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Research Article

Assessment of Relationship between Nutritional Status and Cognition of Primary School Children in Ilesa, South West, Nigeria

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Abstract

Objectives

Childhood malnutrition poses both short and long term burden to children. Many children have low cognitive function sequel to long term effect of malnutrition. The adverse effects of malnutrition on the cognition of children have not been well researched in Nigeria, hence this study determined the Intelligent Quotient (IQ) and academic performance (AP) of children with malnutrition and compare with that of children without malnutrition.

Material and Methods

The study was done among 1280 randomly selected pupils aged 5-11years in Ilesa. Sociodemographic information was obtained from the parents through a self-administered questionnaire. Nutritional status was assessed by measuring weight, for height, height-for-age, weight-for age and weight-for-height z-score of the pupils. Intelligent quotient and Academic Performance were assessed with draw a person test (DAPT) and Continuous assessment (CA) scores respectively.

Results

About one-tenth (9.2%) of the pupils had Poor academic performance while 90.8% had good performance. In this study, 70.8% of the stunted had subnormal IQ (p=0.001) while and 60.1% of the underweight pupils had subnormal IQ (p=0.004). Twenty six (16.9%) stunted pupils had poor academic performance while 87 (8.4%) of children with optimal height had poor academic performance (χ^2 =13.184, p = 0.002). There is significant association between socio economic factors and cognition.

Conclusion

The Stunted and underweight pupils with low socio class had higher association with subnormal intelligence and poor academic performance in this study. Hence, good nutrition especially in early years of life and improved socio economic factors will assist to improve cognition among Nigerian pupils.

Introduction

Cognition is the mental processes involved in acquiring knowledge and comprehension. It is a higher-level functions in problem solving. Cognition of a child can be evaluated by assessing the intelligence quotient and the academic performance or achievement [1]. The intelligence quotient can be assessed with psychometric tools in which IQ is defined as mental age / chronological age multiply by 100. Academic performance can be assessed with continuous assessment or achievement test [2,3]. Malnutrition is a state of imbalance between supply of nutrient and utilization causing adverse effects on tissue function [4]. It can be an over-nutrition (occurring from over consumption of nutrients more than the body metabolic requirement) or under nutrition (resulting from inadequate nutrients intake require for normal development) [5]. Goon DT *et al* observed that about a quarter of children below aged 5years in sub-Saharan Africa are undernourished and the prevalence of under-nutrition in school-aged children varies across different regions in Nigeria ranging from 0.4% in the South East to 53% in the North West of the country [6].

The building block for sound mind and health is laid during the early years of life which is the critical period of growth [4]. Malnutrition during this crucial period may lead to irreversible mental deficit, psycho-social imbalance and poor academic performance [4,5]. Studies have shown that poor nutrition leads to cognitive impairment and stunted growth [7,8]. Several evidences also exist that poor nutrition is associated with stunted growth and delayed mental development, poor school performance and intelligence quotient [9,10]. Cognition is well enhanced by optimal nutrition particularly in the first 2 years of life when over 50% of the adult brain size is achieved [11]. Under-nutrition in early life may adversely affect future cognitive potentials. Chronic malnutrition often leads to neuro -pathological changes in the brain with consequential cognitive impairment later [11-13]. Among the psychometric tools for IQ determination, DAPT has been culturally friendly and has been found to be useful across different ethnic and geographical backgrounds in the world [14-17]. It assesses the child's capability to reproduce the human image concept by drawing body parts and placing them appropriately to each other proportionately. It is easier to use and cultural

friendly than other psychometric tools [15,16]. Moreover, this test has been earlier standardized and validated for use among Nigerian children [18]. Nutritional status and intelligence may be influenced by several factors such as parents' social status, parents' education, and family size [19-21]. The impact of these factors on nutrition and the child's intelligence is not well research in Nigeria. This study thus aimed at determining the relationship between the nutritional status and the cognition of the school-age children in Ilesa.

Materials and Methods

This survey was a descriptive cross-sectional study that involved 20 primary schools, across Ilesa metropolis. Ilesa is the largest town in Ijesa land, situated on latitude 7°35´ N and longitude 4°51´E and is about 200km North-East of Lagos [22]. A multistage sampling method was used to select the pupils. Ten public and ten private schools in Ilesa metropolis were selected by simple random sampling among 31 private and 29 public primary schools in Ilesa. The number of pupils recruited from each school was based on proportionate sampling method. Pupils were recruited from primary 1-6 classes at each selected school. The number of pupils recruited from each class in the selected school was also determined by the proportionate sampling method. Systematic random sampling was used to select the pupils from each selected class from their class register putting into consideration the sex and age of the subjects.

