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Research Article

# Assessment of Nutritional Status of Children with Attention Deficit Hyperactivity Disorder in Ile Ife, Nigeria

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## Abstract

**Background**

One of the leading neuro- behavioural disorders of childhood is attention deficit hyperactivity disorder (ADHD). There have been controversies on the nutritional status of children with ADHD. There are paucity of researches globally on nutritional status of children with ADHD and no documented study on this in Nigeria. Hence, the need for this study.

**Objectives**

The study aimed to determine the nutritional status of the primary school children aged 5-11 years with ADHD in Ile Ife.

**Material and Methods**

A prospective cross sectional study conducted on 1200 pupils aged 5-11 years who were selected with multistage random sampling. The Pupils were screened for ADHD with Disruptive behavioural rating scale (DBDRS) according to Diagnostic Statistical Manual of Mental Disorder fifth edition

(DSM V) and the nutritional status of the subjects was assessed by measuring anthropometric parameters such as height, weight, weight-for-age, and height-for-age and weight-for-height z-score of the pupils.

**Results**

The different in mean values for weight, height and BMI in children with ADHD and the healthy group were not statistically significant (p> 0.05). The mean ±SD of BMI in children with ADHD was 15.2±1.6 while that without ADHD was 15.2±1.8 (p=0.067). Meanwhile, thirteen (15.7%) of children with ADHD were stunted while 8 (9.6%) had tall stature. Ten (12%) of children with ADHD were also underweight while 2(2.4%) and 1(1.2%) of them were overweight and obese respectively.

**Conclusion**

The nutritional status of children with ADHD was similar to other children without ADHD. Underweight is more common with ADHD than obesity in this study.

## Introduction

ADHD is a neurobehavioural disorder characterized with persistent inattention, hyperactivity, or impulsiveness, manifesting before 12years lasting for at least 6months [1]. It could impair the child's functioning such as school achievement, self-control, social skills development and self-esteem [2]. All these behaviours must not be appropriate for the age of the child [1,2]. The worldwide prevalence of ADHD was 5% [3] while prevalence of ADHD in Nigeria varies from 4.7% - 10.1% in southwest and 7.6- 23.1% in south east of the country. [4-7] ADHD had been found to have higher male to female preponderance [4-7]. Malnutrition has been documented in some researches to be associated with ADHD [8-10]. There was also studies on school aged children that had implicated malnutrition as a cause of ADHD [10] Insufficient nutrition / unbalanced diet in the early childhood may trigger hyperactivity and other adverse behavioral patterns in children [11]. It is reported that developmental impairment of central nervous system from severe early childhood malnutrition has been implicated as one of the risk factors in the development of ADHD [12]. A study had shown an association between food intake and brain electrical activity in children with ADHD [13]. Malnutrition is an imbalance between nutrient supply and utilization leading to abnormal tissue function [14]. It can either be an over-nutrition or under nutrition [15]. Goon DT *et al* reported under nutrition in about 25% of under 5 children in sub-Saharan Africa while 6.88% of under 5 children had obesity [15,16]. The prevalence of under-nutrition in school-aged children in North West of Nigeria was 53% [16]. There has been increasing interest on possible association of ADHD with obesity or overweight [17,18]. Cortese *et al* found association between obesity in childhood and adults [18,19]. Proposed link between ADHD and obesity were: (1) Impulsivity and inattention have been linked to irregular eating patterns and life-style with subsequent weight gain [20-29]. (2) sleep-disordered, breathing disorder and deficits in arousal/alertness associated with obesity manifest as ADHD-like symptoms (3) ADHD and obesity shared dopaminergic receptor dysfunction in their pathophysiology [18,23]. However, some researches have failed to report a significant association between ADHD and obesity/overweight [30].

The impact of these factors on nutrition and ADHD is not well research in Nigeria. This study thus aimed at determining the nutritional status of the primary school children with ADHD in Ile Ife.

## Materials And Methods

A multistage sampling method was adopted to select the pupils from eighteen (18) out of 72 primary schools in Ile Ife. The number of pupils recruited from each school was done on proportionate sampling method. Pupils were selected from classes' 1-6 s in each selected primary school. The recruited pupils from each class in the selected school were also chosen by the proportionate sampling method. Simple random sampling was used to select the pupils from each selected class from their class register considering the sex and age of the subjects.

The study questionnaire that consist of the past medical history, social history of the pupils, family size, parental educational and occupation were filled by the parents of the pupils. Social statuses of the pupils were obtained with Oyedeji *et al* social class classification [31].

The Pupils were screened for Disruptive behavioural rating scale according to Diagnostic Statistical Manual of Mental Disorder fifth edition (DSM V).

