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Physiology

FRAGILITY RESPONSE OF RED BLOOD CELLS TO OSMOTIC STRESS IN TRIBAL AND NON TRIBAL POPULATION OF DHULE AND NANDURBAR DISTRICT

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ABSTRACT Most of the tribal from Dhule and Nandurbar district suffer from anemia mainly due to malnutritional and genetic disorders. The study of red blood cell haemolysis in response to osmotic stress revealed significant differences between tribal and non tribal individuals. The 100% R.B.C. fragility for nontribals occured at 71+1 Mosmoles concentration of buffered saline solution whereas it was 64+3 Mosmoles concentration in the tribal. Simlarly,50% Red blood cell haemolysis has also shown significant difference. The R.B.C. indices like haemoglobin, PCV, MCH, MCHC and E.S.R. affecting the R.B.C. fragility suited in age and weight are matched tribal and non tribal and are compared.

KEYWORDS : haemolytic anemias, osmotic fragility of RBCs, difference in osmotic stress.

INTRODUCTION:

Haemolytic anaemia due to genetic and malnutritional disorders are very common in the tribal population of Dhule and Nandurbar, district of Maharashtra State (India). The prevalence of stickle cell gene is reported to be about 29% (about 17% sickle cell homozygous and 12% sickle cell trait) among Bhill and Pawara tribal of Dhule District (Old Dhule district included newly formed Nandurbar district) by Nagtilaket.al. (1994-1995). The population of the Tribal is about 42% of the total population i.e. 5.5 millions in the two districts. Majority of the tribal from Dhule & Nandurbar district seek treatment for their serious ailments at the hospital of ACPM medical college, Dhule & district hospital attached to Govt. Medical College, Dhule.

The haemolytic anaemias due to intracorpuscular mechanisms are associated with changes in red blood cells indices and red bleed cell response to osmotic stress. The objective of the present study was to find out red blood cell indices and red blood cell osmotic fragility in the tribal individuals and compared the same with the non tribal individuals with the view to provide a simple screening test before submitting the patients for more sophisticated investigations such as hemoglobin electrophoresis and G6PD estimation.

MATERIALS AND METHODS:

The blood samples of 60 tribal individuals (T) and 60 non tribal individuals (NT) of age group in the range of 30 to40years and weight in the range of 40 to 50 Kg were were collected and analysed from patients attending O.P.D.in the hospital.

Osmotic fragility was measured by the method of Parpet et.al.(1947) as modified by Dacie and Lewis (1991a). Measurement of haemoglobin and other R.B.C. indices like PCV, MCV, MCHC of blood samples was carried out by the methods as described by Dacie and Lewis (1991b). E.S.R. of the blood samples was measured by Wintrobe method (Wintrobe and Londberge,1935). All the chemicals used were of AR and GR grade.

RESULTS:

The study of red blood cell haemolysis (RBCH) in response to osmotic stress has revealed a significant difference between tribal (T) and non tribal (NT) individuals.

The 100% fragility for NT occurred at 71$\pm$1 Mosmoles concentration of buffered saline solution whereas for the T it was at 64$\pm$3 Mosmoles concentration. The 't' value being 10, the difference is highly significant at 0.05%level.

Similarly 50% RBCH for tribal individuals and non tribal individuals also showed a significant difference. The 50% RBCH for the non tribal individuals occurred at 34$\pm$2 Mosmoles concentration. This difference is also highly significant, 't' value being 10 at 0.05% level.

Haemoglobin and other R.B.C. indices like PCV, MCH, MCV, MCHC and E.S.R. of the blood samples of the tribal individuals and non tribal individuals are compared in Table1.

Table1. Comparison of R.B.C. indices of Non Tribal (NT) and Tribal (T)

Sr. No.	Parameter	NT	T	Value of Significance at 't'0.05%Level
1	Hb (gms %)	12.48 + 2	9.37 + 3	6.3
2	PCV (%)	41.05 + 2	29.08+ 2	11.65
3	MCH (Pcg)	31.23 + 2	19.88 +4	6.23
4	MCV(Cubic Microns)	83.0 + 2	63.45 + 5	4.76
5	MCHC (%)	40.21 + 2	37.12 + 5	3.2
6	E.S.R.(mm/hr)	19.78 + 1	26.13 + 5	Not Significant

CONCLUSIONS:

The decreased resistance of the R.B.C. of tribal individuals for osmotic stress observed in the study may be due to altered cell volume, surface area or functional integrity of the cell membrane. The variation of cell lysis with osmotic stress reflects underlying cell subpopulations and their membrane cytoskeletal functionality. Further we have correlated osmotic stress response pattern of R.B.C. of the tribal individuals and non tribal individuals with R.B.C. indices like Hb, PCV, MCV, MDH, MCHO, E.S.R. (Table 1). Significant difference in these parameters except E.S.R. was found between the tribal individuals and non tribal individuals contributing towards the variation in their R.B.C. fragilities.

In addition to genetic disorders, malnutrional disorders like protein energy malnutrion (PEM), nutritional anemia, deficiency of polyunsaturated fatty acids (PUFA) and deficiency of vitamins, especially antioxidant vitamins like tocopherols, carotenes and ascorbic acid are of common occurrence in the tribal individuals. These deficiencies seem to be causes of considerable importance towards the increased R.B.C. fragility observed in the tribal individuals. The erythrocyte membrane is a complex structure, the shape of which depends partly on the lipid composition of its membrane (Shohet,1972). Both increase of cholesterol and phospholipids molar ratio and decrease of polyunsaturated fatty acids make R.B.C. membrane more rigid (Brudkdorfer et.al.1969). Therefore the dietary deficiencies of PUFA and thereby phospholipids and that of antioxidant vitamins (required for the protection of the PUFA from lipid peroxidation) decrease the

integrity of the R.B.C. membrane. Many of the tribal people consume Tolambi (Mahua) oil, a type of sweet oil extracted from the seeds of Tolambi (Mahua) trees (Bassia longifolia and Bassia latifolia). Patil and Jagtap (1999) have studied the nutritional value of the Tolambi oil. It was found to be very low from the view point of supplying beta carotenes (Precursor of vitamin A) and polyunsaturated fatty acids. Moreover the quantity of the sweet oil consumed by the tribal persons is also very less.

Many of the tribal persons consume home prepared Mahua alcohol which is obtained from fermentation of flowers of the Tolambi tree. Nagtilak (1998) has found significant increase in the oxidative stress (free oxygen radicals) and decrease in the activities of super oxide dismutase (SOD) glutathione peroxidase (GPX) and catalase enzymes of erythrocytes and thereby causing pronounced antioxidant deficiency in the Mahua tribal persons. The decreased antioxidant status seems to be responsible for the increased lipid peroxidation of PUFA by the free oxygen radicals causing increased R.B.C. fragility in the tribal persons. Possible reasons for the significant difference in fragilities of red blood cells between tribal population and non tribal population needs to be further evaluated.

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