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Research article

Age at menarche, menstrual characteristics, and its associated morbidities among secondary school students in Abakaliki, southeast Nigeria

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ABSTRACT

Background: Menstruation has a variable pattern. Knowledge of age at menarche and providing accurate information to adolescent girls is necessary to allay anxiety, treat menstrual morbidities, and improve their quality of life.
Objective: To determine the age at menarche and menstrual characteristics of adolescent secondary school girls in Abakaliki.
Materials and methods: A cross-sectional descriptive study was conducted in seven secondary schools in Abakaliki among 960 female students. A total of 450 girls were randomly selected for the study. A pretested self-administered questionnaire was used in data collection. Four hundred questionnaires were properly filled and used for the final analysis.
Results: The age range of the students was between 10 - 21years. The mean age of the respondents was 16.2 ± 1.7 years. The average age at menarche was 13 ± 1.0 years. Urban dwellers had menarche 0.2years earlier than rural dwellers. There is an association between menarche and social class ($X [2]$ 372.9 (2), p = 0.001). About 87.75% of the respondents had an average cycle length. Most (88.3%) of the respondents had a menstrual flow duration of 3–5 days. Dysmenorrhoea was present in 82% of respondents and was severe enough to cause absence from school in 56.5% of students. Oligomenorrhea and menorrhagia occurred in 8.5 % and 6.25 % of the student studied. Mothers (80.0%), friends (75.0%) and teachers (74.5%) accounted for the bulk of the information on menstrual health.
Conclusion: The average age at menarche was 13 ± 1.0 years. Dysmenorrhea is a major cause of morbidity amongst this age group and should be empathically addressed. It is therefore important that the students, their parents, and school managers in the study area be educated on the issues of menstrual problems that can occur in an adolescent.

1. Introduction

Menarche is a significant event that marks the onset of sexual and reproductive maturation in girls [1, 2]. It is the last in the series of events involved in the process of normal pubertal development [2]. The mean age at menarche varies from population to population and reflects various characteristics of the population such as nutritional status, geographic location, environmental condition, and socioeconomic status of the society [1, 3, 4]. For most females, menarche usually occurs between the ages of eight and fourteen years [1, 5, 6, 7, 8, 9, 10, 11]. In

Nigeria, various studies have reported a decreasing trend of the menarcheal age which is attributed to an increase in the social, health, nutritional, and economic wellbeing of the Nigerian society. The mean menarcheal age of 15 years was reported by Umeora et al. in the study area which is higher although comparable with 13.7years in Sokoto, 13.9 years in River state, 13.4 years in Edo state, 13.6 years in Maiduguri, 13.08 ± 1.61 years in Ile-Ife and 14 years in Ibadan [12, 13]. There is a general trend of declining age at menarche especially in developed countries [1, 3, 5]. The rate of decline in the age of menarche is about 2–3 months per decade in developed countries and 6 months per decade in

developing countries [6, 14]. This finding has been attributed to an increase in a population standard of living [2, 3, 4, 5, 7, 8]. Improvement in the standard of living is associated with good nutrition with increasing fat stores, improvement in health status, and psychological factors that are implicated in the activation of the hypothalamic-pituitary-ovarian axis for initiation of menarche. These factors are associated with an increase in body fat stores and therefore the Leptin level that triggers menstruation [15].

Disturbances of menstruation which include dysmenorrhea, irregular menses, premenstrual syndrome, and excessive menstrual bleeding are the commonest complaints among young school girls [8]. Of these problems, dysmenorrhea is the commonest and most debilitating complaint amongst adolescent girls [16]. Dysmenorrhea disrupts the educational and social life of young girls [8, 9], and accounts for 28–48% of reasons for absenting from school and perceived quality of life losses [8, 10, 17, 18, 19].