The parents 'version of DBDRS described by Pelham *et al* were used to screen pupils for ADHD symptoms according to DSM V and was back translated to Yoruba [32]. The Disruptive Behaviour Disorder Rating Scale (DBDRS) consists of 45 items representing symptoms of ADHD, Conduct Disorder (CD) and Oppositional Defiant Disorder (ODD). Eighteen (18) of the 45 items on DBDRS were the DSM-V ADHD symptoms criteria used in screening the subjects. Each symptom on DBDRS was rated on a 4-point likert scale according to the severity of symptoms: not at all, just a little, pretty much and very much. Information from parents was gotten by researcher through the questionnaires. The parents of each selected pupil were officially contacted through the head teachers of the selected school to inform them of the interviewer's visit and to obtain their consent to participate in the study. The pupils that had ADHD symptoms and met the full DSM V criteria for the diagnosis of ADHD from parents' DBDRS were considered to have ADHD after clinical interview were done to ascertain the diagnosis. The parents were contacted again to obtain missing information and the parents' response rate was 100%.

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

### Ethical Consideration

The study was conducted 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 obtained from the Zonal inspector of education in Ile Ife and permission was taken from headmaster/headmistress and class teachers of the selected pupils. Written informed consent was obtained from the parents and assent from the pupils.

### Inclusion Criteria

All apparently healthy school children aged 5-11 years whose parents gave consent and they assented to the study were included.

### Exclusion Criteria

Children outside the age of 5-11years and those whose ages could not be determined were excluded. The pupils who declined participation in the study and whose parent(s) did not give consent. Children with history of chronic or acute illness were also excluded.

### Data Analysis

Data were processed with the statistical software package SPSS 20. The t- test was used to compare means of the continuous variables. Chi-square was used to determine the association between ADHD and nutritional status, Fisher's exact test was used for associations of proportions for cells that had values less than five. The level of significance for the chi square test was $p < 0.05$.

## Result

### Socio Demographic Characteristics of the Subjects

The mean±SD for the age of the pupils in the study were 7.74± 1.7 years. Both males and females were averagely represented as 49.4% and 50.6% respectively. About 15.7% of the pupils were from the middle class, 57.8% are in upper class, and 26.5% are in lower class. About a (20.1%) of the pupils were aged 10-12years, (35.3%) of the pupils were aged 8-9years and 44.6% were between 5-7years. Both Pupils from Public and private school were also averagely represented as 49.2% and 50.8% respectively.

### Anthropometric Parameters of Children with ADHD and Those Without ADHD

The Anthropometric parameters of children with ADHD and those without ADHD were shown in Table 1. The different in mean values for weight, height and BMI in children with ADHD and that of those without ADHD were not statistically significant ($p>0.05$). The mean ±SD of BMI in children with ADHD was 15.2±1.6 while that without ADHD was 15.2±1.8 and the difference was not statistically significant ($p=0.067$).

***Table 1:*** *Anthropometric parameters of children with ADHD and those without ADHD*

| Variables | ADHD n= , x ±SD | Without ADHD n=, x ±SD | t | P Value |
|---|---|---|---|---|
| OFC(cm) | 52.9±1.6 | 53.04±1.7 | 0.797 | 0.821 |
| Height(cm) | 124.3±10.6 | 124.8±10.6 | 0.400 | 0.616 |
| BMI(kg/m$^2$) | 15.2±1.6 | 15.2±1.8 | 0.067 | 0.276 |
| Weight(kg) | 23.7±5.1 | 23.9±5.4 | 0.362 | 0.459 |

Independent sample t- test

**Socio Demographic Characteristics of Children with ADHD and Those Without ADHD**

Socio demographic characteristics of children with ADHD and those without ADHD were shown in table 2. The children in this study are more in low and middle social class than upper social class and the difference was statistically significant (P= 0.004). There was no statistically significant difference in other socio demographic characteristics of children with ADHD and those without ADHD (P> 0.05).

***Table 2:*** *Socio demographic characteristics of children with ADHD and those without ADHD*

| Variables | ADHD n=83 (%) | Without ADHD n=1117 (%) | $\chi^2$ | P Value |
|---|---|---|---|---|
| Age | | | 0.045 | 0.978 |
| 5-7 | 37(44.6) | 498(44.6) | | |
| 8-9 | 30(36.1) | 394(35.3) | | |
| 10-11 | 16(19.3) | 225(20.1) | | |
| Gender | | | 0.461 | 0.497 |
| male | 44(53.0) | 549(49.1) | | |
| female | 39(47.0) | 568(50.9) | | |
| Social class | | | 10.823 | 0.004 |
| Upper social class | 7(8.4) | 181(16.2) | | |
| Middle social class | 42(50.6) | 652(58.4) | | |
| lower social class | 34(41.0) | 284(25.4) | | |
| Family size | | | 1.271 | 0.260 |
| Large family size>6 | 9(10.8) | 83(7.4) | | |
| Small family size<=6 | 74(90.2) | 1034(92.6) | | |
| School type | | | 0.183 | 0.669 |
| public | 39(47.0) | 552(49.4) | | |
| private | 44(53.0) | 565(50.6) | | |

