Vitamin-Mineral Status on Copying Tasks Completion of Children with Attention Deficit Hyperactivity Disorder (ADHD)

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Abstract
The purpose of this study was to investigate the vitamin-mineral status of children with attention deficit hyperactivity disorders, and determine how disorders in children affect classroom copying tasks performance. The study was motivated by the persistent attention problems that often disrupt learning, lower classroom task involvement and performance of children with ADHD. Four research questions were formulated for the study. The study used quasi experimental research with the population of children with ADHD, who as a result of the disorders led to copying tasks incompletion, poor performance and other learning activities in schools. Purposive sampling technique was adopted, in which eight (8) children with ADHD were sampled. Conners’ Teachers Rating Scale – Revised (CTRS-R), Behaviour Measurement Scale (BMS) and Quantum Magnetic Resonance Image Analyser (QMRIA) were instruments adapted for the study. CTRS-R and BMS’s reliability indexes at of 0.92 and Cronbach’s Alpha (α) = 0.89 (p < 0.001) respectively, at 0.05 significant level. The results of the study among others revealed that there is missing or reduced vitamin-mineral status in most of the vitamin-mineral elements tested in children with ADHD. Also, the findings revealed that ADHD contributed to the performance of all the children on the copying tasks of letters, numbers and shapes, where the tasks showed the low scores in the aggregate of 30 scores per child. Conclusion and recommendations were drawn from findings of the study.

Keywords: ADHD, Vitamin-Mineral, Copying Tasks, Children with ADHD

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Attention Deficit Hyperactivity Disorder (ADHD) is the term used to describe a neurobiological condition that affects between 5 and 12 per cent of children worldwide with impairing levels of inattentive or hyperactive/impulsive behaviours. A diagnosis is based on developmentally non-desirable behavioural symptoms that begin in pre-school years and tend to persist through childhood, adolescence, and adulthood (American Psychiatric Association, 2000). The symptoms include inattention, hyperactivity, or impulsivity. Moreover, children with ADHD exhibit the behavioural and attention problems that could certainly disrupt learning, lower school or classroom involvement and performance. It is an umbrella term of an abnormally increased and sometimes uncontrollable activity or muscular movements. It is a behavioural disorder which often becomes obvious in most of the school or growing children, and is due to three major underlying problems of poor attention, hyperactivity and impulsivity.

Furthermore, Attention Deficit Hyperactivity Disorder (ADHD) becomes a problem when one or more of the behaviours’ underlying factors are exaggerated, compared with other children of the same age, and when the behaviours affect the children, the school, social and family life. The learning problems are poorly modulated behaviours with marked inattention and lack of persistent learning or task involvement, pervasiveness over situations and persistence over time. Other characteristic traits of the behaviours include lack of attention, short attention span, out of seat tendencies, impulsivity, fidgeting, frequent night-waking or general sleep disturbance, repetitive rocking or repetitive movement.

As children with ADHD, Osuorji (2012) stated that children with the learning behaviour characteristics experience difficulties in learning because of an inability to focus the attention on the learning task at hand. This implies that Attention Deficit Hyperactivity Disorder poses serious concern and worry on the child, teachers, parents and the developing peers both at schools and homes. Ihenacho (2007) maintained that children with ADHD constitute daily problems in the classrooms, as teachers most often cannot handle children that present such non-physical disorders in the classrooms, resulting to school poor performance. Attention deficit hyperactivity disorder is present depending on the age, setting, in school, home and playground. Not all children with ASD have all the symptoms. It means some can just have problems with poor attention, while others are mainly hyperactive (Adebisi, 2017). The manifestation of the learning behaviour problems in children with ADHD on copying tasks completion could lead to poor academic performance, lack of persistent learning, lack of task involvement and accomplishment. Copying tasks completion mean the repeated manual reproduction or tracing of spatial patterns of letters, numbers, shapes, drawings and so on, requiring accomplishment within a specific or given time. For instance, in copying tasks of tracing or copying numbers, letters of the alphabet, shapes and other activities that require perseverance and task accomplishment in a given time; a child who has poor attention, out of seat tendencies, problem sustaining attention or poor task organisation will find it difficult to copy and complete any given tasks. The exhibited behaviours could result in poor class involvement and performance (Adebisi, 2017).

