Effect of Anemia on Cognitive Capacity of Adult Students in Sokoto, Nigeria

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ARTICLE INFORMATION

ABSTRACT

Anemia due to iron deficiency or inherited sickle cells nowadays threatens public health in many respects. Among the effects of anemia is its ability to affect cognitive or related abilities. Thus, this study aimed to assess the effect of iron deficiency anemia and sickle cell anemia on the cognitive ability of participants in Sokoto. The study design involved recruiting 50 participants (25 healthy and 25 tested to be anemic) who were subjected to Montreal Cognitive Assessment. Another fifteen sickle anemia patients, and twenty-five healthy persons were evaluated using Montreal cognitive assessment. The scores of all the respondents were recorded and subjected to the $X2$ test and revealed significant differences at ($p<0.05$). The result of the study indicated that the anemic participants scored fewer mean marks (420.0 ± 14.0) in contrast to the healthy participants (820.0 ± 32.6) at ($P<0.05$). The effect of sickle cell anemia was revealed with a significant difference ($p<0.05$), showing that the healthy adult participants of the study scored higher marks (240.0 ± 16.0) compared to the anemic participants (924.0 ± 30.8). Thus, the anemia of any kind can potentially affect the cognitive capacity of students in the state.

INTRODUCTION

Iron is the second in abundance among all the earth's metals. The element is crucial in oxygen transportation, oxidative metabolism, catalytic reactions, and cellular proliferation; therefore, the iron level in the body must be beneficial only on maintained at balance levels (Yiannikourides & Latunde-Dada, 2019). Indeed, iron is a pivotal micronutrient and essential that plays a vital role in human blood functions in the body. Iron is a prerequisite in many enzymes, such as peroxidases, catalases, and cytochromes, necessary for respiration. Iron is a functional element in hemoglobin, enzymes, and tissues. It also exists as stored iron in ferritin and transferrin circulating iron, highlighting some iron roles in the body (Sarkingobir et al., 2023) Alhazmi et al., 2021). Parable, the cytochrome P450 (an iron-requiring enzyme) detoxifies foreign substances entering the liver. Iron is needed signal and control neurotransmitters in the brain (Gupta, 2014).

The world is plagued by illiteracy, ignorance, food insecurity, malnutrition and poverty, and diseases. Anemia is a dubbed condition of low red cells or hemoglobin level, and in turn, the primary function of hemoglobin to convey oxygen along the body parts is militated (Abbaspour et al., 2014). The most common anemia is iron deficiency anemia, mainly considered nutritionally based (Abbaspour et al., 2014).

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Iron deficiency anemia is a widespread and cumbersome issue toiling public health and affecting about 1 billion inhabitants worldwide. As a result of this disease, many people suffer poor academic/ cognitive performance, poor immunity, low fertility, neurological disorders, low physical activity, poor intelligence, poor growth, and quasi (Soleimani, 2011; Igbal et al., 2015).

Indeed, another type of anemia is hemolytic anemia, with the dominant sickle cell anemia affecting many people with extreme adverse effects (Abbaspour et al., 2014). Moreover, sickle cell anemia is a congenital disorder characterized by severe life-threatening and lifelong anemia, pain crises, chronic organ damage, reduced life span (Koduri, 2003). Iron deficiency anemia and sickle cell anemia affect iron levels by causing iron imbalance and instigating biological problems prior to cognitive decline (Castro & Viana, 2019; Felek, 2023). Thus, Sokoto, a state challenging poor health care, malnutrition, poor educational achievement, and food insecurity, needs to evaluate the effects of anemia and sickle cell anemia on the cognitive achievement of its people for proper policy on intervention measures such as nutritional supplementation, screening before marriage, early screening of diseases, drug administration etc (Sarkingobir et al., 2023). Thus, this study aimed to assess the effect of iron deficiency anemia and sickle cell anemia on the cognitive ability of participants in Sokoto.

METHOD

The study was carried out in Sokoto State, Nigeria. In comparison, the study design involved voluntarily recruiting 50 participants (25 healthy and 25 tested to be anemic). All these participants were subjected to Montreal cognitive assessment. On the other hand, another fifteen participants tested positive for sickle anemia, and twenty-five healthy persons were evaluated using Montreal Cognitive Assessment (Mahendra et al., 2015; Felek, 2023). The scores of all the respondents were calculated and subjected to the X^2 test and revealed significant differences at ($p<0.05$).

RESULT

Table 1. The effect of anemia on the cognitive ability of some adult students in Sokoto, Nigeria

	N (individuals)	Mean marks scored	Standard deviation	X^2	Remark
Anemic patients	25	420.0	14.0	129.032	Significant
Healthy people	25	820.0	32.6		
Total	50				

In Table 1, a total of fifty participants were involved in evaluating the effect of anemia on the cognitive ability of adult participants of the study. Table 1 shows the effect of anemia on the cognitive capacity of adult patients and healthy individuals recruited for the study in Sokoto. The result of the study indicated

that the anemic individuals had less mean mark score (420.0 ± 14.0) compared to that of healthy participants (820.0 ± 32.6) at (P<0.05).

