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## SECULAR CHANGES IN AGE AT MENARCHE IN 1924—1970 IN NORTHERN MORAVIA (CZECHOSLOVAKIA)

*ABSTRACT — The present study is the result of longitudinal research of influences on the onset on menarche caused by living conditions. Further numbers of families living in Northern Moravia, Czechoslovakia, were examined. Seasonality of menarche in the course of a year and secular trends in the onset of menarche were studied, both the phenomena in correlation with the conditions of the womens' growth from their birth to the onset of menarche. At the same time the possible influence of changing solar activity on the onset of menstrual cycles was investigated.*

*KEY WORDS: Menarche — Seasonality of menarche — Acceleration — Secular trends in the onset of menarche — Mean age at menarche — Menarche and solar activity.*

### MATERIAL AND METHOD

The material of this study consists of the data accumulated from 1,615 women belonging to 639 families. The investigation was realized in 1985 at an apprentice school in Olomouc, anonymous questionnaires being used for this purpose. The girls included in this study come from Olomouc (200 m above sea level, 100,000 inhabitants, Northern Moravia, Czechoslovakia) and from villages situated near Olomouc. The girls were instructed how to fill in the cards and at the same time they were asked to give accurate answers. They were also informed that their data would be studied as a part of long lasting research and so they were asked not to fill in the questionnaire if their elder sister had done so some time ago. The girls were asked about all their families, e.g. the dates of birth, the places of birth, the dates of birth and of menarche of the mother and all her daughters, the social background of both the mothers and the daughters from their birth to the occurrence of menarche, the birth order of all children in the family, sports activity etc.

For the statistic survey all women were divided into groups. First they were groups "mothers" and

"daughters" in both of which 639 women were studied. "Daughters" were the girls who were asked to record their data. In this group no attention was paid to the birth order. These two groups were later divided into "urban mothers" and "rural mothers" and "urban daughters" and "rural daughters" according to the environment in which they developed from their birth to the date of their first menarche. At last all 639 mothers with all their 976 daughters were divided according to the years of their births. The data of mothers born 1940—1950 and daughters born 1961—1970 are fairly numerous and efficient for statistics. As mentioned before the investigation is long-termed and carried out in one region only. That is why the data ascertained in this investigation could have been linked up with those published by Hajn 1983 and Hajn and Komenda 1982, 1985 and 1985. The groups originating in this way have been marked with a star as "mothers\*" and "daughters\*". The total number of data in the first group is from 3,684 women and in the second group from 5,407 women. These groups enable to understand the secular trends to regression of menarcheal age, this being the main task of longitudinal study started in 1977.

TABLE 1. Seasonality of the onset of menarche

		Month											
		1	2	3	4	5	6	7	8	9	10	11	12
Urban mothers n = 192	n	40	18	11	16	17	6	13	14	11	12	13	21
	%	20.83	9.38	5.73	8.33	8.85	3.13	6.77	7.29	5.72	6.25	6.77	10.93
	t.m. m.a.*	13.72	11.98	7.81	7.64	6.67	6.25	5.73	6.60	6.42	6.25	7.99	12.84
Rural mothers n = 447	n	17	20	32	39	47	88	46	54	40	24	22	18
	%	3.80	4.47	7.16	8.72	10.52	19.69	10.29	12.08	8.95	5.37	4.92	4.03
	t.m. m.a.	4.10	5.14	6.78	8.80	12.97	13.50	14.02	10.44	8.80	6.41	4.77	4.25
Urban daughters n = 290	n	53	27	20	23	20	16	15	23	19	22	23	29
	%	18.27	9.31	6.90	7.93	6.90	5.52	5.17	7.93	6.55	7.59	7.93	10.00
	t.m. m.a.	12.53	11.49	8.05	7.24	6.78	5.86	6.21	6.55	7.36	7.36	8.51	12.06
Rural daughters n = 349	n	24	16	26	27	27	48	52	44	20	23	18	24
	%	6.88	4.58	7.45	7.74	7.74	13.75	14.90	12.60	5.74	6.59	5.15	6.88
	t.m. m.a.	6.11	6.30	6.59	7.64	9.74	12.13	13.75	11.08	8.31	5.83	6.21	6.30

\* T.m.m.a. — three months moving averages.

