INTERNATIONAL JOURNAL OF CURRENT RESEARCH IN BIOLOGY AND MEDICINE
ISSN: 2455-944X
www.darshanpublishers.com
DOI:10.22192/ijcrbm Volume 2, Issue 1 - 2017

Original Research Article

DOI: http://dx.doi.org/10.22192/ijcrbm.2017.02.01.002

Evaluation of changes in some haematological indices of malnourished infants in Umuahia

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Abstract

The study was done to determine the changes in some haematological indices of the malnourished infants in Umuahia.The study was done in children Emergency Ward 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(10 males, 10 females) and thirty (30) apparently healthy infants (15 males, 15 females). 2ml of venous blood was withdrawn into dipotassium EDTA anticoagulant tubes. This was used for the determination of all the haematological parameters studied, using manual method. The results were analysed using t-test and level of significance set at $p<0.05$.Significant lower mean values were observed in the red blood cell count, packed cell volume and haemoglobin values in infants with malnutrition as compared to controls. This shows anaemia in malnourished infants and reduced immunity which will affect them to withstand infection. The study showed significant increase in WBC and neutrophil.This could be as a result of metabolic stress and infection. The infants should receive adequate attention and feed well to avert the dangers associated with malnutrition.

Keywords: Red cell count, White cell count, Platelets, Malnourished Infants, Umuahia

Introduction

Malnutrition is a public health challenge especially to the developing countries like Nigeria (Obeagu *et al,2016*[a]).The cases of malnutrition may be increased due to economic recession the country is facing and other human factors such as war, terrorism and militancy. It can equally increase by natural disaster such as earthquake, volcanic eruption, flooding and food scarcity (Obeagu *et al.,2016*[b]).

Malnutrition according to World Food Programme (WFP) is a state in which the physical function of an individual is impaired to the point where he or she can no longer maintain adequate bodily performance process such as growth,pregnancy,lactation,physical work and resisting and recovering from disease. It can equally be insufficient nutrient intake or excess nutrients intake(Olu,2012;Obeagu *et al.,2016*[c]; Young,2012). If under nutrition occurs early in life of a baby, it may result to permanent physical and mental damage (Rasmusseu,2001).

Undernourishment is most often due to not enough high quality of food available to eat. This is associated with high food prices and poverty. A lack of breast feeding may contribute, as may a number of infectious diseases such as: gastroenteritis,pneumonia,malaria and measles which increase nutrient requirement (WHO,2014).

Efforts to improve nutrition are some of the most effective forms of development aid. Breastfeeding can reduce rates of malnutrition and death in children and efforts to promote the practice increase rates. In young children providing food in addition to breast milk between six months and 2 years improves outcomes (Bhutta *et al.,2013)*.

Malnutrition affects every system in the body and always results in increased vulnerability to illness, increased complications and in very extreme cases even death (Schaible and Kaufmann,2007;Stillwaggon and Eileen,2008).

In those with malnutrition some of the signs of dehydration differ.Children,may still be interested in drinking, have decreased interactions with the world around them, have decreased urine output, and may be cool to touch (WHO,2005).

Malnutrition has become an urgent global health issue, with under nutrition killing or disabling millions of children each year. Malnutrition also prevents millions more from reaching their full intellectual and productive potential. The world Health Organisation estimates that malnutrition accounts for 54% of child mortality worldwide (Manary *et al., 2013*).Even mild degrees of malnutrition double the risk of mortality for respiratory and diarrheal disease mortality and malaria (Walker *et al., 2008)*.

Malnutrition could predispose children to some variations of haematological indices when compared to healthy children. This is possible because their total protein levels are reduced compared to healthy children and haematological parameters are products of micronutrients and nutrients.

Aim

To determine the changes in some haematological indices of malnourished infants in Umuahia.

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Materials 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.

