

Original Research Article

Onset of Menarche among Adolescent Girls in Gas and Non- Gas Flaring Environment in Bayelsa State, Nigeria

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Abstract: This research study investigated the onset of menarche among adolescent school girls living in non-gas and gas flaring environment in Bayelsa state. The participant in this study were eight hundred and twenty six (826) in number. The result obtained from the study shows that one hundred and fifty six (156) within the ages of 10-14years making (18.9%) are yet to attained menarche from gas flaring environment while (81.1%) have attained menarche in both environment. The overall age at menarche compared with body mass index was (12.6yrs) and (17.3kg/m²) from both group. Furthermore the age at menarche among adolescent residents in non-gas flaring environment was (11.8yrs) compared with those in gas flaring environment (12.9yrs). However the mean age at menarche among adolescent girls attending private schools was (12.7yrs) with a body mass index of (18.5kg/m²) in comparison with (12.5yrs) and (16.7kg/m²) of adolescent school girls attending public schools. The result from this study has shown that (50.8%) of school girls from gas flaring environment have attained menarche compared with (30.3%) from non-gas flaring environment at the age of (11.8yrs) with an increase positive percentage difference of (34.1%) between body mass index and the age at menarche among non-gas flaring adolescent and (37.2%), (22.9%) in gas flares stack surrounded communities in Bayelsa state.

Keywords: Menarche, girls, Adolescent, gonadotropin, body mass index, age.

INTRODUCTION

Menarche is an important event in a woman's life marking the progressive commencement of menstruation and sexual onset of girls characterized with processes leading to puberty development. The occurrence of changes in the ovaries during the female sexual cycle is dependent on certain hormones secreted by the anterior pituitary gland i.e. gonadotropin, luteinizing and follicle stimulating hormones. During childhood the ovaries are not stimulated by these hormones but progressive secretion begins at the age of nine years accompany by the initiation of the female monthly sexual cycle at eleven to sixteen years (Guyton and Hall 1996). Certain factors ranging from genetic, environmental and nutritional habits plays a key role regarding age variation that menarche occurs. Other factors associated with age include family income, family size, season at birth, body mass index, occupation, socio-economic condition, race etc (Olga and Anastasios 2010). The maturation of hormonal patterns have been established several months before the onset of the first menstrual bleeding among perimenarcheal girls with normal weight and that the onset of menarche may not be solely

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dependent on neuroendocrine axis or reproductive hormones (Katie *et al.*, 2008). Significant association between age at menarche and social class of students at menarcheal age was lower in girls from higher social class (Chidebe *et al.*, 2020). The mean age at menarche varies in different population and is a sensitive indicator of nutritional status with magnitude of socio-economic factor in a society. However the overall mean age at menarche from study conducted in Northern Nigeria shows 13.7 years comparable to most previous studies (Abubakar *et al.*, 2011). Menarche remains a significant milestone during adolescent as normal pubertal development and breast bud begins to appear. The onset of the menstrual bleeding at an early age may be attributed to elevated standard of nutritional and health status while most variations may be due to environmental factors (Aswathy *et al.*, 2019). The onset of bleeding in adolescent girls is the most widely used indicator to ascertain sexual maturation and most accurately recalled indicator of puberty among girls compared with other physiological changes that may occur gradually (Adesuwa 2013).

Though the age at menarche has been reported in some part of the country but information regarding adolescent girl's menarcheal age in Bayelsa state remains very scanty. Therefore this study becomes imperative to enable us ascertain the actual ages at menarche and other influential factors affecting the onset of the first menstrual bleeding among girls in this part of the Niger Delta region of Nigeria.

ENDOCRINE ROLE

The event of puberty is influenced by the anterior pituitary gland in response to stimulation from the hypothalamus. The gonadotropin releasing factor activates the anterior pituitary to secrete gonadotropic hormones that stimulate the female gonads located in the shallow fossa in the lateral walls of the female pelvis to begin physiologic changes. The gonadotropin hormones include follicle stimulating hormone responsible for the stimulation and development of follicular cells in females. This hormone also induce the secretion of estrogen from the follicle while the luteinising hormone cause the rupture of follicle with subsequent release of the ovum to cause conversion of the ovarian follicle into yellow body-the corpus luteum. This hormone also induces the secretion of estrogen and progesterone from the corpus luteum. Estrogen is responsible for the female characteristics. The appearance of secondary characters is orderly but highly variable due to variations in female sexual maturity and development of adolescent compared to chronological age (Barbara and Pearl 1992; Guyton and Hall 1996).

