Original Research Article

Assessment of Serum Iron Status of Malnourished Infants in Umuahia, Abia State, Nigeria

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Abstract: The study was done to determine the iron status of the malnourished infants in Umuahia, Abia State, Nigeria. The study in children Emergency Unit of Federal Medical Centre, Umuahia. A total of fifty subjects (50) were recruited for the study. Twenty (20) subjects were malnourished infants aged 1-12 months (10 males, 10 females) and thirty (30) apparently healthy infants (15 males, 15 females).2.5ml of venous blood was drawn into Iron free clean plain tubes and the serum separated for the estimation of Iron in the samples. Iron was measured spectrophotometrically by Ferrozine method using TECO Diagnostics IRON/TIBC Reagents. The results were analysed using t-test and level of significance set at $p<0.05$.The study showed significant increase ($p<0.05$) is serum iron of malnourished infants ($80.0\pm7.0\mu g/dl$) compared to control subjects (42.5 ± 3.6 μg/dl) as well as in the %TSA ($25.4\pm5.6\%$) and ($12.2\pm3.2\%$) respectively and no significant difference ($p>0.05$) in TIBC. This could be related to iron therapy on the malnourished infants in the hospital to avert the danger of iron anaemia.
Keywords: Serum iron, TIBC, UIBC, %TSA, Malnourished infants, Umuahia

INTRODUCTION

Iron is a vital nutrient in the body which can be in form of haem or nonheme iron. Iron can be obtained from our diets either from animal source or plant source. Iron is a major component of haemoglobin that is needed for proper oxygenation for the metabolism of the body.

Malnutrition is a condition that results from eating a diet in which nutrients are not enough or are too much such that it causes health problems. It can be under nutrition or over nutrition [1]. If under nutrition occurs during pregnancy or before 2 years of age, there could be permanent problems with physical and mental development [2].

Undernourishment is most often due to not enough high quality of food available to eat. This could be related to high food prices and poverty. A lack of breast feeding may contribute to malnutrition as well as some infections which increase nutrient requirement such as malaria, measles, pneumonia, etc [3].

Malnutrition affects every system in the body and always results in increased vulnerability to illness, increased complications and in very extreme cases death [4, 5].

Diarrhea and other infections can cause malnutrition through decreased nutrient absorption, decreased intake of food, increased metabolic requirements and direct nutrient loss. Also, parasitic infections especially helminthiasis can lead to malnutrition [6]. Deriving too much of one's diet from a single source, such as eating almost exclusively corn or rice, can cause malnutrition. This may be as a result of lack of education about proper nutrition, or from only having access to a single food source.

Malnutrition has become global health issue, with under nutrition killing or disabling millions of children each year. Malnutrition prevents millions more from reaching their full potentials. The World Health Organisation estimated that malnutrition accounts for 54% of child mortality worldwide[13]. There are three commonly used measures for detecting malnutrition in children; stunting, underweight and wasting[14].

AIM
To determine the serum iron status of the malnourished infants in Umuahia

MATERIAL AND METHODS
Study Area: The study was done in Federal Medical Centre, Umuahia.

Subjects: A total of fifty (50) subjects were selected for this study. The test subjects included twenty (20) malnourished infants comprising 10 females and 10 males aged 1-12 months while thirty (30) apparently healthy aged matched infants were recruited as the control subjects comprising fifteen (15) males and fifteen (15) females.

Ethical Consideration: The consents of the parents/attendants were obtained and the procedure for the study explained to them and confidentiality assured to them.

Collection of blood: The subject and his/her attendants were given a detailed briefing about the purpose of the study. With all aseptic precautions 2.5ml of venous blood was drawn randomly on day of admission before treatment was started by the physicians. The serum was used for the estimation of iron by spectrophotometric technique.

STATISTICAL ANALYSIS:
The results were presented as mean ± standard deviation (SD) and analysed using t-test and level of significance set at $P<0.05$.

Determination of serum iron concentration by Ferrozine method
The quantitative determination of serum iron concentration was carried spectrophotometrically with TECO Diagnostic IRON/TIBC Reagent set, Anaheim, USA (CA92807).

Principle: The iron in serum is dissociated from Fe (ii) transferrin complex by the addition of an acidic buffer containing hydroxylamine. The addition reduces the Fe (iii) to Fe (ii).The chromogenic agent ferine, forms a highly coloured Fe (ii) complex that is measured spectrophotometrically at 560nm against a reagent blank. The standard was as well treated as that of the test.

Procedure
Iron free clean tubes were labeled as test, blank and standard. The 2.5ml of iron buffer reagent was added to all the labeled tubes.0.5ml of the samples was added to the respective tubes and was mixed. The reagent blank was used to zero the spectrophotometer at 560nm.The absorbance of all tubes were read and value were recorded (A1 reading).0.5ml of iron colour reagent was added to all the tubes and mixed properly. The tubes were placed in a heating bath at 37^0C for 10 minutes. The reagent blank was also used to zero the spectrophotometer at 560nm and another absorbance of all tube was read and the value obtained was recorded (A2 reading).

