

ORIGINAL ARTICLE

Cognitive Function of Primary School Children in Ilorin, Kwara State, Nigeria

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ABSTRACT

Background: Cognition is a measure of a child's intelligence and reflects the child's performance relative to that of children of the same age. The development of intelligence is critical especially in the first 1000 days of life. Cognitive capacity can be determined by the evaluation of intelligence quotient (IQ), using sets of standardized and validated tools such as the Draw-A-Person Test (DAPT). The cognitive performance of children has not been well studied in Nigeria.

Objective: To determine and compare the intelligence quotient (IQ) of public and private primary school children in Ilorin.

Methods: Cross-sectional descriptive studies of school children aged 6-12 years in three Local Government Areas (LGA) of Ilorin Kwara State, using multi-staged sampling techniques. A total of 16 primary schools, 8 public and 8 private school pupils were recruited for the study. The Draw-A-Person Test was used to determine IQ.

Results: There were 221 (46.0%) males and 259 (54.0%) females. The mean age was 9.2 ± 1.8 years, and mean IQ was 98.0 ± 14.1 . The mean IQ of the private school children (99.6 ± 15.2) was significantly higher than that for the public school children (96.5 ± 12.9) $p < 0.0170$. The prevalences of intellectual deficit, low IQ and superior IQ in the study population were 2.5%, 9.6% and 8.8%, respectively.

Conclusions: The mean IQ of school pupils was significantly higher in private than the public schools. Superior IQ was higher among private than the public school pupils, while low IQ and intellectual deficit were higher in public school pupils.

Keywords: Draw-A-Person test, intelligence quotient, school age

INTRODUCTION

Intelligence Quotient (IQ), which measures cognitive function of individual, is derived from a German term *intelligenz quotient*. The IQ is a highly reliable measure of general intellectual functioning that captures overall ability across differentiable cognitive functions.¹ The scoring of IQ is derived from one of the several standardized tests designed to assess "intelligence" which include verbal and non-verbal skills, short-term memory and speed of information processing.² The average IQ score on most tests is 100, with a standard deviation of 15.

Most IQ scores (about 68%) fall within one standard deviation on either side of the mean (e.g. between 85 and 115), and almost all scores (99% of the population) fall within 3 standard deviations above or below the mean.² Therefore, a child's intelligence is considered low when the IQ test score is ≤ 84 , normal at IQ of 85-115 and superior >115 .³

The low IQ, however, includes children with borderline IQ (70-84) and those that are mentally retarded (<70), otherwise, referred to as intellectually impaired.⁴ Children with borderline IQ have intelligence test scores below one standard deviation, and they are slow learners, though, able to adjust with supervision, unlike the intellectually impaired children that require special care, special education and adequate monitoring of their day to day activities.⁴

Intelligence tests are reasonably accurate at predicting school performance. Thus, IQ tests are the best single indices of how well a child will perform in school.²

Commonly used tools for assessment of IQ include:

1. **Bayley Scale of Infant Development (BSID):** This is the most commonly used infant intelligence scale for the assessment of language, as well as visual, behavioural, gross and fine motor skills. It is used in children aged 1month - 3 years.⁵
2. **Wechsler Scales:** Used in children older than 3 years.⁵
 - a. **Wechsler Preschool and Primary Scale of Intelligence (WPPSI):** used for children 3-

7years, measures overall cognitive ability in verbal and performance IQ.

- b. **Wechsler Intelligence Scale for Children (WISC-IV):** for children aged 6-16 years to assess overall cognition.
- c. **Wechsler Adult Intelligence Scale (WAIS):** used among the adult population.
3. **Raven's Progressive Matrix (RPM) Test:** Used for children ≥ 6 years old.
4. **Stanford-Binet Intelligence Scales (SBIS):** Used in children aged ≥ 2 years. It measures cognition across domains such as verbal reasoning, quantitative reasoning, abstract reasoning and short-term memory.³
5. **Draw-a-Person Test (DAPT):** This is, otherwise, called the Draw-a-Man test, used for children aged 6-12years. Harris assumes that changes in a child's drawings of a man represent the development of cognitive complexity expressed by increasingly complex representations of the human figure.^{6,7}

Several studies suggested that children's drawing illustrate an array of mental and cognitive abilities which move from simple (e.g. stick figures) to complex representations (such as individuals in clothing of different styles with detailed facial features).⁸ The Draw-a-Man test, as a standardized way of assessing the intellectual and emotional states of children, was first described by Florence Good-Enough in 1926.⁷ Ebigo and Izuora validated the Draw-a-Man test according to Ziller's test which is relatively free of cultural interference for use in Nigerian children.⁷ The fast development of the use of this test can be explained by its ease of administration and satisfactory correlation with other IQ tests.⁸ The global prevalence of intellectual deficit is estimated to be 1-4%.³ The Diagnostic Statistical Manual (DSM) IV categorized intellectual disability as follows: mild (55-69), moderate (40-54), severe (25-39) and profound as (<25).