Environmental Factors

The impact of environmental factors associated with early onset of menarche have been frequently studied than those associated with late menarche. Several studies have focused on the role of environmental pollutants and toxins in delaying the onset of menarche most especially exposure to heavy metals from gas flares such as lead and fetal exposure to polybrominated diphenyl ether were all associated with late menarche (Silvia and Mary 2020). Findings from Mokelu *et al* (2020) have also shown that testosterone and lactate dehydrogenase activities in blood specimen among male residents in gas flaring environment have been significantly affected. Abnormalities in reproductive hormonal secretion is a most likely cause of primary amenorrhea by age sixteen resulting from structural or underdeveloped ovaries, obesity, malnutrition, and extreme weight loss. The presence of heavy metals such as lead and cadmium have been reported by (Solomon *et al.*, 2021; Solomon *et al.*, 2021) in the blood serum of pregnant and non-pregnant women residing in gas flaring polluted environment (Gbarain and Immiringi) in levels higher than the world Health Organization permissible range in Bayelsa state, Nigeria. These metals are capable of crossing the placenta blood barrier to cause low birth weight, nervous system disorders and severe fetal brain damage which could have a lasting effect on the growing female child menarcheal age and the age at menarche.



Figure 1: Oil rich Kingdom with constant gas flares

MATERIALS AND METHODS

This is a cross sectional study conducted in public and private schools within Yenagoa metropolis and Sagbama. The total number of participants was eight hundred and twenty six (826) selected randomly using systematic sampling method. Menarcheal year were collected from girls within the ages of 10-16 years at study entry and entered into structured questionnaires. The subjects were recruited from Igbogene, Yenegwe, Akenfa, Edepie, Tombia and Sagbama using oral communication.

Data Collection

The data were collected using self-adjusted questionnaires and information obtained includes place of residence, weight measurement with shoes removed and minimum clothing, height on a smooth surface using a bathroom scale and meter rule calibrated in kilograms and meters. While the body mass index calculated from the square of the height used to divide individual weight of the participants.

Informed consent

Permission was granted by the school authorities and the importance of the research was explained to each participant before they could participate freely in the study.

Ethical consideration

The proposed methodology for this research study was approved by the University of Port Harcourt

Inclusion Criteria

Subjects within the ages of 10-16 years at study entry, apparently healthy, no family history of hyper-androgenism were recruited for the study.

Exclusion Criteria

Subjects below ten and above sixteen years and obvious obesity were excluded from the study.

Analysis

The statistical analysis was done using a one way analysis of variance (ANOVA) and by a simple percentage calculation.

RESULTS

Table 1: Age at menarche among different age group in non-gas flaring environment

Age (yrs)	No	%	Age at menarche (yrs)
10	-	-	-
11	11	4.4	10.7±1.07
12	45	18	11.6±1.18
13	66	26	11.8±3.75
14	45	18	12.1±0.54
15	56	22.4	12.4±2.69
16	27	10.8	12.3±2.33
Total	250	100	11.8±0.61

Table 1 above shows the percentage and the age at menarche among school girls in Sagbama, Bayelsa state.

Table 2: Relationship between menarcheal age and BMI in non-gas flaring environment (Sagbama)

Mean age (yrs)	Mean BMI (kg/m ²)	Mean age at menarche(yrs)	% Difference
13.6±3.42	16.8±4.16	11.9±1.72	34.1

Table 3: Age at menarche among different age group in gas flaring environment (private)

Menarcheal age (yrs)	No	%
10	-	-
11	41	18.6
12	70	31.8
13	72	32.7
14	20	9.1

15	10	4.6
16	7	3.2
Total	220	100

Table 3 above shows the age at menarche and percentage number of school girls attending private schools in Yenagoa Bayelsa state.

Table 4: Mean age at menarche and BMI of adolescent school girls in gas flaring environment (private)

Mean age (yrs)	Mean BMI(kg/m ²)	Mean age at menarche(yrs)	% Difference
14.3±2.53	18.5±5.21	12.7±3.02	37.2

Table 5: Mean BMI and age at menarche among adolescent school girls in gas flaring environment (public)

Mean age (yrs)	Mean BMI(kg/m ²)	Mean age at menarche(yrs)	% Difference
14.6±1.28	16.5±3.10	13.1±1.68	22.9

Table 6: Mean age and BMI of adolescent at pre-menarche in gas flaring environment (private) Yenagoa

Mean BMI (kg/m ²)menarche (yrs)	Mean age (yrs) at pre-menarche	% Difference
15.5±6.42	11.3±1.56	31.3

Table 4, 5, and 6 above also shows the percentage difference between the mean body mass index and mean age at menarche among the participants studied.

