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Age at menarche in French Canadian urban girls

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Summary. In 1969-1970, a random sample of 1002 girls aged 10.5 to 15.0 from different socio-economic strata were interviewed in Montreal schools. The mean age at menarche of these urban girls was 13.08 ± 0.04 years (S.D. 1.10) from probit analysis. French Canadian girls today commence menarche at about the same age as British girls and about 8 months earlier than Montreal girls three decades ago. Contrary to findings in most other populations (with a different level and way of life), French Canadian girls from upper socio-economic groups mature *later* than girls from lower socio-economic groups.

Girls from large families or with more linear physique were older at menarche than others. Family size and the type of physique were independent factors. There was a close relation between social class and family size, and we consider family size to be one of the most important factors contributing to the different onset of sexual maturation of girls in different socio-economic strata.

1. Introduction

The purpose of the present study was to determine the age at menarche of contemporary French Canadian girls as compared with other populations and to study selected social, economic, cultural and familial factors which may affect sexual maturation.

The age at menarche as an index of developmental and biological age has been reviewed by several authors (Backman, 1948; Tanner, 1962; Thomazi, 1964; Tanner, 1966; Damon, Damon, Reed and Valadian, 1969; Zacharias and Wurtman, 1969). The effects of nutrition, the socio-economic level of families, morbidity, number of siblings, constitutional type and the season of birth have all been described (Kralj-Cerček, 1956; Štukovský, Valšík, Bulai-Stirbu, 1967; Aw and Tye, 1970; Laska-Mierzejewska, 1970; Shakir, 1971; Widholm and Kantero, 1971). The influence of psychological factors, urbanization and cultural milieu cannot be precisely determined because of the difficulties involved in their exact measurement and quantitation. Climate also seems to play a minor role (Bojlén and Bentzon, 1968; Eveleth and de Souza Freitas, 1969; Roberts, 1969; Zacharias, Wurtman and Schatzoff, 1970). The secular trend towards earlier menarche has been attributed chiefly to improved nutrition (Tanner, 1966).

The collection of data on the age of menarche may be made either by exacting longitudinal studies (prospective method), retrospective studies or, more usually, the status quo method (De Wijn, 1966).

In recent studies, probit (Finney, 1964) or logit analysis of status quo data is the most widely used method for estimating the mean age at menarche.

Very little information is available concerning the age of menarche of contemporary Canadian girls. The mean age at menarche for Montreal girls was formerly 13.8 years (Mills, 1937; method of computation unpublished). The most recent data, taken from a retrospective study of the population of the Province of Ontario, sets the age at 12.96 (Buck and Stavraky, 1967).

2. Materials and methods

During 1969, a cross-sectional study of the growth and development of French Canadian school age children in Montreal was undertaken. The ancestors of the children over 3 generations were French Canadians. The children were selected from a random sample of schools in three metropolitan areas each containing populations of different socio-economic class levels (Demirjian, Jenicek and Dubuc, 1972).

A total of 2332 girls (age 6-16) participated. The 1002 girls aged 10-16 were asked whether they had begun to menstruate, always by the same well-trained technician.

Socio-economic data were available for 78% of these girls, the remaining 221 representing the undetermined socio-economic class.

(a) Father's occupational status:	<i>Score</i>
professionals and managers	1
semi-professionals, small owners, administrators	2
white-collar workers, salesmen	3
blue-collar workers, manual workers	4
unqualified manual workers	5
(b) Father's education:	<i>Score</i>
university or high school	1
secondary education completed	2
secondary education uncompleted	3
primary education completed	4
primary education uncompleted	5
(c) Total family income per year:	<i>Score</i>
more than \$15 000	1
\$10 000-15 000	2
8000-10 000	3
7000- 8000	4
6000- 7000	5
5000- 6000	6
4000- 5000	7
less than 4000	8

From these variables a weighted score for each child was computed, this being the score for the category of education plus twice the scores for the categories of occupation and income. Scores of 5-12 were called upper or well-off class, 13-23 the middle class, and 24-31 lower class.

