Indian J Physiol Pharmacol 1999; 43 (1) : 114–116

RED CELL MEMBRANE LIPID COMPOSITION IN IRON DEFICIENCY ANEMIA

D. C. SHARMA* AND NEELIMA HEMKAR

Department of Biochemistry,
S.M.S. Medical College
Jaipur – 302 004.

(Received on April 1, 1998)

Abstract : Red cell membrane cholesterol, phospholipids and total lipids were determined in 42 non-anaemic and 53 iron-deficient anaemic women. Significant changes were observed in total lipids, phospholipids and cholesterol levels in iron deficient anaemic subjects. In addition, a highly significant correlation coefficient (r=>0.693) was found between these lipid fractions and hemoglobin, iron and percent saturation which suggests that iron deficiency anaemia is the cause of these changes.

Key words : iron deficiency anaemia red cell membrane choloesterol phospholipids total lipids

INTRODUCTION

The incidence of iron deficiency anaemia (IDA) is very high in India and many other countries (1). Several changes are known to occur in iron deficiency (2). While microcytosis is known to occur in IDA for many decades, it is not clear whether it is also accompanied by chemical changes in the composition of erythrocyte membrane. The aim of the present investigation was to study changes, if any, in the lipid composition of red cell membrane in severe iron deficiency anaemia.

METHODS

The subjects for anaemic group were selected from outdoor patient Department of Gynaecology and Obstetrics of S.M.S. Medical College and attached Hospitals, Jaipur. The women having hemoglobin below 12 g% and who were free from infection or febrile disease were included in this group. The emphasis were to get the anaemic patients with Hb value as low as possible. Healthy females with blood hemoglobin value above 12 g% served as control (non-anaemic group). The blood was drawn in a heparinised vial and immediately analysed for hematological parameters (3), plasma iron (PI) and total iron binding capacity (TIBC) on a Merck auto-analyzer (selectra) using Merck's kits (4). Phospholipids (PL), total cholesterol (TC) and total lipids (TL) of erythrocyte membrane were determined by the methods described by Shohet and Mohan Das (5).

*Corresponding Author

TABLE I : Red Cell Membrane Lipids in Iron Deficiency Anaemia.

Group	Total Lipids		Phospholipids		Total Cholesterol	
	(mg/ml)	($\mu g / 10^6$ RBC's)	(mg/ml)	($\mu g / 10^6$ RBC's)	(mg/ml)	($\mu g / 10^6$ RBC's)
Non-anaemic (n=42)	1.874±0.251	0.350±0.045	0.809±0.211	0.164±0.014	1.149±0.244	0.232±0.052
Anaemic (n=53)	3.629±0.941	0.700±0.232	2.183±0.705	0.420±0.132	0.514±0.276	0.096±0.045

All the values in anaemic group are significantly different from that of non-anaemic group (P<0.0005).

RESULTS

The existence of anaemia was confirmed by the presence hypochromic microcytic erythrocytes in peripheral blood films and Hb, TRBC and PCV values in anaemic group (7.43 ± 1.77, 3.06 ± 0.69, 23.34 ± 5.58) as against 12.31 ± 0.32 g%, 3.96 ± 0.44 million/ cu.mm., and 34.52 ± 2.64 %, respectively in non-anaemic group. The PI, TIBC and PS values were 50.8 ± 15.1, 370 ± 45.3 and 14.0 ± 5.2 in anaemic group and 106.3 ± 13.0 µg%, 352.4 ± 27.7 µg% and 30.3 ± 4.4% in non-anaemic group.

The red cell membrane lipid composition in the two groups is shown in the table-I. It has been expressed as usual in mg/ml blood and more rationally as µg/million RBC's. It can be seen that in iron deficiency the amount of total lipids doubled and phospholipids trebled while the cholesterol was halved. All these changes were highly significant (P<0.0005).

The correlation factor or coefficient (r), between lipid fractions on one hand and Hb, PI and PS values separately on the other hand, in the combined group of anaemic and non-anaemic patients was -0.900, between Hb & PL; + 0.786, between Hb & TC; -0.870, between PI, + 0.713, between PI & TC; -0.750, between PS & PL; + 0.693, between PS & TC.

DISCUSSION

An increase in phospholipids and decrease in cholesterol is known to increase fluidity of RBC membrane (6) and thus affect its deformability (6), fragility (7) and perhaps life span (6). The decreased fragility of iron deficient erythrocytes has been attributed to thinner cells/microcytosis (7), but it may partly be due to altered lipid composition. That alteration in lipid composition is caused by iron deficiency anaemia is supported by significant changes in lipid fraction, Hb, PI and PS value.

The red cell membrane lipid compositions in iron deficient anaemic patients was earlier studied by Kirilenko & Paramonova (8). These authors also found increased levels of total lipids, phospholipids and significantly decreased levels of cholesterol esters and lysophospholipids, but have not furnished any explanation/ mechanism of the observed changes and also had not correlated these changes with membrane properties.

REFERENCES

1. DeMaeyer EM, Adiels - Tegman M. The prevalence of anaemia in the world. World Health Stat Q 1985; 38: 302–316.
2. Heilmayer L, Harwerth HG. Clinical manifestations of iron deficiency. In Iron Deficiency, (Eds.), L Hallberg, HG Harwerth, A Vannotti, London, Academic Press, 1970; 375–382.
3. Dacie JV, Lewis SM. Practical Haematology, 8th ed., Edinburg, Churchill Livingstone, 1994; 49–82.
4. Merck E. Diagnostica Merck, Darmstadt, E Merck, 1994; 1–63.
5. Shohet SB, Mohan Das N. Red Cell Membrane, New York, Churchill Livingstone, 1988; 172–175.
6. Lee JR, Bithell TC, Foerster J, Athens JW, Lukens JN. Wintrobe Clinical Haematology, Vol. I, 9th ed., Philadelphia, Lea & Febiger, 1993; 106 & 198.
7. Henry JB. *Clinical Diagnosis and Management by Laboratory Methods,* 18th. ed., Philadelphia, Saunders, 1991; 629.
8. Kirilenko NP, Paramonova IV. Erythrocyte membrane lipid composition in patients with iron deficiency anaemia during treatment. *Gematol Transfuziol* 1992; 37: 20–23.