



ORIGINAL ARTICLE

Age at menarche in schoolgirls with and without excess weight^{☆,☆☆}



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Received 30 January 2014; accepted 14 May 2014

Available online 10 September 2014

KEYWORDS

Menarche;
Adolescent;
Body mass index

Abstract

Objective: To evaluate the age at menarche of girls, with or without weight excess, attending private and public schools in a city in Southeastern Brazil.

Methods: This was a cross-sectional study comparing the age at menarche of 750 girls from private schools with 921 students from public schools, aged between 7 and 18 years. The menarche was reported by the *status quo* method and age at menarche was estimated by logarithmic transformation. The girls were grouped according to body mass index (BMI) cut-off points: (thin + normal) and (overweight + obesity). In order to ensure that they belonged to different strata, 328 parents of these schools answered a questionnaire to rate the student's socioeconomic level.

Results: Menarche was reported by 883 girls. Although they belonged to different classes ($p < 0.001$), there was no difference in the nutritional diagnosis ($p = 0.104$) between them. There was also no difference in age at menarche between the girls studying in private (12.1 years, 95% CI: 12.0-12.2) and public schools (12.2 years, 95% CI: 12.1-12.3; $p = 0.383$). When evaluated by nutritional status, there was difference only in the age at menarche between girls from private schools with excess weight and without excess weight (11.6 and 12.3 years; $p < 0.001$). The girls with excess weight attending private schools also had earlier an menarche than those attending public schools (respectively, 11.6 and 12.1 years; $p = 0.016$).

Conclusions: Although the students from private schools belonged to a higher socioeconomic status, there is currently no longer a large gap between them and girls from public schools regarding nutritional and socioeconomic factors that may influence the age at menarche.

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[☆] Please cite this article as: Castilho SD, Nucci LB. Age at menarche in schoolgirls with and without excess weight. J Pediatr (Rio J). 2015;91:75–80.

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PALAVRAS-CHAVE

Menarca;
Adolescente;
Índice de massa
corporal

Idade da menarca em escolares com e sem excesso de peso**Resumo**

Objetivo: Avaliar a idade da menarca em meninas, com e sem excesso de peso, que frequentam escolas particulares e públicas de uma cidade do sudeste do Brasil.

Métodos: Estudo transversal que comparou a idade da menarca de 750 meninas de escolas particulares com 921 alunas de escolas públicas, com idades entre sete e 18 anos. A menarca foi relatada pelo método *status quo* e a idade da mesma estimada pelo logito. As meninas foram agrupadas pelos pontos de corte do IMC em (magreza + eutrofia) e (sobrepeso + obesidade). Com o intuito de certificar que elas pertenciam a classes diferentes, 328 pais responderam a um questionário para classificar o nível econômico dos alunos.

Resultados: A menarca foi referida por 883 meninas. Embora elas pertençam a classes econômicas distintas ($p < 0,001$), não houve diferença quanto ao diagnóstico nutricional ($p = 0,104$). Também não houve diferença na idade da menarca entre as que estudam em escolas particulares (12,1 anos; IC95%: 12,0-12,2) e públicas (12,2 anos; IC95%: 12,1-12,3); $p = 0,383$. Quando avaliadas pelo diagnóstico nutricional só houve diferença na idade da menarca das meninas com e sem excesso de peso de escolas particulares (11,6 e 12,3 anos; $p < 0,001$). As meninas com excesso de peso das escolas particulares também menstruaram mais cedo do que as das escolas públicas (respectivamente, 11,6 e 12,1 anos; $p = 0,016$).

Conclusões: Embora as alunas das escolas particulares ainda pertençam a classes mais altas, atualmente, não existe mais um abismo nutricional e socioeconômico tão grande entre elas quanto a fatores que podem influenciar na idade da menarca.

