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Family background and age at menarche among secondary schoolgirls in Nigeria

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Abstract:

BACKGROUND: Menarche signifies the onset of menstruation and is one of the milestones in women's lives.

AIM: The aim of the present study was to elucidate the influence of birth order, family size, parents' level of education, and body size parameters on age at menarche among samples of Nigerian secondary schoolgirls.

MATERIALS AND METHODS: A cross-sectional study of age at menarche of Nigerian secondary schoolgirls ($n = 600$) aged 11–18 years was done. The effect of birth order, family size, and parents' educational attainment on age at menarche was analyzed. Data pertaining to menarche and family background were collected using a self-administered structured questionnaire and analyzed using SPSS version 22.

RESULTS: Mean age at menarche was 13.54 ± 0.90 years. Father's level of education showed statistical significant effect on the mean age at menarche ($P < 0.05$), while mother's level of education did not show significant influence on the mean age at menarche ($P > 0.05$). The result showed that firstborn girls have earlier age at menarche (12.82 ± 0.68 years) than later-born girls (14.09 ± 0.58 years, $P < 0.01$). Again, girls born in small families of one child, reach maturity earlier (12.78 ± 0.57 years), than those born in families of four or more children (14.02 ± 0.68 years, $P < 0.01$). Linear regression model using birth order and family size was used to ascertain the mean age of menarche for the overall sample population.

CONCLUSION: The results suggest that birth order, family size, and parents' level of education have influence on age at menarche.

Keywords:

Adolescent girls, birth order, educational level, family size, menarche

Introduction

Age at menarche marks the beginning of women's reproductive years, and it occurs as a result of the interactions between genetic and environmental factors (Towne *et al.*, 2005; Wardle *et al.*, 2008; and Perry *et al.*, 2009). The mean age of onset of menarche is important because it sets the baseline for ascertaining precocious and delayed puberty, both of which could arise as a result of a pathology in the hypothalamic-pituitary-gonadal axis (Edward *et al.*, 2007). Precocious puberty had been defined as the onset of menarche before the age of 8 years, while delayed puberty was defined as the onset of menarche after 13 years of age (Dick *et al.*, 2001). However, it is now recognized that the transition from childhood to reproductive competency of adulthood occurs across a wide range of ages in normal, healthy adolescents (Palmert and Boepple, 2001).

Some studies provide evidence of ethnic differences at menarche (Al-Sahab *et al.*, 2010 and Talma *et al.*, 2013). For instance, girls in Northwest India experience

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menarche earlier (12.50 years) than girls in South India (12.90) in a study conducted between 1965 and 1985 to determine their mean menarcheal age. The same study reported a mean menarcheal age of girls from Somalia to be 13.10 years while that of Nigerian girls was 13.30 years (Eveleth and Tanner, 1990 and Torres-Mejía *et al.,* 2005). A cross-sectional study performed among Assamese and Bengali schoolgirls in India reported a mean age at menarche of 12.45 and 12.25 years, respectively (Deb, 2009). Two independent studies performed in the US, Bogalusa Heart Study, and the Third National Health and Nutrition Examination Survey demonstrated that the mean age at onset of menarche among African girls was lower than white girls (Wu *et al.* 2002).

Among the anthropometric dimensions that could influence age at menarche are weight, height, body mass index (BMI), and skinfold thickness. For instance, earlier studies have shown that early menarche (<12 years) was associated with higher BMI and subcutaneous fat levels at puberty (Freedman *et al.,* 2002; Goon *et al.,* 2010; and Kim *et al.* 2010). Moreover, a European study, recently, described how BMI and waist circumference were associated with age at menarche after identifying adiposity-related loci (Elks *et al.* 2010). Shorter stature and increased weight gain at puberty result in early age at menarche (Ahmed *et al.* 2009). A critical body weight and weight gain for the onset of menarche were proposed by Frisch and Revelle, (1970). Age at menarche is positively associated with waist circumference and negatively associated with hip and thigh circumference (Lassek and Gaulin, 2007). Anthropometric dimensions, genetic and environmental factors might be responsible for the difference in menarcheal age.

