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Original article

Is menarche occuring earlier among Lebanese girls?

Un âge plus précoce de ménarche chez les filles libanaises : une réalité épidemiologique ?

L.W. Abdou [a], K.N. Daou [b,*], I.R. Bou-Orm [c,d], S.M. Adib [a]

[a] *Department of Epidemiology and Population Health, Faculty of Health Sciences, American University of Beirut, Beirut, Lebanon*
[b] *Department of Pediatrics and Adolescent Medicine, American University of Beirut Medical Center, Beirut, Lebanon*
[c] *Institute for Global Health and Development, Queen Margaret University, Edinburgh, United Kingdom*
[d] *Faculty of Medicine, Higher Institute of Public Health, Saint-Joseph University, Beirut, Lebanon*

A R T I C L E I N F O

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A B S T R A C T

Background. – Early menarche is associated with increased risks for several diseases such as cardiovascular diseases and breast cancer. This analysis aimed at generating evidence on a historical trend towards younger age at menarche among Lebanese girls.
Methods. – A secondary analysis was conducted on data consolidated from three serial cross-sectional national surveys of women in Lebanon (2007, 2009 and 2012). A total of 6150 women were included in order to study the association between date of birth intervals and age at menarche.
Results. – The mean age at menarche was 13.06 years, with a peak of the distribution at age 12. Women born before 1950 had a significantly higher mean age at menarche (13.21) compared to those born in 1970 and thereafter (12.95). A stratified analysis showed that women living outside the metropolitan Greater Beirut (GB) area were characterized by an older mean age at menarche (13.11) in all date of birth intervals compared to those in GB (12.89). However, age at menarche declined more significantly over the last two decades among women outside GB, compared to those living in GB.
Conclusions. – Epidemiological figures emerging from this study confirm that trends in Lebanon are in line with a global pattern of decreasing age at menarche. Urban-rural differences suggest that higher caloric content of diet and consequent early overweight, more evident in urban areas, are likely determinants of younger menarche. Evidence from this study calls for an urgent implementation of comprehensive multisectoral obesity prevention in children in Lebanon.

Mots clés :
Puberté
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R É S U M É

Objectif. – La ménarche précoce prédispose à plusieurs maladies, notamment le cancer du sein et les maladies cardiovasculaires. Cette étude visait à démontrer l'existence d'une tendance historique vers une ménarche précoce chez les filles libanaises.
Méthodes. – Une analyse secondaire a été menée sur des données consolidées de trois enquêtes nationales ciblant les femmes au Liban (2007, 2009 et 2012). Au total, 6150 femmes ont été incluses pour tester l'association entre la date de naissance et l'âge de survenue de la ménarche.
Résultats. – L'âge moyen à la ménarche était de 13,06 ans et le mode de la distribution à 12 ans. Les femmes nées avant 1950 avaient un âge moyen à la ménarche significativement plus élevé (13,21 ans) que celles nées après 1970 (12,95 ans). Une analyse stratifiée a démontré que, comparées aux femmes vivant dans la région métropolitaine du Grand Beyrouth (GB), les femmes vivant en dehors de cette région avaient un âge moyen plus élevé à la ménarche (13,11 ans), et ce à tous les intervalles de naissance étudiés (12,89 ans). Cependant, l'âge à la ménarche a diminué plus significativement au cours des deux dernières décennies chez les femmes hors du GB, par rapport à celles vivant dans le GB.

* Corresponding author: Department of Pediatrics and Adolescent Medicine, American University of Beirut Medical Center, Beirut, Lebanon.
E-mail address: karim.n.daou@gmail.com (K.N. Daou).

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Conclusions. – Cette étude confirme que la tendance au Liban est conforme à la tendance mondiale de la diminution de l'âge à la ménarche. Les différences entre zones urbaines et rurales suggèrent qu'une teneur élevée en calories du régime alimentaire et par conséquent un surpoids à un âge jeune surtout dans les zones urbaines sont des déterminants probables de cette tendance. Les résultats de cette étude appellent à la mise en œuvre d'une approche multidisciplinaire pour la prévention de l'obésité chez les enfants au Liban.

