



A Survey on the Prevalence of Anaemia in Pregnant and Lactating Women Eating Processed Food

Shakti Ketan Prusty^{1*} and Pratap Kumar Sahu¹

¹*Department of Medical, Siksha 'O' Anusandhan (Deemed to be University), Bhubaneswar, Odisha, India.*

Authors' contributions

This work was carried out in collaboration between both authors. Author SKP designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors PKS and SKP managed the analyses of the study. Author PKS managed the literature searches. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2020/v32i4031036

Editor(s):

(1) Dr. Vasudevan Mani, Qassim University, Saudi Arabia.

Reviewers:

(1) Chidiebere Otuu, University of Nigeria, Nsukka, Nigeria.

(2) Kalharie Pitigala, KAAATSU International University, Sri Lanka.

Complete Peer review History: <http://www.sdiarticle4.com/review-history/64111>

Original Research Article

Received 20 October 2020

Accepted 26 December 2020

Published 11 January 2021

ABSTRACT

Anaemia is a medical condition in which there is less number of red blood cells in the blood. Lack of sufficient healthy red blood cells in blood is observed in anaemia patients. In human beings, blood carries oxygen to other body tissues, transport of oxygen is done by red blood cells. An anaemic person always feels tired and weak. Weakness is because of less oxygen in body tissues. The body requirement of iron in pregnant and lactating women is generally high, insufficient intake of iron results in anaemia. Survey on the prevalence of anaemia in the different age group is done but the current survey also puts light on a factor which is not covered before. Because of good taste and availability, processed food intake is increasing in every household. A close link of high intake of processed food and nutrient deficiency in pregnant and lactating women, especially iron deficiency is observed. The current survey opens the future perspective to conduct more research on the connection between packaged food eating habits and prevalence of various diseases.

Keywords: Anaemia; processed food; haemoglobin; red blood cells; iron.

*Corresponding author: E-mail: researchsub01@gmail.com;

1. INTRODUCTION

Anaemia is a lack of enough healthy red blood cells in the blood. In human beings, red blood cells work in the transport of oxygen from the lungs to the rest of our body. Red blood cells also carry carbon dioxide from all our body to lungs. Then, lungs breathe out the carbon dioxide coming from body cells. Iron supplements are given to anaemia patients. Red blood cells constitute 70% of total body iron level in human blood in the form of haemoglobin. Iron plays a role in the conversion of blood sugar to energy. Iron boosts the immune system, supports healthy skin, hair, nails, and aids cognitive function [1,2].

Haemoglobin, protein-containing iron in the red blood cells of the blood of many animals. Haemoglobin works in the transport of oxygen to the tissues. Fig. 1 shows uptake of oxygen coming from the lungs, by red blood cells and transfer of oxygen by red blood cells to the body tissue [3]. Haemoglobin forms an unstable bond with oxygen. The bond between oxygen-haemoglobin is reversible. Haemoglobin in the oxygenated state is called oxyhaemoglobin. Oxy haemoglobin is bright red. Oxy haemoglobin is purplish-blue in the reduced state. Haemoglobin is a protein comprises four polypeptide chains. A heme group is attached to every polypeptide chain. The heme group is made up of porphyrin, the iron atom is attached to porphyrin. The complexes of iron-porphyrin are responsible for the role of haemoglobin in oxygen transport in the blood [4].

When red blood cells die, haemoglobin breaks and iron is saved. Then, iron is transported to the bone marrow. Transferrin proteins transport iron to the bone marrow. Transferrins are glycoprotein, transferrin glycoprotein is found in vertebrates. Transferrin's function is to mediate the transport of iron (Fe) through blood plasma. Transferrin contains binding sites for two Fe^{3+} atoms, transferrin is produced in the liver. Later, iron is used in the production of new red blood cells. Fig. 2 shows the transfer of iron from cell to blood, iron then attaches with transferrin protein. The remaining haemoglobin forms bilirubin. Bilirubin is a chemical that gives the faeces a yellow-brown colour, bilirubin is excreted into the bile.

