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Research Article

Descriptive Study of the Growth Curve of Igbo Children in Aba 5-10 Years of Age Using Weight

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Abstract: ***Background:*** Weight is a very useful and important parameter in the study of growth patterns especially in children. This study was carried out to determine the pattern of growth or the growth curve of Ibo children between the ages of 5-10 years old in Aba, a town in Abia state Nigeria. ***Materials and Methods****:* A weighing scale was used to measure the weight of a total of 834 children all living in Aba and the data obtained was used in the analysis of their growth pattern. ***Results and Discussions****:* The result showed that the boys have heavier birth weight while the girls mature earlier. The Aba children compared favourably with their Uniport counterparts at the earlier ages at the 3rd weight percentile but less with children whose weight fall within the 50th and 97th weight percentiles. The Aba children also compared favourably with the English children and the WHO's figures recommended for measuring nutritional changes at the 3' weight percentile but falls below the 50th and 97th percentiles. ***Conclusion****:* The result showed that Aba children were slightly below the WHO figures recommended for measuring nutritional changes which is as a result of their socio-economic status.

Keywords: Descriptive, Growth curve, Igbo, Children, Weight.

INTRODUCTION

Growth is the increase in size and mass as a result of cellular and extracellular components in the body. Growth can be multiplicative that is increase in the number of cells brought about by cell division (mitosis) or auxetic which is accumulation of intracellular materials in the individual cell due to increase in the protein substance within the cells. It can also be accretionary which is due to an increase in the amount of extracellular matrix between tissue cells e.g. bone and cartilage (Cole, 2012).

Other terms used in describing growth include allometric growth that is different rates of growth of different parts of the organism, isometric growth which occurs when different organs or parts of an organism is growing at the same rate; Histotypic growth that is uncontrolled growth of cells e.g. tumor cells. Relative growth is an expression of the comparison of the increases in size of similar organisms, organ or parts and interstitial growth which means expansion from within the cells of multiplicative growth (Taylor, Green and Stout, 1984; Fallah *et al.*, 2018).

Environmental pressures, natural selection and the genotype influence the growth pattern of humans. The rate of growth at any age is the outcome of these factors. In general, growth in man is found to follow a general pattern that is true for both height and weight (Ayatollahi *et al.*, 2015).

In addition to genetic factors, growth is dependent on a nurturing and sensitive care giving system. Interventions to promote growth should consider child and family characteristics including maternal perception of child health and temperament and maternal mealtime behaviour (Black and Krishnakuma, 1999).

Growth curves show at a glance the pattern of growth of individual or a people (Tanner 1976, Jalali *et al.*, 2019). They are produced by plotting different parameters of growth such as length, height, weight and volume against time or age. There are 3 types of growth curves namely Absolute growth curve or actual growth curve- it is produced by plotting data such as length, height or weight against time. It shows the overall growth pattern and the extent of growth. Absolute growth rate curve- it shows how the rate of growth changes with time. The rate is measured as the change

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in a particular parameter such as height or weight in a particular time. It shows the period when growth is most rapid and this corresponds to the steepest part of the absolute growth curve. Relative growth rate curve-it takes into account existing size e.g. if a 5year old and a 10year old human both gained 5kg in weight in one year, their absolute growth rates would be the same, but the 5-year-old would be growing relatively faster and have a greater relative growth rate.

In humans, the absolute growth curve shows four distinct phases of increased growth with adulthood having the maximum weight. The absolute growth rate curve shows that the rate of growth is fastest during infancy and adolescence with a distinct adolescent spurt of growth. While the relative growth rate curve shows that relatively speaking, growth is greatest during embryological development (Ghaemmaghami *et al.*, 2018).

In plotting figures for weight curve (growth curve), reference lines are usually provided to allow comparism between the actual growth curves. This is important for the reason that each child has its own trajectory of growth. Therefore, in all communities, some children are light while others are heavy and remain unchanged throughout childhood even though they grow at a normal rate. The parametric variables could be plotted in such reference lines as percentiles or centiles. A percentile is any value that divides the area of a histogram into 100 equal parts i.e. the value of the measured variable corresponding to the $(P/\ 100)^{th}$ member of the distribution when members are arranged in ascending order (Morley and Woodland 1979; Jalali *et al*., 2019).