To manage the learning behaviours characteristics therefore, there are a myriad of intervention approaches and therapies identified for ADHD. Many methods exist that promise remarkable improvement. Some of the strategies work for some, and do not work for other children on the spectrum (Sztamari, Bryson, Duku, Vaccarella, Zwaigenbaum & Bennett, 2009). However, there are varieties of intervention and educational approaches that may reduce various challenges associated with ADHD and autism. In Nigeria, little or no valid intervention is developed to meet the needs of children with ADHD and other related conditions.
disabilities. Akande (2013) lamented that it is worrisome that there are scanty statistics and valid programmes to work with, as parents often rely on doctors and school teachers to confirm the fear with little or no breakthroughs.

To this effect, one of the intervention strategies that parents and professionals are adopting for the management of ADHD is the use of vitamin – mineral supplementation (Wong & Smith, 2006). Vitamins-minerals supplements are substances that are either essential for normal body functions or to enhance the body’s functioning. Vitamins-minerals are required in small amounts by all humans for normal growth and development. Food intake of more proteins and carbohydrates foods over vitamin and mineral foods could result to deficiencies in essential vitamins and minerals in school children. The outcome is believed to be the manifestation of ADHD, which could have negative effects on learning and copying tasks completion and performance. Intake of required vitamin-mineral supplements could help reduce the restlessness of the children in the classroom and improve the eating habits, thereby enhancing learning and desired behaviours (Babudoh & Ihenacho, 2013).

Vitamin-mineral supplementation is a replacement therapy of the administration of a natural substance, as prescribed by Quantum Magnetic Resonance Image Analyzer, that compensates for a lack or deficiency caused by inadequate nutrition, certain organic dysfunctions, or loss of a body organ or tissue that normally produces the substance. Again, vitamin - mineral supplementation are presumed to improve ADHD and help normalize biochemical markers in children. The improvement is with the aim that when supplementation is given, it helps to reanimate the cells and tissues, improving the brain cells and enhance learning, so that the child’s eating habit is improved and will be able to return to school and accomplish any given tasks especially copying or tracing tasks of letters, numbers and shapes (Ihenacho, 2007). A number of clinical centres in Nigeria have explored the number of children with ADHD using vitamin-mineral supplementation. In a report, examining the prevalence of the use of trace elements with 65 case files of the children in one of the clinics in Jos, 84% of the case files were using vitamin-mineral supplementation to manage children (Unimuke, 2013).

Also, factors that are assumed to warrant the use of vitamin-mineral supplementation include children exhibiting ADHD that lead to feeding problems which require the use of vitamins - minerals intake. What may also affect nutritional status include gastrointestinal (GI) complications as well as differences in metabolism and utilization of nutrients. Gastrointestinal (GI) complaints are common among children with ADHD. It is against this background information that the researcher intends to analyse the vitamin – mineral status on copying tasks completion of children with attention deficit hyperactivity disorders in Jos, Plateau State, Nigeria.

**Statement of the Problem**

The behavioural concerns of poor attention or short attention span, out of seat, impulsivity, fidgeting, frequent night-waking or general sleep disturbance, repetitive rocking or repetitive movement of children with ADHD affect the child’s school learning and performance, as a result of task avoidance. Also, poor healthcare in the children may manifest as a result of vitamin – mineral deficiencies, which may result to inattention and hyperactive behaviours thereby leading to poor tracing or copying task performance and other learning activities in schools. In this case, the need for additional healthcare that could attend to learning behaviour problems should be sought. Hence, this study intends to find out the vitamin - mineral status of children with attention deficit hyperactivity disorders how disorders in children affect classroom writing, tracing or copying tasks performance.
Purpose of the Study
The purpose of the study was to find out the vitamin-mineral status of children with attention deficit hyperactivity disorders and how the disorders in children affect classroom copying tasks performance. Specifically, the study tends to:
- Establish the vitamin-mineral status of children with attention deficit hyperactivity disorders.
- Establish the missing or reduced vitamin-mineral supplements for children with attention deficit hyperactivity disorders in the experimental group.
- To identify the copying task completion scores of children with attention deficit hyperactivity disorders.
- Determine how attention deficit hyperactivity disorders in children influence classroom copying task performance.

Research Questions
The following research questions guided this study:
- What are the pretest and posttest missing vitamin-mineral status of children with attention deficit hyperactivity disorders in the two groups?
- What are the missing or reduced vitamin–mineral supplements provided for children in the experimental group?
- What are the copying task completion scores of children with attention deficit hyperactivity disorders in the two groups?
- To what extent does attention deficit hyperactivity disorder influences the copying tasks completion scores of children in the two groups?