A pilot study was carried out among 80 pupils in a school that was not involved in the main study to pre-test the research tool. The study questionnaires that consist of the pupils' medical and social information, such as family size, parental educational were completed by the parents of the pupils. Questionnaires was completed and social status obtained using Olusanya *et al* social class classification [23].

Stadiometer was used to measure height to the nearest 0.1 cm and the weight was measured to the nearest 0.1kg. WHO/NCHS growth references was used to determine the weight-for-age, body mass index and height-for-age z-scores (WAZ, BMIZ and HAZ, respectively). The reference z-scores for thinness (BMIZ < -2SD), underweight (WAZ < -2SD), stunting (HAZ<-2SD), overweight (BMIZ > +2SD) and obesity (>+3SD) were done.

Continuous Assessment for first and second term examinations of each pupil were graded as excellent (≥ 75%), good (50 - 74%) and below average (< 50%) [24,25]. Pupils were considered to have poor academic performance if the score was less than 50%. The record of school absenteeism of each pupil for the academic session was obtained from the attendance register and high school absenteeism were considered if number of days not present in class were > 10 school days [26].

Draw- a- Person test (DAPT) was used to evaluate the IQ of the school children after careful explanation (appendix ii and ii b) [18]. The intelligence quotient test scores were categorized into grades (I-V) and were subsequently re-classified into optimal (Grades I-III) and subnormal intelligence (Grades IV and V). The DAPT has good correlation with WISC, Standford-Binet and ravens [27]. The children were all examined clinically and the head circumference, weight and height, vision and the hearing of the pupils were assessed.

Ethical Consideration

The procedures followed were in accordance with the ethical standards of Obafemi Awolowo University Teaching Hospital complex (OAUTHC) research and ethical committee and with the Helsinki Declaration of 1975, as revised in 2000. Approval was sought and obtained from the Zonal inspector of education in Ilesa. Permission was also taken from headmaster/headmistress and class teachers of the selected pupils. Written informed consent was obtained from the parents/guardians, while assent was obtained from the pupils.

Inclusion Criteria

All apparently healthy school children aged 5-11 years whose parents (guardians) gave consent while they themselves assented to the study were included.

Exclusion Criteria

Pupils below the age of five years and above the age of eleven years and those who declined participation in the study. Children whose parent(s) / guardian(s) did not give consent and those with history of mental deficit, seizure or cerebral palsy chronic or acute illnesses were excluded.

Data Analysis

Data were processed using the statistical software package SPSS 20. The mean and standard error of the mean (SEM) values of age, weight, height, height-for-age z-score, head circumference, and IQ were determined. The spearman correlation coefficients were calculated in order to decide if inter-correlated variables may be included as predictor variables. Chi-square was used to determine the association between IQ and nutritional status, as well as academic performance and nutritional status. Fisher's exact test was also used for cells that had values less than five. The level of significance for the chi square test was $p < 0.05$. Binary logistic regression analyses were performed between socio-demographic characteristics (independent variables), the nutritional status and IQ as well as academic performance (dependent variables) of the pupils. The strength of association was evaluated with odds ratios (OR) and the corresponding 95% confidence intervals (CI).

Result

The measured parameters and their means in the study were as follows: age, 7.94±1.83 years; weight, 24.32±5.67kg; height, 1.26±0.11m; height-for-age z-score, -0.02±3.25, weight for age z-score -0.54±1.04 and IQ, 76.85±15.35, OFC 53.09±1.67, Continuous Assessment 67.42±11.56, BMI 15.24±1.79.