Table 7: Comparison of menarcheal age among different age group in gas and non-gas flaring environment (Yenagoa and Sagbama)

Pre-menarche			Menarche (private Yenagoa)		Menarche (public, Yenagoa)		Menarche (public Sagbama)	
Age (yrs)	No	%	No	%	No	%	No	%
10	51	6.2	-	-	-	-	-	-
11	48	5.8	41	4.9	5	0.6	11	1.3
12	31	3.8	70	8.5	32	3.9	45	5.5
13	14	1.7	72	8.7	60	7.3	66	7.9
14	12	1.5	20	2.4	67	8.1	45	5.5
15	-	-	10	1.2	30	3.6	56	6.8
16	-	-	7	0.8	6	0.7	27	3.3
Total	156	18.9	220	26.6	200	24.2	250	30.3

Table 7 above shows the different age group among adolescent school girls in gas polluted environment that are yet to attained menarche and the ones that have attained menarche.

Table 8: Menarcheal age and BMI in gas and non-gas flaring environment among adolescent school girls (combined)

Mean BMI (kg/m ²)	Mean age at menarche (yrs)	%Difference
17.3±4.16	12.6±2.14	31.4

The table (8) shows the menarcheal age and body mass index of the entire study population from Sagbama and Yenagoa local government area with a positive percentage difference in Bayelsa state.

DISCUSSION

Findings from this research study have reveal a mean body mass index among adolescent school girls in non-gas flaring environment (Sagbama) Bayelsa states as (16.8kg/m²), mean age at menarche (11.9yrs) and mean age of the participants (13.6yrs). However there was no mean age at menarche among school girls at age 10yrs in non-gas flaring environment but at age 11yrs ie there was (4.4%) with a mean age of (10.7yrs) that attained their first menstrual bleeding (menarche).

Furthermore, school girls at age eleven, twelve, thirteen ,fourteen, fifteen and sixteen attained menarche at age (11.6), (11.8), (12.1), (12.4) and (12.3) years bringing the mean total age at menarche among school girls in Sagbama to (11.8yrs).Also the percentage number of school girls in Sagbama within the ages of 12-16 years that have attained menarche were (18%), (26.4%), (18%), (22.4%) and (10.8%). Comparison of the body mass index with menarcheal age

among public (Sagbama), public (Yenagoa) and private (Yenagoa) adolescent school girls were (16.8kg/m²)(11.9yrs); (16.5kg/m²) (13.1yrs) and (18.5kg/m²), (12.7yrs) respectively. This is an indication that parents of children in private schools are most likely financially buoyant enough to care for their offspring's despite economic hardship in terms of nutritional diets. A similar trend was also observed among public school girls in Yenagoa as well. In general well-nourished girls have been observed to attain menarche earlier than the malnourished (Adesuwa and Oliemen 2013).

It has been observed that the ages at which girls from middle class families attain menarche is 12 and 13 years while those from low income class was between 12-14 years (Ofuya 2007). Adienbo *et al.*, (2021) also observed a mean age of (12.1yrs) and age range at menarche was (10 -16yrs) whereas the body mass index was (19.4kg/m²) among indigenous girls in the Niger delta region of Nigeria.

The mean age and menarche among school girls attending private schools were (14.4yrs) and (12.7yrs), though at age eleven to sixteen years the percentage number that have attained their first menstrual bleeding in gas flaring environment was (32.7%), (31.8%), (18.6%), (9.1%) and (3.2%). A study conducted by Paul *et al.*, (2018) observe a similar significant lower mean age of (12.7) at menarche among the Yoruba ethnic tribes compared with (13.1yrs) among other tribes in Nigeria. It is interesting to note that out of the eight hundred and twenty six (826) participants including private and public schools from gas and non-gas flaring environment in Yenagoa and Sagbama, (18.9%) between the ages of 10-14 years are yet to attained menarche. Solomon *et al.*, (2021) have observed a significant decrease in body mass index among pregnant and non-pregnant women living in gas flaring communities in Bayelsa state which could also have an effect on the fetus and the growing girls in gas flares polluted environment. However comparison of the different age group among adolescent school girls studied in gas flaring environment with non-gas flaring environment have shown that (26.6%), (24.2%) and (30.3%) from private and public schools have attained menarche. The combination of the entire study population from both non-gas (Sagbama) and gas flaring (Yenagoa) environment of adolescent school girls have shown the menarcheal age at (12.6yrs) and body mass index (17.3kg/m²) as the attained age at menarche, mean body mass index and increase positive percentage difference of (31.4%) . However the percentage of the entire population studied at menarche is (81.1%) compared to the observation of Abubakar *et al.*, (2011) of (90%) in his Sokoto study population.

