

Age of Pubertal Maturation of Girls in South Western Nigeria

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Abstract

Background: Secondary sexual characteristics appear at puberty with rapid physical, emotional, and cognitive developments. In girls, thelarche is usually the first sign of puberty, followed by the growth of pubic hair. In Nigeria, unlike many developed countries, there are few studies on puberty. **Aim:** This study aims to document the age of attainment of all the Tanner stages of sexual maturation, the sequence of these events, and the age of attainment of menarche among female secondary school students in Abeokuta. **Subjects and Methods:** This was a descriptive cross-sectional study carried out among girls with an age range between 10 and 20 years of schooling in Abeokuta, South-West Nigeria. Multistage randomly selected participants answered questions on the pro forma. Physical examination including pubertal staging was done. The data were analyzed using Microsoft Excel[®] 2010 and SPSS 22.0. **Results:** Seven hundred and eleven subjects were recruited. The mean age of the subjects was 14.4 ± 1.9 years. The earliest sign of puberty among the subjects, B2, was seen at a mean age of 12.4 ± 1.5 years, followed by the onset of pubic hair development, and PH 2 at a mean age of 13.4 ± 1.7 years. The mean age of attainment of menarche was 13.1 ± 1.7 years, while the age for completion of pubic hair development is 16.2 ± 1.6 years. Out of 499 subjects who had attained menarche, 324 (64.9%) were in Stage 4 of breast development and 307 (61.5%) were in Stage 3 of pubic hair development. **Conclusion:** The age of onset and completion of pubertal maturation in this study is 12.4 ± 1.5 years and 16.2 ± 1.6 years, respectively. Thelarche as the first sign of puberty is followed by pubic hair development.

Keywords: Girls, Nigeria, puberty, South-Western

INTRODUCTION

During puberty, secondary sexual characteristics appear, a skeletal growth spurt occurs and the capacity for fertility is realized.^[1] This is a period of rapid physical, emotional and cognitive growth and development.^[2] All of these are stimulated by the activation of the hypothalamic-pituitary-gonadal axis.^[1] Thelarche, the elevation of the breast and increase in the diameter of the areola, is usually the first sign of puberty in girls which is followed by further development of the breast and growth of pubic hair.^[3] Other changes include growth of axillary hair, accentuated body contour, accelerated linear growth, and physiologic and anatomic maturation of the uterus and vagina.^[1] Menarche, a major event in puberty for girls, is easily remembered during a girl's transition to full reproductive capacity.^[4,5]

These changes were classified by Tanner into the five stages of sexual maturity rating (SMR) including breast and pubic hair development in girls.^[6] The age of attainment of each of these stages is well-documented mostly in developed countries but

such studies are few in Nigeria. The available studies reviewed from South-West Nigeria did not include all the stages of sexual maturation. They all studied the mean age at menarche without including the mean age when breast and pubic hair development occur.^[7-9] A study done among secondary school girls by Abiola-Kuteyi *et al.* showed a mean menarcheal age of 13.94 ± 1.34 years which was strongly and positively associated with nutritional status. It was further observed that girls from higher socioeconomic classes attained menarche by 11 months earlier than those from lower socioeconomic classes.^[7] On the other hand, Raji *et al.* obtained the mean age at menarche to be 13.66 ± 1.82 years among female

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undergraduate students in Ogbomoso, South west Nigeria, and observed a significant linear relationship ($P = 0.004$) between body weight and age at menarche. An insignificant indirect relationship was seen between body surface area, height, and age at menarche.^[8] Adefuye *et al.* evaluated the menarche and critical age hypothesis among girls in Sagamu, Southwest Nigeria. They obtained a critical mean weight of 45.9 ± 0.9 kg and a mean age of menarche at 13.65 ± 1.26 years.^[9]

This study is designed to document the age of attainment of all the stages of sexual maturation and the age of attainment of menarche among female secondary school students in Abeokuta.

SUBJECTS AND METHODS

Subjects are drawn from apparently healthy female adolescents aged 10-20 years attending secondary school in Abeokuta, Ogun state, Southwest Nigeria.^[10] The estimated population of Abeokuta was 888,924, of which adolescents constitute 23% (204,452).^[11] The following information was obtained about the two local government areas in Abeokuta.

- i. Total number of secondary school students – 61,602
- ii. Total number of female secondary school students – 31,217.

The sample size was calculated with a power of 80% and a 99% confidence interval.

Subjects with suspected or known chronic illnesses and those on long-term medications were excluded.

Subjects were selected by a multistage sampling technique.

Following written parental consent and the subject's verbal assent, the participants were recruited from selected secondary schools. Sociodemographic information and ethnic group as well as the father's occupation and educational qualification of the mother were recorded to determine the socioeconomic status as recommended by Olusanya.^[12] The family size, birth order, and date of first menstruation for those who have attained menarche were recorded in a pro forma. Physical examination of the subjects was done behind a screen to provide privacy.