Methodology

Research Design
The researcher considered quasi experimental research of Ex Post facto research design. The design used what already existed and look backward to explain why two or more existing groups are compared retrospectively. Sharma (2012) stated that Ex-post facto research is systematic empirical inquiry in which the researcher does not have direct control of independent variables because the variables’ manifestations have already occurred or because they are inherently not manipulated. This is relevant to this study, in that, the researcher analysed vitamin–mineral status on copying tasks completion of children with attention deficit hyperactivity disorders in Jos, Plateau State, Nigeria.

Area of the Study
The study was carried in Jos Township, Plateau State of Nigeria, in the schools and centres for children with developmental disabilities. The school and centres included Learning Disabilities Diagnostic and Assessment Centre, Ganaka Special School, Othnuel Special Education School and University of Jos Model Teaching Centre, all in Jos Township. Jos Plateau is the twelfth largest state of Nigeria, and is located approximately in the centre of the country. It is geographically unique in Nigeria because its boundaries surround the Jos Plateau, having the entire plateau in its central and northern part. The capital is Jos.

Jos Plateau State is celebrated as “The Home of Peace and Tourism”, an image that had been fractured in previous years by religious crisis in the state, but it is now recovering as socio-economic activities are now thriving as well as a growth in population in the state. Though situated in the tropical zone, a higher altitude means that Plateau State has a near temperate
climate with an average temperature of between 13 and 22 °C. Harmattan winds cause the coldest weather between December and February. The warmest temperatures usually occur in the dry season months of March and April. The mean annual rainfall varies 131.75 cm (52 in) in the southern part to 146 cm (57 in) on the Plateau. The highest rainfall is recorded during the wet season months of July and August. The Jos Plateau, makes it the source of many rivers in northern Nigeria including the Kaduna, Gongola, Hadejia and Yobe rivers. The state has over forty ethno-linguistic groups. Some of the indigenous tribes in the state are the Berom, Afizere, Amo, Anaguta, Aten, Bogghom, Buji, Challa, just to mention few. These ethnic groups are predominantly farmers and have similar cultural and traditional ways of life. People from other parts of country have come to settle in Plateau State; these include the Igbo, Yoruba, Ibibio, Annang, Efik, Ijaw, and Bini.

Study Population
Population of the study was eight (8) children diagnosed with attention deficit hyperactivity disorders, who were having problem completing writing tasks of tracing or copying letters of the alphabet, numbers and in shapes, in four special schools and clinical centres in Jos Township. The children were diagnosed with ADHD using Conners’ Teachers Rating Scale – Revised (CTRS-R). The sample of children that were used for the study comprised all the 8 children in the population identified as having ADHD, with the age range of 6 – 14 years. The children were selected irrespective of the parents’ socio-economic status, age range, height, body mass, degree of ADHD and gender.

Sampling Technique
The purposive sampling technique was adopted. This sampling technique is relevant to the study as the samples possess the specific characteristics to be studied, and they appear to be representative of the population defined by the research problem. Awotunde and Ugodulunwa (2004) define purposive sampling as sampling whereby sample possess the specific characteristic traits to be studied, and they appear to be representative of the population as defined by the research problem. The samples were therefore assigned to groups through simple random sampling technique. In assigning samples to groups, the researcher used lottery method. Each of the N population members was assigned a unique number (1 and 2). Among the 8 children identified as children with ADHD, the researcher randomly assigned 4 children to experimental group and 4 children to control group.

Instruments for Data Collection
Three set of instruments were used by the researcher for data collection. These are: Conners’ Teachers Rating Scale – Revised (CTRS-R) by Conners, 1997 was adapted, Behaviour Measurement Scale (BMS) by Ihenacho, 2013 were adapted and Quantum Magnetic Resonance Image Analyser (QMRIA) were adopted for the study. CTRS-R assists in the diagnostic processes, identifies and qualifies children to be included or excluded in the study. QMRIA obtains magnetic field sensor of frequency and energy from the human body, determined directly holding a sensor. It compares the individual with the resonance spectra of standard quantum of conditions and nutrition indicators report of the vitamin – mineral levels. While BMS is a behaviour observation scale that scores the various measurement traits in children with ADHD, behaviour and social disturbances. It is used for frequency counting and scoring of the behaviour traits of the children with behaviour problems.

Validity and Reliability
The instruments were validated by two experts in the field of Special Needs Education, one expert each in the fields of Psychology and Paediatrics, while the adapted CTRS-R was
subjected to test – re- test analysis with a three week interval (N = 92), in Abuja School for the Handicapped, Kuje Abuja, Nigeria, with a reliability index of 0.92. Also, BMS was subjected to interrater reliability for the raters in the same location, and was found to be Cronbach’s Alpha (α) = 0.89 (p < 0.001).