Studies carried out in the 20th century reported various factors that influenced age at menarche. These include place of residence at childhood and adolescent, physical activity, ethnicity, and socioeconomic status (Heidi, 1986). Others are order of birth and family size (Heidi, 1986; Cameron and Nadgdee, 1996; Sánchez-Andrés, 1997; and Apraiz, 1999). Firstborn girls and girls in small families experience menarche at a younger age than later-born girls and girls from larger families (Aryeetey *et al.* 2011). The various factors responsible for the onset of puberty and age at menarche are interrelated and cannot be attributed to a single factor.

Socioeconomic status graded in terms of parents' educational level has been associated with age at onset of menarche. According to several studies, menarche is earlier in girls whose parents are educated (Oduntan *et al.,* 1976; Uche and Okorafor, 1979; and Henneberg and Louw, 1995). On the other hand, findings by some authors (Demoulin, 1998; and Papadimitriou *et al.,*1999) did not indicate a significant influence of parents' educational level. In general, more studies agreed that age at onset of menarche is earlier among girls from high socioeconomic status than those from families of low socioeconomic status (Palmert and Boepple, 2001; Al-Sahab *et al.,* 2010; Talma *et al.,* 2013). Better nutrition, standard of living, and favorable environment among several other factors are responsible for the difference in age at menarche based on social status (Dick *et al.,* 2001; Torres-Mejía *et al.,* 2005). This influence is even more marked in developing countries like Nigeria where there is sharp division based on social class.

Although industrialized countries have been in the leading position of obesity epidemic, developing countries have recently shown striking trends in obesity (Popkin, 2009 and Finucane *et al.,* 2011). Leptin produced in adipose tissues regulates energy expenditure and produces a permissive effect on the onset of puberty (Grumbach, 2002 and Shalitin and Phillip, 2003). Leptin level has been found to be high in obese girls (Kaplowitz *et al.* 2001). The association between obesity and pubertal development may be a means to ensure that the presence of adequate amount of fat that will support both the mother and baby if pregnancy occurs (Kaplowitz, 2008). Age at menarche is considered a marker of endocrine-driven (hypothalamic-pituitary) pubertal development in girls.

The aim of the present study was to elucidate the influence of birth order, family size, parents' level of education, and body size parameters on the age at menarche among samples of Nigerian secondary schoolgirls.

Materials and Methods

Overview and study setting

The current cross-sectional study was done in Enugu and Kaduna States of Nigeria in 2014.

Study participants

Participants for the current study were randomly selected from secondary schoolgirls. There were three hundred girls from Enugu and another three hundred girls from Kaduna State. Eligible participants were between those who had had their menstrual cycle but not older than 18 years.

We assessed the relationships between socioeconomic status and age at menarche using data collected from 600 schoolgirls. The study was approved by the Health Research Ethics Committee, Ahmadu Bello University Teaching Hospital, Zaria, Nigeria and authorities of the participating schools. Only participants who gave their informed consent were enrolled for the study.

Questionnaires and data collection

We used questionnaires (self-administered) to collect information on age at menarche, ethnicity, birth order, family size, and parents' level of education. Age at menarche was based on participants' response to the question "Have you already had your menstrual periods?" Birth order was based on response to the question "What's your birth order?" birth order was categorized into (A) first born, (B) second born, (C) third born, and (D) later born. Information on family size was based on the response to the question "How many siblings do you have?" There were four options from which participants chose one: (A) 1, (B) 2, (C) 3, (D) ≥4 while parents' educational background was determined by asking subjects to select their parents' educational background from an encoded list from none to tertiary education for both parents.

Anthropometry of subjects

Following the completion of the questionnaire, anthropometrics including height and weight, for each subject, were measured following standard procedures by trained female research assistants who had shown test–retest reliability of $r \geq 0.90$. Height was measured using stadiometer to 0.1 cm and weight using mechanical weighing balance to 0.1 kg. BMI was calculated as weight (kg)/height^2 (m).