Anthropometry is an aspect of anthropology that deals with physical measurements and their variation in different human populations. Physical anthropometry is generally useful in growth assessment.

Weight is a very important parameter in the assessment of growth. The World Health Organization has used it extensively in the assessment of nutritional status. Growth velocity in weight can be measured in order to assess the physical status of an individual with reference to development and growth (WHO, 2018).

Among all the anthropometric parameters for the assessment of growth, body weight is the most widely and single variable used as index of growth. According to Morley, body weight is a better indicator of the adult health status and weighting is something a health worker can grab in a few days (Emamian *et al.*, 2019).

Internationally, weight charts are highly appreciated for clinics and as a basis of determining nutritional status. Knowledge of growth chart is primarily of interest to the pediatrician; it equally provides others with a basis for an understanding of the functional activity of the individual both before and after maturity. The disadvantage of weight is its inability to distinguish between body content of fat, muscle and water. Thus, it cannot distinguish oedema or obese.

There are few works that have been done on growth curve by other authors in the past (Abduulbari and Abdulaziz, 2005; Santos *et al*., 2010; Cole, 2012; Ayatollahi *et al.*, 2015; Fallah *et al.*, 2018; Emamian *et al.*, 2019; Jalali *et al*., 2019).

This study was aimed at determining the weight of Ibo children (5-10 years old) in Aba a town in Abia state Nigeria and the relative growth patterns of Ibo boys and girls (5-10 years old) in this area.

MATERIALS AND METHODS

The study was descriptive cross-sectional with the volunteers were selected using purposive sampling method from selected primary schools in Aba, Abia State, Nigeria. A total of 834 participants recruited for this study. The participants were pupils of Igbo origin whose parents and four grandparents are natives of Igbo ethnic group.

The ethnic origin of the subjects was got from the school records of the respective schools and confirmed by the parents after they gave consent on behalf of the subjects to participate in the study. The volunteers were made to remove their shoes and wear only light clothes and then stand on the weighing scale. Their weights were taken and recorded on the note book. The weights were measured to the nearest 0.1 kilogramme. Care was taken to ensure accuracy by resetting the weighing scale to zero after taking every five measurements. Parallax error was also avoided by looking at the scale directly before recording. The age of each participant was taken by interviewing the participant and in some cases, the teachers and parents.

The participants were recruited from the following schools : Rapid Academy Aba, Champions International Schools Aba, AIMS International Missions Schools Aba, College Primary School Aba, Ngwa Road Primary School Aba, Old Court Primary School Aba, Golden Foundation Nursery and Primary School Aba, Ohabiam Primary School Aba, Assemblies of God Church, 16-20 Obohia Road Aba, Foursquare Gospel Church, 460 Port Harcourt Road Aba. In addition, home visitation was done to reach the children.

RESULTS AND ANALYSIS

The measurements obtained in the study were processed and analyzed statistically and recorded in the tables below.

Table 1: Mean (Weights in Kilogramme)

AGE (YEARS)	MALES	FEMALES	TOTAL MEAN
5	18.01	17.63	17.82
6.	20.70	20.17	20.14
7	22.52	21.69	22.11
8	23.98	24.13	24.06
9	25.67	26.09	25.88
10	27.75	27.29	27.52

Table 2: Standard Deviation (SD)

AGE (Years)	MALES	FEMALES	TOTAL SD
5	2.27	2.05	2.16
6	2.69	2.08	2.39
7	2.92	2.23	2.58
8	3.17	3.12	3.15
9	2.94	3.24	3.09
10	3.08	3.28	3.18

Table 3: Percentile Growth Chart

AGE (YEARS) BOYS (kg)	3^{RD}	50^{TH}	97^{TH}	AGE GIRLS (kg)	3^{RD}	50^{TH}	97^{TH}
5	14.20	17.50	21.65	5	14.21	17.03	21.40
6	15.69	20.19	26.14	6	15.97	20.09	24.19
7	18.13	21.67	27.52	7	17.37	20.81	25.81
8	18.34	23.50	29.70	8	19.29	23.38	29.22
9	20.40	25.14	31.33	9	21.40	25.56	31.66
10	22.38	27.42	33.55	10	23.50	28.00	34.50

Analysis

Table 1 shows the distribution of weights around the mean and the 50th percentile. From the graph, it is seen that the average weights are slightly heavier than the 50th percentile weights.

