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RESEARCH ARTICLE

MENARCHEAL AGE OF ADOLESCENT GIRLS IN ADO- EKITI, EKITI STATE

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ABSTRACT

This research was carried out to determine the age at menarche of adolescent girls in Ado Ekitiand also to identify any decline in the average age at menarche over the years and if factors such as nutrition type, academic level and socioeconomic lifestyle of parents affect its' onset. Three hundred and forty two (342) girls were randomly selected in both public and private Schools in Ado-Ekiti, Ekiti state using well structured and closed endedquestionaires. Some socio-economic variables were "measured" such as fathers and mothers educational level, occupation of father and mother, type of accommodation and nutritional type. Multivariate Regression Model was considered and fitted since the age at menarche was a continuous measurement. Backward elimination method was used to select the most parsimonious model. This study reveals that menarcheal age of adolescent girls in Ado Ekiti is 12.85 $\pm$ 0.0995 at 95% confidence interval (95% CI= 12.95-12.75) and also demonstrated a decline in the menarcheal age of adolescent girls. The study also reveals that father's education, mother's education, father's occupation and nutritional type affect age at menarche.

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INTRODUCTION

Menarche, the occurrence of the first menstruation is a unique and relatively late marker of female puberty (Tanner, 1962). It is a significant event in the lifecycle of an adolescent girl. It is also a critical time in the adolescent girls' reorganization of her body image and sexual identity (Moffitt *et al.,* 1992). Menarche occurs at different times for individual adolescent girls. It varies between races (Marshall and Tanner, 1986; Eveleth *et al*., 1990). It also varies among urban and rural areas, indicating that in developing countries inequalities related to socioeconomic status or life setting (urban vs rural) are still prominent and might account for important variations in the timing of puberty within and among countries (Eveleth, 1978; Eveleth *et al*., 1990). The age at menarche reflects various aspects of a population and these includes the timing of sexual maturation, growth, nutritional and environmental conditions.
Age at menarche has been reported in several parts of the world (Anderson, 2003; Anderson, 2005; Biro, 2006). In Nigeria in particular, studies have reported ages at menarche in some parts of the West, East, North and Southern zones of the country (Ellis, 1950; Tanner *et al*., 1962; Oduntun *et al*., 1976; Uche *et al*., 1979; Fakeye, 1985; Modebe, 1987; Thomas *et al*., 1990; Rehan, 1994; Abioye-Kuteyi, 1997; Ikaraoha *et al*., 2005; Ofuya, 2007; Sule *et al*., 2007). Ado–Ekiti is a town and the capital of Ekiti State in Nigeria. The state is unique because it is situated at the centre of all other western states in the country. Studies reporting the onset of menarche in the western part of Nigeria were only reported in Lagos (Ellis, 1950), Ilorin (Fakeye, 1985), Ibadan (Marshall and Tanner, 1986; Eveleth and Tanner, 1990) and Ile-Ife (Thomas *et al.,* 1990) and most of these studies were reported in the 19th century which is more than a decade making the information regarding the current status for menarcheal age of adolescent girls in this region to be outdated. However, no study has been done, reporting the menarcheal age of adolescent girls in Ado-Ekiti. Therefore this study seeks to determine the age at menarche in adolescent girls in Ado-Ekiti and to identify any decline from the previous reports at age at menarche with those of current findings. Also, to determine factors affecting its early onset.

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MATERIALS AND METHODS

The data used for this study was obtained through primary source. This involved the use of well-structured with close-ended questionnaires where questions such as father's and mother's level of education, father's and mother's occupation, accommodation type, nutrition level and the age at menarche

were asked. The mother and fathers' education shows the level of academic achievements of the parents which was specified as no education, primary/secondary education and higher education. Parental occupation was defined based on the job or work each parent engaged in to earn a living and this was specified as business/trading, civil servants (teachers, doctors, lawyers etc), others (fashion designers, carpenters, bricklayers etc.). About 400 questionnaires were made available but only 342 were completed with about 58 representing 16.96% lost on transit. The target population was the adolescent girl-child between the ages of nineyears and twenty years (9 and 20 years)selected from different private and public schools in Ado-Ekiti, Ekiti State, Nigeria.