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

Collection of blood: The subjects and their attendants were given a detailed briefing about the purpose of the study. With all aseptic precautions, 2ml of venous blood was withdrawn into dipotassium EDTA anticoagulant tubes. This was used for the determination of all the haematological parameters studied, using manual method.

Haemoglobin estimation (Cyanmethaemoglobin method)

Principle: The haemoglobin is treated with a reagent containing potassium ferricyanide,potassium cyanide and potassium dihydrogen phosphate. The ferricyanide forms methaemoglobin which is converted to cyanmethaemoglobin by the cyanide.

Procedure

With the tubes properly labeled according to the subject's number, 4ml of Drabkin solution was pipetted into the tubes, following with the addition of 0.02ml of well mixed venous blood, mixed and allowed to stand for 4 minutes at temperature. The absorbance was read at 540nm against reagent blank. The readings were obtained from the calibration graph.

Packed Cell Volume (PCV)

Princinple: The packed cell volume is that proportion of whole blood occupied by red cells, expressed as a ration (litre/litre).Anticoagulated blood in a glass capillary of specified length, bore size, and wall-thickness is centrifuged in a microhaematocrit centrifuge at RCF 15,000 for 3 minutes to obtain constant packing of the red cells. A small amount of plasma remains trapped between the packed red cell.

The PCV value is read from the scale of a microhaematocrit reader.

Procedure

The capillary tubes were filled two-third full with well mixed EDTA anticoagulated venous blood of each subject, sealed the unfilled end, using a sealant material. The filled tubes were then placed in the microhaematocrit centrifuge and spun at 15,000 xg for 3 minutes.The PCV was read immediately after centrifuging.

Total White Cell Count

Principle: Whole blood is diluted 1 in 20 in an acid reagent which haemolyses the red cells leaving the white cells to be counted.White cells are counted microscopically using improved Neubauer ruled counting chamber and the number of WBCs per litre of blood calculated.

Procedure

Three hundred and eighty microlitre of Turk's solution was dispensed into a test rube and 20 microlitre of well mixed EDTA anti-coagulated blood was added and mixed well. The counting chamber was mounted with cover slip and allow to charge with test solution after re:: g th test solution. The charged chamber was left undisturbed for 2-3 minutess for the cells to settle. The chamber was* mounted on a light microscope, the ruling were focused and the cell counted using 10 objectives. The total number of cells counted was subjected to the first principle formular.

$WBC = N \times 20 \times 10^6 / 0.4$
Where N = number of cells counted
20= dilution factor
0.4 = dept of the well

Platelet Count

Principle: Blood is diluted 1 in 20 in a filtered solution of ammonium oxalate reagent which lyses the red cells. Platelets are counted microscopically using an improved Neubauer ruled counting chamber and the number of platelets per litre of blood calculated.

Procedure

With the test tubes labeled accordingly.038ml of filtered ammonium oxalate diluting fluid was dispensed into the tubes and 0.02ml of well mixed venous blood of the subjects added and allowed for 20 minutes undisturbed on blotting paper and covered with a lid. The chamber was placed on the microscope and the platelets counted.

Blood film/differential white cell count

Making, Fixing And Staining Blood Films

Procedure

Thin blood films were made from well mixed EDTA anticoagulated blood,air dried and covered with Leishman stain for 2 minutes, double diluted with buffered water of PH 6.8 and allowed to stain for 10 minutes. The stain was washed with tap water. The back of the slide was wiped clean and stood in a draining rack for the smear to dry. A drop of immersion oil was placed on the lower third of the blood film and covered with a clean cover glass.
The film was examined microscopically using 10 times objective with condenser iris closed sufficiently to see the cells clearly and changed to 100X for differential count.