Table 2 shows the weight (3rd, 50th and 97th) percentiles of Aba children plotted against their ages. It seems to suggest that 97% of Aba boys of 10 years old will have their weight between 22.4kg and 33.5kg and for 5 years between 14.2kg and 21.7kg. 97% of girls of ages 9 years and 6 years will have their weights between 21.4kg and 31.7kg; and 16kg and 24kg respectively. It also seems to suggest that 50% of girls and boys of age 10 years will be below 26 kg and 27kg respectively, while 3% will have their weights below 14kg for both girls and boys of age 5 years.

Other works in Nigeria

Fig 1 and 2 show the 3', 50th and 97th weight percentiles for Aba and Uniport children. The graph seems to suggest that Aba children compare favorably with their Uniport counterparts between the ages of 5-7 years (especially for the percentile) but from the ages of 8-10 years, the Uniport children are heavier in weight generally for the 3rd, 50th and 97th percentiles. From the graph, Aba boys are heavier than Uniport boys at the age of 6 years for the 97th percentile. While the Aba girls are heavier than their Uniport counterparts at the age of 7 years for the 3rd percentile.

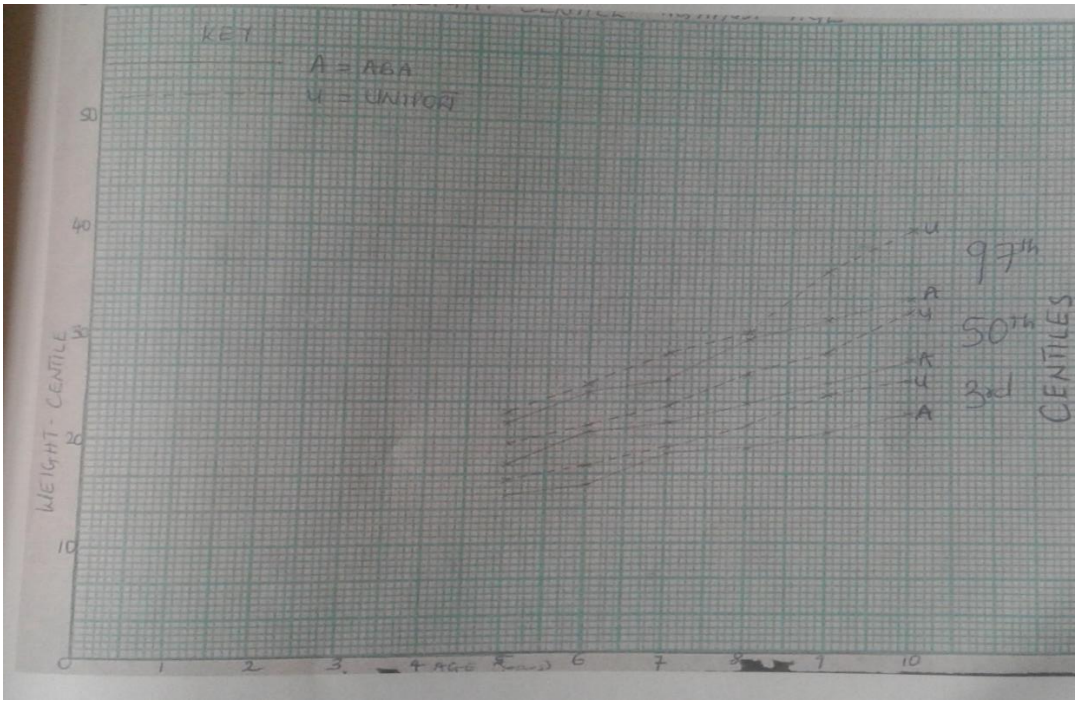

Figure 1: Comparison of growth curve of boys from the current study and another study done on primary school boys of the same age in University of Port Harcourt Demonstration Primary school, Port Harcourt, Nigeria.