Haemoglobin molecule contains heme and globin. Four heme groups surround a globin group and form a tetrahedral structure. The heme group is composed of porphyrin, Porphyrin is a large ring-like organic compound consist of 4 pyrroles. Pyrroles are ring compound composed of 1 nitrogen and 4 carbon atom. A series of single and double bonds connected form a large pyrrole molecule. In Fig. 3, a detailed structure of oxy-haemoglobin is shown, the haemoglobin molecule carries oxygen to transport oxygen to different parts of the body. Deoxyhaemoglobin structure, shown in Fig. 3, is a form of haemoglobin without oxygen over it. Oxygen is attached with the iron atom in haemoglobin, the iron atom is attached with porphyrin. Oxygen is transferred as the blood travels between the lungs and the tissues. Haemoglobin contains four iron atoms. Every iron atom can bind with one atom of oxygen [7].

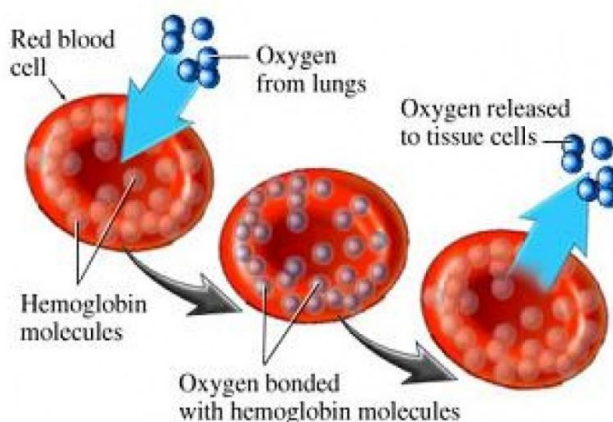


Fig. 1. Figure showing oxygen getting attached to red blood cells of blood and release of oxygen from red blood cells [5]

Iron Uptake into the Blood

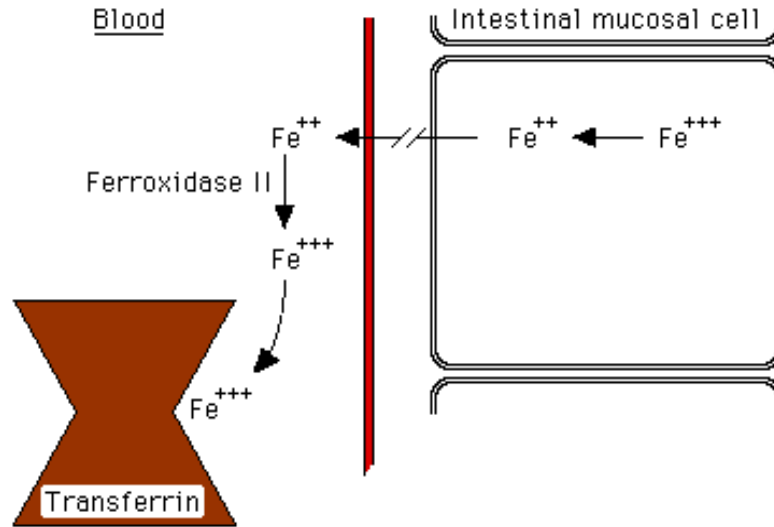


Fig. 2. Transfer of iron from cell to blood [8]