## RESULTS

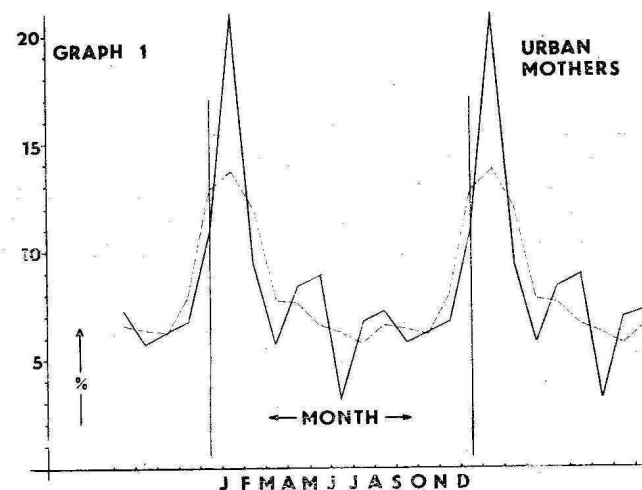
The seasonality of the onset of menarche is shown in Table 1 and Graphs 1—4.

In the groups "urban mothers" and "urban daughters" the curves show an outstanding peak in winter with the maximum of cases in January. Lower tops of the curves are registered from April to August. Hajn and Komenda 1982 and 1985 came to analogical conclusions.

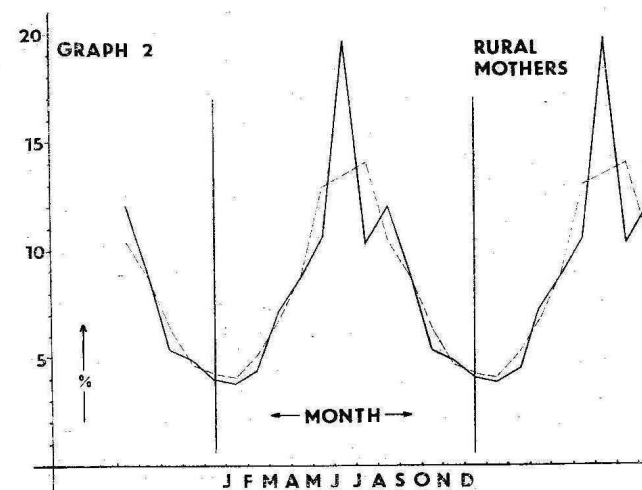
On the other hand in the groups "rural mothers" and "rural daughters" we observe a clear summer peak with the maximum in June or July. Besides, a lower top is evident in winter months December and January in the group "rural daughters".

TABLE 2. Seasonality of the onset of menarche—survey of different quarters of the year

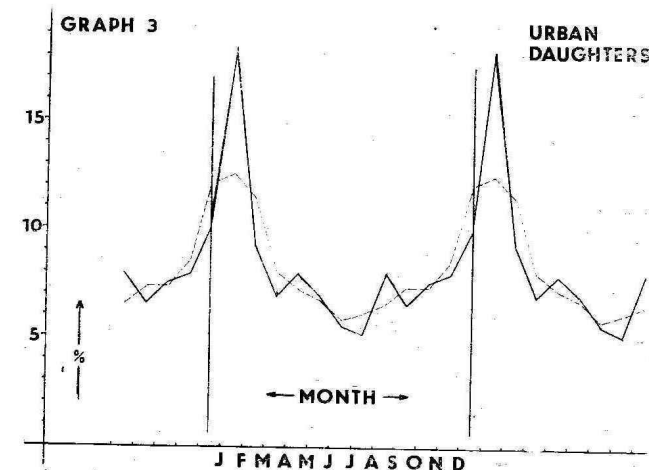
Quarter	I	II	III	IV
Month	2—4 %	5—7 %	8—10 %	11—1 %
Urban mothers n = 192	23.44	18.75	19.27	38.54
Rural mothers n = 447	20.35	40.50	26.40	12.75
Urban daughters n = 290	24.14	17.59	22.07	36.20
Rural daughters n = 349	19.77	36.39	24.93	18.91



