

# BLOOD GLUTATHIONE AND ASCORBIC ACID IN NORMAL PREGNANCY AND IN PRE-ECLAMPTIC TOXAEMIA

By

SUBHASH MUKHERJI AND SACHCHIDANANDA BANERJEE

*Department of Physiology, Presidency College, Calcutta.*

*(Received June 17, 1958.)*

Toxaemia of pregnancy occurs more frequently in undernourished women than in those who are well-fed (Brews, 1953; Burke *et al.*, 1943; Hamlin, 1952). Various biochemical and clinical investigations were undertaken to correlate pre-eclampsia and eclampsia with different avitaminotic or hypervitaminotic states (Dieckmann, 1952; King and Ride, 1932). Theobald (1932), Sirotkina (1945) and Dieckmann (1952) reported that pre-eclampsia and eclampsia were associated with serious vitamin C-deficiency. Capillary haemorrhage in different parts of the body is a very common feature of both avitaminosis C and eclampsia. It is, therefore, possible that vitamin C-nutrition has relation with the onset of toxemia of pregnancy.

Banerjee *et al* (1952) observed that glutathione level of blood and tissues are diminished when guinea pigs develop scurvy. They also reported that dehydroascorbic acid which was absent in the tissues of normal guinea pigs was present in considerable amount in the tissues of scorbutic guinea pigs. Patterson (1950) reported that dehydroascorbic acid was toxic to rats. Patterson and Lazarow (1950) observed that the toxic action of dehydroascorbic acid could be prevented by a prior injection of glutathione. Dehydroascorbic acid present in the tissues of scorbutic guinea pigs might combine with glutathione of the tissues and thereby cause a fall in the available glutathione concentration in the tissues. It was, therefore, of interest to study the ascorbic acid, dehydroascorbic acid and glutathione contents of blood of patients suffering from toxaemia of pregnancy.

## MATERIALS AND METHODS

*Selection of subjects:* Toxaemia of pregnancy cases who had persistent hypertension with systolic blood pressure above 150 mm. of mercury and diastolic blood pressure above 100 mm. of mercury, who were excreting moderate amount of albumin in urine and had edema were selected. Normal pregnant women who took admission at full term of pregnancy were used as controls.

*Estimation of ascorbic acid, dehydroascorbic acid and glutathione contents of blood:* Blood was collected in tubes containing mixed oxalates from anticubital vein

in the early hours of the morning before food. Ascorbic acid and dehydroascorbic acid of the blood was estimated by the method described by Banerjee and Belavady (1953). Blood glutathione was estimated by the method of Woodward and Fry (1952). Results are given in Table I.

TABLE I.

Ascorbic acid, dehydroascorbic acid and glutathione contents of blood of normal pregnant women and in patients suffering from pre-eclamptic toxæmia.

Subjects.	Blood ascorbic acid (mg. %)	Blood dehydroascorbic acid (mg. %)	Blood glutathione (mg. %)
	*		
Normal (12)	0.911±0.032	0	43.68±1.57
Pre-eclamptic toxæmia (35)	0.788±0.024	0.006±0.009	36.90±1.43
Difference of means	0.123		6.78
Standard error of difference between two means.	0.04		2.12
t	3.0		3.2

\*Mean± standard error. Figures in parenthesis indicate the number of subjects.

## RESULTS

In normal pregnant women blood ascorbic acid and glutathione levels were respectively 0.911 mg. and 43.68 mg. per 100 ml. blood. Dehydroascorbic acid was absent in the blood.

In patients suffering from toxæmia, ascorbic acid, dehydroascorbic acid and glutathione values of blood were respectively 0.788 mg., 0.006 mg. and 36.90 mg. per 100 ml.

## DISCUSSION

Blood glutathione of patients suffering from pre-eclamptic toxæmia of pregnancy was significantly diminished as compared to normal full term pregnant women. Certain enzymes of the body depend on—SH groups for

their activity and if the—SH groups are inactivated the enzymes become inactive (Barron and Singer, 1945). The lost activity may be revived in most of the cases by the addition of glutathione (Hopkins *et al.*, 1938). Glutathione is supposed to protect the—SH groups of enzymes which play a great role in the intermediary metabolism of carbohydrate, protein and fat in the body. Dehydroascorbic acid, which was absent in the blood of normal full term pregnant woman, appeared in some cases suffering from pre-eclamptic toxæmia. Dehydroascorbic acid being toxic (Patterson, 1950), glutathione of tissues combines with it leading to a fall in the concentration of available glutathione, which consequently cannot protect the—SH groups of enzymes. The toxæmia of pregnancy, therefore, might be due to liberation of some toxins in the blood.

Blood ascorbic acid significantly diminished in toxæmia of pregnancy cases either due to diminished intake or to increased utilization by the tissues of the patients. As the dietary intake of ascorbic acid of the patients could not be determined it cannot be said what was the cause of the diminished ascorbic acid content of the blood. However, it may be recommended that ascorbic acid should be administered to these patients so as to maintain the ascorbic acid nutrition of the body.

#### SUMMARY

Ascorbic acid, dehydroascorbic acid and glutathione were estimated in the blood of 12 normal full term pregnant women and 35 patients suffering from pre-eclamptic toxæmia.

Blood levels of ascorbic acid and glutathione were significantly lower in the toxæmic patients. Dehydroascorbic acid which was absent in the blood of normal pregnant women appeared in the blood of a few toxæmic patients. The lowered glutathione content of blood of toxæmic patients might be due to its reaction with toxins produced in the disease.

Clinical materials were obtained from the Chittaranjan Hospital, Calcutta National Medical College by the courtesy of Dr. M. N. Sarkar, Superintendent of the hospital.

#### REFERENCES

1. Banerjee, S., and Belavady, B. (1953): *Lancet*, **2**, 912.
2. Banerjee, S., and Deb, C., and Belavady, B. (1952): *Jour. Biol. Chem.*, **195**, 271.
3. Barron, E.S.G., and Singer, T.P. (1945): *Jour. Biol. Chem.*, **157**, 221.
4. Brews, A. (1953): *Eden and Holland's Manual of Obstetrics*. 10th Ed., J. A. Churchill., London., page 115.

5. Burke, B.S., Beal, V. A., Kirkwood, S. B., and Stuart, A. G. (1943): *Am. Jour. Obst and Gynec.*, **46**, 38.
  6. Dieckmann, W. J. (1952): *Toxaemias of Pregnancy, Ed. II p. 134.*
  7. Hamlin, R. H. J. (1952): *Lancet.*, **1**, 64.
  8. Hopkins, F. G., Morgan, E. J., and Lutwakman, C. (1938): *Biochem. Jour.*, **32**, 1829.
  9. King G., and Ride, L. (1932): *Jour. Obst. and Gynec. Brit. Emp.*, **39**, 1854.
  10. Patterson, J. W. (1950): *Jour. Biol. Chem.*, **183**, 81.
  11. Patterson, J. W., and Lazarow, A. (1950): *Jour. Biol. Chem.* **186**: 141.
  12. Sirotkina, R. (1945): *Akushhezttoi i Genekol*, **2**, 19.
  13. Theobald, G. W. (1943): *Lancet*, **1**, 626.
  14. Woodward, G. E., and Fry, E. G. (1932): *Jour. Biol. Chem.*, **97**, 465.
-