Original Article

DOI: 10.17354/ijss/2016/253

Hemoglobin Content and Total Red Blood Cell Count in Different Ethnic Groups of Assam with a Special Reference to Glucose 6 Phosphate Dehydrogenase

Bobyjeet Goswami[1], Jolly Bhattacharjya[2]

[1]Associate Professor, Department of Physiology, Jorhat Medical College, Jorhat, Assam, India, [2]Assistant Professor, Department of Physiology, Jorhat Medical College, Jorhat, Assam, India

Abstract

Introduction: Although glucose-6-phosphate dehydrogenase (G6PD) deficient individuals are generally asymptomatic throughout their life, the clinical burden of this genetic condition includes a range of hematological conditions, including acute hemolytic anemia, neonatal jaundice, and chronic non-spherocytic anemia.

Materials and Methods: Samples were collected randomly from 80 people (18-45 yrs) of different ethnic groups in Jorhat District. Hemoglobin estimation was done by cyanmethemoglobin method. Total red blood cell (RBC) count was done by using hemocytometer. Quantitative estimation of G6PD is done by kit method.

Results: Correlation coefficient between G6PD status and hemoglobin was 0.072. This correlation was found to be statistically insignificant ($P > 0.05$), and a negative correlation was noted to establish a relationship between the above two parameters. Correlation coefficient between G6PD status and RBC count was −0.21. This correlation was found to be statistically insignificant ($P > 0.05$), and a negative correlation was noted to establish a relationship between the above two parameters.

Conclusion: From this study, it can be concluded that a negative correlation exists between G6PD status and hemoglobin content and RBC count.

Key words: Glucose-6-phosphate dehydrogenase, Hemoglobin, Total red blood cell count

INTRODUCTION

Glucose is the main source of energy for the red blood cell (RBC), which is metabolized by two major routes; the glycolytic pathway and the hexose monophosphate (HMP) shunt. Glucose-6-phosphate-dehydrogenase (G6PD) is an X-linked enzyme that catalyzes the first step in the HMP pathway of glucose metabolism and it produces NADPH, which is required for the maintenance of reduced glutathione (GSH). GSH is essential for protecting RBCs from oxidative damage.[1,2] Hence, this enzyme is important in RBC metabolism and its deficiency renders the RBC extremely vulnerable to any kind of oxidative stress.[3,4]

G6PD deficiency is a hereditary, sex-linked enzyme defect that results in the breakdown of RBCs when the person is exposed to the stress of infection or certain drugs. Although most affected individuals are asymptomatic, there is a risk of neonatal jaundice and acute hemolytic anemia, triggered by infection and the ingestion of certain drugs and broad beans (Favism).[2,5] G6PD deficiency is very common among humans, affecting around 400 million people worldwide.

This study is undertaken with the following objectives within different ethnic groups of Jorhat. Comparison of hemoglobin content with G6PD status, comparison of total RBC count with G6PD status, and to find out if there is any relationship between hemoglobin content, RBC, and G6PD status.

Access this article online

www.ijss-sn.com

Month of Submission : 03-2016
Month of Peer Review : 04-2016
Month of Acceptance : 05-2016
Month of Publishing : 05-2016

Corresponding Author: Dr. Jolly Bhattacharjya, Department of Physiology, Jorhat Medical College, Jorhat, Assam, India.
E-mail: jollybhattacharjya.jb@gmail.com

MATERIALS AND METHODS

The present study was carried out in the Department of Physiology, Jorhat Medical College, Jorhat. About 80 (18 – 45 years) subjects were selected randomly from Jorhat district.

Under aseptic and antiseptic care, 3 ml of venous blood was collected from anticubital vein and transferred to a vial of ethylene diamine tetra acetic acid.

Hemoglobin estimation was done by cyanmethemoglobin method. This is the World Health Organization's recommended method for determining hemoglobin concentration of blood.[6]

Total RBC count was done by using hemocytometer. In this method, a known volume of blood is diluted 200 times with a fluid which is isotonic with blood and which will prevent its coagulation. RBCs in known volume of diluted blood are counted in a special counting chamber, and the number of RBC per cumm of the undiluted blood is calculated from there.[7]

Estimation of G6PD is done by using GSIX kit reagent which is based on methemoglobin reduction method. The basis of this test is a coloric reaction using sodium nitric and methylene blue chloride reagent. Color change of blood was assessed qualitatively. Diagnosis of G6PD was made if the sample produces a dark brown color.[8]

RESULTS

In Ahom community, of total 15 cases, two were G6PD-deficient cases. Mean hemoglobin was 10.23 g% and mean RBC was 3.79 million/cumm.

In Kachari community, 9 cases were tested; only one case was G6PD-deficient. Mean hemoglobin was 11 g% and mean RBC was 3.8 million/cumm.

In Brahmin community, 10 cases were tested and no G6PD deficiency was noted. Mean hemoglobin was 10 g% and mean RBC was found to be 3.1 million/cumm.

In Kalita community, 21 cases were tested, no G6PD deficiency was noted. Mean hemoglobin was 12 g% and mean RBC was 3.1 million/cumm.

In Burmese community, two cases were found and both were G6PD-deficient. Mean hemoglobin was 12 g% and mean RBC was 3.6 million/cumm.

In Chutia community, three cases were tested; no G6PD-deficient case was noted, mean hemoglobin was 12.2 g% and mean RBC was 4.8 million/cumm.

In Muslim community; six cases were tested, one case was G6PD-deficient. Mean hemoglobin was 11.4 g% and mean RBC was 4.8 million/cumm.