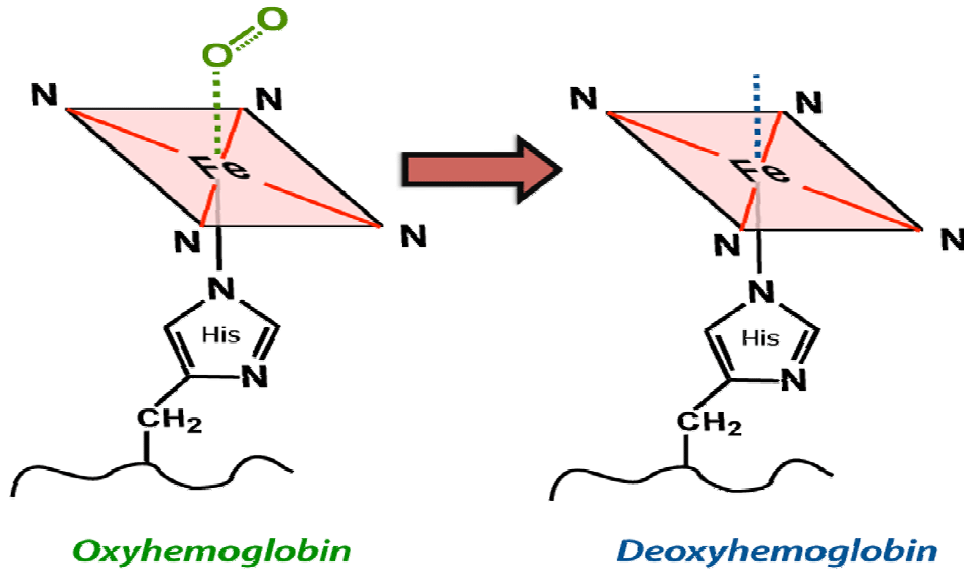


Fig. 3. Structure of oxy-haemoglobin and deoxyhaemoglobin [6]

1.1 Components of Blood

Blood is a body fluid and has four main components: Plasma, Red Blood Cells (RBCs), White Blood Cells (WBCs), Platelets. Fig. 4 shows a cross-section view of the human artery.

1.1.1 Plasma

Plasma is the liquid part of the blood. Plasma is yellow and holds the blood cells of whole blood in suspension. Plasma mainly contains water, salts, enzymes, hormones especially proteins are present in the blood.

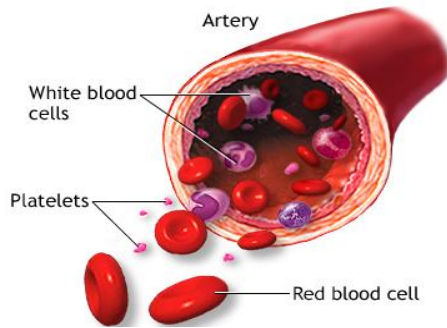


Fig. 4. Shows the cross section view of human artery [9]

1.1.2 Red blood cells

Red blood cells are also known as red blood corpuscles or erythrocytes contain haemoglobin. Haemoglobin is a protein, carries oxygen from lungs to all body parts. Human body cells use oxygen to produce the energy required for functioning and in return releases carbon dioxide. Haemoglobin also gives the red colour to blood.

1.1.3 White blood cells

White blood cells are also known as leukocytes. White blood cells are a major component of the human body's immune system. White blood cells protect the body from infection. White blood cell count is linked with infection in the body and inflammatory diseases, leukaemia and bone marrow disorders.

1.1.4 Platelets

Platelets are also known as thrombocytes. Platelets play an important role in forming clot and preventing bleeding. Platelets have no cell nucleus. Platelets are fragments of cytoplasm. Bone marrow contains stem cells, stem cells later develop into red blood cells, white blood cells and platelets.

1.2 Processed Food

Food that is already cooked, canned food, frozen food, packaged food, baked, dried or when the nutritional composition of food is changed with fortifying, preserving or preparing in different ways. Some commonly used processed food are:

1.2.1 Breakfast cereals

Corn flakes, ketchup, jam, ready to eat food.

1.2.2 Cheese

flavoured cheese spread.

1.2.3 Tinned fruits / Vegetables

Vegetables canned in a sugar solution, antioxidants and acidity regulators to prevent fruits/vegetables from getting rotten. Added preservatives not only decreases the nutritional value of food but also causes harmful effects on the person consuming it regularly.

1.2.4 Snacks

A variety of snacks are available in the market nowadays. Snacks include chips, biscuits, cookies, flavoured fryums, desserts and traditional canned sweets.

1.2.5 Microwave meals or ready meals

A lot of ready meals are available in the market, ready meals are sold in an airtight packet. The consumer has to open it and heat it before eating.

1.2.6 Cakes and biscuits

A variety of cakes – chocolate, strawberry, plum cakes, muffins, cookies are available in the market. A vast variety of flavour available in the market makes it consumed in almost every household.

1.2.7 Drinks

Drinks include Energy drink, sweetened fruit juice, shakes, coffee, flavoured milk, and aerated soft drinks.

