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ANEMIA DUE TO LOW-IRON AFFECTS COGNITIVE CAPACITY OF ADOLESCENT GIRLS SCHOOLING IN SECONDARY SCHOOLS IN SOKOTO, NIGERIA

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Abstract

Anemia is a problem occurring due to poor iron intake or hereditary sickle cells threating public health in many adolescents and adults. Anemia is able to affect cognitive ability of people especially adolescents (youngsters). This study evaluates the effect of iron-deficiency anemia and sickle cell anemia on cognition of some adolescents schooling girls from Sokoto, Nigeria. The study consisted of recruitment of 80 girls (40 normal, and 40 anemic) subjected to Montreal Cognitive Assessment. 10 girls diagnosed with sickle cell anemia and 25 normal girls were assessed with Montreal cognitive assessment. The mean marks of the respondents were noted; therewith, chi-square test revealed significant difference at ($p<0.05$). The anemic girls earned less mean marks (400.0 ± 13.0) compared to the normal girls (960.0 ± 25.0). The healthy participants in the study scored higher marks (945.0 ± 10.0) than the sickle cell anemia patients (90.0 ± 3). Therefore, anemia is of the potential to affect

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cognitive capacity of schooling girls in Sokoto. Nutritional and related interventions are important, because poor cognition may affect education and overall potential of girls to be keys in growth and development of societies.

Keywords: Cognition, Cognitive Capacity, Iron-Deficiency Anemia, Education, Sickle Cell Anemia

INTRODUCTION

Education determines the growth or development of any society and any nation. It serves as a pillar for emancipation, empowerment, and guidance of people in all societies (Abubakar et al., 2022). Education is important for humans at all phases of life. Irrespective of sex or any other societal difference education is key to success and guidance, as well as healthy behaviors incorporation (Abubakar & Kwashabawa, 2021). Parable, education influences girls to be healthy, socially-oriented, economically empowered and liberated, and achieve greater heights (Ibrahim et al., 2021). Girls should be educated at least to a secondary school stage for the betterment of all. A girl child education is important for spiritual, economics, social, emotional, physical, and mental culturing (Abubakar & Kwashabawa, 2021).

However, a crucial life stage in girls education is the adolescence period. At adolescence stage, girls are vulnerable, and can be exposed to uncertainties due to the characterized growth and overall changes that on many occasions trigger ill health. Of great concern in adolescent life in our nation is the issue of malnutrition or undernutrition. Malnutrition or undernutrition has been linked to anemia and is rampant in our country (Trivedi, 2012; Iqbal et al., 2014; Moghaddam et al., 2016). Many girls in the northern Nigeria are malnourished and underweighted. Consequently, the effects manifest as infectious diseases, menstrual problems, later pregnancy problems, general ill health, and cognitive impairment (Trivedi, 2012; Abubakar et al., 2022).

Malnutrition is vividly a causer of anemia, and on many occasions is due to Fe deficiency (Elrazak et al., 2019). Fe is a trace element vital in the cells functions in biological systems and affect many enzymes vital for maintenance of constant internal environment (Gupta, 2014; Matondo et al., 2020; Umar et al., 2022). Fe partakes in brain biochemistry, neurotransmitters synthesis, and dopamine-opiate system functioning (Cumurcu et al., 2009). In oxidative stress cushioning, Fe helps in removing the superoxide anion and in

turn protecting cells against damage (Cumurcu et al, 2009; Fretham et al. 2011; Sarkingobir et al., 2022; Umar et al, 2023). Fe deficiency generally is a commonly prevalent nutritional deficiency affecting over 2 billion individuals; therewith, 30% of the affected are women and offspring. This deficiency molests the cognitive ability of processing, learning, memory (Fretham et al., 2011; Gupta, 2014; Yiannikourides, A. & Latunde-Dada, 2019).

Unfortunately, many children in Sokoto were reported to be challenged by inaccessibility to education and malnutrition as well (Sarkingobir et al., 2023ab; Shehu et al., 2023). Umar et al., (2019) in their work show that the female students in Sokoto experience poor performance in mathematics, a key science subject and basic for advance education (Umar etal, 2019). Another work among secondary school girls in Sokoto decried that, inadequate iodine incites a decrease in academic performance in the affected subjects (Umar et al., 2018). Ehabor et al., (2013) reported a high prevalence of Fe-deficiency anemia in pregnant women at a hospital in Sokoto city, Nigeria and called for Fe supplementation among pregnant women in Sokoto. From the forgone, malnutrition is a factor affecting girls in the state. However, few information was related especially concerning Fe-deficiency anemia among adolescent girls. The objective to be fulfilled by this study is to evaluate the effect of Fe-deficiency anemia among schooling adolescent girls in Sokoto, Nigeria.