1. Introduction

Puberty is a physiological process initiated by the activation of the hypothalamic-pituitary-gonadal axis, leading to physical changes affecting the body size, shape and composition, the maturation of reproductive organs and the development of secondary sex characteristics [1]. Menarche is the first menstrual period, which accompanies sexual maturity and marks the transition for girls from childhood into adulthood. Menarcheal age is affected by heredity, ethnicity, and body size parameters such as the body mass index (BMI), given the role of fat tissues in initiating the whole process of puberty [2]. Early menarche has been associated with increased risk for several pathologies in later life. In particular, a UK cohort study of more than 16,000 women followed up from 1993 to 2007 has revealed a higher incidence of insulin resistance, hypertension, cardiovascular diseases and cancer mortality associated with earlier menarche [3]. Earlier age at menarche determines a higher risk for breast cancer through earlier initiation of breast tissue stimulation by estrogens. The association has been documented worldwide and in Lebanon [4]. This paper uses data from serial cross-sectional studies to generate evidence on a historical trend towards younger age at menarche among maturing girls in the Arab world.

2. Background

The global epidemic of overweight and obesity in children, indicated by increased BMI and waist circumference, has been linked to decreasing menarcheal ages, especially in countries in socio-economic transition. Menarche is triggered when a higher density threshold of the adipose tissue is reached, which signals the pituitary gland to start releasing puberty-inducing hormones [5]. It has been shown that girls with earlier documented age at menarche were significantly more overweight or obese [6]. In Saudi Arabia, a longitudinal study between 2006 and 2012 showed that Saudi girls had their menarche earlier than their mothers [7]. Differences in the economic situation of urban dwellers of Khartoum were found to be related to the onset age of menarche. Among 1372 Sudanese girls attending state schools within the capital city, representing three different socioeconomic groups, earlier ages were found in the most well-off girls (13.35 years), compared to 13.85 in the middle class and 14.06 in poorer girls [8].

Age at menarche in Scandinavian nations, Britain, Hungary and the USA has already witnessed a secular decline but has reached a stable range at around 13 ± 0.5 years [9–12]. In France, average age at menarche declined from 12.78 years in 1979 to 12.6 years in 1994 [13], followed by a stable level at 12.5 ± 0.08 years, for more than 15 years [14]. Among Chinese girls of eight rural and urban regions, breast and pubic hair development appeared earlier in those with a body mass index $\geq$ 85th percentile, compared to those with lower BMI [15]. In India, a secular trend among ever-married women showed that the age at menarche had declined by three months from 13.83 years (95% CI: 13.81–13.85) among women born prior to 1955–1964, to nearly 13.62 years (95% CI: 13.58–13.67) among women born during late 1985–1989 [16].

This study aimed to observe the historical trend in the occurrence of menarche across various birth cohorts in the past 50 years in Lebanon. Results can be used in stressing the need for preventive action on weight gain in children in this part of the world.

3. Methods

3.1. Subjects

This secondary analysis used previously collected data from serial national surveys initiated since 2003 to investigate the uptake of mammography screening in Lebanon. Those surveys targeted women aged ≥ 40 residing permanently in Lebanon. They were conducted at varying intervals under the umbrella of the Ministry of Public Health (MOPH). Three waves in 2007, 2009 and 2012 were available for analysis to determine the age at menarche in various birth cohorts of female participants, spanning a large portion of the twentieth century.

3.2. Procedures and data analysis

Methodological details regarding the surveys have been previously published [17,18]. The sample selection method is comparable in all three waves of surveys. The sample selection was performed using a "multi-stage random cluster" sampling procedure. In each of the five Lebanese administrative districts, two subdistricts were selected, in addition to the Greater Beirut (GB) area. GB area includes Beirut, the capital city and its north and south suburbs. In each subdistrict, communities were randomly selected from complete listings and blocks from numbered detailed maps. Successively, buildings were randomly selected in these blocks. One apartment was randomly selected in case building housed multiple apartments. One woman was selected to be interviewed per household randomly, whenever more than one adult woman was residing in a household at the time of selection. Selected woman was queried for her verbal consent to participate after receiving thorough explanation of the purpose of the study. Women refusing to participate were automatically excluded. The surveyors went up one floor above in case women were unavailable in household or they all refused to participate. To ensure that desired sample size in each district was obtained, surveyors randomly selected a new additional building when all woman in a building refused to participate, and no other floors were available. Participation rates and bias could not be assessed because of automatic replacement.