Statistical analysis

Descriptive results were expressed as a mean ± standard deviation for continuous variables, number, and percentages for noncontinuous variables. To investigate the influence of birth order, family size, and parents' level of education on age at menarche, analysis of variance (one-way and two-way) was used. Linear and multiple regression analyses using some of the social variables and age at menarche as dependent variable were computed to test the impact of birth order, parity, maternal as well as paternal level of education on age at menarche. In both regression analyses, age at menarche was often tested as a continuous explanatory variable.

A two-sided $P < 0.05$ was used to determine statistical significance. All analyses were done using SPSS version 22 (SPSS IBM Corporation, Chicago, IL, USA).

Results

The 600 participants were divided into four groups according to birth order, parity, father, and mother level of education. Participants were categorized as being first, second, third, and fourth or later born. For parity, participants were categorized as either singletons, if they are the only child or classed as having one, two, and three or more siblings.

Table 1 summarizes the influence of birth order, parity, and parents' level of education on body size parameters, namely, weight, height, and BMI. From the table, weight and BMI decreased significantly with increase in birth order and parity ($P < 0.01$). Stature showed insignificant difference with birth order and parity ($P > 0.05$). Results from the same table revealed that mothers of most of the girls had secondary education (53.0%) followed by tertiary education (23.0%). Mothers of 17.5% of the schoolgirls had no form of formal education. With regard to father's level of education, 56.7% had tertiary education whereas 0.5% had primary education, 33.2% had secondary education. Of the three parameters considered, only BMI showed insignificant difference to the maternal level of education.

Table 2 is the results of the univariate and factorial ANOVA. In the first step, univariate analysis was conducted to investigate the influence of birth order, parity, and parents' level of education on age at menarche. Results from the table revealed that age at menarche is influenced by birth order ($F = 57.81$, $P < 0.001$), parity ($F = 49.34$, $P < 0.001$), and paternal level of education ($F = 2.81$, $P = 0.039$). Maternal level of education did not indicate a significant influence on the mean age at menarche ($F = 2.24$, $P = 0.082$). In the second step, a two-way ANOVA was done with birth order and parity as the independent explanatory variables. Paternal and maternal levels of education were considered as the independent explanatory variables for the second two-way ANOVA. In both cases, age at menarche was the dependent explanatory variable. Age at menarche associated significantly with birth order ($F = 7.72$, $P < 0.001$) even after interacting with parity ($P < 0.001$). No significant association was observed between parity and age at menarche ($F = 0.78$, $P = 0.504$). The result in Table 2 also showed that the maternal and paternal levels of education did not show significant association with age at menarche ($P > 0.05$).

In the last step of the analysis, menarcheal age was used as a continuous variable. As is seen in Table 3, birth order and parity are significantly positively associated with menarcheal age while father's level of education and mother's level of education showed negative significant association with menarcheal age. The results also showed that weight and BMI were significantly associated with menarcheal age.

Discussion

Age at menarche is an important indicator of female sexual maturation. The present cross-sectional study investigated the influence of sociodemographics particularly, birth order, parity, and parents' level of education on menarcheal age of contemporary secondary schoolgirls in Nigeria. Birth order, as in several previous studies, has the highest significant influence on mean

Table 1: Sample means and standard deviations of weight, height, and body mass index of Nigerian schoolgirls according to sociodemographic characteristics