**Procedure for Data Collection**

The pretest of the target behaviours of both the experimental and control groups was determined by the use of QMRIA and BMS. The Quantum Magnetic Resonance Image Analyser (QMRIA) was to determine the vitamin and mineral levels of the children of the two groups at pretest. The use of Behaviour Measurement Scale (BMS) was to repeatedly rate the attention deficit hyperactivity disorders of the children of the two groups from start to the end of the pretest. The QMRIA analysed the levels of reduced/ missed deficient vitamin/minerals in the children of the two groups, while BMS collected the behavioural data throughout the pretest. The collection of data on each target behaviours, was done in the classroom setting for a period of 5 minutes, four times a week (Monday to Thursday) until a fixed number of 2 weeks. Also, to check the pretest class performance of the children in the two groups on writing or copying tasks, the children were engaged on class activities involving copying or tracing letters of the alphabets, numbering and shapes. These activities took place for a period of 2 minutes for all the children of the two groups.

After the pretest data collection on the experimental group, the treatment began for the period of 8 weeks on only the children of the experimental group in an intact class or location. The caregivers of the children brought the children to receive the administration of the vitamin-mineral supplements, as administered by the researcher. This was observed for the entire period of eight weeks at 7:30am and 6:00pm each day. The administration of the treatment to the children in intact class was to control the extraneous variables and the environments that were related to individual differences, age, body mass, possible treatment reactions of the children. The researcher tried, as much as possible to control the variables. At this point, data collection stops, until the end of 8 weeks. The researcher, with the assistance of the accompanying caregivers, guided the administration and intake of the dosage on the children. The dosage considered the age, body weight of each child of the experimental group, as prescribed or specified by the QMRIA, following the results of the digital test conducted on the children. Compliance was monitored by a daily supplementation checklist and was above 95% in all cases. Moreover, the posttest took the same procedure as pretest.

**Method of Data Collection**

For research questions one and two, data were presented in table; research question one showed the status of the vitamin - mineral in each of the children in both experimental and control groups as Normal (N), Mildly Abnormal (MA), Moderately Abnormal (MoA) and Severely Abnormal (SA) for each element tested, as revealed by the QMRIA. Research question two was also presented in table indicating vitamin mineral supplements for the experimental group. Data for research question four was also presented in tables but were analysed with simple percentages. However, research question three was presented using bar chart to show the copying tasks completion scores of children with attention deficit hyperactivity disorders.
RESULTS

**Research Question One:** What are the pretest and posttest missing vitamin-mineral status of children with attention deficit hyperactivity disorders in the two groups?

**Table 1:** Reduced/ Missing Vitamin – Mineral Status of the Children

<table>
<thead>
<tr>
<th>Testing Item</th>
<th>N.R</th>
<th>AMV</th>
<th>AMV</th>
<th>AMV</th>
<th>AMV</th>
<th>AMV</th>
<th>AMV</th>
<th>AMV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ch. 1</td>
<td>Ch. 2</td>
<td>Ch. 3</td>
<td>Ch. 4</td>
<td>Ch. 5</td>
<td>Ch. 6</td>
<td>Ch. 7</td>
</tr>
<tr>
<td>Calcium</td>
<td>1.219 - 3.021</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td>1.151 - 1.847</td>
<td>MoA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
</tr>
<tr>
<td>Zinc</td>
<td>1.143 - 1.989</td>
<td>MoA</td>
<td>MoA</td>
<td>MoA</td>
<td>MoA</td>
<td>MoA</td>
<td>MA</td>
<td>MoA</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.568 - 0.992</td>
<td>MoA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MoA</td>
<td>MA</td>
<td>MoA</td>
</tr>
<tr>
<td>Vit. A</td>
<td>0.346 - 0.401</td>
<td>MoA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td></td>
</tr>
<tr>
<td>Vit.C</td>
<td>4.543 - 5.023</td>
<td>MoA</td>
<td>MA</td>
<td>MA</td>
<td>MoA</td>
<td>MA</td>
<td>MA</td>
<td>MoA</td>
</tr>
<tr>
<td>Vit.E</td>
<td>4.826 - 6.013</td>
<td>MA</td>
<td>MoA</td>
<td>MA</td>
<td>MA</td>
<td>MoA</td>
<td>MA</td>
<td>MA</td>
</tr>
<tr>
<td>Vit.B1</td>
<td>2.124 - 4.192</td>
<td>MA</td>
<td>MoA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MoA</td>
<td></td>
</tr>
<tr>
<td>Vit.B2</td>
<td>1.549 - 2.213</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td></td>
</tr>
<tr>
<td>Vit.B3</td>
<td>14.477-21.348</td>
<td>MoA</td>
<td>MoA</td>
<td>MoA</td>
<td>MoA</td>
<td>MoA</td>
<td>MoA</td>
<td></td>
</tr>
<tr>
<td>Vit.B6</td>
<td>0.824 - 1.942</td>
<td>MA</td>
<td>MoA</td>
<td>MA</td>
<td>MA</td>
<td>MoA</td>
<td>MoA</td>
<td>MA</td>
</tr>
<tr>
<td>Folic Acid</td>
<td>1.449 - 1.246</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td></td>
</tr>
<tr>
<td>Vit.K</td>
<td>0.717 - 1.486</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
<td>MA</td>
</tr>
</tbody>
</table>