Early age of menarche has been linked to several adverse effects during childhood such as eating disorders, depression, type 2 diabetes mellitus, metabolic syndrome, breast cancer, cardiovascular diseases, and overall mortality [4, 14]. Establishing the age of menarche is also critical for patient education and may guide the clinical evaluation of such patients to identify deviation from normal [4]. The last study on this topic in Abakaliki was nine years ago that reported a mean age of menarche of 15 years which was a community-based study with a study population ranging from less than 19 years to above 50 years. This study sampled women of different age strata majority of whom had attained menarche several years before the studies were conducted. The quoted age might therefore not be representative of the actual age at menarche as at the time of the study. Sampling the older population will likely increase the chances of recollection bias and the higher level of illiteracy in the study area is a confounding factor as some might not be able to say the actual age. The present study was therefore conducted to determine the current age of menarche in Abakaliki and also to ascertain if there has being a decline in the mean age of menarche in Abakaliki from the previous study. This might be expected with changes in the socio-economic wellbeing of the people over time. It will also help to identify menstrual patterns and their associated disorders as well as the main sources of knowledge about menstrual health matters among our adolescent population in Abakaliki. The acquisition of this knowledge will assist in advocacy among the health managers on the problems of our girl child and the need for intervention. It will also help to generate the necessary seminars and workshops needed to educate the students, their parents, and school managers on the issues of menstrual problems facing the students. This will help to improve their overall quality of life [11, 14, 20, 21, 22, 23, 24].

2. Materials and methods

2.1. Study area

This cross-sectional study was carried out in Abakaliki, Ebonyi State. Ebonyi State is one of the states in the southeast geopolitical zone of Nigeria and was created in 1996 from the old Enugu state. It has a total landmass of 5,533km^2 and a population of about 2, 176, 947 million according to the 2006 Nigeria census. It has 13 local governments, one urban, one semi-urban, and other rural. Abakaliki is the urban local government in the state [25]. It is inhabited and populated primarily by the Igbos with the city of Abakaliki as its capital and largest city. Ebonyi is primarily an agricultural region.

Abakaliki urban has a total of 20 secondary schools, 12 of them are government-owned while 8 are privately owned institutions. The total student population is in the range of 30,000–40,000. Each secondary school has an average student's population of 1600 with an average male to female ratio of 3:2. Each school has classes from junior secondary 1, 2 & 3 to senior secondary 1,2 & 3 with each class subdivided into A to E. The students come from all parts of the state and a minority from neighboring states of Enugu, Abia, and Imo which are Igbo speaking areas of Nigeria.

2.2. Study population

The study population was secondary school students in Abakaliki which was recruited between March and June 2015. The participating schools were grouped into government-owned schools and private-owned schools. It was coded and numbered. A ballot method of simple random sampling was used to select four (4) secondary schools from the government-owned school and three (3) secondary schools from private owned schools. Twenty pieces of white cardboard paper (name of schools written) were added in a black polythene bag following which seven (7) cards were drawn with replacement. These seven (7) schools formed the schools for the study. An average of sixty (60) students was selected from each participating school and an average of ten students were selected from each class level of the participating schools using ballot method of simple random sampling technique with replacement. The social class of the respondent was determined based on the social class of their mothers based on the work of Olusanya et al. [26] The social class of their students were determined using the educational level of their mother (primary/no formal education, secondary and tertiary) and the occupation of their father (professional, skilled and unskilled) according to the work of Olusanya et al. [26] In this system, a score of 1, 2 and 3 is given to the primary, secondary and tertiary level of education respectively. For the father's occupation, a score of 0, 1, and 2 is given respectively to the professional, skilled, and unskilled occupation. The respondent's social class was obtained by the summation of the individual score of their parent. The social class was categorized into 1, 2, 3, 4, and 5. The social was reclassified as follows: upper social class – social class 1 and 2, middle social class – social class 3 and lower social class – social class 3 and 4. Selected students took the questionnaire in their classrooms under the supervision of members of the research team.

2.3. Sample size

The minimum sample size (N) was calculated using the formula

$$N = Z^2pq/e^2$$

where

Z = standard deviation at 1.96, a constant (which corresponds to a 95% confidence interval).

p = 0.5 which the probability of the event occurring

q = 1-p = 0.5 which is the probability of the event not occurring

e = the desired level of precision also known as sampling error: 5% = 0.05

$N = (1.96)^2 \times 0.5 \times 0.5/(0.05)^2 = 384.16$

An attrition rate of 10% was added to the sample size hence the final sample size was 384.16 + 38.41 = 422.6 approximately 423 and was increased to 450, which formed the final sample size.

