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Menarcheal Age and Nutritional Status of Secondary School Adolescent Girls in Nnewi, South-East Nigeria

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Abstract

Background: Menarche is an important indicator of pubertal development in adolescent girl. Age at menarche has declined over the years attributable to many factors. Objective: To determine the age at menarche of secondary school adolescent girls and its relationship with anthropometric values, nutritional status, social class of parents, and category of school. **Subjects and Methods:** Cross-sectional study of 311 secondary school adolescent girls (10 - 19 years) from two secondary schools (boarding school- Maria Regina secondary school Nnewi and Anglican Girls Secondary School Nnewi-day school) in Nnewi North LGA of Anambra State, Southeastern Nigeria, between May and June 2018. Semi-structured questionnaires were used to extract their data on sociodemographic characteristics and age at menarche. Height and weight were measured using WHO recommended methods. Body mass index (BMI) was determined using the Quetelet index (kg/m^2). The relationship between menarche and anthropometric measurement was determined. **Results:** Of the 313 participants, 212 (68.2%) were post menarcheal, while 99 (31.8%) were pre-menarcheal. The mean age at menarche was 12.79 ± 1.20 years. Early menarcheal age was associated with significantly higher anthropometric values and BMI. Boarding-students had significantly lower menarcheal age (12.69 ± 1.26) compared to the day students (12.86 ± 1.15); students with parents of the high social class had lower menarcheal age (12.56 ± 1.51), compared to those with parents of low social class (12.90 ± 1.05). **Conclusion:** There was a significant relationship between age at menarche and the nutritional status of the participants. Students with parents of high social class and those in boarding houses had a relatively lower age at menarche. Adequate attention should be given to the nutrition of premenarcheal school girls and those of parents with low social class. Boarding school authorities should ensure measures to alleviate stress amongst boarding-school students.

Keywords

Adolescent, Nutritional Status, Menarche

1. Introduction

Menarche, the first menstrual period is a landmark indicator of puberty, and the age at which girls attain menarche has shown variation across the globe [1]. The average age at menarche has been on the decrease, and this is attributed to several factors such as nutritional status, genetic, environmental conditions, socioeconomic status, and education [2]. Notable among the above factors is the nutritional status. Girls with poor nutritional status have been shown to have delayed menarche compared to those that have good nutritional status [3]. The amount of body fat needed for menses to occur is about 17% of the total body weight at menarche [4]. It is believed that girls with good nutrition tend to achieve this minimum percentage of body fat, and hence, earlier menarcheal age.

The age of menarche varies globally. For instance, the age at menarche in England is 13.1 years while that in the Burundi tribe in Papua New Guinea is 18.8 years [5]. In Indonesia, menarcheal age is 13 years [6]. Carnelo *et al.*, in a systematic review, reported age at menarche in a USA population to be 12 years [7]. In Nigeria, the average age at menarche varies from one geopolitical zone to another [8]-[13]. For example, In Port Harcourt, the average age at menarche has been reported by Okagua *et al.* to be 12.45 ± 1.24 yrs [8], while in Benin City it is 12.3 yrs [10]. However, Tunau*et al.* [12] reported a higher age at menarche of 15.26 yrs among school girls in Sokoto, Nigeria.

Nutrition plays a vital role in several aspects of the development of women—during the adolescence, pre-pregnancy, pregnancy, and postpartum period, and has constituted a major policy thrust in several nations of the world, including Nigeria [14] [15] [16] [17]. Nutritional concern has also constituted the basis for several studies related to macro- and micro-nutrients and the need for their supplementation especially in pregnant women [18] [19] [20].

Reports have shown that girls who have higher BMI are likely to attain menarche earlier than their premenarcheal peers, indicating the relationship between nutritional status and menarche [11] [13] [21]. This study has been undertaken to determine the relationship between menarcheal age and anthropometric indices among secondary school adolescent girls in Nnewi, Southeastern Nigeria. It also elicits the relationship if any between the age at menarche and the social class of the parents of the students together with the pattern of their schooling system *i.e.* whether boarding or day students.

2. Subjects and Methods

This was a cross-sectional study, conducted among 311 secondary school ado-

lescent girls (10 - 19 years) from two secondary schools (one boarding school and one day school) in Nnewi North LGA of Anambra State of south-eastern Nigeria between May and June 2018. Nnewi North LGA is one of the 21 local government areas of Anambra state. It is located in the southern senatorial zone of Anambra State, and comprises Nnewi urban town and the adjoin Ichi rural community. The city spans over 2789 km square [22] and is mainly inhabited by traders with few civil servants and artisans.