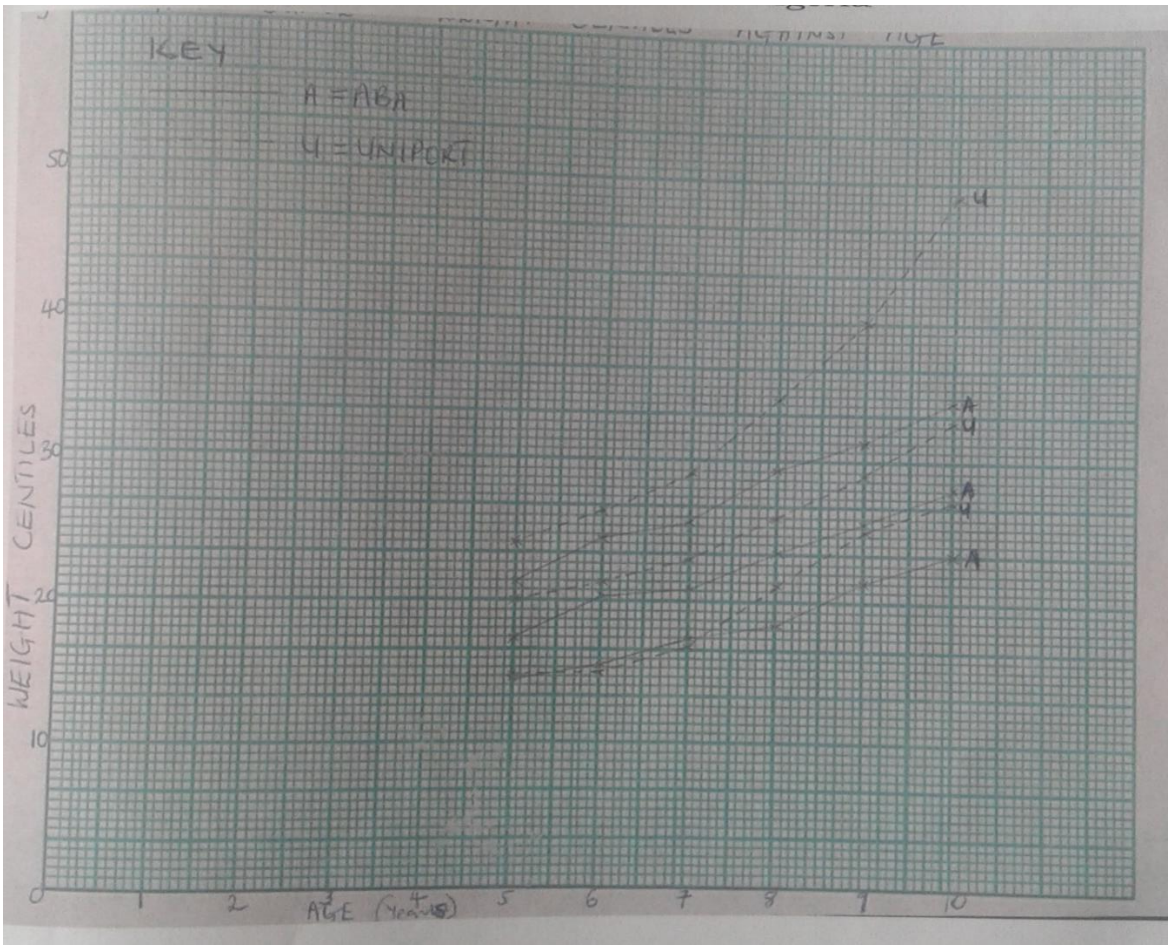

Figure 2: Comparison of growth curve of girls from the current study and another study done on primary school girls of the same age in University of Port Harcourt Demonstration Primary school, Port Harcourt, Nigeria.