2. MATERIALS AND METHODS

2.1 Design

The survey involves 90 samples which include 90 Females. The sample size was chosen randomly and 90 samples are divided into A, B and C category in the current survey. In each group, A, B and C, 30 females are surveyed. A group (Table 1) includes ladies from 1st month to 6 months of pregnancy. B group (Table 2) involves 6th month to 9th-month pregnancy and C group (Table 3) involves 0 to 1-year lactating women. The A, B and C group is divided into three subgroups I, II and III.

The survey on the prevalence of anaemia in pregnant and lactating women belonging to I, II, III subgroup eating chemically processed food is done on three different parameters of economic background. Ladies belonging to the low-income group are surveyed together. Ladies belonging to the middle-income group are grouped and the group of ladies belonging to the upper-middle class are analysed together. All the samples were asked to fill a consent form before participating in the survey.

2.1.1 Low-income group

The low-income group includes pregnant and lactating women residing in the slum area. The slum area is mostly a small area where a large number of population is residing. Low-income group women residing in slum area are generally devoid of proper food required for health and growth of pregnant and lactating women. Proper sanitization and education about healthy food during pregnancy and lactation is not available for low-income women. A balanced diet and why eating a balanced diet is during pregnancy and lactation is not known to women of low-income group.

2.1.2 Middle-income group

The middle-income group includes women residing in flats, societies, flats and societies have better sanitization in comparison to. The middle-income group resides mostly in a less

closely packed area. Middle-income group women stay where relatively less number of population is residing. Middle-income group pregnant and lactating women are not devoid of proper food required for health and growth of the baby during pregnancy and after birth. Middle-income group women know the importance of the balanced diet during pregnancy and lactation.

2.1.3 High-income group

The high-income group include women residing in bungalows, big societies, and in the area has very good sanitization. People belonging to the high-income group resides in a big area where very less number of population is residing. High-income group women know the importance of a balanced diet and the effect of eating healthy food during pregnancy and lactation. The growth of foetus and baby after birth during the lactation period is very much affected by healthy eating is known to high-income group women.

C Gomes et al. studied the effect of the intervention of health professionals by educating pregnant and lactating women eating ultra-processed food. Intervention reduced energy intake of ultra-processed food in the first and second trimester in pregnant women [10].

Table 1. Effect of eating habits on haemoglobin count of 1 to 6 months pregnant women

Income group	Average Haemoglobin count of 30 candidates	Eating habits (Percentage eating of processed food)
Low-income group	9.3	39%
Middle-income group	10.4	74%
High income group	10.2	82.6%

Table 2. Effect of eating habits on haemoglobin count of 6 to 9 months pregnant women

Income group	Average Haemoglobin count of 30 candidates	Eating habits (Percentage eating of processed food)
Low-income group	11	44%
Middle income group	10.6	79%
High-income group	10.2	87%

Table 3. Effect of eating habits on haemoglobin count of 0 to 3 months lactating women

Income group	Average Haemoglobin count of 30 candidates	Eating habits (Percentage eating of processed food)
Low-income group	13.8	42%
Middle-income group	12	85%
High-income group	13	89.6%

3. RESULTS AND DISCUSSION

The results obtained in Fig. 5 show that the average haemoglobin count of women having 1 to 6 months of pregnancy belonging to low income group is 9.3 g/dl (grams per decilitre), women having 1 to 6 months of pregnancy belonging to middle income group is 10.4 g/dl, and women having 1 to 6 months of pregnancy belonging to high income group is 10.2 g/dl. Average packaged food consumption in a day as compared to home cooked balanced meal in women having 1 to 6 months of pregnancy belonging to low income group is 39%, women having 1 to 6 months of pregnancy belonging to middle income group is 74%, and women having 1 to 6 months of pregnancy belonging to high income group is 82.6%.

Women having 6 to 9 months of pregnancy belonging to low income group is 11 g/dl (grams per decilitre), women having 6 to 9 months of pregnancy belonging to middle income group is 10.6 g/dl, and women having 6 to 9 months of

pregnancy belonging to high income group is 10.2 g/dl. Average packaged food consumption in a day as compared to home cooked balanced meal in women having 6 to 9 months of pregnancy belonging to low income group is 44%, women having 6 to 9 months of pregnancy belonging to middle income group is 79%, and women having 6 to 9 months of pregnancy belonging to high income group is 87%.