Socio Demographic Characteristics of the Subjects

Twenty two percent of the parents of the pupils were artisan, 0.6% of were unemployed, 62.6% were civil servant and 14.8% were professionals. About two third (69.5%) of the pupils' mother had tertiary education, 3.4% had no formal education, 4.4% had primary education, 20.6% had secondary education and 2.1% had postgraduate education. Also, about two third (69.9%) of the father of the pupils had tertiary education,

3.8% had no formal education, 3.3% had primary education, 20.5% had secondary education and 2.5% had postgraduate education. The percentage of Males was 49.1% and females 50.9% respectively. About half (57.7%) of the pupils were from the middle class, 15% are in upper class, and about a quarter (27.3%) are in lower class. About a quarter (25.1%) of the pupils were aged are 10-11 years, one third of the pupils were aged 8-9 years and 41.8% were between 5-7 years. Above 90% of the pupils were from small family size while less than ten percent (8%) were from large family size. Both Pupils from Public and private school were also averagely represented as 50.2% and 49.8% respectively.

IQ Test Score Classification

The DAPT IQ scores as seen in Table 1 showed that 33.3% of the pupils had deficient IQ, 37.8% had borderline IQ and 28.9% had optimal IQ

Table 1: *IQ grades of the Subjects*

Grade	N=1280	(%)
Superior	7	0.5
Above average5	25	2.0
Average	338	26.4
Below average	484	37.8
Deficient	426	33.3
Total	1280	100
Categories		
DEFICIT	426	33.3
BORDERLINE	484	37.8
OPTIMAL	370	28.9
Total	1280	100

Relationship between Nutritional Status, Intelligent Quotient and Academic Performance

Table 2 showed relationship between nutritional status and intelligent quotient of the pupils while Table 3 showed nutritional status and academic performance of the subjects. Above two third (70.8%) of pupils with stunting had subnormal IQ while 39.6% of children with optimal height had subnormal IQ. The IQ score of the pupils and their height for age was statistically significant (χ^2 =69.983, p = 0.001). Sixty percent of the pupils with thinning had subnormal IQ while 41.3% of children with optimal weight had subnormal IQ. There was statistically significant difference in the IQ score of the pupils and their weight for age (χ^2 =19.432, p = 0.001). About seventeen percent (16.9%) of pupils with stunting had poor academic performance while 8.2% of children with optimal height had poor academic performance. The academic performance score of the pupils and their height for age was statistically significant (χ^2 =13.184, p = 0.002). There was no statistically significant difference in the academic performance score of the pupils and their weight for age (χ^2 =10.375, p = 0.007).

Table 2: *Relationship between Nutritional status and intelligent quotient*

Variable	Normal IQ (%)	Subnormal IQ (%)	*Total n=1280* (%)	P value
Height For Age				0.001
Stunted	45 (29.2)	109 (70.8)	154 (12.0)	
Normal stature	606 (58.6)	428 (41.4)	1034 (80.8)	
Tall stature	74 (80.4)	18 (19.6)	92 (7.2)	
Weight For Age				
Thinning	55 (39.9)	83 (60.1)	138 (10.8)	0.001
Normal weight	670 (58.7)	472 (41.3)	1142 (89.2)	
Weight /Height^2				
Underweight	126 (62.1)	77 (37.9)	203 (15.9)	0.117
Healthy weight	565 (55.1)	460 (44.9)	1025 (80.1)	
Overweight	22 (61.1)	14 (38.9)	36 (2.8)	
Obese	12 (75.0)	4* (25.0)	16 (1.2)	

*Fisher's exact test

Table 3: *Relationship between Nutritional status and Academic performance*

Variable	Good academic performance (%)	Poor performance (%)	*Total n=1280* (%)	P value
Height For Age				0.002
Stunted	128(83.1)	26(16.9)	154 (12.0)	
Normal stature	947(91.6)	87(8.4)	1034 (80.8)	
Tall stature	87 (94.6)	5* (5.4)	92 (7.2)	
Weight For Age				0.007
Thinning	115 (83.3)	23 (16.7)	138 (10.8)	
Normal weight	1047 (91.7)	95 (8.3)	1142 (89.2)	
Weight /Height^2				0.331
Underweight	180 (88.7)	23 (11.3)	203 (15.9)	
Healthy weight	932 (90.9)	93 (9.1)	1025 (80.1)	
Overweight	34 (94.4)	2* (5.6)	36 (2.8)	
Obese	16 (100)	0 * (0.0)	16 (1.2)	

*Fisher's exact test

Socio-Demographic Factors Affecting Academic Performance and IQ of the Subjects

Table 4 and 5 revealed socio-demographic factors affecting academic performance and IQ of the subjects. The relationship between socio-demographic characteristics such as the age groups, social class, school type, mothers' education, fathers' education and academic performance of the pupils were statististically significant (p = 0.001). The relationship between socio-demographic characteristics such as the age groups, social class, school type, mothers' education, fathers' education and IQ of the pupils were statististically significant (p = 0.001).