Works in other Countries

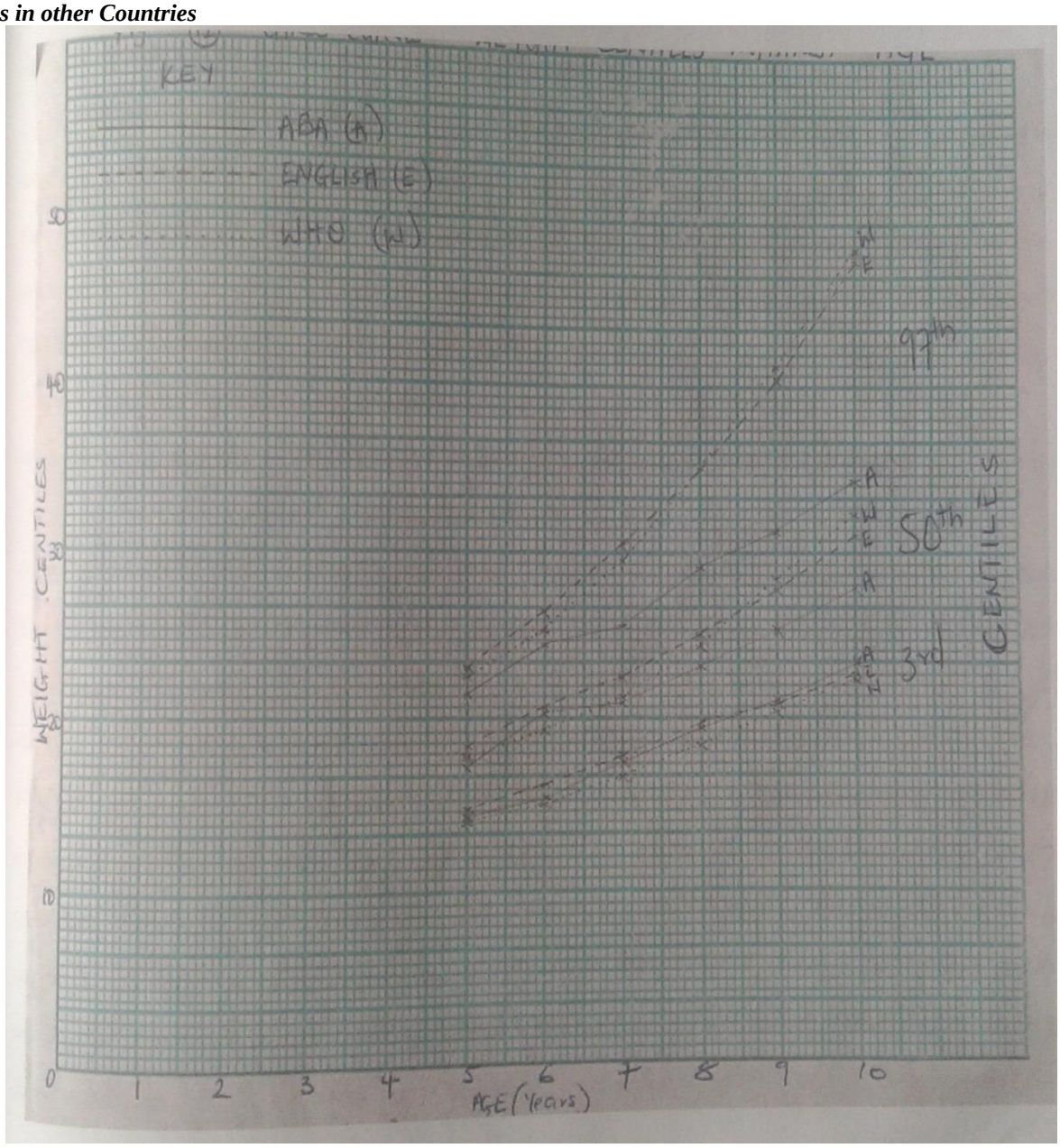

Figure 3: comparison of growth curve of participants in Aba, English children and WHO reference values.

Figure 3 shows the 3rd, 50th and 97th percentiles for Aba, English children and WHO's figures for boys and girls within the same age range (5-10 years old). The graph show that Aba girls are heavier than the WHO's figure at the 3rd percentile for the ages of 5-8 years while the Aba boys compare very favorably at the 3' centile for the ages of 5-10 years with both their English counterparts and the WHO figures. Aba boys are heavier than both their English counterparts and the WHO figures at the age of 7 years for the 3' percentile.