Results

Table 1: Haematological Indices of the Subjects

Parameters	Healthy Infants	Malnourished Infants	P-level
RBC($x10^{12}$/L)	4.3±1.3	2.4±1.8	P<0.05
Hb(g/dl)	12.8±1.6	7.1±1.5	P<0.05
PCV (%)	38.4±3.2	21.3±4.3	P<0.05
Platelets($X10^9$/L)	354.0±63.6	270.0±68.4	P<0.05
WBC($X10^9$/L)	5.7±1.4	13.2±3.2	P<0.05
Neutrophil (%)	42.0±2.9	55.2±8.0	P<0.05
Lymphocyte(%)	58.3±4.2	44.9±8.0	P<0.05

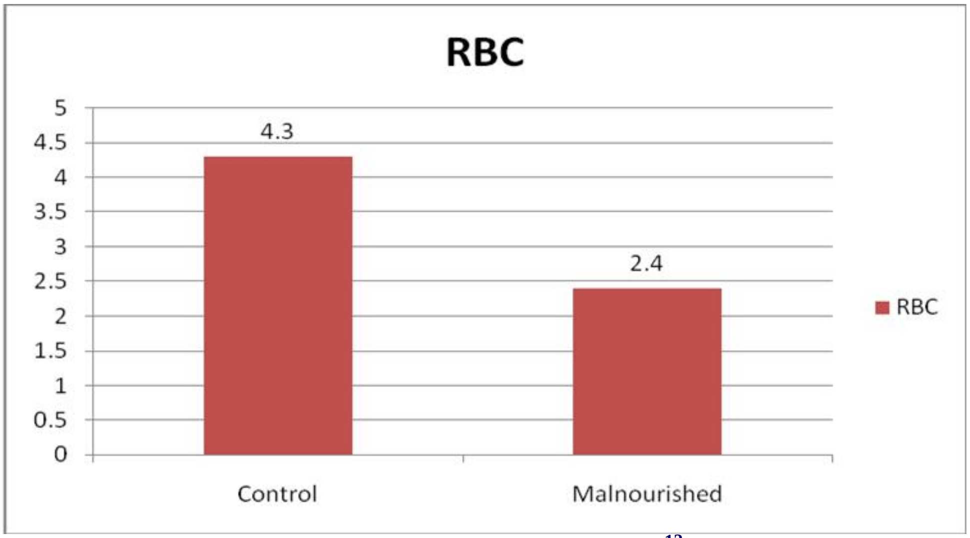

Fig 1: **Showing the mean values of RBC ($X10^{12}$/L) of Subjects**
RBC=Red blood cell