	n (%)	Mean±SD		
		Weight (kg)	Height (cm)	BMI (kgm^{-2})
Birth order				
1st	113 (18.80)	50.13±4.36[a]	154.16±5.18	21.14±2.01[a]
2nd	132 (22.00)	49.06±3.96[a,b]	155.05±5.64	20.53±1.96[b]
3rd	186 (31.10)	48.87±3.18[b]	154.99±5.54	20.40±2.33[a,b]
4th or later born	168 (28.00)	48.35±3.72[b]	155.27±5.37	20.12±2.02[b]
F		5.00*	1.00, NS	5.37*
Parity				
Singletons	91 (15.20)	50.45±4.59[a]	154.30±5.04	21.24±2.10[a]
One sibling	146 (24.30)	48.97±3.11[b]	154.60±5.65	20.54±1.88[b]
Two siblings	187 (31.20)	48.85±3.90[b]	154.74±5.58	20.51±2.29[b]
Three or more siblings	176 (29.30)	48.48±3.79[b]	155.70±5.28	20.07±2.07[b]
F		5.56*	1.84, NS	6.23*
Maternal education				
None	105 (17.50)	47.67±2.68[a]	154.04±5.34	20.16±1.84
Primary	39 (6.50)	49.87±3.96[b]	155.92±5.87	20.61±2.44
Secondary	318 (53.00)	49.04±3.71[a,b]	154.61±5.29	20.58±2.00
Tertiary	138 (23.00)	49.76±4.58[b]	156.03±5.58	20.53±2.50
F		6.86*	3.67*	1.07, NS
Paternal education				
None	58 (9.70)	47.41±2.33	153.50±5.33	20.19±1.70
Primary	3 (0.50)	48.67±5.86	155.67±5.51	20.24±3.73
Secondary	199 (33.20)	48.70±2.94	154.35±5.37	20.50±1.74
Tertiary	340 (56.70)	49.49±4.39	155.49±5.45	20.55±2.38
F		5.64*	3.36*	0.48*

*P<0.01, means with different superscripts are significantly different at P<0.05. NS - Not significant, SD - Standard deviation, BMI - Body mass index

Table 2: Mean menarcheal age of schoolgirls by birth order, parity, and parents' level of education one-way and two-way analysis of variance

	n (%)	Mean±SD	Age at menarche (mean±SD)	*F* (df)	*P*	*P*-value trend
Birth order						
1st	113 (18.80)	12.82±0.68[a]	12.60±0.16[a]	7.72 (3, 592)	<0.001	-
2nd	132 (22.00)	13.45±0.92[b]	13.38±0.18[b]			
3rd	186 (31.10)	13.56±0.92[b]	13.59±0.18[b]			
≥4th	168 (28.00)	14.09±0.58[c]	14.00±0.15[c]			<0.001
F, P	57.81, <0.001					
Parity						
Singletons	91 (15.20)	12.78±0.57[a]	13.33±0.19	0.78 (3, 592)	0.504	-
One sibling	146 (24.30)	13.40±0.94[b]	13.55±0.17			
Two siblings	187 (31.20)	13.58±0.90[b]	13.43±0.18			
Three or more siblings	176 (29.30)	14.02±0.68[c]	13.57±0.14			
F, P	49.34, <0.001					
Maternal education						
None	105 (17.50)	13.70±0.81	13.59±0.16	0.30 (3, 593)	<0.770	-
Primary	39 (6.50)	13.51±0.76	13.50±0.20			
Secondary	318 (53.00)	13.56±0.90	13.54±0.15			
Tertiary	138 (23.00)	13.41±1.00	13.45±0.17			0.148
F, P	2.24, 0.082					
Paternal education						
None	58 (9.70)	13.78±0.84	13.70±0.16	0.94 (3, 593)	0.423	-
Primary	3 (0.50)	13.33±0.58	13.29±0.52			
Secondary	199 (33.20)	13.62±0.81	13.60±0.08			
Tertiary	340 (56.70)	13.46±0.96	13.48±0.07			
F, P	2.81, 0.039					

Means with different superscripts were significantly different at P<0.05. SD - Standard deviation