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Introduction

The age at which menarche occurs is of interest, as this event establishes the end of the sexual maturation period in girls, signaling that they are ready to procreate.¹ This implies their introduction into the adult world and, consequently, the onset of sexual activity, exposing them to both the risk of sexually transmitted diseases and pregnancy, whose early occurrence brings a number of difficulties.^{2,3}

Several factors have been associated with sexual maturation, which influences age at menarche. According to Tanner, girls of higher social class and those who are better nourished menstruate earlier.¹ Other studies have shown that obesity also anticipates menarche.^{4,5}

In recent decades, Brazil and other developing countries have faced problems related to changes in the nutritional profile of their populations.⁶⁻⁸ If, previously, the high prevalence of malnutrition was of concern, currently the most noteworthy issues are related to overweight and obesity rates.⁹ During the first decade of this century, there have also been significant changes in the socioeconomic distribution of Brazilians, reflecting the social mobility that started in the 1970s.^{10,11} With the advent of industrialization, the base of the social pyramid slowly began to narrow, but it was not until 2005 that these changes created a new form of socioeconomic distribution of the population. With people migrating from lower to higher levels, the old pyramid-shaped representation of social class distribution has been replaced by the diamond-shaped distribution, in which the majority of the population belongs to an intermediate purchasing power stratum.¹⁰

Recent changes in the nutritional and socioeconomic profile of the Brazilian population have raised the question about the influence that these factors have had on the age at menarche. Faced with this new reality, this study aimed to evaluate and compare the age at menarche in girls with and without excess weight who attend private and public schools in a city of southeastern Brazil.

Methods

This study described and compared data on 1,671 girls, aged 7-18 years, evaluated in private (in 2010, $n = 750$) and public (in 2012, $n = 921$) schools in Campinas, SP, Brazil. The schools were selected by drawing lots among all private and public schools of the municipality, and the girls enrolled in study did so after an informed consent was obtained from the principals and parents/guardians, who agreed with data collection. Of the assessed girls, those who reported pregnancy, non-controlled diseases that could interfere with growth or weight gain, and those who had at the time of study a condition that could interfere with measurements, such as wheelchair use or wearing a plaster splint, were excluded from the study.

The sample size was calculated so that the adolescents would be distributed evenly according to the Tanner maturation stages for breast (B) development, based on Brazilian studies that established the mean age for each stage¹² and the body mass index (BMI) variability for that age.¹³ Using the sample size formula for the mean of a quantitative variable (BMI) from a descriptive study, considering the lowest sampling error ($d = 0.7 \text{ kg/m}^2$), the highest estimated standard deviation ($SD = 2.9 \text{ kg/m}^2$), and a significance level

of 1%, it was established that at least 114 girls would be necessary for each maturation stage in each sample (minimum of 1,140 girls).

Weight and height were measured according to the international standards¹⁴ using Tanita scale SC3315 (Tanita, Illinois, United States) and WISO wall anthropometer (WISO, Santa Catarina, Brazil), respectively, and the girls were questioned regarding the occurrence of menarche by the *status quo* method (menarche: yes or no). As maturation obtained by comparative self-assessment of pubertal development illustrative boards (Tanner stages) had a high correlation with that determined by the researcher in the first sample (private schools), according to already published data,^{5,7} in public schools maturation was obtained by self-assessment. Based on the BMI/age Z-score assessed by cutoff points of World Health Organization (WHO) curves of 2007, the girls were divided into two groups: those with excess weight (overweight and obesity) and those without excess weight (underweight and normal weight).

Data were collected in public and private schools in order to represent different socioeconomic classes. To confirm this choice, in 2012, 328 parents of students (assessed proportionally in each school) answered the Brazil Economic Classification Criterion (Critério de Classificação Econômica Brasil – CCEB) questionnaire of the Brazilian Association of Research Companies.¹⁵

The analyses were performed using SPSS for Windows v.17.0 (SPSS Inc., Chicago, United States) software; the chi-squared test was used to compare proportions, the Mann-Whitney test to compare the numerical means, and logistic regression to compare age at menarche per school (public and private) and nutritional diagnosis (with and without excess weight). The logarithmic transformation method was used to calculate the median age of menarche (age at which 50% of the girls stated having menstruated). The level of significance was set at 5%.