The methodology used in this paper is the multivariate regression analysis. In many scientific research, it is often needed to determine the relationship between a response (or dependent) variable (y) and more than one regressors (or independent variables) ($x1; x2;....xk$). A general form of amultiple linear regression models is given by$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \varepsilon$where $\varepsilon$is the random error. Here, regressors$x1; x2... xk$may contain regressors and their higher order terms. In the classical setting, it is assumed that the error termhas the normal distribution with a mean 0 anda constant variance, σ^2. The first impression of the multiple regression may be a response plane.However, some regressors may be higher order terms of other regressors, or may even be functions of regressors as long as these functions do not contain unknown parameters.

Thus, multiple regression models can be a response surface of versatile shapes. The regression coefficients are estimated using the least squares principle. It should be noted that it is not necessary to assume that the regression error term follows the normal distribution in order to find the least squares estimation of the regression coeficients. It is rather easy to show that under the assumption of normality of the error term, the least squares estimation of the regression coefficients are exactly the same as the maximum likelihood estimations (MLE) of the regression coeficients. The hypothesis tested in the study is that: there is no significant relationship between the age at menarche and the explanatory variables $X_1, X_2, X_3, X_4, X_5, and\ X_6$which could not beexplained on the basis of chance alone. The Multiple linear regressions is defined by

$$Y = f(X_1, X_2, X_3, X_4, X_5, and\ X_6)$$

Where X_1 = Father's highest level of education

X_2= Mother's highest level of education
X3= Father's occupation
X_4 = Mother's occupation
X_5 = Accommodation type
X_6= Nutrition type

A backward elimination method was used to select the factors that affect age at menarche. In a backward elimination method all the variables are first entered and any variable that do not contribute significantly to the model is subsequently deleted from the model until we arrived at the most parsimonious model.

RESULTS

The result from the analysis indicates that three models were fitted to the data and were statistically significant at 0.05 alpha. This is an indication that the three models can be used to predict age at menarche among young girls in Ekiti State (Table 1).

In other to pick the most parsimonious model, hence, model 3 was selected as the best model after eliminating the variables that did not contribute to the model (Table 2). Model 3 contain, Father's education, Mother's education, fathers' occupation and nutritional level, whereas Mother's occupation and accommodation were deleted from the model.

Table 1. ANOVA Model Sum Squares Df MeanSquare FSig

1					
Regression	70.564	6	11.761	8.367	.000[b]
Residual	470.890	335	1.406		
Total	541.453	341			
2					
Regression	70.525	5	14.105	10.064	.000[c]
Residual	470.928	336	1.402		
Total	541.453	341			
3					
Regression	70.244	4	17.561	12.559	.000[d]
Residual	471.209	337	1.398		

This shows that mother's occupation and accommodation type do not affect age at menarche. Father's education affects age at menarche because the man is seen as the bread winner of the family. He determines to a larger extent the economic status of the family which may go a long way to affect the nutritional pattern of the adolescent girl-child.

Table 2.Test of Parameters

Model	B	Standard Error	t	Significance
1				
(Constant)	13.460	.609	22.120	.000
Father's education	-.568	.167	-3.401	.001
Mother's education	-.278	.144	-1.931	.054
Father's occupation	.242	.109	2.223	.027
Mother's occupation	.052	.111	.468	.640
Accommodation type	.028	.171	.165	.869
Nutrition	.699	.292	2.390	.017
2				
(Constant)	13.475	.600	22.444	.000
Father_edu	-.561	.160	-3.496	.001
Mother_edu	-.273	.140	-1.944	.053
father_occu	.245	.107	2.297	.022
mother_occu	.049	.109	.448	.654
nutrition	.697	.292	2.389	.017
3				
(Constant)	13.494	.598	.000	.000
Father_edu	-.553	.159	.001	.001
Mother_edu	-.268	.140	.056	.056
father_occu	.257	.103	.014	.014
nutrition	.700	.291	.017	.017

However, research has shown that the level of education of both parents (male and female) correlate positively (Adarabioyo *et al*., 2012). Therefore, we could also conclude that mother's level of education contribute to some extent to the age at menarche of the girl-child.