At the 50th and 97th percentiles, Aba children are generally lower than their English counterparts and WHO figures for measuring nutritional changes.

DISCUSSIONS

Children whose weights appear below the 3rd percentiles could probably be as a result of malnutrition if they have genetic potential to be heavy children. This malnutrition could be as a result of infections or due to lack of essential food or irregular meal. The children could be genetically smaller children within the community; thus, they could be regarded as normal or slightly malnourished children. They could probably weigh lower as a result of prematurity or lower birth weight defined by WHO as children weighing 2500g or less at birth. Studies have shown that children of lower birth weights have their subsequent weights lower before puberty.

The children of weights below the 3rd percentile could probably have risen as a result of social deprivation. This could result from superimposition of a disordered environment on genetic potential. It could be as a result of lower social privilege class among the community. Endocrine depression can also cause lower weights. Systemic causes could probably restrict growth in these children when severe e.g. chronic renal disease. Juvenile hypothyroidism could also be the cause and this usually results in severe retardation of skeletal development.

Children whose weights appear above the 50th percentiles could probably be taken as well-nourished or abnormally big genetically. Thus, nutritional status of children cannot be solely dependent on the basis of a single weight measurement compared against percentiles (Jalali *et al*., 2019).

Children of weights above the 97th percentiles could be as a result of overfeeding or high birth weights. These children could be genetically heavier children in the community or heavier children as a result of obesity.

The heavier weights registered for boys than the girls agree with the reports of previous authors (Ayatollahi *et al.,* 2015; Fallah *et al.,* 2018). The heavier weights registered by the boys could probably be as a result of higher birth weighs usually recorded by boys.

The girls tend to weigh heavier than the boys at 9 years of age. This could be as a result of early maturation.

The lower anthropometric measurements of Aba children than their Uniport counterparts could probably be as a result of differences in their socio-economic status. The parents of Uniport children are better placed in the knowledge of upbringing of their children, environmental sanitation and good standard of health profile. The parents here often have family doctors for their homes.

Heavier weights registered by English children above the 50th percentile could probably show earlier maturity than their Aba counterparts. This agrees with the findings of Tanner 1950 among the Igbo girls and Ellis 1950 among the Yoruba girls showing that Nigerian attain maturity later than English children. It could probably be as a result of infection especially malaria which affects Africans more than their European counterparts (Theodoridis *et al*., 2019).

The lower weights registered by the Aba children could probably result from adverse environmental factors on the already existing precarious nutritional status of African children (Emamian *et al.,* 2019). It could result from lower standard of living or difference in socio-economic status in Nigeria and Europe.

This work shows that children whose weights fall within the 97th percentile and above are malnourished. Those whose weights are within the 3rd percentile or above are adequately nourished while those whose weights are within the 50th percentile is fairly feed as WHO recommended. In general, this project seems to suggest that the nutritional standard of Aba children as compared with WHO (Geneva, 1983) recommendation is slightly lower but not significantly different.

The factors that could be responsible for this is the socioeconomic status of the people living in Aba which generally affects every other thing like the health care system, cleanliness of the environment and the type of food they eat. Most times, the children are subjected to street hawking after school hours when they should be resting.

CONCLUSION

In studying the growth curve of Aba children aged 5-10 years old, it was observed that the boys had heavier birth weight than the girls but the girls had the tendency of maturing earlier than the boys. The result showed that Aba children were slightly below the WHO figures recommended for measuring nutritional changes which is as a result of their socio-economic status basically.

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Conflict Of Interest

We write to state that there is no conflict of interest.

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Author's Contribution

We write to state that all authors have contributed significantly and that all authors are in agreement with the contents of the manuscript. 'Author A' (Peter D. Okoh) designed the study and protocol, wrote the first draft of the manuscript; reviewed the design, protocol; 'Authors B' (John N. Paul) examined the intellectual content of the manuscript, 'Authors C' (Esther O. Okonkwo) did the analysis of the study and literature search. All authors read and approved the final manuscript.

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