The sexual maturity of each subject was assessed using Tanner's SMR^[6] The sexual maturity was thereafter documented in the proforma.

Approval was obtained from the Hospital Research Ethics Committee and other relevant stakeholders.

The data was analysed using Microsoft Excel[®] 2010 and IBM Statistical Package (SPSS) software version 22.0 (Statistical Package for Social Sciences Inc Illinois, USA).

RESULTS

Seven hundred and eleven subjects were recruited. The mean age of the subjects was 14.4 ± 1.9 years. The distribution of the subjects by age group is shown in Table 1. More than half of the total subjects were mid-adolescents.

Table 1: Distribution of the subjects by age group

Variables	Frequency (n=711), n (%)
Age groups (years)	
10-13 (early adolescent)	276 (38.8)
14-16 (mid adolescent)	380 (53.5)
17-20 (late adolescent)	55 (7.7)

Table 2: Distribution of the subjects by age and various stages of sexual maturation

	Frequency (n=711)	Mean age \pm SD
Breast stage		
B1	22	12.0 \pm 1.1
B2	61	12.4 \pm 1.5
B3	157	13.3 \pm 1.5
B4	346	14.9 \pm 1.6
B5	125	15.7 \pm 1.4
Pubic hair		
PH 1	41	12.0 \pm 1.2
PH 2	211	13.4 \pm 1.7
PH 3	351	14.9 \pm 1.6
PH 4	91	15.5 \pm 1.3
PH 5	17	16.2 \pm 1.6

SD: Standard deviation

Table 2 shows the mean age of attainment of each of these stages of pubertal development. As illustrated, the earliest stage of puberty among the subjects, B2, was seen at a mean age of 12.4 ± 1.5 years followed by the onset of pubic hair development, PH 2 at a mean age of 13.4 ± 1.7 years. This observation continued with the corresponding pubic hair development following breast development until the last stage PH 5 is attained at age 16.2 ± 1.6 years. The duration from onset to completion of breast development was 3.4 years compared with 2.7 years for pubic hair development.

Figure 1 describes the mean ages of pubertal events in the subjects. It shows that both breast and pubic hair development progressed with the increasing age of the subjects until full maturity.

Figure 2 shows that 499 (70.2%) of the subjects had attained menarche. The mean age of attainment of menarche was 13.1 ± 1.7 years.

As shown in Figure 3, out of 499 subjects who had attained menarche, 324 (64.9%) were in Stage 4 of breast development and 307 (61.5%) were in Stage 3 of pubic hair development.

DISCUSSION

This study has shown that the first sign of puberty in the subjects is breast development at a mean age of 12.4 ± 1.5 years. The first sign of puberty is the same in the study conducted by Tanner and Marshal,^[6] Fakeye and Fagbule^[13] and Biro *et al.*^[14] but Nwokocha and Okoro^[15] working among Igbo girls documented pubic hair development as the first sign of puberty.