0 to 3 months old lactating women belonging to low income group is 13.8 g/dl (grams per decilitre), 0 to 3 months old lactating women belonging to middle income group is 12 g/dl, and 0 to 3 months old lactating women belonging to high income group is 13 g/dl. Average packaged food consumption in a day as compared to home cooked balanced meal in 0 to 3 months old lactating women belonging to low income group is 42%, 0 to 3 months old lactating women belonging to middle income group is 85%, and 0 to 3 months old lactating women belonging to high income group is 89.6%.

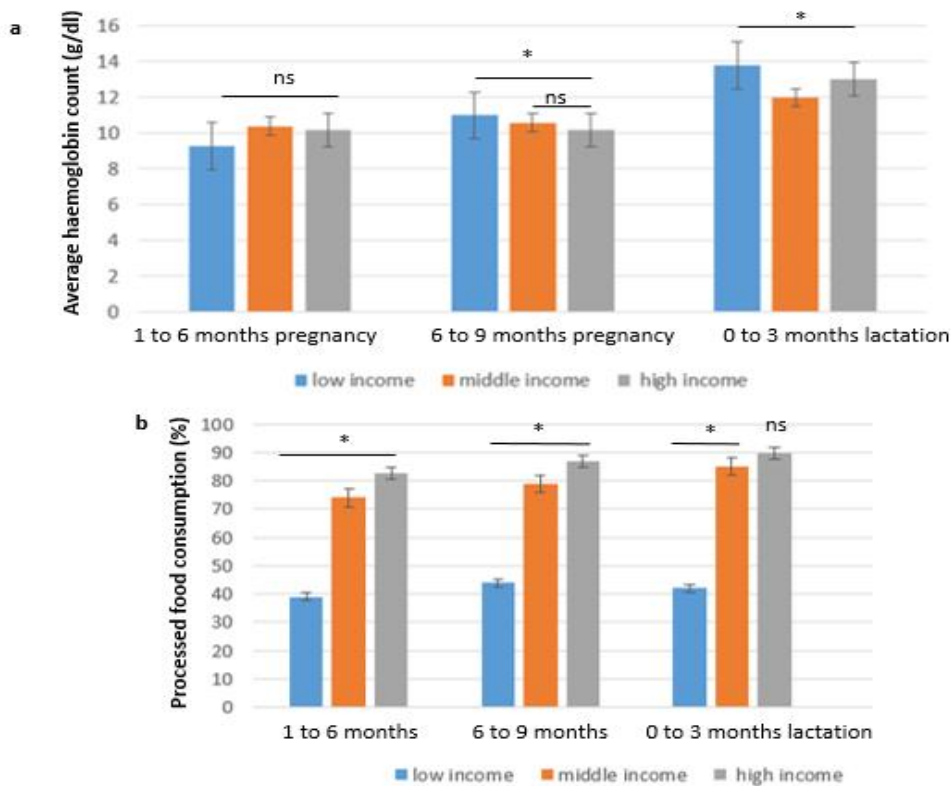


Fig. 5. Correlation between women of different income groups and pregnancy period on haemoglobin count (*p<0.5, One Way ANOVA, ns- non significant)

4. CONCLUSION

The survey conducted shows that women belonging to a low-income group with less percentage of processed food intake showed high haemoglobin. Whereas, women belonging to a middle-income group and the high-income group even having education about healthy eating habits showed less haemoglobin count. During pregnancy and lactation body require more energy. Processed food provides instant energy and hence it is preferred. As discussed with every woman, the reason behind the low haemoglobin count of the middle and high-income group is, it provides instant energy and also tastes good. The high sodium content and added sugar as a preservative present in processed food provide instant energy, as a result, the person eats it again and again. High intake of processed food affects healthy eating as a result lack of essential nutrients for the growth of the baby during pregnancy and lactation. The current survey opens the future perspective for further research on the link between packaged food eating habits and prevalence of various diseases.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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DOI: 10.1007/s10995-018-2690-z

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Peer-review history:
The peer review history for this paper can be accessed here:
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