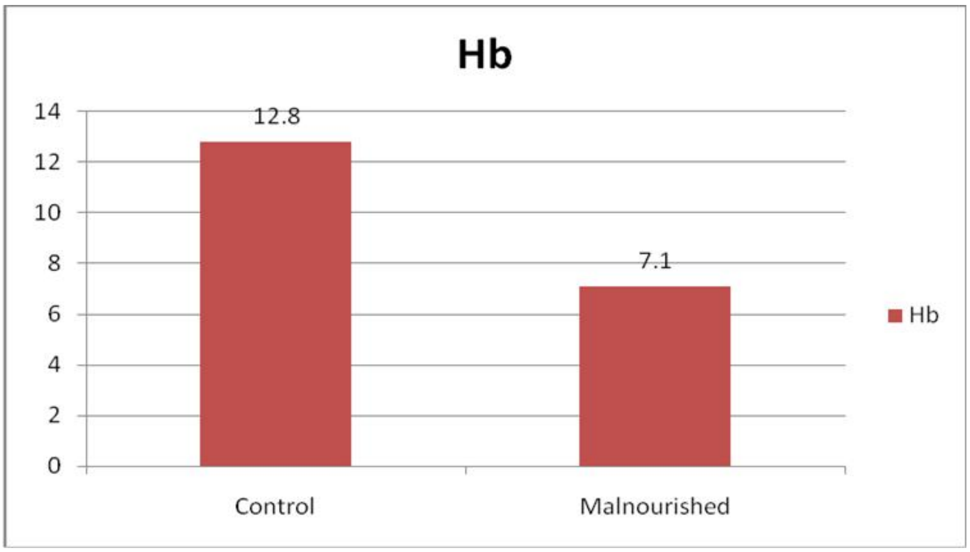

Fig 2: **Showing the mean values of Hb (g/dl) of Subjects**
Hb=Haemoglobin

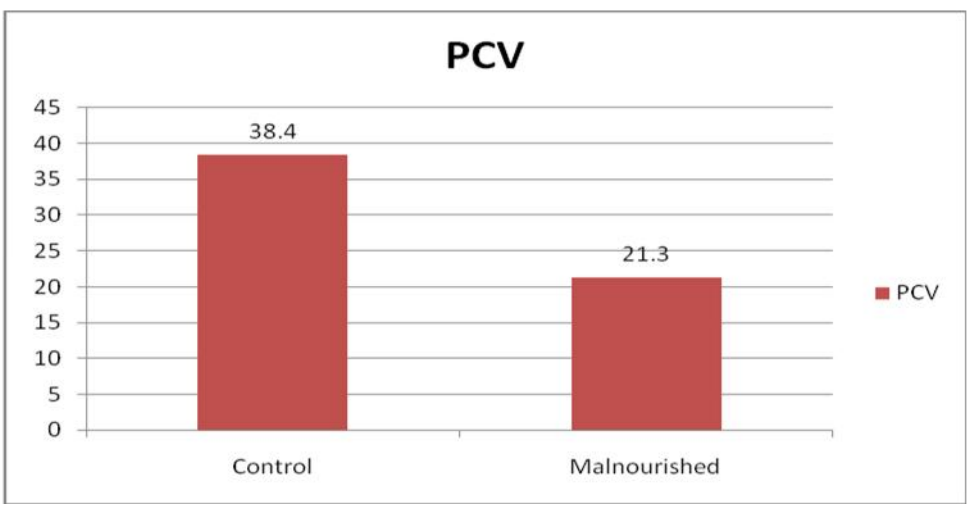

Fig3: Showing the mean values of PCV (%) of Subjects
PCV=Packed Cell Volume