Other variables were also considered, the mother's education was evaluated in the same way as the father's, giving five categories according to the educational level achieved.

The size of families from which girls came were also determined. The birth order was not studied.

The girls' age was determined as the midpoint of a six month interval (e.g. 10.75-11.249 for 11 years).

Standing height, biacromial and bicristal diameters were measured by techniques and equipment recommended by the International Biological Programme (Weiner and Lourie, 1968). The relative body width (index of laterality) was defined as biacromial width (cm) \times 100/height (cm) and bicristal width (cm) \times 100/height (cm). Both indicators were used separately, and categories of small, medium and large frame were determined on the basis of percentile standards ($\leq P_{25}$, $P_{25}-P_{75}$ and $\geq P_{75}$) for French Canadian children (Demirjian and Jenicek, 1972).

The mean age at menarche was computed by using the BMDO3S programme for probit analysis (1971).

3. Results

The youngest girls to experience menarche were in the category midpoint 10.5 years old and by the age of 15.5, 90% of girls had experienced menarche. This age range involved 1002 girls (table 1). For the whole sample the menarche was 13.08 ± 0.04 years.

Table 2 gives the estimated parameters for age at menarche for each category involving the different social, economic and educational criteria of families, the

Age (midpoint)	Total number of girls	Girls menstruating
10.5	159	3
11.0	85	3
11.5	74	7
12.0	128	18
12.5	83	24
13.0	26	14
13.5	102	64
14.0	170	139
14.5	114	94
15.0	61	55

Table 1. Sample of French Canadian girls (Montreal), in which the age at menarche was studied.

different family size and the different type of skeletal frame. The χ^2 values indicate a good estimation of parameters in most cases.

We found a later age at menarche in the upper socio-economic class, in the category of highest family income, in families of parents having the highest educational and occupational levels, in girls having better educated mothers, in girls from large families and in girls who had a small skeletal frame following biacromial or bicristal index of laterality.

Since there is a dependence of age at menarche upon socio-economic stratum as well as family size and individual physique, the interrelationship between these factors must be analysed.

	<i>n</i>	\bar{x}	S.D.	S.E.	χ^2 (d.f.=8)
<i>Total sample</i> (all socio-economic classes plus group of undetermined status)	1002	13.08	1.10	0.04	7.90
<i>Socio-economic classes combined (I+II+III)</i>	781	13.13	1.10	0.04	7.23
<i>Socio-economic class:</i>					
Upper (I)	162	13.43	1.10	0.09	17.14*
Middle (II)	439	13.03	1.10	0.05	6.37
Lower (III)	180	13.12	1.08	0.08	3.82
Undetermined	221	12.92	1.11	0.08	12.29
<i>Category of family income:</i>					
1.	73	13.48	1.04	0.12	3.19
2.	79	13.19	1.12	0.13	6.46
3.	113	13.37	1.09	0.10	19.78**
4.	103	13.02	1.11	0.11	6.66
5.	178	12.95	1.10	0.08	10.99
6.	126	13.04	1.09	0.10	9.22
7.	71	13.45	1.11	0.13	6.74
8.	39	13.20	1.05	0.17	2.24
<i>Category of father's occupation:</i>					
1.	76	13.59	1.05	0.12	4.75
2.	185	13.06	1.12	0.08	4.83
3.	124	13.42	1.09	0.10	16.88*
4.	307	13.01	1.09	0.06	5.99
5.	74	12.97	1.12	0.13	5.01
<i>Category of father's education:</i>					
1.	81	13.28	1.11	0.12	22.32**
2.	163	12.97	1.11	0.09	17.00*
3.	235	13.20	1.09	0.08	8.33
4.	204	13.10	1.10	0.08	4.09
5.	77	12.90	1.09	0.12	5.58
<i>Category of mother's education:</i>					
1.	42		insufficient data		
2.	142	13.21	1.09	0.09	10.88
3.	290	13.13	1.09	0.06	10.42
4.	210	13.13	1.11	0.08	3.61
5.	60	12.69	1.12	0.15	6.30
<i>Girls having working mothers</i>	146	13.12	1.10	0.09	9.22
<i>Girls having not working mothers</i>	634	13.13	1.10	0.04	7.98
<i>Body frame (laterality):</i>					
According to the index					
biacromial width (cm) $\times 100/\text{height (cm)}$					
large ($\geq P_{75}$)	200	13.28	1.09	0.08	12.86
medium ($P_{25}-P_{75}$)	410	13.08	1.10	0.05	6.52
small ($<P_{25}$)	226	12.92	1.11	0.07	7.56
According to the index					
bicristal width (cm) $\times 100/\text{height (cm)}$					
large ($\geq P_{75}$)	192	13.45	1.09	0.08	13.96
medium ($P_{25}-P_{75}$)	418	13.13	1.09	0.05	12.52
small ($<P_{25}$)	226	12.72	1.12	0.07	7.74
<i>Family size (total offspring):</i>					
1 child	64	12.68	1.09	0.14	9.66
2-3 children	395	12.94	1.10	0.06	8.63
4-5 children	159	13.20	1.09	0.09	13.66
6 and more children	178	13.45	1.12	0.08	5.51