OBJECTIVE

To determine and compare the intelligence quotients of the private and public primary school children in Ilorin.

METHODOLOGY

Study Design: It was a descriptive cross-sectional study where subjects were primary school children aged 6–12years. The study was conducted among public and private primary school children in Ilorin, the capital of Kwara State situated in the North Central zone. Ilorin has 3 Local Government Areas (LGA); Ilorin East, West and South.⁹

The number of private and public primary schools in Ilorin at the time of the study was 668 across the three LGAs.¹⁰ The total population of pupils in both the private and public primary schools in the 3 LGA was 109,492, at the time of this study.¹⁰ The number of schools recruited per LGA was based on population size at a ratio 2:1:1 in Ilorin West, South and East, respectively. The minimum sample size calculated using the Yamane formula was 480.¹¹

A multi-stage stratified sampling technique was used for the selection of subjects for the study by using the schools list provided by the State Ministry of Education; the primary schools in each LGA were stratified into public and private schools. The *Table of Random Numbers* was used to select 16 (8 public and 8 private) schools from the above list. In each of the selected schools, 30 pupils were recruited to make a total of 480 pupils.

Exclusion Criteria

Excluded from the study were children with cerebral palsy, history suggestive of sickle cell disease and other chronic diseases. Similarly, those with visual and hearing impairment without corrective measures in place, upper limb anomaly, stimulant use and neurological sequelae, were all excluded from the study.

Data Analysis

Mean and standard deviation were determined as appropriate. The Student's *t*-test and Analysis of Variance (ANOVA) were used to analyze continuous variables and to identify the significance between two or more means, respectively. Discrete variables were compared using the *Chi-square* test. The level

of significance was established at *p*-value <0.05.

Ethical Approval and Consideration

Ethical approval was obtained from the Ethical Review Committee of University of Ilorin Teaching Hospital. Written permission was obtained from Kwara State Ministry of Education. Permission was also obtained from the school head teachers and class teachers during field work. Additionally, written informed consent was obtained from the parents / guardians of the participants. Assent was, also, obtained from participants aged 10years and above.

RESULTS

Demographic Characteristics of the Study Population

A total of 480 primary school pupils were recruited for the study; 240 each from public and private schools. The gender distribution of the children between the public and private schools were comparable. Of the total study population, 259 (54.0%) were females, with a male to female ratio of 1:1.2 (Table 1).

The mean age ($\pm$ SD) was 9.2 $\pm$ 1.8 years, and the mean ($\pm$ SD) of children in public schools (10.0 $\pm$ 1.6 years) was significantly higher than those in the private schools (8.3 $\pm$ 1.7 years) $p=0.0001$. The mean age (SD) of males in the public schools (9.8 $\pm$ 1.7years) was significantly higher than in the private schools (8.5 $\pm$ 1.7years) ($p=0.0001$). Similarly, the mean age (SD) of females in public schools (10.1 $\pm$ 1.6 years) was significantly higher than those in the private schools (8.2 $\pm$ 1.6years) $p=0.0001$ (Table 2).

Effect of Demographic Factors on Intelligence Quotient

Pupils aged 10–12years had a significantly higher mean IQ than pupils aged 6–9years ($p=0.0001$). Private school children had a significantly higher mean IQ than public school children $p=0.0001$. There was no significant difference in IQ between males and females ($p=0.0001$), see Table 3.

Table 1. Demographic characteristics of the study population

	Public n (%) n=240	Private n (%) n=240	Total n (%) N = 480
Age (years)			
6	5 (10.9)	41 (89.1)	46 (100.0)
7	13 (21.3)	48 (78.7)	61 (100.0)
8	34 (47.2)	38 (52.8)	72 (100.0)
9	38 (45.8)	45 (54.2)	83 (100.0)
10	49 (52.1)	45 (47.9)	94 (100.0)
11	43 (70.5)	18 (29.5)	61 (100.0)
12	58 (92.1)	5 (7.9)	63 (100.0)
Gender	n=240	n=240	N=480
Male	111 (50.2)	110 (49.8)	221 (100.0)
Female	129 (49.8)	130 (50.2)	259 (100.0)

Table 2. Age and anthropometric parameters of public and private school children

Age/Anthropometry	Public Mean ± SD	Private Mean ± SD	t	p value
Age (years)	10.0 ± 1.6	8.3 ± 1.7	10.9	0.0001
Male	9.8 ± 1.7	8.5 ± 1.7	5.5	0.0001
Female	10.1 ± 1.6	8.2 ± 1.6	10.0	0.0001
Weight (kg)	27.9 ± 8.0	25.3 ± 7.3	3.7	0.0001
Male	27.1 ± 7.1	26.6 ± 7.7	0.5	0.6280
Female	28.7 ± 8.7	24.3 ± 6.7	4.6	0.0001
Height (cm)	131.3 ± 12.3	126.7 ± 10.9	4.4	0.0001
Male	129.9 ± 12.0	128.4 ± 11.1	0.9	0.3590
Female	132.5 ± 12.5	125.2 ± 10.5	5.1	0.0001