METHODS

This work was conducted in Gwadabawa, Sokoto state, Nigeria. Whereas, the study design recruited of 80 girls (40 normal, and 40 anemics, using the hospital register) on voluntary basis. The participants were evaluated with Montreal cognitive assessment. While, 10 sickle cell anemic girls, and 25 normal girls were assessed using Montreal Cognitive Assessment (Mahendra et al., 2015; Felek, 2023). The scores of earned by the respondents were calculated and subjected to Chi-square test and revealed significant difference at ($p<0.05$).

RESULTS AND DISCUSSION

Table 1: Showing the effect of anemia on cognitive ability of some adolescent schooling girls in Sokoto, Nigeria

	N (individuals)	Mean marks scored	Standard deviation	X^2	Remark
Anemic patients	40	400.0	25.0	230.588	Significant
Healthy people	40	960.0	13.0		
Total	80				

Fe-deficiency anemia is linked to malnutrition bedeviling the parts of the world including the Northern region of Nigeria; and it is due to insufficient iron or lesion in iron intake. Fe is conferring the blood with capacity to act as carrier that deliver oxygen to tissues (Koduri, 2003; Abbaspour et al., 2014; Iqbal et al., 2014; Castro & Viana, 2018; Erdem et al., 2021). On the other hand, Fe is a parcel of many enzymes such as cytochromes (that act in preventing oxidative stress). Cytochrome p450 is important in detoxifying the body system from xenobiotics. Moreover, Fe containing enzymes partake in synthesis of steroid hormones, transmission of neurotransmitters (like dopamine and serotonin) attached to the brain function in cognition and relations (Gupta, 2014; Soleimani & abbaszadeh, 2011; Tebbi et al., 2022; Umar et al., 2022; Sarkingobir et al., 2023). Thus, this work conducted to assess the effect of low-iron anemia on cognitive ability of adolescents schooling girls in Sokoto is significant. Table 1 shows the effects of Fe-deficiency anemia on schooling adolescents girls cognitive capacity in Gwadabawa, Sokoto State, Nigeria. The result therewith indicate that the patients scored a mean of 400.0 which is lower than the healthy girls that scored 960.0. This could point to the fact that Fe-deficiency anemia might have affected the cognitive capacity of the adolescents girls. Thus, the Fe-deficiency anemia could act to affect the academic achievement or attainment or performance of the affected girls. This observation invariably points to the significant importance of Fe in the brain functioning in the human biological system especially to the developing youngsters. This result (in Table 1) that revealed the effect of low iron on cognitive capacity was similarly reported elsewhere (Cumurcu et al., 2009). Fretham et al., (2011) reveals how alteration of hippocampal nature and plasticity affects learning and memory in mice experiment and

reiterated that hypoxia in cells reduces cognition. Gutema et al., (2023) revealed in their work that, supplementation with Fe improves intelligence, concentration, attention, and memory of schooling children. In a conflicting information, Cumurcu et al., (2009) divulged a finding that shows excess Fe, Zn, and Cu in patients after surgery is linked to delirium.

Table 2: Showing the effect of sickle anemia condition on cognitive ability of some adolescents' girls studying in Sokoto, Nigeria

	N (individuals)	Mean marks scored	Standard deviation	X^2	Remark
Anemia patients	10	90.0	3.0	685.953	Significant
Normal girls	25	924.0	10.0		
Total	35				

Table 2 shows the effects of anemia on schooling adolescents girls in Gwadabawa Sokoto, Nigeria. The results show that sickle cell patients score lower than the healthy girls. Thus, it is possible to link low cognitive capacity with sickle cell anemia and that could be associated with lesion in iron metabolism (Abaspour et al., 2014; Adewoyin, 2015; Castro & Viana, 2018; Alhazai et al., 2022; Siamisang et al., 2023). This finding (Table 2) was similarly found by Youssry et al., (2023) therewith, sickle cell impaired cognitive and hearing functions. A Jamaican work indicates that cognitive ability in sickle cell children was deficient and in turns can militates academic performance as well (King et al., 2023). Cognitive ability was also revealed to be affected in sickle cell condition especially due to changes in brain nature as reported by Hamdule et al., (2023). In the same streak, another finding decried that cognitive impairment is notable in children affected by sickle cell and later life quality is affected (Hamdule & Kirkham, 2023).

CONCLUSION

Adolescent period is very important especially in girls. Therefore, they need better education and cognitive potential. However, malnutrition and other biochemically related issues such as anemia effects may affect schooling girls potentials. This work evaluated the ability of anemia (Fe-deficiency anemia and sickle cell anemia) to affect cognition in girls in

Sokoto. Upon an evaluation with Montreal Cognitive Assessment, the results show that, the Fe-deficiency anemia and sickle cell anemia girls earned less marks compared to normal girls. Nutritional and related interventions are important, because poor cognition may affect education and overall potential of girls to be keys in growth and development of societies.

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