

# Age or menarche and associated anthropometric changes in secondary school girls in Northern Nigeria

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## ABSTRACT

*This study was undertaken to determine the age of menarche and analyse some anthropometric factors that influence the onset of menarche among secondary school girls in the North-Eastern sub-region of Nigeria.*

*This is a cross-sectional study in which female students from six secondary schools were randomly selected. These consisted of 242 non-menstruating girls and 415 menstruating girls. Their ages range between 9 and 21 years. The ages and anthropometric data of the two groups were analysed.*

*The mean menarcheal age of 13.6 (SD 0.3) was evaluated for the post-menarcheal girls and a significant menarcheal delay was observed. The weight of girls not menstruating by the age 15 years was lower than those of girls who were already menstruating by the age of 12 years (43.36. vs 43,75 kilograms). The mean weight of the menstruating girls was  $49.6 \pm 0.4$  (SD) kilograms. The mean height of menstruating girls was found to be  $152.7 \pm 1.32$  (SD) centimeters, which is greater than that of non-menstruating girls for all ages with the exception of age 16 years. And the mean percentage body fat of menstruating girls was greater than those who had no evidence of menarche.*

*Menarche is seen to be delayed by about 1 year in Maiduguri girls compared to their colleagues in other parts of Nigeria. The menarcheal age is also influenced by the height, weight and percentage body fat of the girls.*

## INTRODUCTION

The first menstrual period, the menarche, is a notable experience in the life of the developing girls. It is an important event not only to the individual but to the

society at large. It marks the onset of reproductive capability to the individual while to the society it expresses the rate of sexual maturation of a specific generation which is important for demographic planning<sup>1-5</sup>.

The onset of menarche is regarded as the culmination of the transitional stage in a girl's development<sup>4-7</sup>. It is a single event in the total process of linking the zone of immaturity of childhood with the maturity of adulthood<sup>7-8</sup>. The onset may be modified by heredity, nutrition or environment<sup>2-6;8-13</sup>.

The objective of the study was to determine the age of menarche, and analyse some factors governing the onset of menarche in the Northeastern part of Nigeria. Particular emphasis was laid upon factors like height, weight and percentage body fat of the girls.

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## MATERIALS AND METHODS

This prospective study was conducted over a 12 month period, January to December 1996 in Department of Anatomy and Obstetrics and Gynaecology, University of Maiduguri, Maiduguri. Maiduguri is the capital of Borno state, located in the North-Eastern corner of Nigeria, incorporating a segment of Lake Chad with a bearing of Latitude 11.53 N Longitude 13.16 E<sup>13</sup>.

It is hot and dry for the greater part of the year, temperature reaching as high as 46°C and relative humidity as low as 18%; with an annual rainfall of 348.5 mm over the months of May to September. It has a population of 700,000; 45.8% being females<sup>14</sup>.

The predominant occupations are (a) farming (b) herding livestock and (c) fishing – occupations that lead to long exposure to the inclement weather.

The vegetation comprises Sudan savannah characterized by scrub vegetation interspersed with few tall trees. The diet of the indigenous population consist of mainly millet, guinea corn, wheat, rice and maize.

A total of 657 young girls selected randomly from six secondary schools in Maidurugi Metropolis were included in the study. This comprised girls between the ages of 9 and 21 years. Two hundred and forty-two (36.8%) of the girls had never experienced menarche, while 415 (63.2%) had menstruated at most three times at the time of the interview.

The questionnaires/data forms were designed to obtain data on age of menarche, menstrual awareness and profession of parents. The height were measured using a meter scale, and the units expressed in centimeters. Weights were obtained in kilograms using ordinary weighting scale which was corrected to zero. The girls were weighed only in their school uniform consisting of light cotton material, and any other form of additional dressing were removed. The weight of 50 uniforms was separately taken for each school and the mean value was subtracted from overall weight to give the actual weight of the girls. Anthropometric techniques were applied in estimation of body mass and skin fold prediction equation to determine body density (percentage body fat), as described by Harrison et al, 1998<sup>8</sup>. Ross plastic skin fold calipers were used with scale precision of 2 mm and measurement scale of 40mm<sup>8</sup>. The results were then expressed in tables. The chi-square was used for statistical analysis with the limit of significance set at  $P < 0.05$ .

## RESULTS

The mean age of 242 non-menstruating girls was 12.6 years ( $\pm 0.42$  SD). The range of ages was between 9 and 16 years. While the mean age of 15.2 years (SD  $\pm 0.39$ ) was for the menstruating girls with a range between 12 and 21 years. A significant statistically difference ( $P < 0.001$ ) was observed.