2.4. Data collection

Data collection was done using a self-administered pre-tested questionnaire that was adapted from previous studies [1, 2, 3, 11, 12]. Pre-testing was done among 50 students selected at random from a school not included in the final study population. Information obtained includes socio-demographic characteristics of the respondents such as age, marital status, educational level of the mother, father's occupation, ethnic group, and place of residence. The height and weight of the study population were obtained using a weighing scale and a stadiometer. Questions relating to menstruation included age at first menses, menstrual pattern, pre-menstrual symptoms, the impact of the menstrual disorder on school attendance, source of menarcheal information, and need for medical intervention during menstruation.

2.5. Data analysis

Out of 450 students that responded to the questionnaire, only 400 had experienced menarche by the time of this study. The data of 50 respondents were excluded from the study because they were pre-menarcheal. The data obtained were analyzed using the IBM SPSS statistic (version 20). Descriptives statistics namely frequency, percentages, mean, range and pie chart were used to represent the categorical and continuous variable where it is applicable. Association between the age at menarche and some sociodemographic characteristics of the student was accessed using chi-square. The test of significance was at the p-value of 0.05.

2.6. Ethical consideration

Ethical approval was obtained from the ethical committee of the Federal Teaching Hospital Abakiliki, Ebonyi state (REC/VOL1/27/05/ 2015-13/07/2015). Informed consent was obtained from the parent or guardian of the students via a consent form given to the students to give their parents to read and sign. A prototype of the questionnaire was also given to the student for their parent perusal with a version in the Igbo language. The authorities of the secondary schools and the respondents concerned were informed and educated on the proposed study. Signed informed consent was obtained from each of the girls on the first page of the questionnaire, and the school authorities' consent was also obtained before the study was carried out.

3. Results

Table 1 shows the socio-demographic characteristics of the participants and sources of menstrual health knowledge. The mean age of

Table 1. Socio-demographic characteristics of the respondents and sources of menstrual health education (n = 400).

Variables	n (%)
Age (years)	
11–13	70 (17.5)
14–16	150 (37.5)
17–19	140 (35.5)
≥20	40 (9.5)
Body mass index (kg/m^2)	
Underweight	75 (18.7)
Normal	268 (67.0)
Over weight	52 (13.0)
Obesity	5 (1.3)
Residence	
Urban	186 (46.5)
Rural	214 (53.5)
Ethnicity	
Igbo	389 (97.3)
Yourba	6 (1.5)
Hausa	5 (1.2)
Social class	
Upper social class	100 (25.0)
Middle social class	173 (43.2)
Lower social class	127 (31.8)
Menstrual information*	
Mother	320 (80.0)
Friends	300 (75.0)
Siblings	158 (39.5)
Mass media	30 (7.5)
Book	90 (22.5)
Teachers	298 (74.5)

* Multiple answers allowed.

respondents was 16.0 ± 1.7 years with a range of 11–19 years. The mean BMI was with the majority (268, 67.0%) of the respondent, a normal body mass index. The study population is mainly Igbos' of Nigeria and the place of a resident is mainly (214, 53.5%) rural. The three common sources of information on menstrual health were mothers (320, 80.0%), friends (300, 75.0%), and teachers (298, 75.5%).

From Tables 2 and 3, and Figure 1, the age range at menarche was 11–16 years and the mean was 13.3 ± 1.2 years. The difference in the age of menarche between urban and rural dwellers was 0.3years. Three hundred and fifty of the girls had a menstrual cycle length between 21-35 days and dysmenorrhoea was present in 82% (328) of the respondents. School absenteeism was present in 56.5% (226) of the girls due to dysmenorrhoea. Fatigue was the commonest menstrual symptom. All the girls studied did not seek the advice of a medical practitioner for the management of their menstrual disorder. The medication was provided by their parents or guardian.

In Table 4, there is an association between the age of menarche and the social class of the respondents with 30.2% of the girls that belong to a lower social class having an age of menarche greater than 13 years.