This research complies with the ethical principles of the Declaration of Helsinki and was approved by the Ethics Committee of PUC-Campinas (protocol 693/09 and 574/11).

Results

Table 1 includes descriptive data of the sample regarding the distribution of girls evaluated in private and public schools per nutritional diagnosis and maturation stage. It can be observed that there was no significant difference regarding the nutritional diagnosis in girls attending different educational systems ($p=0.104$). The prevalence of overweight was 32.5% of the students from private schools and 32.9% of students from public schools.

The application of the CCEB showed statistically significant differences in the socioeconomic class of children attending schools assessed in the private and public network ($p<0.001$). While in the private schools 90% of the students belonged to classes A and B (with a predominance of A2 and B1) and only 10% belonged to class C, in public schools 53% belonged to the class B (predominantly B2), none belonged to class A, and 47% belonged to the lower classes (C and D).

There was no difference between the number of girls from public and private schools who reported menarche

Table 1 Distribution of 1,671 girls evaluated in private and public schools in Campinas, SP, Brazil between 2010 and 2012, according to BMI/age cutoff points in WHO 2007 curves and maturation stage (Tanner).

| Variable | Private school n (%) | Public school n (%) | p-value ^a |
|-------------------------------------|-------------------------|------------------------|----------------------|
| <i>Nutritional diagnosis</i> | | | |
| Obesity | 79 (10.5) | 117 (12.7) | 0.104 |
| Overweight | 165 (22.0) | 186 (20.2) | |
| Normal weight | 503 (67.1) | 606 (65.8) | |
| Underweight | 3 (0.4) | 12 (1.3) | |
| <i>Maturation stage^b</i> | | | |
| B1 | 138 (18.4) | 186 (20.2) | < 0.001 |
| B2 | 135 (18.0) | 118 (12.8) | |
| B3 | 145 (19.3) | 138 (15.0) | |
| B4 | 193 (25.7) | 240 (26.1) | |
| B5 | 139 (18.5) | 239 (26.0) | |
| Total | 750 (44.9) | 921 (55.1) | |

^a Chi-squared test.

^b Tanner maturation stage for breast development.

($p=0.717$); 400 (53.3%) and 483 (52.4%), respectively. Table 2 shows their distribution by maturation stage.

Among the girls included, only 16 were classified as having early or late menarche. Six girls from private schools and two from public schools had menarche before age 9, while only two from private schools and six from public schools had menarche after age 15. The youngest was 8.4 years and the oldest was 15.9 years at menarche.

The median age at menarche in girls from private schools was 12.1 years (95% CI: 12.0 to 12.2) and in girls from public schools it was 12.2 years (95% CI: 12.1 to 12.3). Although age at menarche was younger in girls assessed in private schools, there was no statistically significant difference in relation to those assessed in public schools ($p=0.383$). When evaluated according to the nutritional diagnosis, it was observed that overweight girls from private schools had an earlier menarche (Table 3).

Discussion

This study found that there was actually no difference in age at menarche between adolescent girls attending private (12.1 years) and public (12.2 years) schools in Campinas, SP, Brazil. Regarding nutritional diagnosis, overweight girls from private school have an earlier menarche (11.6 years) than those with normal weight (12.3 years), but there was no difference in age at menarche of girls enrolled in public schools (12.1 and 12.3 years, respectively). Moreover, there was no difference in age at menarche in girls without excess weight from private and public schools (12.3 and 12.3 years, respectively), but those with overweight from private schools had an earlier menarche (11.6 and 12.1 years, respectively).