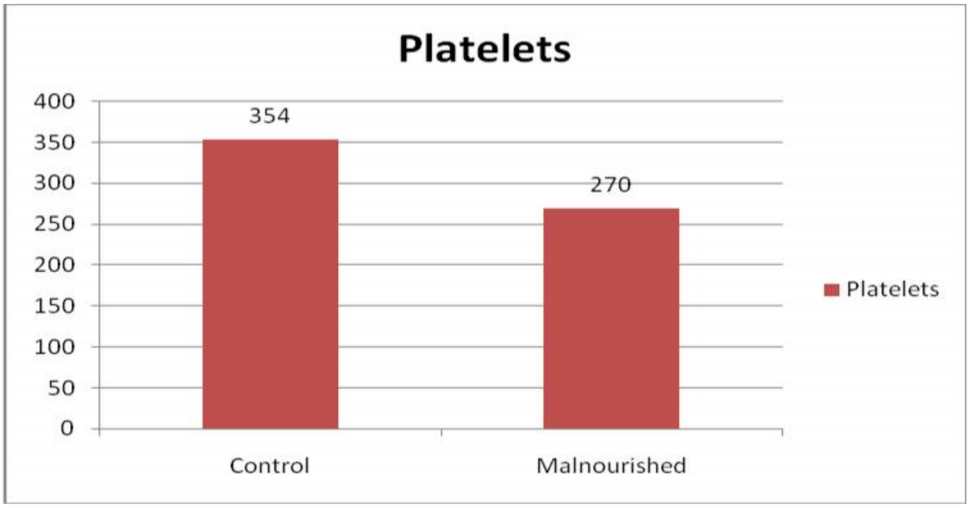

Fig4 : Showing the mean values of Platelets ($X10^9/L$) of Subjects

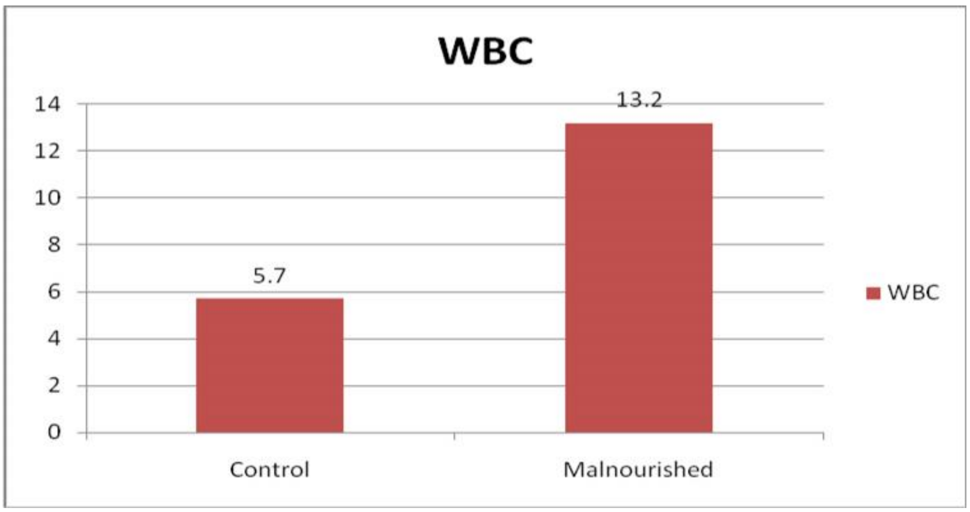

Fig5: Showing the mean values of WBC ($X10^9/L$) of Subjects
WBC=White blood cell