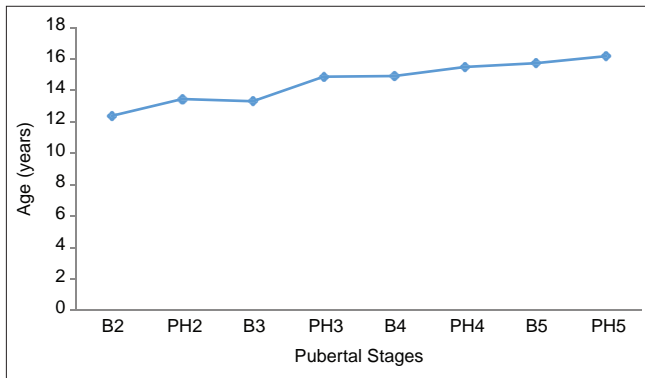


Figure 1: The mean ages of pubertal events in subjects

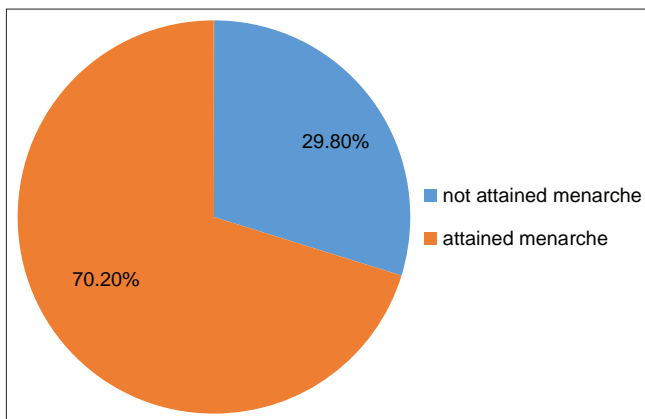


Figure 2: Menstruation status of the subjects

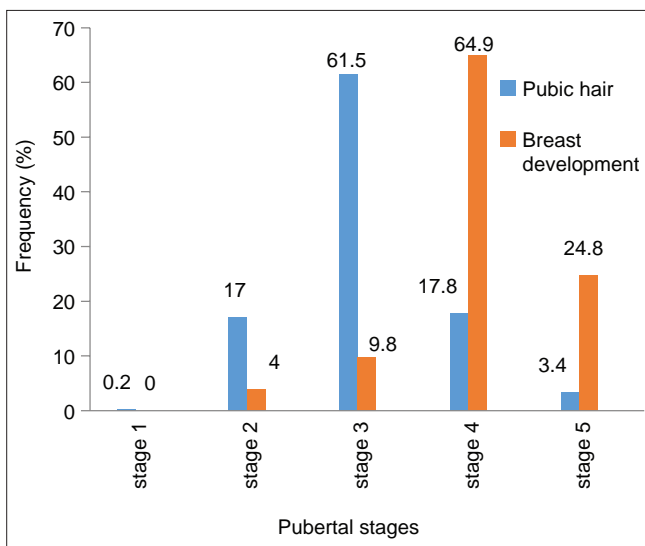


Figure 3: Proportion of the subjects at menarche in various current stages of sexual maturation

Both pubic hair and breast development are initiated by androstenedione secreted by the adrenal gland. The expression of this hormone is dependent on the genetic constitution which is a function of the ethnicity of the individual.^[6]

The age of onset of breast development is slightly lower than in the study by Fakeye and Fagbule^[13] who reported a mean

age of 12.7 ± 1.0 years in 1990. It is however much higher than the figure of 10.9 ± 1.8 years obtained in Enugu in 1997.^[15] The results of the three studies have come from different parts of Nigeria where the tribal and therefore genetic constitution, environment, diet, level of pollution, and socioeconomic class are different and might be responsible for this noted age difference.

This study also shows that the onset of puberty occurs later than in South Africa^[16] (9.8 years) and Tanzania^[17] (11.5 years). It is noted that unlike this study which is cross-sectional, these two were longitudinal studies. This design of the study (longitudinal) enabled early identification of girls as they commenced puberty.

Outside the continent, Biro *et al.*^[14] documented seven years as the age of onset of breast development in the United States of America (USA), 10 years in Greece^[18], and 9.9 years in Copenhagen.^[19] Reasons adduced for the earlier age of puberty in these developed countries' studies compared to the present study are enrolment of younger age as low as six years and possible exposure to other environmental factors such as endocrine disruptor chemicals (e.g., phthalates and polychlorinated biphenyls) which may result in early age at onset of puberty.^[20] Children in developed countries take high fatty food and are also obese or overweight which may be associated with early puberty reported in them.^[21]

The age of completion of breast development in this study was 15.7 ± 1.4 years which is the same age obtained in Enugu by Nwokocha and Okoro^[15] but higher than 14.7 ± 1.4 years obtained by Fakeye and Fagbule^[13] in Ilorin.

In this study, the onset of pubic hair development occurred at a mean age of 13.4 ± 1.7 years while for completion is 16.2 ± 1.6 years. The equivalent figures for Fakeye and Fagbule^[13] are 12.8 ± 0.9 years and 14.4 ± 1.4 years; for Nwokocha and Okoro,^[15] 10.4 ± 1.8 years and 15.5 ± 1.5 years respectively. Outside the Country, Tanner and Marshal^[6] reported 11.7 ± 1.1 years and 14.4 ± 1.4 years while in Tanzania^[17] and South Africa,^[16] pubarche was documented to have commenced at 12.0 years and 10.8 years, respectively.

The mean age of menarche in this study was 13.1 ± 1.5 years with most of them in Stage 3 of pubarche and Stage 4 of thelarche. This figure is lower than the results obtained by Fakeye and Fagbule^[13] (14.0 years); Nwokocha and Okoro^[15] (13.2 ± 1.3 years); Abiola-Kuteyi *et al.*^[7] (13.9 years); and Raji *et al.*^[8] (13.7 years). Goon *et al.*,^[22] however, obtained a lower mean menarcheal age of 13.0 ± 3.0 years.

Studies done outside the country showed that girls attained menarche at an earlier age when compared with this study; Sachan *et al.*^[23] in India, 12.8 ± 1.4 years; Abdelmoty in Egypt,^[24] 12.5 ± 1.2 years; Huang *et al.*^[25] in the USA, 12.7 ± 1.2 years.

CONCLUSION

The age of onset of pubertal maturation in this study is 12.4 ± 1.5 years. Thelarche is the first sign of puberty which is followed

by pubic hair development. The age of menarche is lower than in previous Nigerian studies. A longitudinal study among various groups of apparently healthy children in Nigeria will provide a comprehensive data base of pubertal development in the country.

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Conflicts of interest

There are no conflicts of interest.

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