The fitted regression equation is expressed as follow:

$$y_{ij} = 13.493 - 0.553x_{Father_{edu}} - 0.268x_{mother_{edu}} + 0.257x_{father_{occup}} + 0.7x_{nutrition}$$

The above model can be used to predict age at menarche of a girl child at any level of measurement of the factors fitted in the model. From our study, the mean age of menarche is 12.85±0.0995 at 95% confidence interval (95% CI= 12.95-12.75).

For example for a girl child whose father's educational level is 1, mother's education, 1, father's occupation, 1 and nutrition level, 2, the age at menarche is derived as

Y_{ij} = 13.493-0.553(1) -0.268(1) + 0.257(1) + 0.7(2) = 14 years
Y_{ij} = 13.493 - 0.553(3) -0.268(3) + 0.257(2) + 0.7(1) = 12 years
Y_{ij} = 13.493-0.553*(2)-0.268*(2) + 0.257*(3)+0.7*(1)= 14 year

We can obtain age at menarche if levels of factors are known. Table 3, shows studies on mean age at menarche across the country. Table 4 shows the mean ages at menarche at different socioeconomic levels.

From Table 4, the meanmenarcheal ages for girls who had theirdietary content rich in protein was 12.85 years while the mean menarcheal age for girls who did not have their dietary content rich in protein was 13.39 years.

DISCUSSION

In the best of our knowledge, the present study is the first study carried out in Ado Ekiti in Ekiti State to report the menarcheal age of adolescent girls. Concern that menarche is occurring early among adolescent girls over the past decades highlights the need for current information on the age at menarche among young girls and the associating factors affecting such early occurrence. Reports on the age at menarche in Nigerian adolescent girlsin recent times have been sparse and besides, most of these studies were reported in the 19th century.

In our present study, the mean menarcheal age of adolescent girls in the selected public and private secondary schools is 12.85 ± 0.995. The present finding suggest that most adolescent girls in Ado-Ekiti experience menarche at a mean age of 12.85 ± 0.995.

Table 3. Studies on the mean age at menarche in different parts of Nigeria

Year	Noof Participants	Age	Sample	Age at Menarche	Reference
1950	250	8-18	Urban School Girls in Lagos	14.3	Ellis, 1950
1962	335	12-19	Urban School Girls (IBO)	14.07±0.16	Tanner *et al*.1962
1976	2029	10-17	Urban School Girls in Ibadan	13.7±0.03	Oduntun *et al*. 1976
1979	1365	10-18	All	13.54±0.07	Uche *et al*. 1979
1985			Mixed Illorin	13.7±1.0	Fakeye, 1985
1987	2207	10-19	Urban (ENUGU)	13.3±1.09	Modebe, 1987
1990			School Girls Ile-Ife	13.4±1.4	Thomas *et al.* 1990
1994	5736	11-18	Schoolgirls	13.42±1.51	Rehan, 1994
1997	352	13-15	Urban School Girls	13.94±1.31	Abioye-Kuteyi *et al*. 1997
2005	859		Urban School Girls in Port Harcourt	13.19±1.32	Ikaraoha *et al.* 2005
2007	358	12-18	School Girls in Kaduna	12.81±1.31	Sule *et al*. 2007
2007	900	10-20	Urban School Girls in Port Harcourt	13.43±2.19	Ofuya, 2007
2010	722	12-18	Rural School Girls in Tarka	13.02±3.0	Goon *et al*. 2010