Table 4: *Effects socio-demographic factors on academic performance of the subjects*

Variable	Good academic performance ()	Poor academic performance ()	Total 1280 (100%)	P value
Age (years)				0.001
5-7	512 (95.7)	23(4.3)	535 (41.8)	
8-9	389 (91.8)	35 (8.2)	424 (33.1)	
10-11	261 (81.3)	60 (18.7)	321 (25.1)	
Social class				0.001
Upper	183 (95.3)	9 (4.7)	192 (15.0)	
Middle	685 (92.7)	54 (7.3)	739 (57.7)	
Lower	294 (84.2)	55 (15.8)	349 (27.3)	
Gender				0.700
Male	568 (90.4)	60 (9.6)	628 (49.1)	
Female	594 (91.1)	58 (8.9)	652 (50.9)	
School type				0.131
Public	575 (89.6)	67 (10.4)	642 (50.2)	
Private	587 (92.0)	51 (8.0)	638 (49.8)	
family size				0.001
Small family size	1080 (91.8)	97 (8.2)	1177 (92.0)	
large family size	82 (79.6)	21 (20.4)	103 (8.0)	
Mothers education				0.001
No education	31 (70.5)	13 (29.5)	44 (3.4)	
Pry	40 (71.4)	16 (28.6)	56 (4.4)	
Secondary	238 (90.2)	26 (9.8)	264 (20.6)	
Tertiary	827 (93.0)	62 (7.0)	889 (69.5)	
Postgraduate	26 (96.3)	1* (3.7)	27 (2.1)	
Fathers education				0.001
No education	29 (60.4)	19 (39.6)	48 (3.8)	

Pry	35 (83.3)	7 (16.7)	42 (3.3)	
Secondary	246 (88.8)	31 (11.2)	277 (21.6)	
Tertiary	820 (93.1)	61 (6.9)	881 (68.8)	
Postgraduate	31 (96.9)	1 * (3.1)	32 (2.5)	
School absenteeism				0.300
< 10days	1144 (90.8)	116 (9.2)	1260 (98.4)	
>10days	2* (10.0)	18 (90.0)	20 (1.6)	

*Fisher's exact test

Table 5: *Effects socio-demographic factors on Intelligent Quotient of the subjects*

Variable	Optimal IQ	Subnormal IQ	Total 1280 (100%)	P value
Age (years				0.001
5-7	455 (85.1)	80 (14.9)	535 (41.8)	
8-9	205 (48.4)	219 (51.6)	424 (33.1)	
10-11	65 (20.2)	256 (79.8)	321 (25.1)	
Social class				0.001
Upper	134 (69.8)	58 (30.1)	192 (15.0)	
Middle	439 (59.4)	300 (40.6)	739 (57.7)	
Lower	152 (43.6)	197 (56.4)	349 (27.3)	
Gender				0.410
Male	363(57.8)	265 (42.2)	628 (49.1)	
Female	362(55.5)	290 (44.5)	652 (50.9)	
School type				0.001
Public	304 (47.4)	338 (52.6)	642 (50.2)	
Private	421 (66.0)	217 (34.0)	638 (49.8)	
family size				0.019
Small family size	678 (57.6)	499 (42.4)	1177 (92.0)	
large family size	47 (45.6)	56 (54.4)	103 (8.0)	
Mothers education				0.001
No education	19 (43.2)	25(56.8)	44 (3.4)	
Pry	23 (41.1)	33 (58.9)	56 (4.4)	
Secondary	120 (45.5)	144(54.5)	264 (20.6)	
Tertiary	545 (61.3)	344(38.7)	889 (69.5)	
Postgraduate	18 (66.7)	9 (33.3)	27 (2.1)	

Fathers education				0.001
No education	19 (39.6)	29 (60.4)	48 (3.8)	
Pry	17 (40.5)	25 (59.5)	42 (3.3)	
Secondary	121 (43.7)	136 (56.3)	277 (21.6)	
Tertiary	536 (60.8)	345 (39.2)	881 (68.8)	
Postgraduate	21 (65.6)	11 (34.4)	32 (2.5)	
School absenteeism				0.564
< 10days	712 (56.5)	548 (43.5)	1260 (98.4)	
>10days	7 (35.0)	13 (65.0)	20 (1.6)	