Studies on social inequality, education, and school performance in Brazil point to a reality where socioeconomic variables, such as family income and maternal education, determine the choice of school where children are

Table 2 Proportion of girls (evaluated in private and public schools in Campinas-SP, in 2010-2012) who reported menarche, by maturation stage.

| Maturation stage | Private schools | | | Public schools | | |
|------------------|---------------------------|---------|------------|---------------------------|---------|------------|
| | Menarche | | Total n | Menarche | | Total n |
| | Yes n (%) ^a | No n | | Yes n (%) ^a | No n | |
| B1 | 0 | 138 | 138 | 0 | 186 | 186 |
| B2 | 2 (1.5%) | 133 | 135 | 0 | 118 | 118 |
| B3 | 70 (48.3%) | 75 | 145 | 35 (25.3%) | 103 | 138 |
| B4 | 189 (97.9%) | 4 | 193 | 209 (87.1%) | 31 | 240 |
| B5 | 139 (100%) | 0 | 139 | 239 (100%) | 0 | 239 |
| | 400 | 350 | 750 | 483 | 438 | 921 |

^a % of weight per Tanner stage of breast development (B).

Table 3 Comparison of age at menarche according to type of school they attended (private or public school) and nutritional diagnosis (with and without excess weight) of schoolgirls; Campinas, SP, Brazil (2010-2012).

| School | Nutritional diagnosis | n | Median age at menarche (years) | p-value |
|---------|-----------------------------|-----|--------------------------------|---------|
| Private | Underweight + normal weight | 506 | 12.3 ^a | < 0.001 |
| | Overweight + obesity | 244 | 11.6 ^b | |
| Public | Underweight + normal weight | 618 | 12.3 ^a | 0.271 |
| | Overweight + obesity | 303 | 12.1 ^b | |

Logistic regression.

^a p = 0.5436.

^b p = 0.0166.

enrolled.¹⁶⁻¹⁹ The families from the upper classes, seeking to ensure better learning and a place in higher education, often choose to enroll their children in private schools. Thus, presupposing the assessment of two different socioeconomic levels, data were obtained from students attending public and private schools. However, considering the recent socioeconomic changes in Brazil, the authors also decided to apply the CCEB (questionnaire) to verify whether social mobility had changed that assumption. For that purpose, a subsample of parents of students enrolled in these schools answered this questionnaire, which defines social class based on the purchasing power of the interviewees and the head of the household level of schooling.

It can be observed that although the students from the private schools still belong to higher classes, currently there is no longer such a large economic gap between the latter and those who study in public schools, regarding factors that may influence the age at menarche. A few decades ago (1978), a study that assessed sexual maturation of 3,368 girls (10-19 years) in Santo André, SP, Brazil, demonstrated that menarche occurred at 12.6 years.¹² When the girls were subdivided according to the mean monthly household per capita income, it was observed that those in the two lower socioeconomic levels had a later menarche (12.8 years), when compared with those in level 3 (12.4 years) and that those at higher levels had an even earlier menarche (12.2 years).

The social mobility recorded in the last decade, with the rise of the lower classes to an intermediate stratum,^{10,11} has led to the adoption of unhealthy habits by the population that moved from a lower to a higher social class.

Ingestion of a high-calorie diet of lower nutritional value (low in fiber and high in fat and sugar content), which was previously accessible only to the classes with greater purchasing power, has excessively increased the weight gain in part of the population vulnerable to malnutrition due to food scarcity.^{9,20} Unfortunately, that nutritional transition has occurred faster in Brazil than in other countries that are experiencing the same process, probably because dietary habits are influenced by sociocultural factors.⁶ The increase in the prevalence of overweight and obesity among the Chinese population (14.7% and 2.6%, respectively) is a matter of concern for the Chinese government, even though the incidence of overweight and obesity are well below those detected in the Brazilian population.²¹