Table 4. Mean distribution at different socioeconomic levels

Socioeconomic Levels	Categories	Mean Menarcheal Age
Fathers' level of education	1) No Education	14.24years
	2) Primary/Secondary Education	13.15years
	3) Higher Education	12.69years
Mothers' Level of Education	1) No Education	13.67years
	2) Primary/Secondary Education	13.13years
	3) Higher Education	13.06years
Fathers' Occupation	1) Business or Trading	12.85years
	2) Civil Servants	12.85years
	3) Others(Carpenters, Bricklayers Fashion Designers etc)	13.06years
Nutrition Status	1) Eat High Protein Rich Food/Diary Food Regularly	12.85years
	2) Do not eat High Protein Rich Food/Diary Food Regularly	13.39years

For fathers' level of education, the mean menarcheal ages for fathers who had no education, primary/secondary education and higher education were 14.25 years, 13.15 years and 12.69 years respectively. For mothers' level of education, the mean menarcheal ages for mothers who had no education, primary/secondary education and higher education were 13.67 years, 13.13 years and 13.06 years respectively. For fathers' occupation, the mean menarcheal ages for Businessmen/Traders, Civil servants and Others were 12.85 years, 12.85 years and 13.06 years respectively.

This result is in contrast with the result of other studies carried out in various parts of Nigeria were most adolescent girls experienced menarche at 13years of age or above (Ellis, 1950; Tanner *et al*., 1962; Oduntun *et al*., 1976; Uche *et al.,* 1979; Modebe, 1987; Fakeye, 1987; Thomas *et al*., 1990; Rehan, 1994; Abioye-Kuteyi *et al.,* 1997; Ikaraoha *et al*., 2005;Ofuya, 2007; Daniel *et al*., 2009). Also, data from our present study is in contrast with the results of studies reported in the western part of Nigeria in the past where menarche occurred mostly between the ages of 13years and 14years (Ellis, 1950; Oduntun *et al*., 1976; Fakeye, 1987; Abioye-Kuteyi *et al.,* 1997).

However, one of the studies carried out among school girls in Kaduna State, the northern part of Nigeria, reported a menarcheal age of (12.81± 1.31) years (Sule *et al*., 2007) which is comparable to our findings. Studies have reported a decline in menarcheal age in developed countries (Anderson, 2003; Anderson, 2005; Biro, 2006) and this decline has also been observed in developing countries (Hwang *et al*., 2003; Hosny *et al*., 2005). Table 3 above provides information on studies on the menarcheal ages of adolescent girls in the different parts of Nigeria. From table 3 above, it is observed that most studies were carried out in the 19th century and most adolescent girls then, experienced menarche between the ages of 13years to 14years. Generally, comparing our findings on age at menarche with the reports of the past, our data suggests a trend of declining age at menarche.

Such a downward trend is also observed in the study carried out by Sule *et al*., in 2007 in the northern part of Nigeria. Particularly, studies carried out in Lagos, Ibadan, Ilorin and Ile-Ife reported mean ages at menarche to be 14.3years, 13.7±0.03years, 13.7±1.09years and 13.4±1.4years respectively (Ellis 1950;Oduntun *et al*., 1976; Fakeye, 1987; Abioye-Kuteyi *et al.,*1997). Comparing, their findings with our current findings on the age at menarche in adolescent girls in Ado-Ekiti suggest that the mean menarcheal age of adolescent girls have declined gradually over the years.

It has been reported that improved nutrition and better socioeconomic status are associated with a decline in menarcheal age (Hausple *et al*., 1997; Chodick *et al.,* 2005). Fluhmann, (1958), suggested that the average age at menarche might be taken as an index of the general well being of a people. In relation to these observations of Fluhmann, (1958), Hoel *et al*. (1983) and Danker-Hopfe, (1986) reported that the age at menarche has shown a downward secular trend in the past century in affluent societies and that this truly reflects changes in dietary habits.