Tabel 1 shows that none of the girls had attained menarche by the age of 11 years, while all girls at 17 years of age and above were post-menarcheal. Approximately 2.3% of the girls in the study were late starters as they were non-menstruating at 16 years. The mean age of onset of menarche for the post menarcheal girls was 13.6 ( $\pm 0.3$  SD) years with majority attaining menarche between the ages of 13 and 14 years. Table 2 shows a gradual and steady fall in the age of menarche in Nigerian secondary school girls over the last 4 decades.

The weight difference is shown in table 3. The mean weight of the non-menstruating girls was 49.6 ( $\pm 0.4$  SD) kg ( $P < 0.001$ ). Interestingly the non-menstrual weight at 15 years was lower than the menstrual weight at 12 years (43.3 vs 43.8kg). And age for age there was a steady incremental difference in the weight between menarcheal and non-menarcheal girls at 12,13,14,15 and 16 years of age respectively. The weight of non-menarcheal girls progressively increases with age while weight of menarcheal girls appears to virtually stop increasing by the age of 17 years.

The mean height of the non-menstruating girls was found to be 152.7  $\pm$  1.32 (SD) centimeters, while that of menstruating girls was 159.9  $\pm$  0.3 (SD) centimeters, ( $P < 0.001$ ), Table 4. Amongst the non-menstruating girls there was a progressive increase in height with age, which was not noticed amongst the menstruating girls. Mean height of menstruating girls was found to be greater that that of non-menatruating girls for all ages with the exception of age 16, which was accounted for by the late starters' (about 3 girls).

Table 5 represents the percentage body fat (% BF). The mean percentage body fat (% Bf) for non-menstruating girls was 19.9  $\pm$  0.5 (SD) while that of menstruating girls was 25.4  $\pm$  0.3 (SD),  $P < 0.001$ . The mean percentage body fat was found to be greater in menstruating girls than that of the non-menstruating girls at all ages studied ( $P < 0.003$ ).

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**TABLE 1**  
Menstrual status of 615 girls in this study

Age in Years	No of Girls and % of Total	No of Girls Menstruating and % in Parenthesis
9	2 (.3)	0 (-)
10	11 (1.7)	0 (-)
11	26 (4.0)	0 (-)
12	40 (6.1)	2 (5)
13	98 (14.9)	19 (19.4)
14	136 (20.7)	82 (60.3)
15	181 (27.5)	152 (84.0)
16	128 (19.5)	125 (97.7)
17	25 (3.8)	25 (100)
18	8 (1.2)	8 (100)
21	2 (0.3)	2 (100)

**TABLE 2**  
Previous studies of menarcheal age in Nigerian girls

Author	Year	Characteristics of The Population Studied	No. of Subjects	Mean Age at Menarche
I Ellis	1950	Lagos School Girls Mainly Igbos and Yoruba	a) 300	±SD 14.22 ± 1.0
II Wilson & Sutherland	1951	a) "PAGANA" from Plateau b) Northern Nigerian School Girls	a) 74 b) 172	14.5 ± 1.24 14.1 ± 0.41
III Tanner & O'Keefe	1962	Igbo School Girls in Eastern Nigeria	344	14.10 ± 0.16
IV Akingba	1968	County Wide Postal Survey of Nigerian School Girls	1728	13.95 ± 1.19
V Emmanuel	1975	Nurses in a Lagos Hospital	102	14.5
VI Oduntan, Ayeni & Kale	1976	a) Urban School Girls in Ibadan b) Rural School Girls at Igbo-ora Ibarapa District	a) 2029 b) 328	13.7 ± 0.03 14.5 ± 0.09
VII Olatunbosun & Alade	1977	Nurses in a Teaching Hospital School of Nursing	202	14.05 ± 1.34
VIII Sogbamu & Aregbesola	1979	The School Girls	105	13.85
IX A.O. Marinho & I.M. Marinho	1979	Ibadan School Girls	360	13.8 ± 1.00
X H. Goyea	1982	Benin City School Girls High & Low Income Groups	148	12.3 13.0
XI Present Study	1996	Maiduguri School Girls a) High Socio Economic Group b) Low Socio Economic Group	415 170 245	13.6 ± 0.3 13.29 ± 0.1 13.73 ± 0.4

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**TABLE 3**

Mean weight of the girls for different age groups (n = 657)