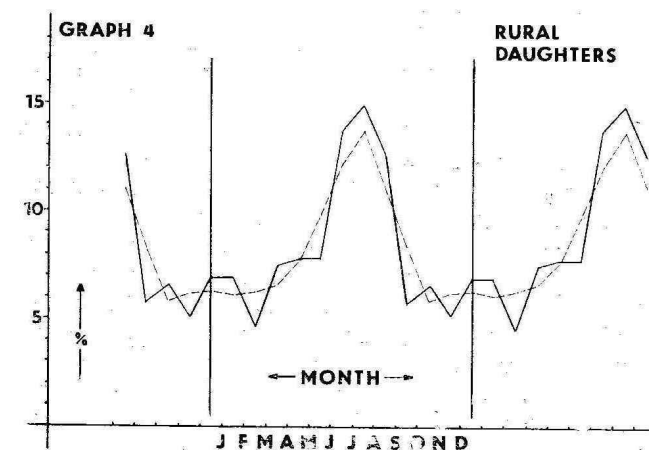
GRAPH 1. Seasonality of the onset of menarche—urban mothers.



GRAPH 2. Seasonality of the onset of menarche—rural mothers.



GRAPH 3. Seasonality of the onset of menarche—urban daughters.



GRAPH 4. Seasonality of the onset of menarche—rural daughters.

TABLE 3. Mean age at menarche—mothers according to the year of birth

Year	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951
n	31	29	29	68	52	80	42	64	54	36	44	14
mean	170.71	162.38	160.86	162.82	162.81	161.50	166.50	165.03	167.69	160.08	162.97	159.42
t.y.m.a.*	—	164.65	162.02	162.16	162.38	163.71	164.34	166.41	164.27	163.58	160.82	—

\* T.y.m.a. — three years moving averages

TABLE 4. Mean age at menarche—daughters according to the year of birth

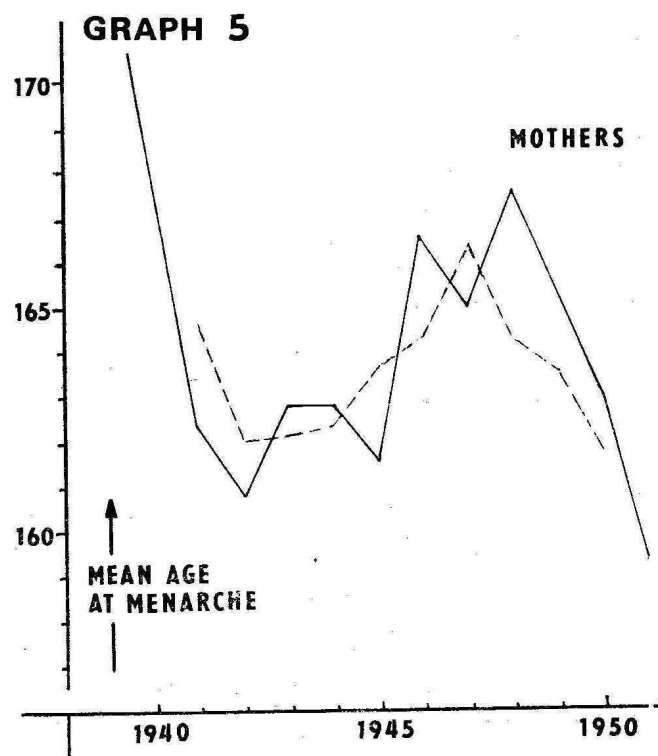
Year	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
n	14	10	15	31	31	61	124	174	222	206	26
mean	159.29	159.10	157.60	161.06	160.32	159.11	158.25	159.89	157.70	155.66	150.31
t.y.m.a.*	—	158.66	159.25	159.66	160.16	159.51	159.08	158.61	157.76	154.56	—

\* T.y.m.a. — three years moving averages.