It is known that excess weight results from an inappropriate association between energy gain and expenditure, so that the sedentary lifestyle also contributes to the increased prevalence of overweight and obesity.^{22,23} In Brazil, the Decree establishing guidelines and bases of education (No. 9,394/1996, amended in April 2013, No. 12,796) determines the mandatory presence of physical education in the school curriculum without, however, establishing the number of class-hours per week.²⁴

A recent study performed in the city of Recife, PE, Brazil, found that while 63.6% of regular public schools have only one class per week, most public schools of reference (88.5%) offer two classes a week, although experts recommend a minimum of three hours. Regarding extracurricular activities, it was observed that almost all reference schools (96%) organize sports tournaments, while only 7.7% of

regular schools do it. The authors believe that the lack of and the poor quality of facilities in public schools indicate the neglect of the government, and the social disregard in relation to the discipline of physical education.²⁵

The School Health National Survey (PeNSE), conducted in 2009 with students from the ninth grade of elementary education at public and private schools across the country, aimed to assess the exposure to risk factors (behavioral) that may compromise the health of these young individuals regarding the development of chronic diseases.²⁶ This research, which included, among other things, questions about diet, physical activity, and inactivity, showed that over half of adolescents did not practice physical activity, varying from 65.8% to 49%. Inactive students predominated in both private and public schools (54.9% and 57.4%, respectively).

Regarding gender, the study found that girls were more sedentary (68.7%) when compared to boys (43.8%). It also observed that consumption of sweets/snacks (50.9%) exceeded that of fruits and vegetables by nearly 20%. Eighty percent of students reported watching TV for two hours or more daily, which exceeds the maximum recommended by the WHO.

For years, the Brazilian government has implemented actions to improve the nutritional status of the population.²⁷ Accordingly, school lunches, initially offered only in schools in the Northeast Region to fight malnutrition, have gradually gained national coverage, and became a constitutional right during the late 1980s. Thus, all students attending public schools receive food at school, in order to ensure a minimum daily nutritional intake. In Campinas, SP, where the girls who participated in this study were evaluated, the menu of these meals has been prepared by dietitians/nutritionists since 2002 (PMAE 2013 - Municipal School Feeding Programme).²⁸

With the improvement of the socioeconomic status, many of the families with children enrolled in public schools no longer suffer from lack of food, and this becomes an extra meal, which may be contributing to the increasing prevalence of overweight in this population. Moreover, contributing to this picture is the fact that many students do not eat these meals, preferring a snack brought from home or purchased in the cafeteria itself, where in general, both in public and in private schools, unhealthy foods are sold, such as fried foods, processed snacks, candy, and soda. Considering this reality, the high prevalence of overweight observed in girls evaluated in this study can be understood.

Several authors have indicated that, for hormonal reasons, obesity anticipates the maturation of girls, leading to an earlier menarche.^{4,29} As excess weight currently affects both girls from the upper classes, as well as those from intermediate ones, it is not surprising that both are having menarche at the same age.

The distribution of the students according to the nutritional diagnosis in both groups showed that overweight girls from private schools have an earlier menarche than those in public schools, even with no difference in the prevalence of obesity among them. However, it is surprising that there was no difference in age at menarche between students with and without excess weight from public schools. It is likely that other factors known to influence menarche, not assessed in this study, such as sedentary lifestyle, number of children in the family, characteristics of housing, employment, and

characteristics of the city areas inhabited by these girls, may have influenced these results and thus, further studies are required to clarify these findings.³⁰

Thus, it is acknowledged that the present study had limitations for not assessing variables other than the type of school and nutritional status, as well as for failing to apply an adequate questionnaire to assess the sample socioeconomic profile, but rather which reported only access to consumption goods. However, there are no other studies that have addressed this issue after the drastic changes in the Brazilian socioeconomic scenario that occurred in the last decade. Thus, it is recommended that the subject continues to be investigated to better understand these results.

Funding

PUC-Campinas.

Conflicts of interest

The authors declare no conflicts of interest.

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