However, efforts have been made by researchers to identify the dietary components that might be responsible for this accelerated age at menarche. Table 4 above, shows the mean menarcheal age of adolescent girls whose diet were rich in high protein/ diary foods to be12.85years while adolescent girls whose diet were not rich in high protein/ diary food to be 13.39years. This result indicates that young girls who consumed high protein foods regularly experienced menarche earlier than young girls who did not consume such foods regularly and therefore proves that dietary content strongly affects age at menarche.

These findings of ours is related to those of Kralj-Cercek, (1956) who observed that Slovenian girls whose diet were rich in protein, had a mean menarcheal age of 12.65±0.13years whereas Slovenian girls whose diet were largely carbohydrate, had a mean menarcheal age to be 14.1±0.11years. Another study reported by Burrell *et al*. (1961) on Bantu girls, found that girls classified as 'poor' by their school authorities had a mean menarcheal age of 15.42±0.04years whereas those girls classified as 'not poor' (on the basis of larger intake of animal protein)experienced menarche at 15.02±0.05years.

These studies and our present study truly lend a hand on the effect of nutritional status on the age at menarche. Table 4, of our present study showed that adolescent girls from parents who attained higher educational level experienced menarche earlier (father-12.69 years; mother-13.06 years) than their counterparts whose parents had no education (father-14.25years; mother-13.67 years) or had only primary/secondary education (father-13.15years; mother-13.13 years). This finding is consistent with those of Abioye-Kuteyi *et al*. (1997) and also with Eiben, (1989) who showed that later onset of menarche among girls of parents with a lower educational level may be a maker for lower socioeconomic status.

Furthermore, some studies (Belsky *et al*., 1991; Beatrice *et al*., 2014) have shown that father's educational level is associated with improved household income and may affect the girl child and make her experience menarche earlier. This is in line with the findings of our present study since girls from fathers' who had higher education, attained menarche earlier (12.69 years) than their counterparts whose fathers' had no education (14.25 years)or had only primary/secondary education (13.15 years).

This further explains the roles of fathers as the heads of families and highest contributors and determinants of household income and provision of better living and nutrition for their daughters which may be contributory to anearly onset of menarche. Our study also found a significant relationship between mothers' level of education and age at menarche. Girls from mothers who attained higher educational level experienced menarche earlier (13.06 years) than their counterparts whose mothers did not. This finding is in accordance with the study of Padez (2003). However, an inverse association was reported by Oduntan *et al*. (1976).

Our present study, found a significant association between fathers' occupation and age at menarche. Girls from fathers who are Civil servants and Businessmen/Traders attained menarche much earlier (12.85 years) than girls whose fathers are carpenters, bricklayers (13.06 years) etc. This could be a reflection of socioeconomic status of the parents.

This shows that girls from families with high socioeconomic status experienced menarche earlier than girls from families with low socioeconomic status. This is consistent with the findings of Abioye-Kuteyi *et al*. (1997). In contrast, a study reported by Tanau *et al*. 2012, in northern Nigeria, did not find any difference in menarcheal age of young girls in relation to socioeconomic status. However, our study did not show any significant relationship between mothers' occupation and age at menarche which is in agreement with the findings of Padez (2003). This shows that mothers' occupation does not affect menarcheal age directly.

We also encountered limitations in our study. Our study did not cover other local government areas in Ado Ekiti, the capital of Ekiti State in Nigeria. Reason being that since it is a capital state and an urban setting we could have a mixed population of participants from other local government areas who must have left the rural settings to dwell in the city. Therefore, I recommend that further studies should be carried out in the rural settings to ascertain the menarcheal age and compare with those of the rural settings.

Conclusion

We conclude that mean age at menarche found in Ado-Ekiti in Ekiti State, Nigeria, is lower than the mean menarcheal ages reported in other studies in Nigeria and particularly in the western part of Nigeria. This demonstrates a clear indication of a decline in menarcheal age in Nigerian girls. Also, this decline in age at menarche, could be associated with better nutritional status and socioeconomic status of the parents.

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