*Fisher's exact test

Spearman's Correlation of Pupils 'Age, Height for Age, Weight for Height, Mothers' Education, Fathers' Education, IQ and Academic Performance of the Subject

Spearman's correlation of pupils 'age, height for age, weight for height, mothers' education, fathers' education, IQ and academic performance of the subject is shown in Table 6. There were weak positive correlation between academic performance score and IQ (r = 0.217, p = 0.001), Height for age and IQ (r = 0.205, p = 0.001), weight for height and IQ (r = 0.118, p = 0.001), mothers' education and IQ (r = 0.155, p = 0.001), fathers' education and IQ (r = 0.144, p = 0.001) of the pupils (r = 0.217, p = 0.001). The age had a strong negative correlation with the IQ of pupils (r = -0.531, p = 0.001). There were also similar correlation between academic Performance and Height for age, weight for height, mothers' education, fathers' education and age as it was with IQ.

Table 6: *Spearman's Correlation of Nutritional Status, pupils 'age, mothers' education, fathers' education and cognition of children*

Variables	**Academic performance**		**IQ**	
	r value	P value	r value	P value
Height for age	0.205**	0.001	0.098**	0.001
Weight for age	-0.048**	0.001	0.032**	0.001
Weight for height	0.118**	0.001	0.089**	0.001
Age of pupils	-0.531**	0.001	-0.187**	0.001
Mothers Education	0.155**	0.001	0.150**	0.001
Fathers education	0.144**	0.001	0.157**	0.001
IQ	0.217**	0.001	1.000	0.001

** =P value <0.01, *= P value <0.05, r is the correlation.

Logistic Regression of Factors Associated with IQ and Academic Performance

Logistic regression of factors associated with IQ and academic performance are shown in Table 7 and 8 respectively. Lower age group and not being stunted were associated with increased odds of having optimal intelligence. Also higher IQ and lower age group were associated with increased odds of having optimal academic performance score.

Table 7: *Logistic regression of factors associated with IQ*

Variables	Odds Ratio	95% C I .for EXP(B)		P value
		lower	upper	
STUNTED(1)	.328	.201	.535	.000
UNDERWEIGHT(1)	1.406	.918	2.153	.117
WASTED(1)	.817	.475	1.405	.466
MOTHERS' EDUCATION				.651
PRY (1)	2.644	.174	40.152	.484
SECONDARY (2)	1.246	.111	13.924	.858
TERTIARY (3)	.978	.092	10.386	.985
POSTGRADUATE(4)	1.355	.138	13.298	.794
FATHERS' EDUCATION				.259
PRY (1)	.768	.058	10.102	.841
SECONDARY (2)	.596	.058	6.123	.663
TERTIARY (3)	1.145	.126	10.447	.904
POSTGRADUATE(4)	.510	.065	4.019	.522
SOCIAL CLASS				.085
SOCIAL CLASS(1)	2.869	1.105	7.447	.030
SOCIAL CLASS(2)	2.653	1.091	6.451	.031
AGEGROUP				.000
AGEGROUP(1)	20.085	13.708	29.430	.000
AGEGROUP(2)	3.120	2.201	4.423	.000
FAMILY SIZE(1)	.846	.509	1.406	.518
GENDER(1)	1.204	.917	1.581	.182
Constant	.285			.370

Table 8: *Logistic regression of factors associated academic performance*

Variables	Odds Ratio	95% C I .for EXP(B)		P value
		lower	upper	
STUNTED(1)	.763	.416	1.401	.383

UNDERWEIGHT(1)	.737	.409	1.329	.311
WASTED(1)	.686	.350	1.345	.273
MOTHERS' EDUCATION				.102
PRY (1)	362318996.709	.000	.	.999
SECONDARY (2)	75203997.240	.000	.	.999
TERTIARY (3)	175092663.067	.000	.	.999
POSTGRADUATE(4)	121181491.741	.000	.	.999
FATHERS' EDUCATION				.051
PRY (1)	.000	.000	.	.999
SECONDARY (2)	.000	.000	.	.999
TERTIARY (3)	.000	.000	.	.999
POSTGRADUATE(4)	.000	.000	.	.999
SOCIAL CLASS				.614
SOCIAL CLASS(1)	1.790	.356	8.991	.480
SOCIAL CLASS(2)	1.202	.275	5.256	.807
AGEGROUP				.002
AGEGROUP(1)	2.458	1.319	4.581	.005
AGEGROUP(2)	2.133	1.297	3.510	.003
FAMILY SIZE(1)	2.046	1.124	3.723	.019
GENDER(1)	.746	.491	1.133	.169
INTELLIGENT QUOTIENT (1)	.282	.164	.485	.000
SCHOOL TYPE(1)	1.463	.931	2.298	.099
Constant	.169			.313