The survey questionnaires explored reproductive phases of development such as age at menarche, age at first pregnancy, number of pregnancies, and age at menopause. Data were merged across waves and participants divided in four birth cohorts: < 1950, 1950–1959, 1960–1969 and ≥ 1970. This consolidated population included 6150 women, whose age at menarche was subsequently studied. The association between the date of birth (DOB) intervals and the age at menarche was tested using a one-way ANOVA. The association was considered as statistically

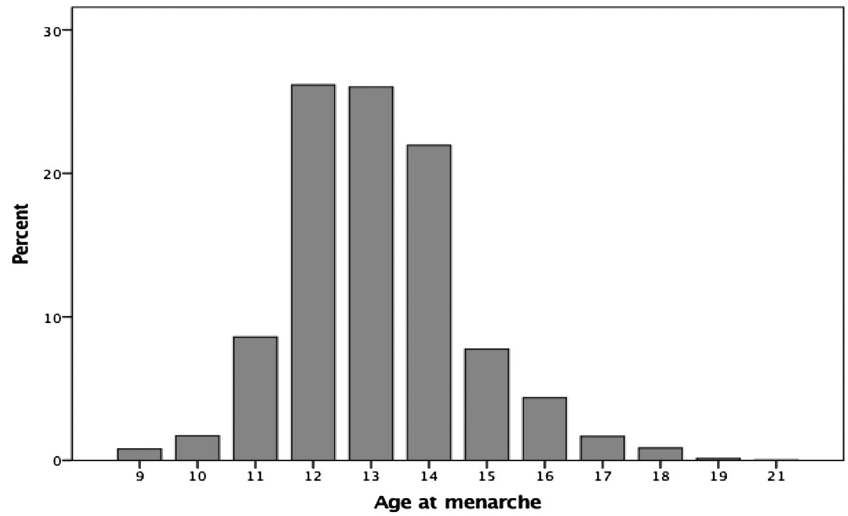

Fig. 1. Age at menarche among Lebanese women surveyed in 2007, 2009 and 2012 ($N = 6032$).

significant if it generated a P-value ≤ 0.05. The association was subsequently stratified by place of residence: GB versus the semi-urban to rural areas outside GB.

4. Results

Among the 6150 women included in three serial waves, 17.9% were born before 1950, 21.1% between 1950 and 1959, 33.5% between 1960 and 1969, and 27.4% born in 1970 or thereafter. The overall mean age at menarche across all four birth cohorts was 13.06 years ($\pm$ 1.542), with a peak of the distribution at age 12. Fig. 1 shows the distribution of age at menarche.

The breakdown of age at menarche for each birth cohort showed a significant decline with more recent DOB intervals (P-value for trend < 0.001). The mean age at menarche among those born before 1950 (13.21 years) was significantly higher than that of the age-cohort born since 1970 (12.95 years), i.e. 3.12 months of difference (Table 1).

The Table 2 shows that women usually living within the urban GB area were globally younger at menarche (12.89 ± 1.58) compared to those living outside GB (13.11 ± 1.53) ($P < 0.05$). The general decline in age at menarche across birth cohorts was found in both strata, but it was mostly significant in women outside GB going down from a mean of 13.29 years in women born before 1950 to 12.99 in those born since 1970 ($-$ 3.6 months). In contrast, the mean age at menarche among women born in the 1950s in the GB was 12.98 and slowly decreased to reach 12.78 years ($-$ 2.4 months) among those born since 1970.

5. Discussion

This analysis provided evidence that the mean age at menarche may have decreased significantly by at least 3 months since the 1950s. The mean age at menarche across four birth cohorts was 13.06 years, but declined significantly with more recent DOB. While age at menarche was younger in urban girls, its decline was slower than that found in rural girls.