CONCLUSION

The results from this study have indicated that the onset of menarche among adolescent school girls attending private schools and resident in non-gas flaring environment attained menarche at early age compared with girls attending public schools and as well residents in gas flaring environment in Bayelsa state.

Conflicting interest: The Authors have declared that there is no conflicting interest.

REFERENCES

- Panti, A. A., Ekele, B. A., Nwobodo, E. I., & Ahmed, Y. (2011). The age at menarche amongst secondary school girls in Sokoto metropolis, North-West Nigeria. *Orient Journal of Medicine*, 23(1-4), 38-43.
- Adesina, A. F., & Peterside, O. (2013). Age at menarche and body mass index (BMI) among adolescent secondary school girls in Port Harcourt, Nigeria. *J Dent Med Sci*, 3(5), 41-46.
- Aswathy, M. G., Saju, C. R., & Mundodan, J. M. (2019). Awareness and practices regarding menarche in adolescent school going girls of Thrissur educational district. *Int. J. Community Med. Public Health*, 6, 755-758.
- Barbara, L. B., & Pearl, P. R. (1992). Textbook of pathophysiology, adaptation and alteration in function 3rd ed. JB Lippincott Company Philadelphia
- Anikwe, C. C., Mamah, J. E., Okoro-chukwu, B. C., Nnadozie, U. U., Obarezi, C. H., & Ekwedigwe, K. C. (2020). Age at menarche, menstrual characteristics, and its associated morbidities among secondary school students in Abakaliki, southeast Nigeria. *Heliyon*, 6(5), e04018.
- Guyton, A. C., & Hall, J. E. (1996). Textbook of Medical Physiology 9th Ed WB Saunders Company Philadelphia, Pennsylvania, 19106.
- Zhang, K., Pollack, S., Ghods, A., Dicken, C., Isaac, B., Adel, G., ... & Santoro, N. (2008). Onset of ovulation after menarche in girls: a longitudinal study. *The Journal of Clinical Endocrinology & Metabolism*, 93(4), 1186-1194.
- Mokelu, I. P., Onyeze, G. O. C., Nwaogu, L. A., & Igwe, C. U. Effect of Chronic Exposure to Gas Flaring on Sex Hormones and Some Antioxidant Parameters of Men from Ebocha, Niger Delta Area of Nigeria. *International Journal of Research and Report in Gynaecology*, 3(1), 9-19.
- Ofuya, Z. M. (2008). The age at menarche in Nigerian adolescents from two different socioeconomic classes. *Online Journal Of Health And Allied Sciences*, 6(4), 3.
- Olga, K., & Anastasios, P. (2010). Determinant of menarche. Biomed Central. <http://www.rbej.com/contents/8/1/115>.

- Ologhago, M. A., & Victoria, T. E. (2021). Age and menarche, menstrual characteristics and associated factors among adolescent girls in indigenous population in Niger Delta region Nigeria. *Journa of advances in medicine and medical research*, 33(10), 24-32.
- Solomon, M. U., Charles, N. N., & Kiridi Emily, G. E. (2021). Blood serum lead and cadmium level among pregnant women in gas flaring communities in Bayelsa state Nigeria. *International Journal of Scientific and Research publication*, 11(5), 11316.
- Solomon M. U., Kiridi Emily G. E., Tonkiri, A., Charles N. N., & Okuroemi, O. H. (2021). Dietary effect on cardio-renal parameters of women residents in gas flares polluted environment in Bayelsa state Nigeria. *International Journal of Scientific and Research publication*, 11(12), 12023.
- Uvoh, S. M., Chuemere, A. N., & Obia, O. (2021). Impact of Gas Flares on Anthropometric Indices of Pregnant and Non Pregnant Women in Selected Gas Flaring Communities in Bayelsa State Nigeria. *IJBMS-International Journal of Biological & Medicine Science*, 4(09), 15-21.
- Canelón, S. P., & Boland, M. R. (2020). A systematic literature review of factors affecting the timing of menarche: The potential for climate change to impact women's health. *International Journal of Environmental Research and Public Health*, 17(5), 1703.
- Tarimobo, M. O., John, N. P., & Osah, O. I. (2018). Age at menarche in Nigerian adolescent girl's case study: (Igbo.Yeruba, Hausa, and Engene) tribes of Nigeria. *European Journal of pharmaceutical and medical research*, 5(9), 152-160.