**KEY:**
- N.R = Normal Range
- AMV = Actual Measurement Value
- MA = Mildly Abnormal
- MoA = Moderately Abnormal
- Ex. = Experimental Group
- Cn = Control Group
- Ch. = Child

Table 1 above showed the fourteen collective vitamin and mineral test reports for children in both groups, in the testing items of Calcium, Iron, Zinc, Magnesium, Vitamins A, C, K and E. Others included Vitamins B1, B2, B3, B6, B12, and Folic Acid. Children 1, 2, 3 and 4 in the experimental group tested either in Mildly Abnormal (MA) or Moderately Abnormal (MoA) in 12, 11, 11 and 10 out of the 14 items tested respectively. Moreover, Children 5, 6, 7 and 8 in the control group also tested either in Mildly Abnormal (MA) or Moderately Abnormal (MoA) in 13, 9, 10 and 11 out of the 14 items tested respectively. However, all the children in both groups were tested ‘normal’ in only Vitamin B12. This implied that all children in both experimental and control groups were deficient, missing or reduced in vitamin – mineral status in most of the items tested.
**Research Question Two:** What are the missing or reduced vitamin – mineral supplements provided for children in the experimental group?

**Table 2:** Missing/ reduced Vitamin – Mineral Supplements Provided for Experimental Group

<table>
<thead>
<tr>
<th>S/N</th>
<th>VMS</th>
<th>Milligram/IU</th>
<th>Ch. 1</th>
<th>Ch. 2</th>
<th>Ch. 3</th>
<th>Ch. 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Calcium+D3</td>
<td>300mg +400IU *</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Iron</td>
<td>5mg *</td>
<td>*</td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>3</td>
<td>Zinc</td>
<td>50mg *</td>
<td>*</td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>4</td>
<td>Magnesium</td>
<td>250mg *</td>
<td></td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>5</td>
<td>Vitamin A</td>
<td>25,000IU *</td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>6</td>
<td>Vitamin C</td>
<td>500mg *</td>
<td></td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>7</td>
<td>Vitamin E</td>
<td>1000mg *</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>8</td>
<td>Vitamin B1</td>
<td>100mg *</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>9</td>
<td>Vitamin B2</td>
<td>100mg *</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Vitamin B3</td>
<td>100mg *</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>11</td>
<td>Vitamin B6</td>
<td>50mg *</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>12</td>
<td>Folic Acid</td>
<td>5mg *</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>13</td>
<td>Vitamin K</td>
<td>500mcg *</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>14</td>
<td>Omega 3</td>
<td>500mg *</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

**KEY:**
- VMS = Vitamin-Mineral Supplements
- Mcg = Microgram
- Mg = Milligram
- IU = International Unit
- Ch. = Child
- * = Supplements provided

Table 2 showed the vitamin – mineral supplements that were provided for children in the experimental groups based on the missing or reduced vitamin – mineral status of the items tested. Children 1 and 2 in the experimental group, who showed both Mildly Abnormal (MA) or Moderately Abnormal (MoA) in the testing items were given 12 and 11 vitamin – mineral supplements except in Vitamin B2, B12; Vitamin B1, B3 and B12 respectively. Also, Children 3 and 4 in the same group, who also showed both Mildly Abnormal (MA) or Moderately Abnormal (MoA) in the testing items were given 12 and 11 vitamin – mineral supplements except in Vitamin B2, B12; Vitamin B1, B3 and B12 respectively.

**Research Question Three:** To what extent does attention deficit hyperactivity disorder influence the copying task completion scores of children in the two groups?
Table 3: The Influence of ADHD on Pretest Copying Tasks Completion Scores of the Children.