Sample Size and Sampling Technique:

The sample size will be determined as per standard method recommended by the WHO Expert Committee (1995) [23] for studies involving nutritional status. The sample will be calculated using a power calculation (Cole 1997) [24].

$$n = \left[Z^2 P(100-P)\right] / X^2$$

where, Z = z value (example 1.96 for 95% confidence interval), P = percentage adolescent girls assumed having poor nutritional status. P will be taken to be 23% since the National Demographic and Health Survey 2013 showed that 23% of adolescent girls were undernourished, 100-P = Percentage of adolescent girls assumed to have good nutritional status. X = Width of the Confidence interval or required precision level is taken to be 5%.

$$\begin{aligned} n &= \left[Z^2 P(100-P)\right] / X^2 \\ &= \left[1.96^2 \times 23(100-23)\right] / 5^2 \\ &= (3.842 \times 23 \times 77) / 25 \\ &= 6804.18 / 25 \\ &= 272.16 \end{aligned}$$

Add 10% of the number to take care of drop out = 28

272 plus 28 = 300

Three hundred adolescent girls were recruited for the study. One fifty (150 participants) from a Day school and the other from a Boarding school. List of schools from the study area was obtained from the Anambra State Ministry of Education. A multistage stratified random sampling technique was employed. The schools were stratified into boarding and day schools, following which one school was selected from each category. Permission for the study was obtained from both the Education Ministry and from the authorities of the participating schools. Ethical approval was obtained from the ethics committee of Nnamdi Azikiwe University Teaching Hospital (NAUTH/CS/66/VOL.10/226/2017/140) and appropriate participatory consent was elicited and obtained from the participants (assent), and in some cases, together with their parents. A pre-validated questionnaire designed by the researchers (containing 13 stems with some subdivisions) was used to elicit information with respect to the socio-demographic characteristics of the students, parents' occupation/educational qualification, age at menarche, duration of flow, associated dysmenorrhoea, height, weight and nutritional status (see the attached). Students with chronic illnesses were ex-

cluded from the study. The height of the participants was measured using a stadiometer with a sliding headpiece while their weight was measured using a portable weighing scale (Scale 2000, Portable Physician's Scale). The BMI, which measured the nutritional status, was calculated as weight in kilogramme (kg) divided by the squared height in meters (m^2). BMI value below 18.5 kg/m^2 indicates undernutrition; between 18.5 and 24.9 kg/m^2 indicates normal nutrition; between 25.0 - 29.9 kg/m^2 indicates over nutrition; and from 30.0 to 34.9 kg/m^2 indicates obesity [25]. Data analysis was performed using SPSS software version 23 (IBM Corporation, Atlanta, GA, USA). Descriptive statistics were determined where applicable such as the mean menarcheal age and mean nutrient intake as well as inferential statistics like the f-test. P-values of less than 0.05 at 95% confidence interval, was statistically significant.

3. Results

Of the 311 students studied, 212 (68.7%) had attained menarche, while 99 (31.83%) had not.

The distribution by age at menarche for frequency and mean menarcheal age is shown in Table 1. Majority of the participants 177 (56.91%) came within the menarcheal age range of 12 - 14 years with mean menarcheal age of 12.90 ± 0.78, followed by those of 10 and 11 years menarcheal age with mean of 10.65 ± 0.64, 23 (7.39%); and those of 15 - 17 menarcheal age with mean of 15.33 ± 0.65 - 12 (3.85%). The difference between the mean menarcheal ages was statistically significant (p = 0.000).

Table 2 shows the distribution by age at menarche for anthropometric measurements and BMI. The earliest age at menarche was 9 years, and the latest was 17 years. Anthropometric measurements (height and weight) and BMI were significantly higher in the postmenarcheal participants compared to their premenarcheal counterparts (P < 0.001). Anthropometric Measurements and BMI also decreased with increasing age at menarche.

The distribution by nutritional status (range of BMI) for mean menarcheal age as shown in Table 3 indicates that mean menarcheal age was highest (13.10 ± 1.18) for underweight (BMI ≤ 18.5 $kg/m^{2)}$; lower (12.76 ± 1.19) for normal (BMI 18.5 - 24.9 kg/m^2), reducing further to 12.70 ± 1.26 for overweight (BMI 25.0 - 29.9 kg/m^2); and lowest (12.25 ± 1.25) for obese (BMI 30.0 - 34.9 kg/m^2).

Table 1. Distribution by age at menarche for frequency and mean menarcheal.