**Nutritional Status of Pupils with ADHD and Those Without ADHD**

The different in nutritional status (degree of wasting, stunting, and malnutrition) of children with ADHD and that of children without ADHD was shown in Table 3. The different in nutritional status (degree of wasting, stunting, and malnutrition) of children with ADHD and that of children without ADHD was not statistically significantly in this study (P> 0.05). Meanwhile, thirteen (15.7%) of children with ADHD were stunted while 8 (9.6%) had tall stature. Ten (12%) of children with ADHD were also underweight while 2(2.4%) and 1(1.2%) of them were overweight and obese respectively.

***Table 3:*** *Nutritional status of pupils with ADHD and those without ADHD*

| Variables | ADHD n=83 (%) | Without ADHD n=1117 (%) | $\chi^2$ | P Value |
|---|---|---|---|---|
| Stunting | | | 2.539 | 0.281 |
| <5-short stature=stunted | 13(15.7) | 123(11.0) | | |
| >=5- <95- normal stature | 62(74.7) | 913(81.7) | | |
| >=95- tall stature | 8(9.6) | 81(7.3) | | |
| Wasting (Thinness) | | | 3.702 | 0.157 |
| <5=thinning | 9(10.8) | 106(9.5) | | |
| >=5-<85 | 68(81.9) | 974(87.2) | | |
| >=85 | 6(7.3) | 37(3.3) | | |
| Degree malnutrition | | | 0.931 | 0.818 |
| <5- underweight | 10(12.0) | 176(15.8) | | |
| >5-<85-healthy weight | 70(84.4) | 894(80.0) | | |
| >=85-<95-overweight | 2(2.4) | 32(2.9) | | |
| >=95-obesity | 1(1.2) | 15(1.3) | | |

## Discussion

This study found that the mean weight, height, and BMI values in children with ADHD were not significantly different from those without ADHD. This result was contrary to the studies of Kiddie *et al* and Cortese *et al* in which ADHD children were found to be heavier and taller than normal children as evidenced by higher weight and BMI [17-19,33]. Some researchers reported a significantly higher prevalence of ADHD in obese patients than in comparable controls [27-29,34,35]. Some other documented studies also reported higher-than-average body mass index and standard deviations scores among children with ADHD than control [36,37]. Although, it is not clear why ADHD children were taller than healthy subjects but some mechanisms have been proposed regarding the link between obesity and ADHD: such as ( i) irregular eating patterns and life-style with subsequent weight gain, (ii) sleep-disordered, breathing disorder and deficits in arousal/alertness associated with obesity(iii) ADHD and obesity shared dopaminergic receptor dysfunction in their pathophysiology [20-29] (iv) the differences in physical activity can also affect energy consumption and weight gain. [37]The main reason behind these contradictory results is unclear. However, Dura'-Trave *et al* reported significantly lower mean weight, height, and BMI values in ADHD children than those of the control group [38] which is also in contrast with our studies in which we found similar mean anthropometric parameter for both ADHD and children without ADHD. The study done by Mustillo *et al* among youths aged 9-16 years found similar result with this index study in which no association was reported between ADHD and obesity [39]. However, there are inconsistencies in the results of various researches and differences in the evaluated anthropometric parameters compared to the index research. This could be as a result of varying prevalence of malnutrition in various countries and especially in Africa and in Nigeria where under nutrition is more pronounced. In this index study, ADHD was more common in low and middle social status than high social class which is in agreement with other researches [38,39].

Several researches that supported the risk of overweight to be higher in children with ADHD than in healthy children had implicated other risk factors such as gender, age, drug therapy and TV exposure [29,40-43] However, in the present study, the percentage of children who were underweight/ low BMI were similar in both healthy group and those with ADHD. The percentage of children with normal weight/BMI was also similar in both groups, while the children who were overweight/ obese were few in number in both healthy group and those with ADHD. Underweight is more common with ADHD than obesity in this study. The reason for the low BMI could be attributed to higher energy expenditure due to the hyperactive nature of ADHD and insufficient energy intake due to their restless nature. Also, the fact that majority of the subjects who participated in this study came from low and middle class can also explain this result.

## Conclusions

The nutritional status of children with ADHD was similar to other children without ADHD and obesity is less common with ADHD than Underweight in this index study.

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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.

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