Discussion

Using the DAPT, 28.9% of the pupils had Optimal IQ, 37.8% had borderline IQ and 33.3% had subnormal IQ in our study. A similar observation was made by Ejekwu *et al* in Enugu [14]. This finding was in contrast with that of Ijarotimi and Ijadunola in Akure who reported that 64.2% had intellectual deficit [28]. This could be due to different psychometric tool used (Ravens progressive matrix). The study conducted in Akure was done among 402 students aged 10-15 years. The children were older and sample size for the study was smaller than our study. The high social class and good educational level of the parents of the pupils had a positive impact on intelligent quotient of the pupils [29]. Similar findings were made by Ebigbo and Izuora in Enugu [16], Ijarotimi and Ijadunola also had similar result in Akure [28]. This is because poverty with its consequential effects contribute to the lower IQ among pupils in the lower social class. Also, educated parents usually takes decisions that will enhance mental and physical development of their children [29]. This study revealed that pupils from private schools had better IQ and academic performance compared

to the pupils from public schools. This was similar to findings of Millones and Leeuwen in Peru [29] who also documented higher scores on Ravens among private school pupils. This may be due to the social background of the pupils in private school since the pupils from private school are usually from well to do family who can afford the school fees in the private school [19]. The pupils-teachers ratio in private school is less than that of public schools and the private schools are also better equipped for effective learning. It was observed in this study that the malnutrition (stunting and underweight malnutrition) pupils had lower IQ and academic performance. These observations were in agreement with those of Ejekwu *et al* [12] which recorded association between malnutrition and impaired cognition. Survana and Itagi in India [20] and Grantham-McGreggor [29] had also reported low intelligence in malnourished children in their studies. In the present study, wasted and thinned pupils had significant association with lower IQ but not with academic performance. This work is in agreement with previous researchers [12-14]. This is because Wasting/thinness is a reflection of an acute or current malnutrition which may not have as much effect on cognitive function as stunting which is a reflection of chronic malnutrition [30,31]. Contrary to the findings from our study and some earlier studies [13,14, 30,31], Ijarotimi and Ijadunola in Akure [28], reported the absence of a significant association between nutritional status and IQ. However, stunted pupils performed worse in the IQ tests compared to the well-nourished subjects in the same study [28]. Higher IQ was observed in younger age group 5-7 years compared to age 10-11years in this study. This was in consonance with other studies [12-14,30]. This result was in contrast with the report of adedeji *et al* in which undernourished pupils with impaired intelligence were more under the age of 9 years [32]. This could be attributed to obvious nutritional neglect usually suffered in early childhood by the children in Jos, Northern Nigeria where Adedeji's study was done. Also, as children grow older they tend to be more distracted and lack concentration as more non curricular activities attract their attention especially in pre-adolescent and adolescent age group. It was also observed in our study that undernourished children with poor socio-demographic variables had a greater prevalence of subnormal intelligence when compared with those of their undernourished counterparts who had a good socio-demographic background. This is similar to the findings in previous studies [11,19,21], who reported that unfavorable socioeconomic factors adversely affect under nutrition and intelligence [33].

Conclusions

Stunted and underweight pupils had higher association with subnormal intelligence and poor academic performance. Socio-demographic factors such as age greater than 10 years, public schools attendance and lower social class, low parental education are factors associated with a greater occurrence of poor cognition among the undernourished children. Hence, good nutrition and improved socio economic factors will assist to improve cognition among Nigerian pupils especially in early years of life.

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Authors' Contribution

All the authors contributed in concept, design, definition of intellectual content, literature search, clinical studies, data acquisition, data analysis, statistical analysis, manuscript preparation, manuscript editing and manuscript review. The manuscript has been read and approved by all the authors.

Conflict of Interest

No conflict of interest

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