In tea garden community, five cases were tested, one was G6PD-deficient. Mean hemoglobin was 11 g% and mean RBC was 3.1 million/cumm.

In Nepali community, two cases were tested, no G6PD-deficient case was found. Mean hemoglobin was 12 g% and mean RBC was 3.1 million/cumm.

In Marwari community, one case was tested and found to be normal. Mean hemoglobin was 12 g% and mean RBC was 4.2 million/cumm.

In Koiborta community, two cases were tested, no G6PD-deficient case was found. Mean hemoglobin was 11.5 g% and mean RBC was 3.4 million/cumm.

In Deuri community, two cases were tested and no G6PD-deficient case was found. Mean hemoglobin was 12 g% and mean RBC was 4 million/cumm. The resuls are shown in Tables 1 and 2.

Correlation coefficient between G6PD status and hemoglobin was −0.072. This correlation was found to be statistically insignificant ($P > 0.05$), and a negative correlation was noted to establish a relationship between the above two parameters.

Correlation coefficient between G6PD status and RBC count was −0.21. This correlation was found to be statistically insignificant ($P > 0.05$), and a negative correlation was noted to establish a relationship between the above two parameters.

DISCUSSION

In this study, correlation analysis and other associated test were performed, and the results are displayed in tabular form. Here, an attempt has been made to study the comparison of hemoglobin content with G6PD status, comparison of total RBC count with G6PD status, and to find out if there is any co-relationship between hemoglobin content, RBC count, and G6PD status.

On reviewing the article as studied by Ajlaan SK, al–Naama LM, and al-Naama MM, Department of Biochemistry, College of Medicine, University of Basrah, Iraq, it has been found that

there was statistically negative correlation between G6PD level, hemoglobin content, and RBC count.

In this present study also, it was found to have a negative correlation between G6PD status, RBC count, and hemoglobin content.

In this part of country, proper study of G6PD deficiency in relation with hemoglobin content and total RBC count was not taken into account.

G6PD deficiency is a common enzymopathy in the group of population where anemia of chronic nature is frequently found.

On reviewing literature, its prevalence in India varies from 0% to 27% in different castes and ethnic groups.[9]

Table 1: Number of cases and percentage of G6PD status with RBC count in million/cumm

RBC count in million/cumm	Number of cases (%)	Number of cases with G6PD status		% of cases with G6PD status	
		Normal	Deficient	Normal	Deficient
<3	0 (0)	0	0	0	0
3-3.5	15 (18.75)	13	2	86.6	13.3
3.6-4.5	54 (67.50)	49	5	90.7	9.2
>4.6	11 (13.75)	11	0	100	0
Total cases	80 (100)	73	7	-	-

Table 2: Number of cases and percentage of G6PD status with hemoglobin in g%

Hemoglobin in g%	Number of cases (%)	No of cases with G6PD status		% of cases with G6PD status	
		Normal	Deficient	Normal	Deficient
<6	0 (0)	0	0	0	0
6.1-9	3 (3.75)	3	0	100	0
9.1-11	5 (6.25)	3	2	60	40
>11	72 (90)	67	5	91.3	6.9
Total cases	80 (100)	73	7	-	-

In the present study, it has been observed that out of the total 80 cases, 8.75% were G6PD-deficient.

Some cases in our study that have low hemoglobin content and RBC count are not G6PD-deficient. The cause may be attributed to socioeconomic background, varied food habits, and religious practices adopted, so further study in this regard may be done with a reference to various mutations of G6PD prevalent in this area and typing of hemoglobin.

CONCLUSION

From this study, it can be concluded that a negative correlation exists between G6PD status, hemoglobin content, and RBC count.

However, there remains a genuine scope for a prospective study on the type of mutation/variants prevalent in this area.

REFERENCES

1. Beutler E. G6PD deficiency. Blood 1994;84:3613-36.
2. Beutler E. G6PD deficiencies and other enzyme abnormalities. In: Beutler E, Lichtmann MA, Coller BS, Kipps TJ, editors. William's Haematology. New York: McGraw Hill Publications; 1995. p. 564.
3. Cappellini MD, Fiorelli G. Glucose-6-phosphate dehydrogenase deficiency. Lancet 2008;371:64-74.
4. Bernstein RE. A rapid screening dye test for the detection of glucose-6-phosphate dehydrogenase deficiency in red cells. Nature 1962;194:192-3.
5. West JB. Best and Taylor, Physiological Basis of Medical Practice. 12th ed. Baltimore: Williams & Wilkins; 1990. p. 384, 383, 382.
6. Glucose-6-phosphate dehydrogenase deficiency. WHO Working Group. Bull World Health Organ 1989;67:601-11.
7. Srivastava BK, editor. Text Book of Practical Physiology. 4th ed. Philadelphia: Lippincott; 2004. p. 8.
8. Sanpavat S, Nuchprayoon I, Kittikalayawong A, Ungbumnet W. The value of methemoglobin reduction test as a screening test for neonatal glucose 6-phosphate dehydrogenase deficiency. J Med Assoc Thai 2001;84 Suppl 1:S91-8.
9. Mohanty D, Mukherjee MB, Colah RB. Glucose-6-phosphate dehydrogenase deficiency in India. Indian J Pediatr 2004;71:525-9.

How to cite this article: Goswami B, Bhattacharjya J. Haemoglobin Content and Total Red Blood Cell Count in Different Ethnic Groups of Assam with a Special Reference to Glucose 6 Phosphate Dehydrogenase. Int J Sci Stud 2016;4(2):62-64.

Source of Support: Nil, **Conflict of Interest:** None declared.