE VIII

Data on which trend lines have been based in Figs 6 and 7

Age (years)	Height		Body weight	
	"a"	"b"	"a"	"b"
12	149.85	2.385	43.76	2.060
13	156.50	0.606	44.46	2.545
14	155.96	0.712	44.92	2.259
15	162.24	—0.216	58.60	—1.263
16	162.22	—0.892	54.09	—0.256
17	160.61	0.094	54.68	0.160

It can be seen that height and body weight were above the average in the year of menarche and in girls who had been menstruating for 1, 2 and 3 years, whereas these parameters were below the average in girls who had menses for 5 and 6 years, the result being that 16-year-old girls with 5 years of menstruation were of

TABLE VII

Data, collected in 1962, arranged according to age and the time of menarche

Age	Measurements	Mean values for not menstruating girls	In the year of menarche	1 year after menarche	2 years after menarche	3 years after menarche	4 years after menarche	5 years after menarche	6 years after menarche	7—8 years after menarche	Mean for menstruating girls	Mean for all subjects	N
	Height	140.06										140.06	
	Weight	32.60										32.60	
10	Dist. crist	22.20										22.20	16
	Dist. spin	16.20										16.20	
	Height	141.60	153.00									142.00	
	Weight	34.61	45.00									34.83	
11	Dist. crist	23.65										23.65	92
	Dist. spin	16.10										16.10	
	Height	146.42	150.63	157.93	155.30							148.07	
	Weight	37.55	46.18	47.15	50.30							39.72	
12	Dist. crist	22.88	25.63	28.46	28.00							23.76	259
	Dist. spin	15.63	20.33	20.00	17.50							16.08	
	Height	151.00	156.00	158.20	160.66	157.00						153.61	
	Weight	47.07	46.36	49.10	53.13	53.50						44.66	
13	Dist. crist	24.08	25.43	26.60	26.30	24.00						25.17	360
	Dist. spin	15.86	17.70	18.70	17.55	—						16.63	
	Height	153.42	155.52	158.40	157.50	161.56	157.50					157.04	
	Weight	42.26	46.92	50.00	50.13	56.43	55.00					48.55	
14	Dist. crist	24.20	25.40	25.55	26.37	26.37	24.00					25.54	282
	Dist. spin	15.60	16.14	17.80	18.60	19.00	—					17.06	
	Height	157.00	162.33	162.10	160.96	160.90	162.00	151.50*				160.77	
15	Weight	48.11	60.33	52.77	53.33	54.00	53.40	51.50*				53.08	150
	Dist. crist	25.80	25.50	26.30	26.45	25.40	26.80					26.09	
	Height	160.00	172.00*	160.80	160.50	159.77	160.63	156.25	157.00		160.00	160.00	
16	Weight	46.00	63.50*	53.65	52.10	55.28	54.76	50.37	53.00		53.91	53.81	75
	Dist. crist	—	21.00*	25.50	25.66	26.22	26.83	24.25	23.00		25.90	25.90	
	Height	—			163.10	157.76	161.10	160.10	162.40		160.53	160.53	
17	Weight	—			56.60	51.60	54.60	53.20	55.00		53.73	53.73	63
	Dist. crist	—			29.50	27.13	27.57	24.11	24.60		26.76	26.76	
	Height				169.00	158.44	160.26	162.00	162.33	161.50	161.14	161.14	
18	Weight				58.50	54.70	54.20	54.62	58.66	64.00	55.63	55.63	45
	Dist. crist				30.00	27.12	25.70	23.75	24.00	29.50	26.34	26.34	

* Explanation in text.

the same height as 12-year-old girls with 2 years of menstruation.

This correlation was less conspicuous in respect of body weight. The weight increment did not stop at the deceleration of growth. In this respect, 13-year-old girls with 3 years of menstruation were on the same level as 15-year-old ones with 5 years of menstruation of 16-year-old girls who had been menstruating for 6 years.

As regards standard deviations, menarche appeared after the highest value in respect of height (s = 7.02 at 12 years, 7.39 at 13 years, 6.82 at 14 years and 5.98 at 15 years of age). The highest standard deviation in respect of body weight was found in the year following that of the menarche (s = 5.80 at 12 years, 6.91 at 13 years, 7.16 at 14 years, 6.36 at 15 years and 6.0 at 16 years of age).