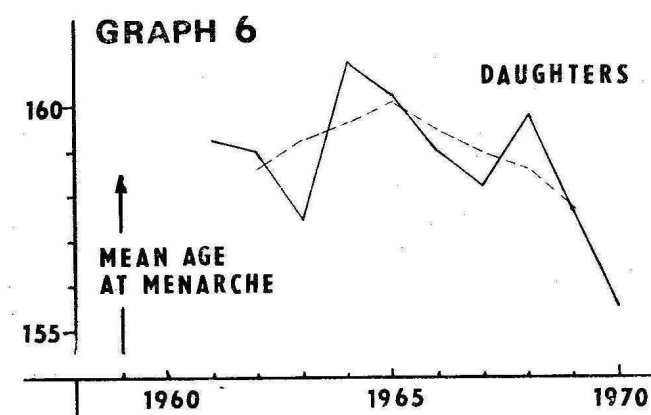
Also in this case the results are the same as those of Hajn and Komenda in 1982 and 1985. Also in evaluating the onset of menarche in different quarters of the year, which is shown in Table 2 we can find the same results as those proved by the above mentioned authors.

The mean menarcheal age of mothers is 13.69 years and that of daughters is 13.13 years. Tables 3 and 4 and Graphs 5 and 6 give the survey of mean menarcheal age in different years both for mothers and daughters. Among mothers the curvilinear regression is evident in the years 1940—42, from 1943 curvilinear upward trend continues with few exceptions to its maximum in the year 1948. In 1949 another decay of values of the mean age at menarche is evident. Our conclusions are in accordance with those of Hajn and Komenda 1985 in women from Olomouc and also with the results of study of Dann and Roberts 1973 in English girls and Demerdžijev and Lazarov 1978 in Yugoslav girls. Among daughters the mean menarcheal age is 13.13 and it is higher than it was during previous studies of the same group. The top values were observed for the years 1964 and 1968. Thus the conclusions stated for this sphere by Hajn and Komenda 1985 are confirmed that after 1960 acceleration trends stop. In the years 1960—70 instead of acceleration slight deceleration is observed. Similar conclusions were obtained also by other authors, i.g. Roberts 1977 in English girls, Malina 1978 in American girls, Richter 1982 in German girls, Eiben 1982 in Hungarian girls and Nakamura et al. 1982 in Japanese girls.

Graph 7 shows the changes of the mean age of menarche in Olomouc women in the years 1924—70 and also the changes of values of solar activity within the same period. In the lower part of Graph 7 the curve represents the values of mean menarcheal age in different years of births of the groups



GRAPH 5. Mean age at menarche—mothers according to the year of birth.