Table 2. Age at menarche of French Canadian girls of different socio-economic strata in Montreal.

* $P<0.05$ level of significance. ** $P<0.01$ level of significance.

Table 3 indicates the relationship between the social class and the family size in our sample. A greater proportion of larger families was observed in upper and lower classes than in the middle social class.

There is no statistical association between the type of physique and the social class, or between the type of physique and the size of the family.

There was no significant difference in the age at menarche of girls whose mothers stayed at home and those whose mothers worked.

Socio-economic class	Family size (offspring)				Mean number of children ± SE
	1 child	2-3 children	4-5 children	6 children	
I	6 (3.7%)	53 (32.7%)	79 (48.8%)	24 (14.8%)	4.2 ± 0.15
II	26 (5.8%)	200 (44.7%)	166 (37.1%)	55 (12.3%)	3.6 ± 0.08
III	3 (1.6%)	66 (35.3%)	69 (36.9%)	49 (26.2%)	4.3 ± 0.10

Table 3. Relationship between the size and the socio-economic status of girls' families.

$$\chi^2 = 31.7484$$

4. Discussion

The mean age at menarche of the total sample was compared with that of other populations obtained over the last decade. The age for contemporary French Canadian girls was close to that of contemporary British girls (Scott, 1961; Roberts and Dann, 1967). A lower age was found in contemporary American girls (retrospective data—Zacharias *et al.*, 1970). The age at menarche in major American longitudinal studies, reviewed by Frisch and Revelle in 1971, is higher than the Zacharias' value.

The age at menarche of French Canadian girls is slightly higher than that of contemporary Ontario girls, who were predominantly English Canadian; however the Ontario data were collected by the retrospective method.

In 1935, Mills found the mean age at menarche of a group of 200 Montreal girls to be 13.8 years, though the details of his study are not available in the literature. We suppose that past and present studies in Montreal differ in sampling techniques and methods of evaluation, and we cannot analyse more precisely the apparent secular trend towards earlier maturation.

The most interesting finding was that girls belonging to families of higher socio-economic status reached menarche *later*. In previous studies the reverse has been found (Tanner, 1962; Aw and Tye, 1970; Laska-Mierzejewska, 1970; Shakir, 1971). Several factors may be responsible: difference in the type of infant feeding (breast or bottle), food intake in preschool years, family size, the number and order of siblings (Roberts and Dann, 1967; Roberts, Rozner and Swan, 1971) as well as the type of physique. In other studies, girls of more linear physique and those from larger families experienced later menarche (Roberts and Dann, 1967; Widholm and Kantero, 1971).

In our study, family size appears to be a factor contributing to the differences in the age at menarche in different socio-economic classes. The relation of family size and social class may vary in different populations and this contributes to interpopulation differences in the relation between the age at menarche and the socio-economic class. The type of physique was another factor affecting the age

at menarche, but in our study this was independent of social class and family size.