4. Discussion

Attainment of menarche is an important milestone in the reproductive life of a woman [11, 19, 27]. The average age at menarche from this study was 13.0 ± 1.0 years. This figure is lesser than 15.0 ± 2.0 years earlier reported in the study area [28]. The difference may be due to improvement in the standard of living and can also be attributed to differences in the study population as the majority of the women in the previous study are above the age of 19 years, had low educational attainment and had their menarche a long time ago before the study was conducted. In our study, our study population is young girls that recently had their menarche with less chance of recall bias. However, it has been reported that there is no statistical difference in menarchial age reports among women irrespective of age at evaluation when recall method was used [29] but this is expected in a clime with good educational background. The mean menarcheal age from our study is similar to the average age reported by some studies in Nigeria [1, 12, 17, 19, 27] but it is higher than the figure reported by Lawan et al. [30] and Adesina et al. [14] in Nigeria where they recorded a mean menarcheal age of 12.9 ± 0.8 years and 12.8 ± 1.2 years respectively. The menarcheal age of 13.0 ± 1.0 years seen in our study is similar to a stable level of age at menarche at around 13 ± 0.5 years reported in Europe and the USA [31] which is attributable to the secular decline in age at menarche. This is a reflection of the general standard of living of a society which is attributed to the interaction of genetics and various environmental factors [32]. Our study also fails to agree to the average age of 11.6 ± 3.6 years reported by Islam et al. in Bangladesh [33], 12.4 ± 1.0 years by Al-Awhadi et al. [4] in Kuwait and 12.5 ± 0.08 years by Lalys et al. [31] in France. The difference in the study population with its difference in socio-economic indices might be responsible for the observed lower age of menarche in the above studies. Variation in menarcheal age between women in an urban and rural setting has been observed [1, 2, 3, 5, 7, 12, 27, 28, 30] and credence to it was seen in our study. This could be attributed to the influence of socio-economic, environmental, nutritional and geographical variation on the age of menarche [34, 35, 36, 37, 38, 39, 40, 41].

Our study showed an association between the age at menarche and respondent body mass index (p = 0.001). Weight and body mass index (BMI) are body size variables that have been shown to have a strong association with the age of menarche [42, 43, 44]. A critical weight has been hypothesized as a sign of good metabolic state for menarche to occur [45]; this set weight brings in motion the increase in pulsatile frequency and maturation of the hypothalamus-pituitary-ovarian axis hormones secretion. This interaction would explain the effect of malnutrition on delaying the onset of menarche and early occurrence of menarche on girls with high BMI or who are obese. Calthorpe et al. [46] in a systematic review and meta-analysis of the association between

Table 2. The age at Menarche among the students according to their place of residence (n = 400).

Age at menarche	n (%)	n (%)	n (%)
	Total	Urban	Rural
11	4 (1.0)	3 (0.7)	1 (0.2)
12	95 (23.8)	50 (12.5)	45 (11.2)
13	180 (45.0)	85 (21.2)	95 (23.7)
14	60 (15.0)	27 (6.7)	33 (8.2)
15	46 (11.5)	18 (4.5)	28 (7.0)
16	15 (3.7)	3 (0.7)	12 (3.0)

Table 3. Menstrual pattern and associated morbidities with treatment (n = 400).

Variables	n (%)
Menstrual cycle length(days)	
<21	16 (4.0)
21–35	350 (87.5)
≥35	34 (8.5)
Duration of menstrual flow	
≤2	22 (5.5)
3–6	353 (88.2)
≥7	25 (6.3)
Menstrual history	
Regular	350 (87.5)
Irregular	50 (12.5)
Dysmenorrhea	
Yes	328 (82.0)
No	72 (18.0)
Drug for dysmenorrhea	
Yes	193 (48.3)
No	207 51.7)
Absent from school	
Yes	226 (56.5)
No	174 (43.5)

menarche and social class. This might be expected as it has been documented that an increase in social class with its attainment child wellbeing is associated with early onset of menarche. In a study by Panti et al. [12] in Sokoto Nigeria, they reported a decrease, even though not significant, of age at menarche with an increase in the social class of their study population. The average age at menarche they reported, based on social class, was 13.2 ± 1.1years (class I), 13.3 ± 1.3years (class II), 13.8 ± 1.5years (III), 13.9 ± 1.2years (class IV) and 13.9 ± 1.1years (class V). This increase in social class and its associated socioeconomic wellbeing is an explainable reason for the secular decline in the age at menarche observed in developed countries [31, 32, 47].