Table 2. The effect of sickle anemia condition on the cognitive ability of some adult students in Sokoto, Nigeria

	N (individuals)	Mean marks scored	Standard deviation	X^2	Remark
Anemic patients	15	240.0	16.0	401.938	Significant
Healthy people	20	924.0	30.8		
Total	35				

In Table 2, 35 participants were involved in studying the effect of sickle cell anemia on cognitive ability in adult students in Sokoto. In Table 2, the effect of anemia was revealed with a significant difference (p<0.05), showing that the healthy adult participants of the study scored higher marks (240.0 ±16.0) compared to the anemic participants (924.0±30.8).

DISCUSSION

This finding shows that the anemia in the patient can potentially reduce the cognitive ability of adult students in Sokoto (in Table 1). Like this study (in Table 1), another work from Iran revealed that students with anemia show low academic achievement compared to the healthy participants in addition to that (Soleimani, 2011). This result aligned with the finding revealed by a Turkey study, showing that the cognitive ability of adult patients attending a hospital is affected by anemia (Youssef et al., 2020; Felek, 2023). Another study from Egypt indicated that most of the students examined had anemia and resultantly suffered low academic achievement due the condition (Youssef et al., 2020). In another study related to Pakistan, it was observed that students with low iron deficiency anemia displayed poor cognitive and academic achievement in contrast with the control group (Igbal et al., 2015). Anemia is a predominate health issue in many parts of society. It is characterized by low hemoglobin levels below the specific ranges set up by WHO, and the condition is primarily due to iron deficiency, which can be prevented through intervention. Iron deficiency anemia has symptoms such as weakness, fatigue, slow memory, slow movement, headache, poor cognition, skin changes, etc. (Felek, 2023). The condition might occur due to loss of iron or poor iron intake or lack of iron bioavailability, infection and quasi (Youssef et al., 2020).

This study, in turn, has indicated that sickle cell anemia condition has the potential to negatively affect the academic or cognitive performance of adult students examined. Other studies have found that sickle cell patients revealed a lower cognitive ability than healthy individuals (Erdem et al., 2021; Felek, 2023). Another study from Saudi Arabia reports that sickle cell anemia in students led to poor academic performance in patients related due to the disease. Students with the diseases had comparatively lower scores compared to the healthy ones, a situation linked to the complications of the disease (Alhazmi et al., 2021).

Invariably, from this study, it has been revealed that anemia can affect the cognitive performance of the study participants. In other words, anemia is primarily due to iron problem, which is dubbed as iron deficiency anemia (Soleimani, 2011; Youssef et al., 2020). The problem of anemia due to iron is a nutrition issue and most prevalent in Africa and other developing nations, Nigeria included (Mahendran et al., 2015). However, it was reported that iron-deficiency anemia at early stages of life or adulthood affects academic or cognitive performance because the brain (enzyme system) is a forefront organ sensitive to iron deficiency. Some shot brain enzymes due to iron deficiency anemia affect behavior of the biological system, ultimately affecting cognitive performance (Mahendran et al., 2015; Umar et al., 2022). In youngsters, the situation of iron deficiency anemia profoundly affects learning, memory, physical activity, health, and later life; in adults, the situation causes similar effects such as fatigue, reduced physical activity, impaired cognitive capacity. In most cases, the situation in adults can be reversed by supplementing nutrients without residual traces. The effects of iron deficiency can be felt by its ability to affect Hippocampus (neuronal metabolism, gene expression, mitochondrial health etc) and hippocampal thyroid hormone, myelination, dopamine etc) (Fretham et al., 2011; Samson et al., 2022).

Also, sickle cell anemia participants in this study have revealed lower cognitive function than healthy participants. This condition of anemia has also been reported elsewhere to be affecting humans' cognitive effort, albeit it is a genetic/ hereditary disorder (Tebbi, 2022; Felek, 2023). It might be able to affect the cognitive performance of patients because of issues that accompany the diseases, such as to poor iron availability or hypoxia, pain crises, and the like (Ojewunmi et al., 2019; Castro & Viana, 2019; Matondo et al., 2020; Alhazmi et al., 2021; Tebbi, 2022). Therefore, both iron deficiency anemia and sickle cell anemia disease can affect cognitive ability in humans. Measures such as nutritional interventions, management of sickle cell anemia, early screening and other interventions should be imbibed, and public awareness is essential for public health promotion. This action would help in the development of education for the population of the country.

CONCLUSION

Iron is an essential micronutrient in the human biological system that is required for various functions. However, the anemia due to iron deficiency and sickle cell disorders are characterized by poor iron in the body and, afterwards, effects that directly or indirectly affect students' cognitive performance. In Sokoto state, where malnutrition and other public health concerns are recorded, data is needed to study the effect of anemia on the cognitive performance of adult students. This study finding revealed that anemia in the form of iron deficiency and sickle cell could negatively lower the cognitive outcome of the study participants. Therefore, more efforts are needed to alleviate the prevalence of anemia in all forms to have a better society, a better workforce, and an educated society.

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