To our knowledge, this is the first study to present evidence of historical decrease in the occurrence of menarche across various birth cohorts in the past 50 years in Lebanon. One strength of the study is the use of data from serial national surveys. Our findings therefore represent the Lebanese female population residing in both urban and rural areas. One limitation is the absence of variables like weight or BMI that would have allowed direct correlations between these factors and age of menarche. This is due to the fact that this analysis was not the first line of interest for which the surveys were initially conducted. Data mining is an important methodology to optimize the efficiency of large data sets as they become available for Public Health researchers.

Our findings are in line with those reported from other areas of the Arab region [7,8], and in other emerging economies [9,10]. Several authors have attributed the change in age at menarche to early increase in BMI in young girls, itself associated with increasing access to more caloric nutrition at younger ages. For example, Hesketh et al. showed that Chinese girls who were significantly heavier and taller than those of the same age were more likely to reach menarche at an earlier age. Differences between urban and rural areas were also found in that same study, indicating a significantly younger average age (12.8 years) in urban areas compared to rural ones (13.2 years) [15]. Our findings suggest that higher caloric food content may have accelerated

Table 1
Mean age at menarche and date of birth among Lebanese women ($N = 6032$).

Date of birth	n	Mean	SD	95% CI	P-value
< 1950	1066	13.21	1.643	13.11–3.31	< 0.001
1950–1959	1270	13.10	1.549	13.01–13.18	
1960–1969	2029	13.06	1.539	12.99–13.12	
≥ 1970	1667	12.95	1.464	12.88–13.02	
Total	6032	13.06	1.542	13.02–13.10	

Table 2
Mean age at menarche and date of birth among Lebanese women in the urban Greater Beirut (GB) area and rural/semi-rural areas outside GB area ($N = 6032$)[a].

	Date of birth	N	Mean	SD	95% CI	P-value[b]
Outside GB area	< 1950	805	13.29	1.639	13.17–13.40	< 0.001
	1950–1959	973	13.14	1.513	13.05–13.24	
	1960–1969	1631	13.10	1.512	13.03–13.17	
	≥ 1970	1388	12.99	1.481	12.91–13.07	
	Total	4797	13.11	1.528	13.06–13.15	
GB area	< 1950	261	12.98	1.636	12.78–13.18	0.470
	1950–1959	297	12.95	1.655	12.76–13.14	
	1960–1969	398	12.88	1.633	12.72–13.04	
	≥ 1970	279	12.78	1.362	12.62–12.94	
	Total	1235	12.89	1.582	12.81–12.98	

[a] The mean age at menarche differed significantly when comparing GBA to areas outside GBA.
[b] P-value for trend.

faster in rural areas in Lebanon, with the delayed introduction of processed and "junk" food items in the second half of the twentieth century, compared to the urban areas experiencing dietary excess at an earlier historical period.

Increases in the incidence of breast cancer have been documented in Lebanon since the 1960s, in parallel with changes in reproductive health behaviors, including the older age at first marriage and lower fertility rates [19]. The contribution of early age at menarche to the increased risk of breast cancer has been mentioned but never explored so far, despite indications of rising overweight rates in Lebanese children. Nasreddine et al. showed that the BMI among Lebanese girls aged between 6 to 9 years has increased from 16.51 ± 3.78 in 1997 to 17.52 ± 2.90 in 2009 [20].

6. Practical implications

This paper establishes for the first time in Lebanon the reality of decreasing age at menarche. Beyond drawing the epidemiologic trends for menarcheal age among Lebanese girls, this paper also sends out an urgent call for policy-makers in public health to implement interventions tackling childhood obesity, thus reducing its complex impact on future morbidity. Strict policies to address this global public health issue should be implemented especially at the level of food items available in food canteens and marketing of "junk-food" to children on prime-time TV slots [21]. Life-cohort longitudinal studies are required to establish specifically the existence of the association between early overweight and earlier menarche, and onwards to increased risks of breast cancer and other health conditions, at individual rather than group level.

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