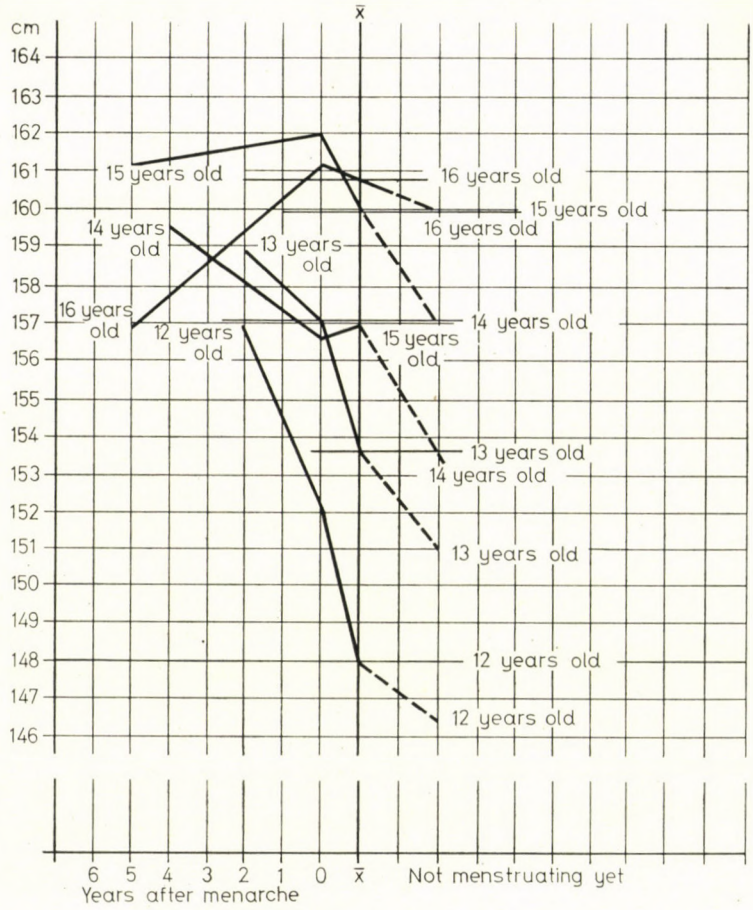

FIG. 6. Correlation between height and age at menarche

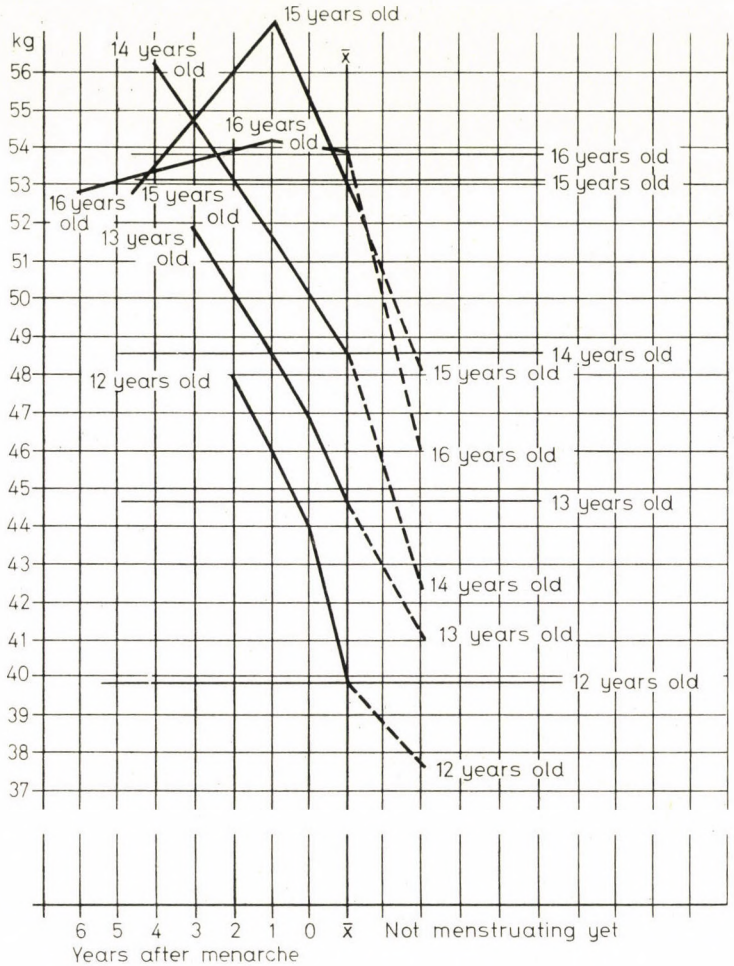

FIG. 7. Correlation between body weight and age at menarche

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