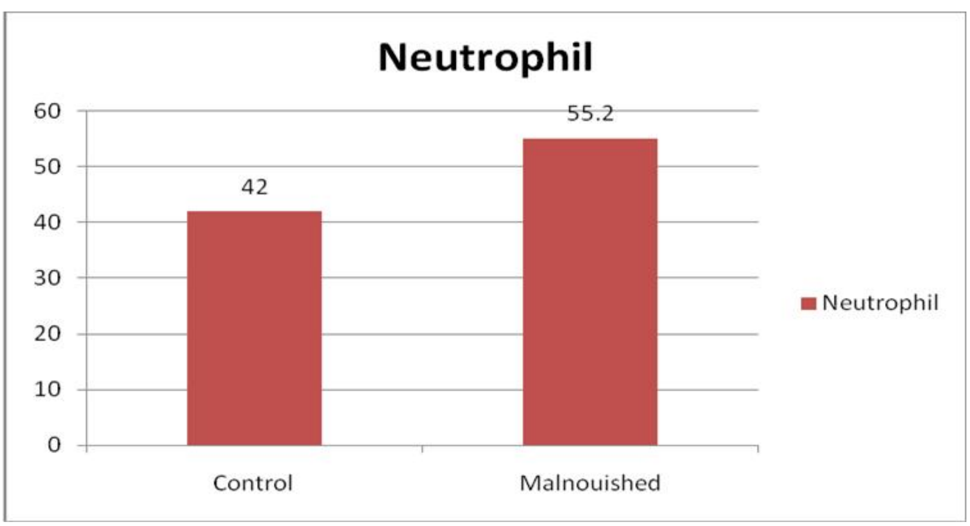

Fig6: Showing the mean values of Neutrophil (%) of Subjects

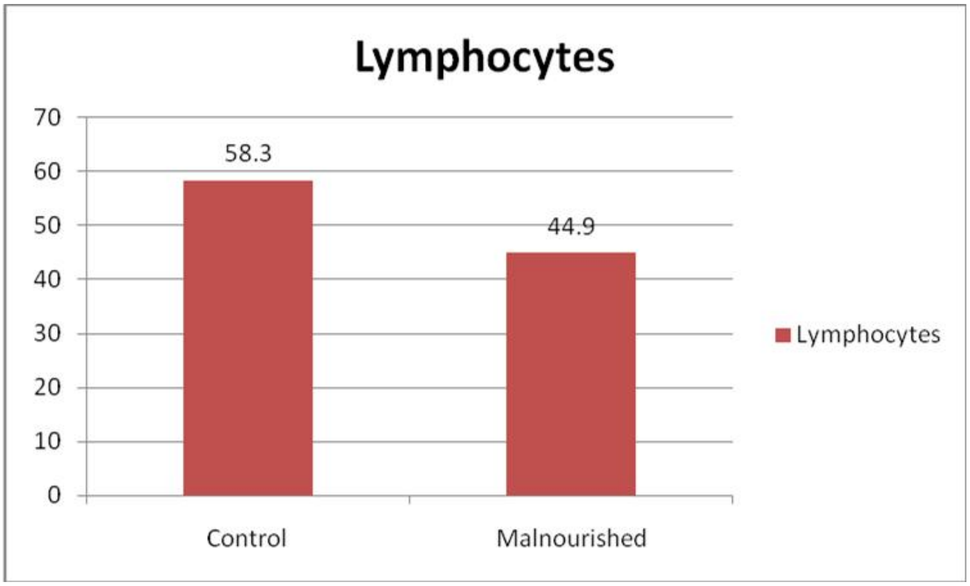

Fig7: Showing the mean values of Lymphocytes (%) of Subjects

Discussion

Lower mean values were observed in the red blood cell count, packed cell volume and haemoglobin values in infants with malnutrition as compared to controls as finding similar to previous studies **(**El – Nawawy *et al.,* 2002; laditan and Tindimebwa 1983). These changes can be attributed to adaptation to lower metabolic oxygen requirements and decrease in lean body mass seen in malnutrition (Abidoye and Sikabofiri, 2000).These changes have also been attributed to changes in the plasma volume as well as the intracellular body water in the body (Uner *et al.*, 2001; Nathan, 1990)

An increase in the plasma volume is seen and is said to be responsible for changes in haematocrit and haemoglobin levels (Kornberg and Sebrell, 1946).This study also found a significant leucocytosis and neutrophilia among infants with malnutrition as compared to control. This is similar to a previous study which showed a significant rise in leukocyte count in the patients with malnutrition compared to the controls (Nathan,1990).Leucocytosis in these infants can be a result of infection which is seen commonly in malnutrition .A lower lymphocyte count was observed in the malnourished children compared to controls. The lower lymphocyte count can be attributed to change in the thymus which is greatly reduced in infants during severe malnutrition. The degree of rhythmic atrophy correlates closely with depletion of lymphocytes and a decrease in the thymic dependent lymphocyte is also associated with impaired immunity (Smith ,1987) .Infants with malnutrition had a significantly lower platelet count. This decrease in bone marrow activities which indirectly affect megakaryocyte functions. This decrease in platelets seen in malnutrition can be attributed to a purported decrease in bone marrow activities which indirectly affect megakaryocyte function. A similar finding has been reported by a previous study (Uner *et al., 2001).*

Conclusion

The study showed significant decrease in packed cell volume,haemoglobin,platelets and lymphocytes compared to the healthy infants. This shows anaemia in malnourished infants and reduced immunity which will affect them to withstand infection. The study showed significant increase in WBC and neutrophil.This could be as a result of metabolic stress and infection. The infants should receive adequate attention and feed well to avert the dangers associated with malnutrition.

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How to cite this article:
Obeagu, Emmanuel Ifeanyi, Ochei,Kingsley Chinedum,Oshim, Ifeanyi Onyema and Obeagu, Getrude Uzoma. (2017). Evaluation of changes in some haematological indices of malnourished infants in Umuahia w. Int. J. Curr. Res. Biol. Med. 2(1): 14-20.
DOI: http://dx.doi.org/10.22192/ijcrbm.2017.02.01.002