<table>
<thead>
<tr>
<th>Child</th>
<th>Group</th>
<th>Pretest Level of ADHD</th>
<th>Pretest Copy Performance Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Out of Seat (%)</td>
<td>Poor attention (%)</td>
</tr>
<tr>
<td>1</td>
<td>Exp.</td>
<td>87.5</td>
<td>37.5</td>
</tr>
<tr>
<td>2</td>
<td>Exp.</td>
<td>87.5</td>
<td>62.5</td>
</tr>
<tr>
<td>3</td>
<td>Exp.</td>
<td>87.5</td>
<td>62.5</td>
</tr>
<tr>
<td>4</td>
<td>Exp.</td>
<td>87.5</td>
<td>62.5</td>
</tr>
<tr>
<td>5</td>
<td>Cnt</td>
<td>12.5</td>
<td>37.5</td>
</tr>
<tr>
<td>6</td>
<td>Cnt</td>
<td>87.5</td>
<td>62.5</td>
</tr>
<tr>
<td>7</td>
<td>Cnt</td>
<td>87.5</td>
<td>62.5</td>
</tr>
<tr>
<td>8</td>
<td>Cnt</td>
<td>87.5</td>
<td>37.5</td>
</tr>
</tbody>
</table>

Table 3 showed the extent in which ADHD had influenced the pretest copying tasks completion of children in the two groups. The levels of ADHD problems exhibited by the children in the two groups rated all the 8 children ‘frequent’ and ‘most frequent’ (7, 87.5%; 1, 12.5%) in out-of-seat behaviours; ‘frequent’ and ‘most frequent’ (3, 37.5%; 5, 62.5%) in poor attention span and ‘frequent’ (7, 87.5%) with ‘less frequent’ (1, 12.5%) on impulsivity respectively. Also, the table showed the low performance scores of all the children on the copying tasks of letters, numbers and shapes. Child 1 scored the aggregate of 9 (30%); children 2, 5 and 6 scored the aggregate of 10 (33%); children 3 and 7 scored the aggregate of 8 (27%), while children 4 and 8 scored the aggregate of 11 (37%) of the total copying tasks. This means that the higher percentages in frequencies ADHD influenced or responsible for low copying tasks scores in Letters, Numbers and Shapes in all the children.

**Research Question Four:** What are the copying tasks completion scores of children with attention deficit hyperactivity disorders in the two groups?

![Figure 1: Pretest and Posttest Copying Task Completion Scores of the Children](image-url)
Figure 1 showed the pretest and posttest copying tasks completion scores for copying of letters, numbers and shapes in the two groups. It showed the aggregate performance scores of each group, such that, under letters, experimental group scored an aggregate of 12 at pretest as against the aggregate scores of 24 at posttest. Also, under numbers, experimental group scored an aggregate of 11 at pretest as against 28 at posttest. Likewise under shapes, the experimental group scored an aggregate of 14 at pretest as against 26 scores at posttest. In contrast, the control group shows the aggregate performance scores of 12 at pretest under letters, and aggregate scores of 15 at posttest. Also, control group scored an aggregate of 13 at both pretest and posttest in Numbers, while under shapes, the control group scored an aggregate of 14 at pretest as against 12 scores at posttest.

Discussion of Findings
The study attempts to present findings on vitamin-mineral status on copying tasks completion of children with attention deficit hyperactivity (ADHD).

Missing or Reduced Vitamin-Mineral Status of Children with ADHD
The study revealed the missing or reduced vitamin-mineral status of children with ADHD. Table 1 showed the areas of vitamin – mineral elements such as Calcium, Iron, Zinc, Magnesium, Vitamins A, C, K and E. Other included Vitamins B1, B2, B3, B6, B12, and Folic Acid, among the children in the experimental and control groups. Children 1, 2, 3 and 4 in the experimental group tested either in Mildly Abnormal (MA) or Moderately Abnormal (MoA) in 12, 11, 11 and 10 out of the 14 items tested respectively. Moreover, Children 5, 6, 7 and 8 in the control group also tested either in Mildly Abnormal (MA) or Moderately Abnormal (MoA) in 13, 9, 10 and 11 out of the 14 items tested respectively. The researcher deduced from the findings that all the children are lacking or deficient in vitamin and minerals as a result of the low or reduced vitamin – mineral levels as tested by QMRIA.