Table 3: Multiple regression analyses of sample

Predictor	Dependent variable: Menarcheal age				95% CI
	B	β	*P*	SE of *B*	
Step 1					
Birth order*	0.39	0.46	<0.001	0.03	0.33-0.45
Parity	0.38	0.44	<0.001	0.09	0.32-0.44
Father level of education	−0.11	−0.11	0.006	0.04	−0.19-−0.03
Mother level of education	−0.09	−0.10	0.017	0.04	−0.16-−0.02
Weight	−0.08	−0.33	<0.001	0.01	−0.10-−0.06
BMI	−0.09	−0.22	<0.001	0.02	−0.12-−0.06
Step 2					
Birth order**	0.38	0.46	<0.001	0.03	0.32-0.44
Father level of education	−0.09	−0.09	0.011	0.04	−0.16-−0.02

*Coded 1 - First born, 2 - Second born, 3 - Third born, 4 - Fourth or later born; **Coded 1 - None, 2 - Primary, 3 - Secondary, 4 - Tertiary education. BMI - Body mass index, SE - Standard error, CI - Confidence interval

age at menarche (Padez and Rocha, 2003; Reddy and Radhika, 2003; and Aryeetey *et al.,* 2011) followed by parity. As regards parents' level of education, maternal level of education has the least effect.

In the first step, a univariate ANOVA was used to verify the influence of these sociodemographic factors on age at menarche and the result showed that birth order, parity, and paternal educational attainment have significant effect on age at menarche among these contemporary schoolgirls, with age at menarche lower among first births, girls from small family size, and those whose father had tertiary education. However, in the subsequent factorial ANOVA, only birth order showed significant influence on age at menarche. The result showed no evidence that the chance of reaching menarche decreases with increase in maternal level of education. It is worth mentioning that unexpectedly, girls whose father had primary education reached menarche earlier than those whose father had tertiary education. Group size may be responsible for this variance.

The present findings that maternal educational attainment has no significant effect in age at menarche are consistent with the report of (Padez and Rocha, 2003; Aryeetey *et al.,* 2011). Contrary to our results on paternal educational attainment, these two studies also reported that paternal level of education has no significant effect on age at menarche.

Socioeconomic status is measured in terms of level of education and occupation. Differences in menarcheal age due to these sociodemographics may be due to socioeconomic status of the family. First birth and girls from small family size are more likely to have access to better nutrition, hygiene, sanitation, and improved health status (Kaplowitz, 2008; Rogers *et al.,* 2010; Sunuwar *et al.,* 2010) and general well-being. Therefore, birth order or parity in itself is not responsible for the early age at menarche observed; rather it is the consequence of the birth order and parity on the socioeconomic status of the family that leads to the early age at menarche.

The wide gap between the rich and the poor in Nigeria may be responsible for the significant influence of birth order, parity, and paternal level of education observed in the present study. Maternal educational attainment has no significant effect on age at menarche perhaps because women are more concerned about the social well-being of the child than women. Nutritional status, and not social status is more responsible for growth and early onset of menarche. Girls from well-fed family experience accelerated growth and hence early onset of menarche unlike their counterparts from poor families.

As regards weight, BMI, and stature, a significant decrease in weight and BMI was observed with increase in birth order and parity. Interestingly, there was no significant difference in menarcheal age due to the differences in stature. This indicates that weight gain is crucial in determining the age at menarche than stature. The inverse relationship between weight, BMI, and age at menarche suggests nutritional influence. This is in agreement with the report of Karapanou and Papamitriou (2010). Frisch and Revelle (1970 and 1971) had proposed a certain weight gain for the onset of menarche. Parents' level of education showed significant influence on weight, height, and BMI. Maternal level of education did not indicate a significant influence on BMI. These body size parameters showed a gradual increase with an increase in parents' level of education. The use of postmenarcheal weight, height, and BMI made it difficult to differentiate the influence of cause and consequence of these variables (height, weight, and BMI) on age at menarche.

Conclusion

Our results indicate that age at onset of menarche increases significantly with increase in birth order, family size, and father's level of education. Maternal level of education did not indicate a significant association with age at onset of menarche. Regarding parents' educational level, we cannot unequivocally say if each parent's roles in the family explain the association observed although it seems mothers are more concerned about the social well-being of children while fathers about family's standard of living.

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Conflicts of interest
There are no conflicts of interest.

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