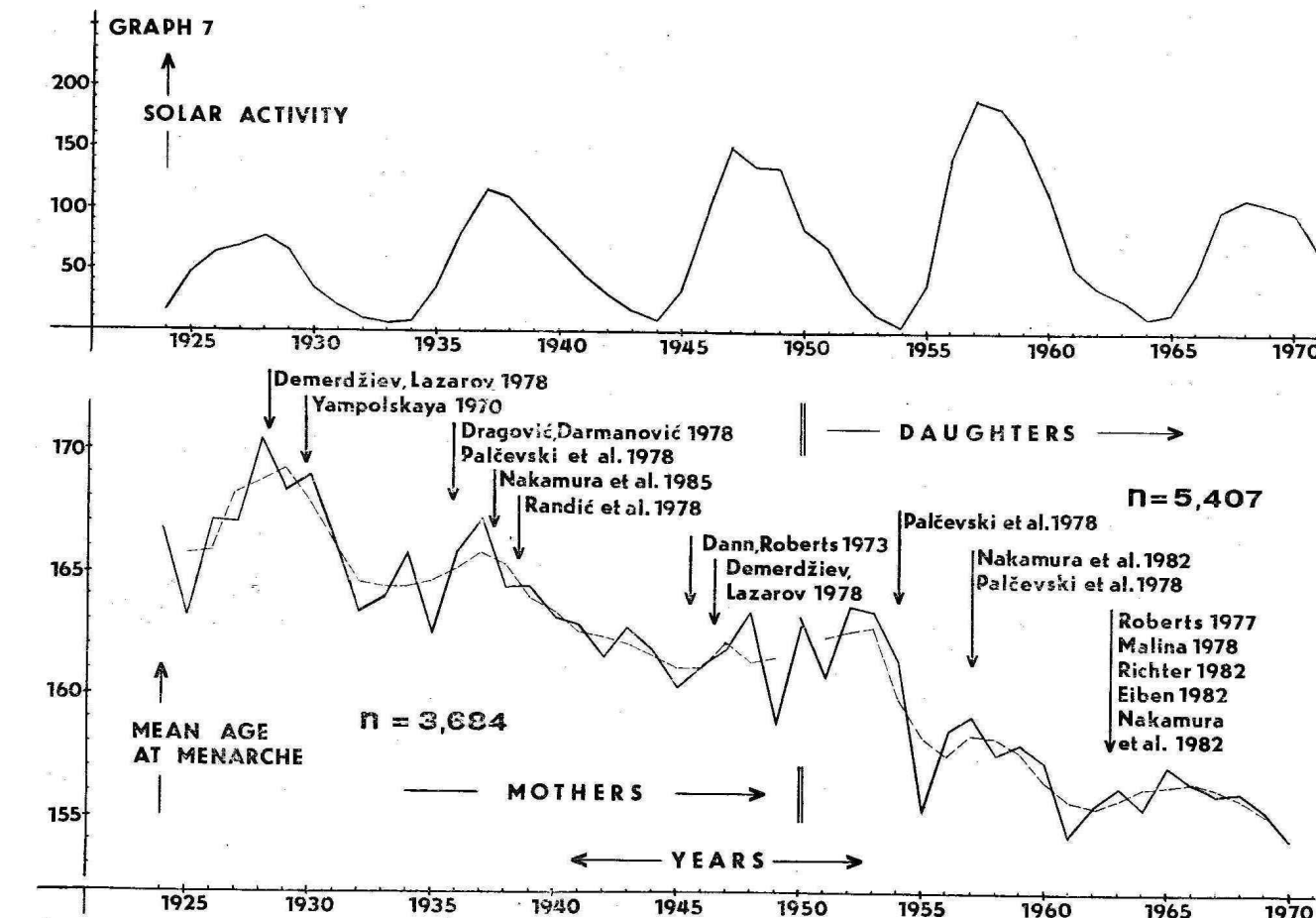
GRAPH 6. Mean age at menarche—daughters according to the year of birth.

“mothers\*” and “daughters\*”. The limit between the data of mothers and daughters is the year 1950. In this context it is interesting to mention the fact that the contemporary findings of the mean menarcheal age in the youngest mothers (born 1950) are in fact concordant with those of the mean menarcheal age of the eldest daughters (born 1950), recorded in 1977. The actual numbers are drawn in the graph in full line, three years moving averages in interrupted line. The values of mean age at menarche decrease from 1924 until 1961. The regression is not linear, but there are certain upward and downward variations. This fact was disclosed by Hajn 1983 and then by Hajn and Komenda 1985. After 1960 the acceleration trend stops and the above mentioned deceleration is observed.