Calculation
Serum iron (μg/dl) =A2 Test-A1 Test x Conc of A2 std-A1 std

Where
A1Test =Absorbance of first reading of test
A2 Test =Absorbance of the second reading of the test
A1 std =Absorbance of first reading of the standard
A2= Absorbance of second reading of the standard

Determination of total iron binding capacity using Ferrozine method
The total binding capacity (TIBC) was estimated quantitatively with TECO Diagnostic Iron/TIBC Reagent set, USA, using the standard Iron Ferrozine method. The method used was indirect method which estimated the unsaturated iron binding capacity (UIBC) and the value were computed with that of serum iron to obtain the total iron binding capacity.

Principle:
The unsaturated iron binding capacity (UIBC) is determined by adding Fe (ii) to serum so that they bind to the unsaturated iron binding sites on transferrin. The excess Fe (ii) ions are reacted with Ferrozine to form the colour complex which is measured spectrophotometrically. The difference between the amount of Fe (ii) added and the amount of Fe (ii) measured represents the unsaturated iron binding. The total iron binding capacity (TIBC) is determined by adding the serum iron value to the unsaturated iron binding capacity value.

Procedure
Iron free clean test tubes were labeled as test, blank and standard.0.2ml of unsaturated iron binding capacity buffer reagent were added to all the tube according to the sample number, while 10ml of iron free water was added to standard tube and was properly mixed. To the test 0.5ml of sample and 0.5ml iron standard were added to the test, and were properly mixed. The reagent blank was used to zero the

spectrophotometer at 560nm wavelength. The absorbance of the samples was read and was recorded as (A1 reading).0.05ml of iron colour reagent was added to the tubes and were mixed properly and were placed in a heating bath at 37^0C for 10minutes.The reagent blank was again used to zero the spectrophotometer at 560nm and another reading taken as the (A2 reading)

Calculation

UIBC (µg/dl) =conc of std-A2 Test-A1 Test x conc of std

A2 std-A1 STD

TIBC (µg/dl) =Iron + UIBC

Where

A1Test =Absorbance of first reading of test
A2 Test =Absorbance of the second reading of the test
A1 std =Absorbance of first reading of the standard
A2= Absorbance of second reading of the standard

Statistical analysis: The results were presented as mean± standard deviation (SD) and data analysed using t-test and significance level set at P<0.05.

RESULTS AND DISCUSSION

Table-1: Comparism of Iron level between the control and the malnourished subjects

Parameters	Control (30)	Malnourished infants (20)	P-Level
Iron (µg/dl)	42.5±3.6	80.0±7.0	P<0.05
TIBC (µg/dl)	347.3±38.1	315.4±41.5	P>0.05
%TSA (%)	12.2±3.2	25.4±5.6	P<0.05

Iron status was significantly higher (p<0.05) in malnourished infants (80.0±7.0µg/dl) than in the control subjects (42.5±3.6µg/dl).This could be because the malnourished infants were on iron supplementation therapy due to anaemia unlike the control subjects who were not placed on iron therapy. Iron deficiency anaemia is common to malnourished children and that is why they were placed on iron therapy [7] (HKI Nutrition Surveillance Project Bull 10, 2002).There was no significant difference (p>0.05 in TIBC between the control subjects (347.3±38.1 µg/dl) and the malnourished infants (315.4±41.5 µg/dl) respectively. There was significant increase (p<0.05) in %TSA of the malnourished infants (25.4±5.6%) compared to the control subjects (12.2±3.2%). Malnutrition associated with iron deficiency is more pronounced in kwashiorkor but not in marasmic children (Jelliffe,1988;Suskind,1990;Reddy and Srikantia,1970).Meanwhile, the severely malnourished infants admitted in the tertiary level hospitals are usually treated by certain vitamins and iron supplements which might have affected the iron status of the malnourished infants in the study.

CONCLUSION

The study showed significant increase in iron status of the malnourished infants as a result of iron therapy given to them in the hospital after being admitted. Mothers and babies should feed well to avert the danger of malnutrition to both the mother and the child. Mothers should feed very well from onset of conception of baby and after child birth especially during breast feeding period. Exclusive breastfeeding should be encouraged among the mothers especially those in the rural areas. This will make the children develop properly and become useful members of the society, utilizing their full potentials. The future belongs to the children; therefore, adequate attention should be given to them by everybody.

The government and non-governmental organizations should make and implement policies that will help for availability of food to the society especially in the rural areas. There should be adequate health education in primary health care centres in the rural areas on proper feeding habits and benefits of breastfeeding. There should be preventive and control measures for infections in the society. There should be reduction of poverty. Children are great gifts from God, let us handle them with love and care so that they will embrace life with the best mindset.

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