Table 3. The effect of demographic factors on Intelligence Quotient

Parameters	IQ Mean $\pm$ SD	<i>t</i>	<i>p</i> value
Age (years)			
6 – 9	95.2 $\pm$ 12.3		
10 – 12	101.7 $\pm$ 15.5	-5.0	0.0001
School type			
Public	96.5 $\pm$ 12.9		
Private	99.6 $\pm$ 15.2	-2.4	0.0170
Gender			
Male	98.6 $\pm$ 15.0		
Female	97.5 $\pm$ 13.4	0.9	0.3830

Mean ($\pm$ SD) IQ of the study subjects 98.0 $\pm$ 14.1.

Stratification of Intelligence Quotient among the Study Population

A large proportion of private school pupils, 31 (12.9%), scored higher on the IQ test when compared with public school pupils 11 (4.5%) $p=0.0034$. There was no child with severe or profound mental retardation in the study population. Twelve (2.5%) children of 480 had mild to moderate mental retardation, with 9 (75.0%) of the twelve belonging to mild

category. Nine (75.0%) out of 12 pupils with mental retardation were from the public school compared to 3 (25.0%) from the private schools ($p=0.0001$). A total number of 30 (12.5%) public school pupils had low IQ (borderline, mild and moderate MR) as against 16 (6.7%) private school pupils (Table 4).

Table 4. Stratification of Intelligence Quotient among the Study Population

Parameters	Public n (%)	Private n (%)	Total	χ^2	<i>p</i> value
IQ category	n=240	n=240	480		
Superior	11 (26.2)	31 (73.8)	42	8.6	0.0034
Normal	199 (50.8)	193 (49.2)	392	0.1	0.8006
Borderline	21 (61.8)	13 (38.2)	34	1.4	0.2299
Mild	6 (66.7)	3 (33.3)	9	3.0	0.0001
Moderate	3 (100.0)	0 (0.0)	3	-	-

Stratification of Intelligence Quotient by Age

A higher proportion 32 (76.2%) of primary school pupils aged 10–12 years had superior intelligence quotient compared to 10 (23.8%) among those aged 6–9 years. Conversely,

more 9 (75.0%) school pupils aged 6–9 years had a higher percentage of mental retardation (mild + moderate) when compared to the pupils aged 10–12 years 3 (25.0%), see Table 5.

Table 5. Stratification of intelligence quotient by age

Parameters	6 – 9 years n (%)	10 – 12 years n (%)	Total
IQ category	n=274	n=206	480
Superior	10 (23.8)	32 (76.2)	42
Normal	233 (59.4)	159 (40.6)	392
Borderline	22 (64.7)	12 (35.3)	34
Mild	7 (77.8)	2 (22.2)	9
Moderate	2 (66.7)	1 (33.3)	3

DISCUSSION

The mean IQ of the study population was 98.0 ± 14.1 , which correlates with previous findings in Enugu and Iran which reported a mean of 95.6 ± 17.3 and 99.5 ± 2.1 , respectively.^{12,13} The similarity between these two earlier studies may be due to the standardized study design, as well as the tool, used. There was no significant difference in the mean IQ of male and female in our study. A similar finding was reported in a study from Nepal.¹⁴ The comparison may be attributed to the similarity in the socio-economic class across gender, seen in these studies.

The prevalence of superior IQ from this study was 8.8%, which is higher than the 7.2% and 2.3% reported in studies in Lagos and Nepal, respectively.^{14,15} The plausible reason for the difference may be that this study was done amongst, apparently, healthy school pupils using a larger sample size (480), compared with the Lagos study which was hospital-based, using a smaller (69) sample size. The difference with the Nepal study may be attributed to an improved parental level of education observed in the present study.¹⁴ On the other hand, a higher prevalence of 29% was reported in India.¹⁶ The observed differences may be due to the classification of superior IQ in this study which was >115 compared to a lower value of 110 used in the Indian study.

The proportion that had mental retardation in this study was 2.5%, which is within the reported global prevalence of intellectual deficit of 1–4%.³ The finding from the present study was lower than the 64.2% reported from Akure.¹⁷ The possible explanation for the difference may be due to the robust inclusion of all primary school classes in this study compared to the Akure study which was restricted to primary 5 and 6 pupils only. Moreover, the multi-staged sampling technique used in this study was meant to eliminate bias to a good extent, compared with simple random sampling method applied in the Akure study. Furthermore, the culturally friendlier and flexible timing of the tool in this study compared with Raven's Matrix used in the Akure study may, also, be a reason for the differences.

CONCLUSIONS

The mean IQ of private school pupils was significantly higher than of public school pupils. Additionally, superior IQ was higher amongst private than the public school pupils. On the other hand, low IQ and intellectual deficit were higher in public than the private school pupils. Also, mental retardation (MR) from this study ranges from mild to moderate.

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