Menstruation is a natural physiological process that requires proper management, especially in a young adolescent commencing her full reproductive life. Unfortunately, the majority of girls in many of the developing counties have poor knowledge and misconceptions concerning menstruation resulting in inadequate menstrual hygiene management (MHM) [48, 49]. One of the reasons adduced for this unacceptable finding in developing economies is the lack of proper education and preparation of these young adolescents to face the challenges of being sexually mature by society in general. In our study, the majority of the girls studied got their menstrual information from their mothers which agrees with earlier findings [48]. This should be expected as mothers is a significant person in the upbringing of a child. The poor MHM seen in girls in developing countries has been attributed amongst others to poor information being given to these girls by their mothers [48]. This calls for the re-education of mothers in our clime on issues of menstruation to reduce their misunderstanding and misinformation of their girls' child. Other significant contributors to menstrual health seen in our study include friends (300, 75%) and their teachers (298, 74.5%). The finding of teachers of these adolescents girls contributing almost equally to female friends to the overall provider of information on
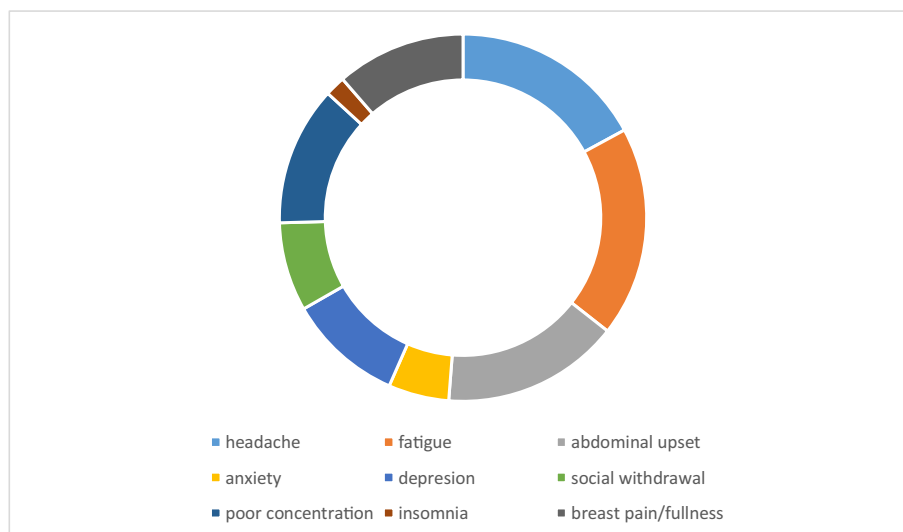
childhood physical activity and age at menarche reported that mean menarchial age is higher in athletes than in non-athletes. They concluded that a behaviourally modifiable trait such as diet, which can affect fat store and BMI, might be a factor in the increase mean age at menarche in athletes. Our study also observed a significant association between age at

Figure 1. Menstrual symptoms.

Table 4. Relationship between the age of menarche with respondent body mass index and social class.

Variables	Age of menarche ≤13	Age of menarche >13	X^2 (p-value)
Body mass index			
Underweight	80 (20.0)	0 (0.0)	101.8 (0.001**)
Normal weight	147 (36.8)	121 (30.2)	
Overweight	52 (13.0)	0 (0.0)	
Obesity	0 (0.0)	0 (0.0)	
Social class			
Upper class	100 (25.0)	0 (0.0)	372.9 (0.001*)
Middle class	173 (43.3)	0 (0.0)	
Lower class	6 (1.5)	121 (30.2)	

** Fisher's exact test.
* Pearson Chi-square.

menstrual knowledge fell to agree with a recent review of literature on this topic by Chandra-Mouli et al. [48]. This review included works done in Nigeria and one of the plausible explanations of our finding might be the issue of difference of study population as other studies were done outside Abakaliki. The social desirability bias could also account for our finding as some students might tick their teachers as one of the sources of information on menstrual health to improve the status of their school. An attempt was however made to reduce this during the counseling/education of the students before the administration of the questionnaire.