Ages at Menarche	Frequency (%)	Menarche Mean ± Std	Minimum	Maximum	f-value	p-value
10-11	23 (7.39)	10.65 ± 0.64	10.00	11.00		
12-14	177 (56.91)	12.90 ± 0.78	12.00	14.00	159.465	0.000
15-17	12 (3.85)	15.33 ± 0.65	15.00	17.00		
Overall mean age at menarche	212 (68.17)	12.79 ± 1.20	9.00	17.00		

Table 2. Distribution by age at menarche for anthropometric measurements and BMI.

Age At Menarche	Freq (%)	HEIGHT Mean ± Std (M)	Min	Max	f-value	p-value
NOT YET	99 (31.83)	1.53 ± 0.08	1.30	1.96		
9 - 11 (Yrs)	23 (7.39)	1.61 ± 0.07	1.50	1.76		
12 - 14 (Yrs)	177 (56.91)	1.60 ± 0.07	1.44	1.87	20.062	0.000
15 - 17 (Yrs)	12 (3.86)	1.57 ± 0.05	1.50	1.67		
Total	311 (100)	1.58 ± 0.08	1.30	1.96		
Age At Menarche	**Freq (%)**	**WEIGHT Mean ± Std (Kg)**	**Min**	**Max**	**f-value**	**p-value**
NOT YET	99 (31.83)	42.51 ± 6.84	29.00	60.00		
9 - 11	23 (7.39)	57.45 ± 9.87	40.00	80.00		
12 - 14	177 (56.91)	56.16 ± 8.44	36.00	79.00	63.011	0.000
15 - 17	12 (3.86)	53.00 ± 10.83	42.00	77.00		
Total	311 (100)	51.79 ± 10.35	29.00	80.00		
Age At Menarche	**Freq (%)**	**BMI Mean ± Std (kg/H^2)**	**Min**	**Max**	**f-value**	**p-value**
NOT YET	99 (31.83)	18.49 ± 2.78	11.90	26.70		
9 - 11	23 (7.39)	22.06 ± 3.41	16.70	32.50		
12 - 14	177 (56.91)	21.85 ± 3.14	16.00	37.00	26.532	0.000
15 - 17	12 (3.86)	21.19 ± 4.00	16.70	29.00		
Total	311 (100)	20.77 ± 3.45	11.90	37.00		

Table 3. Distribution by nutritional status (range of BMI) for mean menarcheal age.

BMI Classification	Freq (%)	Menarche Mean ± Std (Yrs)	Min	Max	f-value	p-value
Underweight (18.5 (kg/m^2)	30 (9.64)	13.10 ± 1.18	11.00	15.00		
Normal (18.5 - 24.9 kg/m^2)	151 (48.55)	12.76 ± 1.19	9.00	17.00		
Overweight (25.0 - 29.9 kg/m^2)	27 (8.68)	12.70 ± 1.26	10.00	16.00	0.990	0.399
Obesity (30.0 - 34.9 kg/m^2)	4 (1.29)	12.25 ± 1.25	11.00	14.00		
Total	212 (68.17)	12.79 ± 1.20	9.00	17.00		

Table 4 shows the distribution by the social class of the parents for age at menarche. Although age at menarche increased with reducing social class of 12.56 ± 1.51; 12.76 ± 1.21; and 12.90 ± 1.05 for high class, middle class, and low class respectively, the difference was not statistically significant ($p = 0.283$).

The Distribution by category of students (boarding vs. day) for mean menarcheal age as shown in Table 5 indicates that mean menarcheal age was significantly higher for the day students (12.86 ± 1.15) compared to the boarding students (12.69 ± 1.26) ($p < 0.001$).

Table 4. Distribution by the social class of the parents for age at menarche.

Social Class	Freq (%)	Menarche (Mean ± Std) (Yrs)	Minimum	Maximum	f-value	p-value
High Class	41 (13.18)	12.56 ± 1.51	9.00	16.00		
Middle Class	63 (20.26)	12.76 ± 1.21	11.00	17.00	1.270	0.283
Low Class	108 (34.73)	12.90 ± 1.05	10.00	16.00		
Total	211 (68.16)	12.79 ± 1.20	9.00	17.00		

Table 5. Distribution by category of students (boarding vs day) for mean menarcheal age.

category of students	Freq (%)	Menarche (Mean ± Std) (Yrs)	Minimum	Maximum	t-value	p-value
Boarding school	89 (28.62)	12.69 ± 1.26	9.00	16.00		
Day school	123 (39.55)	12.86 ± 1.15	10.00	17.00	5.270	0.000
Total	212 (68.17)	12.79 ± 1.20	9.00	17.00		