Ihenacho (2007) posited that the significance of vitamin – mineral elements lie in their functional roles, as determined partly by their changes and mobility, and that reduced or missing of these elements in the body, change the activities of metalloenzymes and characteristic signs and symbols. Many nutrient deficiencies are implicated in behaviour disorders. According to human physiology and nutrition theories, cellular function, and particularly brain function, is partially dependent upon nutritional status (Muazu, Adebisi, Ezekwerre & Unimuke, 2013). Historically, attention has focused on inadequate intake of vitamins - minerals due to poor diet as a major contributing factor to many children’s health problems around the world, including anaemia (low iron), hypothyroid (low iodine), scurvy (vitamin C deficiency), and rickets (calcium and/or vitamin D deficiency). More recently the focus has shifted to the relationship between relative metabolic disturbances and developmental disorders, for example those associated with hyperkinesis (Nogovitsina & Levitina, 2005), learning disorders and intellectual development and children with ADHD.

Missing Vitamin – Mineral Supplements Provided as Treatment for the Children in the Experimental Group
Table 2 analysis revealed the missing vitamin – mineral supplements provided as treatment for the children in the experimental group. These supplements were given to step up the levels of the identified missing elements. These vitamin-mineral supplements were given to the children to assist in stepping up the levels of the observed reduced or missing vitamin and mineral levels. They were given because they perform unique functions in stabilizing and maintaining body tissues and functions that may be responsible for learning behaviour.
problems. The study of Babudoh and Ihenacho (2013) agreed with the current finding that vitamin – mineral supplements provided for pupils in the experimental group were meant to step up the levels of the observed reduced trace elements of special needs children with reading disabilities. They found that supplements like Vitamin B-Complex, B6, C and folic acid were meant to perform unique functions in enhancing cognition and intelligence.

Moreover, the study of Adams and Holloway (2004) on a small (n = 10) open-label pilot study of a customized vitamin/mineral supplement for children with ADHD, which included extensive pre and post measurements of nutritional status (vitamins, minerals, amino acids). The effects of vitamin - minerals supplementation on the symptoms have shown remarkable improvement due to the promising results of the study of a moderate dosage multi-vitamin/mineral supplement in 2002. The supplements were well-absorbed, as indicated by increases in blood levels and urinary excretion, and improved levels of glutathione and some neurotransmitters. The results of that pilot study were used to reformulate the supplements, adjusting the level of some ingredients slightly up or down based on the laboratory findings so solve the identified problems.

Eichenberger-Gilmore, Hong, Broffitt’s (2005) study on longitudinal patterns of vitamin and mineral supplement use in young white children, with the purpose to report longitudinal patterns of nutrient supplementation in children, to quantify nutrient intakes from supplements and diet, and to examine relationships between supplement use and socio-demographic factors. Food diaries were completed to report food and beverage intake among subjects. Estimates of daily intakes of vitamins and minerals were calculated. Fisher's exact tests and t-tests were used to assess the association of socio-demographic variables with supplement use. The study concluded that the use of nutrient supplements was a common behaviour during the first 2 years of life.

The Extent the Attention Deficit Hyperactivity Disorders have Influenced the Pretest Copying Tasks Completion Performance of Children in the Two Groups

Table 3 showed the extent the attention deficit hyperactivity disorders have influenced the pretest copying tasks completion scores of children in the two groups. The levels of ADHD exhibited by the children in the two groups rated all the 8 children ‘frequent’ and ‘most frequent’ in out-of-seat behaviours; ‘frequent' and 'most frequent’ in poor attention and ‘frequent’ with ‘less frequent’ on impulsivity respectively. The researcher inferred that the rating ‘frequent’ and ‘most frequent’ showed that all the children exhibited all the characteristic of ADHD except one child that was rated ‘less frequent’ on impulsivity. This might have contributed to the performance of all the children in the copying tasks of letters, numbers and shapes, where they showed the low scores in the aggregate of 30 scores per child. The researcher read from the finding that children exhibiting characteristics of ADHD could determine the low performance of copying tasks completion in children.

This was in consonance with Osuorji (2012) which maintains that children with these learning behaviours experience difficulties in learning because of an inability to focus their attention on the learning task at hand. This means that their hyperkinetic behaviours pose for serious concern and worry for the child, teachers, parents and their developing peers both at schools and homes. It was also opined that children with ADHD constitute daily problems in the classrooms, as teachers most often cannot handle such children that present such non-physical disorders in the classrooms, resulting to school poor performance (Ihenacho, 2007). Pliszka (1998) maintained that the inattention or hyperactivity becomes a problem when they are exaggerated, compared with other children of the same age, and when they affect the
child, their school, school participation, performance, social and family life. It is also stated that children with problems of attention can appear forgetful, distracted, not seeming to listen, disorganised, take time to start doing things, and then when they do, they rarely finish it. Impaired attention is also manifested by prematurely breaking off from tasks and leaving activities unfinished. The children change frequently from one activity to another, seemingly losing interest in one task because they become diverted to another (World Health Organization, 2010).