ved. The results obtained in studying women from Olomouc are concordant with studies of other ethnic groups. Similar findings for the years 1927—30 were published by Yamporskaya 1970 and concern Moscow girls, for the years 1925—29 by Demerdžijev and Lazarov 1978 and concern Yugoslav girls. For the period round 1935 Palčevski et al. 1978 came to similar conclusions, Dragović and Darmanović 1978 and Randić et al. 1978 in studying Yugoslav girls and also Nakamura et al. 1982 in studying Japanese girls. For the period 1940—48 concordant results concerning English girls were published by Dann and Roberts 1973, for the years 1945—49 studies of Yugoslav girls by Demerdžijev and Lazarov 1978. In the period 1950—60 Palčevski's et al. 1978 results were shown to be concordant with the above given findings and so were Nakamura's et al. 1982, the former dealing with Yugoslav girls, the latter with Japanese girls. The results for the period after 1960 are concordant with the findings of a number of authors who were mentioned in the discussion following the results obtained for the years 1961—1970 (Graph 6, Table 4). In Graph 7 all foreign authors are quoted and the arrow-heads show the periods for which they found concordant results with those of the present study.

Graph 7 shows another fact too. Stagnation or increase of values of mean age at menarche in the years 1961—70 as they were observed by many authors in various ethnic groups are not a typical feature in Olomouc women only in this period. As it was explained above, the curve showing the approximate age at menarche in Olomouc women in the years 1924—70 is fluctuating and that is why we can observe certain accelerative periods in which the mean age at menarche decreases and certain decelerative periods in which the value of mean menarcheal age remains steady or even increases. This secular trend in the onset of menarche observed for Olomouc women may also explain quite great differences in mean menarcheal age recorded in the same region by different authors in short intervals which don't agree with theoretical presumption of continuing acceleration. During his studies a certain author found higher values of mean menarcheal age in girls born later than his predecessor had found in girls born sooner. This fact results in the necessity of more attention paid to studies of different years of birth in detail.

The upper part of Graph 7 shows the curve of variability of solar activity in different years of the period 1924—1970. This curve was constructed from the values of the so called Wolf number published by Vitinskij in 1973. The variability of the curve expressing the values of mean age at menarche for different years of birth was the starting point for Hajn 1983 to compare it with the curve denoting the variations of solar activity in the same years. Slight positive correlation between both of them was found. Similar comparison was made and the same results obtained also by Hajn and Komenda 1985. In the present work we can also observe certain conformity between maxima and minima of both the curves in the whole period of study. Thus the activity of the sun affecting a number of phenomena on the earth seems to have certain influence on the onset of menarche too.



GRAPH 7. Secular changes in mean age at menarche in Olomouc women in the period 1924—70 in comparison with the values of solar activity in the same period. (The arrow-heads show the periods in which the above given results are concordant with those of foreign authors.)

## CONCLUSIONS

In the present study transient and secular trends in the onset of menarche were examined in 1,615 women coming from 639 families. The research was carried out in Olomouc in 1985.

In women growing up in urban community the onset of menarche concentrates in winter months with the maximum of cases in January. Another, lower top of the curve is evident from April to August. We can speak about the so called “big city pattern”, typical for Olomouc as Hajn and Komenda found in 1982 and 1985. In rural women the peak of the occurrence of menarche is in summer months with the maximum of cases in June and July. Another, lower winter top is evident only in daughters in December and January. Also these results are concordant with those of above mentioned authors for the same region.

From 1924 to 1960 we can observe nonlinear decay of values of mean menarcheal age, after 1960 until 1970 the values remain steady or perhaps they increase. Acceleration stops after 1960 and we can speak about deceleration. Both accelerative and decelerative trends recur in the period from 1924 to 1970. Thus the phenomenon is not typical only for the years 1960—1970. The observed secular trend helps to explain to a certain extent the apparent

paradox between the results obtained by different authors. The suggestion is that the values of mean menarcheal age in women born later may be higher than in elder women because of the mentioned secular trend. Studies of women born in a particular year, if carried out in detail, may bring interesting results in the future.

Comparing the curve formed by the values of mean menarcheal age with the curve showing the values of solar activity we find concordance in variability of both the curves between maximum and minimum. This concordance was observed by Hajn 1983 and Hajn and Komenda 1985. The concordance of both the curves gives evidence of the fact that menarche as a very sensible phenomenon is influenced by solar activity.

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