Age	Non Menstruating (n = 242)		Menstruating (n = 415)	
	No. and % of 242	Mean Weight in (Kg)	No. and % of 415	Mean Weight in (Kg)
9	2 (0.8)	27.8	–	–
10	11 (4.5)	31.6	–	–
11	26 (10.7)	34.1	–	–
12	38 (15.7)	36.5	2 (0.5)	43.8
13	79 (32.6)	40.9	19 (4.6)	47.4
14	54 (22.3)	42.7	82 (19.8)	48.7
15	29 (12.0)	43.4	152 (36.6)	49.3
16	3 (1.2)	50.0	125 (30.1)	50.1
17	–	–	25 (6.0)	53.3
18	–	–	8 (1.9)	52.8
21	–	–	2 (0.5)	51.5
TOTAL	242 (38.2)	39.4	415 (63.2)	49.6

**TABLE 4**

Mean height of the girls for each age group

Age	Non Menstruating Girls (n = 242)		Menstruating Girls (n = 415)	
	No. and % of 242	Mean Height in Cm	No. of Cases & % of 415	Mean Height in Cm
9	2 (0.8)	143.5	–	–
10	11 (4.5)	143.2	–	–
11	26 (10.7)	145.1	–	–
12	38 (15.7)	147.8	2 (0.5)	155.0
13	79 (32.6)	154.2	19 (4.6)	159.9
14	54 (22.3)	156.9	82 (19.8)	159.2
15	29 (12.0)	157.3	152 (36.6)	159.8
16	3 (1.2)	163.7	125 (30.1)	160.2
17	–	–	25 (6.0)	162.1
18	–	–	8 (1.9)	157.4
21	–	–	2 (0.5)	156.5
TOTAL	242 (38.2)	–	415 (63.2)	–

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**TABLE 5**  
Mean percentage body fat of girls for each age group

Age	Non Menstruating Girls (n = 242)		Menstruating Girls (n = 415)	
	No. and % of 242	Mean of BF	No. and % of 415	Mean % BF
9	2 (0.8)	15.04	–	–
10	11 (4.5)	16.06	–	–
11	26 (10.7)	18.03	–	–
12	38 (15.7)	18.44	2 (0.5)	24.35
13	79 (32.6)	19.98	19 (4.6)	23.98
14	54 (22.3)	21.09	82 (19.8)	23.79
15	29 (12.0)	22.53	152 (36.6)	25.32
16	3 (1.2)	22.59	125 (30.1)	26.37
17	–	–	25 (6.0)	25.84
18	–	–	8 (1.9)	30.03
21	–	–	2 (0.5)	27.9
TOTAL	242	–	415	–

## DISCUSSION

The mean age at menarche in this study,  $13.6 \pm 0.3$  (SD) years, is slightly less than those earlier reported by Ellis 1950<sup>3</sup>, Akingba 1980<sup>1</sup>, Emmanuel 1975<sup>4</sup>, Fakeye 1984<sup>5</sup>, in Nigeria, ranging between 13.7 and 14.50 years. However, significantly lower mean ages at menarche have been reported in urban girls, smaller family size and improved socio-economic condition<sup>2,7,11</sup>.

In the present study 84% of the 15 year olds were post menarcheal and all girls of 17 years and above were post-menarcheal while a similar study conducted by Marinho and Marinho<sup>10</sup> in Ibadan showed that more than 90 percent of the 15 year-olds were post-menarcheal and all girls of 16 years and above were post-menarcheal. Other reports indicate that there was little or no change in the mean age at menarche in West Africa<sup>11,12,13</sup>.

This study showed a delay of about a year compared to that of Marinho and Marinho in 1979<sup>10</sup>.

It is noteworthy in our study that premenarcheal mean weight at 15 years was found to be lower than postmenarcheal mean weight at 12 years. This gives credence to the suggestion that an optimal body

weight must be attained before menarche could occur. According to Frisch and Revelle<sup>6</sup> a mean body weight of 48 kilogram corresponded to a “critical metabolic weight” which acted as a “trigger” for menarche. In the present study critical body weight for menarcheal onset was evaluated to be 45.15kg. This value compares well with that of Marinho and Marinho<sup>10</sup>.

The critical height was evaluated to be 157.9cm. This also tends to support the suggestion that a correct height does exist for menarche to commence. Previous reports quoted various values such as 152.5cm<sup>10</sup> and 156.8<sup>13</sup>. These differences could be attributed to variation in geographic climatic distribution of menarcheal age of onset<sup>2-12</sup>, and was confirmed by the results of this study. Possibly as a result of increasing oestrogen levels derived from peripheral conversion of androgens, and the amplitude of gonadotrophin – releasing hormone discharges is increased<sup>9</sup>. The critical body fat needed to stimulate menarcheal onset was found to be  $25.4 \pm 0.3$  (SD).

In conclusion the age of onset of menarche has fallen over the last four decades probably as a result of improved socio-economic status of families. It was also observed that a balance is struck between reproductive hormones and an optimal body weight, height and body fat before menarche ensues.

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