**Copying Tasks Completion of Children with Attention Deficit Hyperactivity Disorders in the Two Groups after Intervention**

The study also revealed the copying tasks completion of children with attention deficit hyperactivity disorders in the two groups after intervention. Figure 1 showed the pretest and posttest copying tasks completion scores of copying of letters, numbers and shapes of all the children in the two groups. It showed the pretest and posttest aggregate performance scores in each group. The researcher was of the view that the increase or better school performance of children in the experimental group was as a result of the decrease in ADHD of out-of-seat, improved attention and reduction in impulsivity, due to the vitamin – mineral supplementation on the children in the experimental group. This was in agreement with the study of Babudoh and Ihenacho (2013) with the purpose to assessed special needs children, specifically the children with congenital and profound hearing impairment in primary four, with reading disabilities, to find their difference in performance between the control and experimental groups after treatment. Their study’s finding revealed that the pupils in the experimental group (R=21-17) performed better than those in the control group (R=12-19), in word recognition and comprehension. The study also revealed that all the children had an increase in the total number of sentences written correctly as a result of vitamin – mineral supplementation.

The study also agreed with Ogu (2016) on the effect of micronutrients on cognitive disorders of persons with learning disabilities in Jos metropolis, with the purpose to ascertain the efficacy or non-efficacy of using micronutrients in improving or alleviating cognitive disabilities in persons with learning disabilities. The researcher administered Vitamin B1, B6, B12, Vitamin C, A, Cholin, Zinc, Q10 and iron, given based on the levels and severity of the cognitive problems to samples in the experimental group. The results of the finding revealed that trace elements or nutritional status have a lot to do with cognitive level of children with learning disabilities. It also found that children with cognitive problems showed significant differences in Vitamins B1, B6, B12, Vitamin C, A, Cholin, Zinc, Q10 and iron, which ranged from mildly to severely abnormal. Finding also showed that there was a significant difference in cognition domain test scores of individuals with cognitive disorders.

**Conclusion**

This study analyzed vitamin-mineral status copying tasks completion of children with Attention Deficit Hyperactivity Disorders (ADHD) in Jos, Plateau State, Nigeria. Nutritional imbalances are one of the major biomedical area of worry for families and teachers of children with ADHD. Common signs of nutritional imbalances in children include underweight or overweight, anxiety, mood disorders, sensory issues, aggression, impulsivity, dry hair or skin, and ingestion of inedible items (Adebisi, Okwudire & Nalado, 2016). Raising a child with ADHD can be problematic in trying to balance school, parenting, tutoring, family activities, and find ways to help the child stays calm and focused at the same time. ADHD are most often treated using vitamins.
However, despite all these efforts, many parents see little improvement in copying tasks completion and other learning activities. With the use of vitamin-mineral intake, one may be surprised to learn how much good nutritional support can help. ADHD involves neurotransmitter imbalances. Often, children with ADHD also have deficiencies or imbalances in critical nutrients that are used to make these neurotransmitters in the body. If test is conducted on children with ADHD, one would often see that they are not very efficient at digesting and utilizing their food, and may even have leaking gut or other signs of more serious gut imbalances.

A child experiencing ADHD that interferes with educational and social life, classroom management and other behavioural interventions skills alone cannot solve these problems unless those areas that hinder learning and appropriate behaviours are brought back to normal or near normal (Adebisi, 2007). Experts have exposed that children with ADHD experience difficulties in learning because of an inability to focus their attention on the learning tasks at hand (Osuorji, 2012; Ihenacho, 2007). Deficiencies in vitamins, minerals and other nutritional elements could contribute to these learning problems, and that optimising or levelling up of these deficiencies could reduce or even eliminate these problems. Supporting the nutritional needs of a child with ADHD can really help educational and behaviour intervention strategies. Good nutritional support for ADHD includes support for the brain, gut and metabolism.

Based on findings of this study, the following recommendations were made:
1. There should be proper intake of organic foods or required vitamin supplements which would help reduce the inattention, restlessness of children with ADHD and improve the eating and learning habits.
2. Parents should be advised to feed their children with proper nutrients to optimize their brain functions.
3. There should be regular testing of children to determine the vitamin-mineral levels for correction, and to balance the vitamin-mineral status.
4. Educational interventions should be run concurrently with the clinical or medical intervention for adequate improvement.

References


Ihenacho, J. I. (2013). *Behaviour measurement scale (Scale A and B) (Revised).* Jos: Department of Special Education, University of Jos.


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