4. Discussion

The mean menarcheal age of the students in this study is 12.79 ± 1.20 years. This is similar to menarcheal ages of 13.43 and 12.3 ± 1.18 years reported respectively by Okagua *et al.* [8] in Port-Harcourt and Osemwenkha *et al.* [9] in Benin City both in south-southern Nigeria. Similar observation has also been reported for different parts of Nigeria [10] [11] and also by Gumanga *et al.* [21] (12.50 ± 1.28) in Accra Ghana and Chumlea *et al.* (12.06 - 12.16 yrs) in USA [26]. The menarcheal age observed in this study is however lower than 15.26 years reported by Tunau *et al.* [12] from Sokoto, Northwestern Nigeria. It is similarly lower than 15 years reported by Umeora *et al.* [27] from Abakiliki, Southeastern Nigeria the same area as the present study. This apparent disparity in menarcheal age observed from studies carried out among the women from the same ethnic group as exemplified in our present study, and Umeora *et al.*'s study is not clear, however, it is pertinent to note that Umeora *et al.*'s study was conducted 12 years ago amongst rural women of reproductive age between 15 and 49 years many of whom may not accurately recall their ages at menarche, in contradiction to the present study which has been conducted only recently, and amongst adolescent girls (10 - 19 years) with a higher likelihood of a more accurate recollection of their age at menarche.

The mean weight at menarche of the adolescents in this study, 51.79 ± 10.35 kg, compares favorably with the mean weight of 53.85 ± 8.32 kg reported by Okagua *et al.* [8] in port-Harcourt amongst their adolescents, with menarcheal age similar to the observation in this study 12.45 ± 1.24 and 12.79 ± 1.20 years respectively. In contradiction however to the report from Tunau *et al.* [12] in Sokoto, Nigeria, the mean weight of the adolescents was 48.12 ± 85 kg with mean menarcheal age of 15.26 years. This observation implies that lower menarcheal ages are associated with higher weights, thereby assigning a nutritional

role to age at menarche [10]. This study shows that post-menarcheal girls were taller, and weighed more than the pre-menarcheal girls and this is similar to reports from previous studies [28] [29] [30].

Increasing BMI was also associated with lowering the menarcheal age, and this also agrees with reports from various studies [27] [28] [31]. BMI is a measure of nutritional status. The pre-menarcheal girls in this study have lower BMI (18.49 ± 2.78 kg/m^2) bothering on underweight compared to the postmenarcheal girls with BMI of 21.7 ± 3.78 kg/m^2 which fall within normal weight limits. The place of nutritional status as a determinant of menarcheal age therefore becomes readily evident from this observation.

In this study, although no statistically significant difference occurred for menarcheal age for the various social classes, adolescents with parents of high social class had lower mean age at menarche of 12.56 ± 1.5 compared to those of middle and low social class with mean menarcheal age of 12.76 ± 1.2 and 12.90 ± 1.9 respectively. A Polish study conducted during the Soviet Union era had similarly reported a linkage between high social status and early menarche and low socioeconomic class and late menarche [29]. Adolescents with parents of high social class are more likely to be of better nutritional status than those with parents of low social class. In contrast to the above observation, however, Braithwaite *et al.* [32] had reported that white girls of high social class were protected from early menarche while black girls, irrespective of their social class were not. This suggests that other factors such as race, stress, and environment may be playing a role in the age at menarche.

This study shows that the age at menarche was lower in the boarding-school girls than that of the day-school students. In Nigeria, being a boarding-school student is more expensive to the parents or guardian than being a day student-this indirectly points at the social class of the parents. The disparity in menarcheal age between the boarding and day students may therefore not be unrelated to the likelihood of boarding-school girls being of parents of high social class compared to the day-students whose parents are likely to be of lower social class. In addition, the likelihood of more stress usually experienced by the boarding-school students compared to the day students may constitute a trigger to earlier menarche amongst them [33].

This study has some limitations. The sample size was small and also a school-based study. The finding of this study may not be appropriate for generalization as out-of-school adolescent girls were not included in the study. A more encompassing study involving all the segments of adolescent girls vis-à-vis in-school and out-of-school girls is recommended.

5. Conclusion

This study shows that the mean age at menarche amongst the adolescent secondary school girls was 12.79 ± 1.2 years. There was a significant relationship between age at menarche and the nutritional status of the participants. Students

with parents of high social class and those in boarding houses had a relatively lower age at menarche. Adequate attention should be given to the nutrition of premenarcheal school girls and those of parents with low social class. Boarding school authorities should ensure measures to alleviate stress amongst boarding-school students.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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