Besides this, many of the earlier studies probably involved populations with different standards of living from those found on the North American continent. There may have been a greater disparity between the socio-economic classes in other countries than in the French Canadian urban population. The Montreal metropolitan area is not necessarily representative of the whole Province of Quebec or of its rural regions. If nutrition and financial status are considered the most important factors, even a lower income group in the Montreal population could probably be expected to have better basic nutrition than some socio-economic groups in other countries with different standards of living, besides possible differences in family size. This view is supported by the fact that no significant differences were found in menarcheal age among girls of different socio-economic strata in various parts of Great Britain (Nisbet and Illesley, 1963; Douglas, 1964; Roberts and Dann, 1967; Roberts *et al.*, 1971), i.e. in regions where the level and way of life approximates Canadian living conditions more than life in countries where socio-economic differences are more pronounced. On the other hand, higher age at menarche in lower classes was found in well-developed Denmark (Bojlén, Rasch and Bentzon, 1954) but no information about the food intake and family size in the social classes is given.

If nutritional factors are comparable among the French Canadian girls in our sample, other factors (as discussed above) may be the cause of the higher age at menarche of the more affluent groups. One additional contributing factor in early maturation may be the parents' and especially the mother's education. We have not specifically studied the movement of different social groups from one environment to another, but few migrations probably occur among the more affluent families.

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Zusammenfassung. In 1969-1970 wurden aufs Geratewohl 1002 Mädchen im Alter von 10,5 bis 15,0 aus verschiedenen sozial-ökonomischen Schichten an Schulen in Montreal befragt. Das durchschnittliche Alter bei Menarche dieser städtischer Mädchen war $13,08 \pm 0,04$ Jahre (S.D. $\pm 1,10$) von Probitanalyse. Heute beginnen französisch-kanadische Mädchen Menstruation ungefähr im selben Alter als britische Mädchen und ungefähr 8 Monate früher als Mädchen in Montreal vor drei Jahrzehnten. Im Gegenteil zu den Entdeckungen in den meisten anderen Bevölkerungen (mit sehr verschiedenen Niveau und Lebensweise), die französisch-kanadischen Mädchen der oberen sozial-ökonomischen Gruppen reifen später als die Mädchen der niederen sozial-ökonomischen Gruppen.

Mädchen aus grossen Familien oder mit längerem Körper waren älter bei Menarche als andere. Familienzahl und Körpertyp waren unabhängige Faktoren. Wir fanden auffallende Beziehungen zwischen Familienzahl und sozialer Schichte, und wir betrachten die Familienzahl als eine der bedeutendsten Faktoren, die zum verschiedenem Zeitbeginn der sexualen Reife der Mädchen in verschiedenen sozial-ökonomischen Schichten beiträgt.

Résumé. En 1969-1970, les 1002 filles, âgées de 10 ans et demi à 15 ans, d'un échantillon statistique stratifié selon les milieux socio-économiques, ont été interrogées dans les écoles de Montréal. L'analyse par la méthode des probits donne un âge moyen au ménarche pour ces filles urbaines de $13,08 \pm 0,04$ ans (écart-réduit = $\pm 1,10$). Les canadiennes françaises d'aujourd'hui ont leurs premières règles à peu près au même âge que les britanniques, et environ 8 mois plus tôt que les montréalaises d'il y a 30 ans. Contrairement à ce qui a été observé dans la plupart des autres populations (de niveau de vie et de mode de vie différents), les canadiennes françaises provenant de groupes socio-économiques élevés ont une maturation *plus tardive* que celles de niveaux inférieurs.

Les filles appartenant à des familles nombreuses et celles qui ont une morphologie linéaire ont leurs premières règles plus tard que les autres. La taille de la famille et le type somatique sont des facteurs indépendants. Nous avons trouvé une forte association entre la classe sociale et la taille de la famille, et nous considérons que la taille de la famille est un des facteurs de variation les plus importants pour l'apparition de la maturation sexuelle des filles de strates socio-économiques différentes.