Menstrual disturbances are a common complaint among young school girls [9, 20, 21, 23] and no significant association has been established between age at menarche and menstrual abnormalities seen in the adolescent [50]. In our study, irregular cycle length was present in 24.5% of the respondent. The likely reasons for this may be due to anovulatory cycles which are common within the first two years after menarche. However other factors such as endocrine disorders, brain tumors, and acquired disorders like stress and strenuous exercise may be implicated [4, 7, 30, 31, 35]. Other physical complications found in these groups include premenstrual syndrome and painful menstruation. Painful menstruation (dysmenorrhoea) was present in 82% of our respondents. Our finding is similar to 83.1% incidence rate of dysmenorrhoea reported by Ali et al. in Kassala Eastern Sudan [10] but higher than 70% reported by Sharma et al in New Delhi [9] and 68% found by Busani et al. [24]. The burden of dysmenorrhoea among school girls in a study in Egypt was 94.4% [51] and in Ghana, nearly two-thirds experienced symptoms during most or all cycles [52]. Above is a reflection of the enormity of the suffering that these young girls undergo which calls for intervention and care. Dysmenorrhoea accounted for 48.3% and 56.5% of the students respectively using drugs to relieve pain or being absent from school. All the study population self-medicated based on a piece of advice from a significant adult which is in keeping with earlier report [43], however, effort should be made to stop this because it could lead to misuse of drugs by these young people with its complications. Other common menstrual complaints found in this study were headache, abdominal upset, and poor concentration which is similar to other studies [1, 4, 6, 14, 17, 19, 37, 38]. Polymenorrhea, oligomenorrhoea, menstrual cycle irregularity, and abnormal bleeding length are some of the other menstrual abnormalities seen in schoolgirls [50]. In the index study, polymenorrhoea oligomenorrhoea and cycle irregularity were seen in 4.0%, 8.5%, and 12.5% of our respondents. Immaturity of the hypo-pituitary ovarian (HPO) axis in post menarchial adolescent girls resulting in anovulation might be a plausible explanation of these abnormalities [53] as it takes about two (2) years post menarche to stabilize its (HPO) hormone production. It calls for adequate counseling of these young girls and their guardians about it and to allay their fears of any abnormalities. On the other hand, identification of abnormal menstrual patterns in adolescence may improve early identification of potential health concerns for adulthood.

5. Limitation of the study

Our study is limited by its cross-sectional nature since only a section of the eligible girls were studied. An effort was however made to reduce selection bias by using a probability method of sampling. Causal relationships could not be ascertained between age at menarche and some of the socio-demographic indices of the population studied and there might be a recall and social desirability bias. We tried to limit it by encouraging recall, educating them to try and link it to the class they were when it occurred (ie menarche). They were asked not to write their names, phone number, and were informed that the reporting of the findings would have nothing to do with her and her school. Privacy was also provided for them during the administration of the questionnaire. The questionnaire was pretested before being applied. Our study, however, provides useful information that could guide students, parents, school authorities, hospital managers, and policymakers on the menstrual challenges facing our adolescent girls.

6. Conclusion

The overall mean age at menarche of 13.0 years in this study is lower than 15 years earlier reported in the study area. It is however comparable to most previous reports in Nigeria. Our study indicated a significant association between the age at menarche and the student social class; menarcheal age is lower in girls from higher social class. Efforts should be made towards addressing the common menstrual challenges amongst these adolescents, the most worrisome of which is dysmenorrhea. We recommend that the health managers in the study area should make a concrete effort in educating the female students, their parents, and the school managers on the menstrual challenges that could occur amongst these students and appropriate effort should be made by the school authorities in assisting those students with menstrual challenges.

Declarations

Author contribution statement

C. Anikwe and E. Mamah: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

U. Nnadozie and C. Obarezi: Analyzed and interpreted the data.

K. Ekwedigwe and B. Okorochukwu: Analyzed and interpreted the data; Wrote the paper.

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