SERUM CERULOPLASMIN DURING NORMAL AND PATHOLOGICAL PREGNANCY

by

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The serum ceruloplasmin (Cp) have been shown to increase during toxaemia of pregnancy (Burrow and Pekala 1971; Fattah, *et al* 1976). Also, the serum copper values which closely parallels the Cp in serum, have been reported to be significantly high in these cases (Schenker, *et al* 1971; Wojcicka and Zapalowski 1963). However, the results of other workers (Friedman, *et al* 1969; Tervila *et al* 1975), actually showed a lower serum Cp value. The studies on serum copper in cases of prematurity, postmaturity. Rh-immunization and diabetes during pregnancy have given inconsistant results (Friedman *et al* 1969; Schenker, *et al* 1971). The present study was undertaken because of the paucity of literature and inconsistancy of results reported so far.

Material and Methods

The serial serum Cp estimations were successful in 40 cases of normal pregnancy resulting into full term normal delivery, 15 cases of prematurity due to inapparant cause, 10 cases of postmaturity, 12 cases of mild pre-eclampsia, 3 cases of Rh-immunization, 15 cases of microcytic hypochromic anaemia and 5 cases of diabetes during pregnancy.

The serum Cp estimations were done by colorimetric PPD-oxidase method, as described by Ravin (1961). All the results were analysed statistically to test the significance of change, taking normal pregnancy values of a particular week as control.

Observations

There occurred a continuous gradual rise in serum Cp values during normal gestation, with the peak value at the time of delivery (Table I).

Prematurity: In these cases, the mean Cp value rose normally upto 30th week of gestation, following which the values remained almost stationary. The pooled values, at the time and a week before the delivery were significantly low (Table I). Individually, in 11 cases the values were below the critical level and the diagnosis of forthcoming prematurity could be made with 73.3% certainty, 1 week before labour.

Postmaturity: In this group, there was no significant difierence upto 38th week,

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TABLE I

Serum Ceruloplasmin During Normal Pregnancy, Prematurity and Postmaturity

(Cp values in mg% as mean ± S.D.)

Gestational Weeks	Prematurity (15 cases)	Normal pregnancy (40 cases)	Postmaturity (10 cases)
28	56.8 ± 5.1	57.2 ± 5.3	58.1 ± 5.7
29	59.2 ± 4.7	59.8 ± 5.7	58.6 ± 4.2
30	62.8 ± 5.3	62.2 ± 5.3	60.7 ± 4.8
31	62.9 ± 5.9	63.8 ± 4.8	63.6 ± 4.7
32	61.7 ± 5.2*	65.2 ± 5.6	65.7 ± 5.1
33	62.2 ± 5.3*	67.6 ± 4.8	66.8 ± 6.2
34	—	67.3 ± 5.2	68.7 ± 5.3
35	—	68.6 ± 4.9	70.3 ± 6.1
46	—	71.2 ± 6.8	72.2 ± 4.8
37	—	72.2 ± 5.6	71.8 ± 4.3
38	—	71.6 ± 6.2	72.4 ± 4.19
39	—	—	73.7 ± 5.7
40	—	—	73.6 ± 5.1
41	—	—	72.2 ± 4.8
42	—	—	72.8 ± 5.1

(*P <0.05, in comparison with the normal pregnancy value at a particular week).

as compared to the normal gestation value but thereafter, the values remained, almost stationary (Table I). Therefore, the diagnosis could not be made beforehand in any of the 10 cases studied.

Anaemia: In these cases, the mean Cp values ran almost parallel to that in normal pregnancy. The values were slightly higher but statistically non-significant (Table II).

TABLE II

Serum Ceruloplasmin During Pregnancy Associated with Anaemia, Toxaemia Diabetes and Rh-immunization

(Cp values in mg% as mean ± S.D.)

Gestational Weeks	Anaemia (15 cases)	Toxaemia (12 cases)	Diabetes (5 cases)	Rh-immunization (3 cases)
28	58.1 ± 4.8	62.3 ± 5.8*	59.7 ± 6.7	61.6 ± 5.3
29	60.2 ± 5.2	65.8 ± 5.2*	64.3 ± 5.4	65.8 ± 4.3
30	64.1 ± 4.5	68.2 ± 4.9*	66.8 ± 6.2	67.2 ± 2.9*
31	64.9 ± 4.7	74.7 ± 5.3*	69.5 ± 5.5*	73.7 ± 3.8*
42	66.3 ± 4.1	78.8 ± 6.8*	72.5 ± 4.6*	76.2 ± 2.3*
33	68.4 ± 5.3	79.2 ± 7.6*	73.2 ± 5.2*	76.0 ± 1.5*
34	70.2 ± 4.2	81.7 ± 4.2*	76.2 ± 5.8*	77.8 ± 2.7*
35	71.3 ± 4.8	80.4 ± 5.3*	75.9 ± 6.3*	79.2 ± 3.2
36	72.2 ± 5.7	83.6 ± 6.3*	77.2 ± 5.7*	80.3
37	74.7 ± 6.3	85.2 ± 6.4*	89.3 ± 3.4*	83.7
38	74.9 ± 5.2	84.4 ± 7.2*	81.8 ± 4.2*	86.4

(* P<0.05, in comparison with the normal pregnancy value at a particular week).

Toxaemia: Toxaemia of pregnancy resulted into significantly high values. The values rose vigorously with the advancement of gestation (Table II). Individually, in all the cases, the serum Cp values were above the critical value at any particular week of gestation. However, in 1 case developing severe toxaemia and resulting into still birth, the value at term was 69.2 mg% only.

Diabetes: In these cases also, the mean Cp values were significantly high from 31st week onwards (Table II).

Rh-immunization: In these cases also, the values were significantly high (Table II). Two of these cases resulted into stillbirth, with the term values of 81.2 mg% and 72.6 mg%.

A linear correlation between the mean Cp values and gestational week was observed. During normal pregnancy, the rate of Cp rise was 1.46 mg% per week during last trimester. During various abnormal gestation, there was definite difference in the rate of rise. Highest increase in the rate was found in cases of toxaemia, followed by Rh-immunization, diabetes and anaemia. A slower rise was observed in cases of pre-maturity and post-maturity (Table III).

Discussion

Comparatively low serum Cp values in cases of prematurity and almost stationary values in postmaturity after 36th week onward, as recorded in the present study is in conformity with many other workers, who have implicated this to the feto-placental insufficiency in such cases (Friedman *et al* 1969; Schenker, *et al* 1969).

In cases of anaemia during pregnancy, the mean Cp values remained higher than those in the normal gestation, although statistically non-significant. Venkateshwara Rao *et al* (1975), have reported higher serum Cp values in cases of anaemia, in non-pregnant state. However, in the present study, with the recovery by iron therapy, there was no specific reflection in the serum Cp values.

Statistically higher values in cases of toxaemia, are in conformity with the results of Fattah *et al* (1976). High serum copper values in such cases have also been reported by many other workers (Schenker *et al* 1969; Wojcicka *et al* 1963). The low values, as reported by Trivila *et al* (1975) may be because of the selection of cases, as in the present study,

TABLE III

Regression Equations Showing Rate of Rise of Ceruloplasmin Per Week During Normal and Pathological Pregnancy

Type of Gestation	Regression Equations
Normal pregnancy	$Y = 17.9 + 1.46.\ X$
Prematurity	$Y = 30.7 + 0.98.\ X$
Postmaturity	$Y = 26.3 + 1.19.\ X$
Anaemia during pregnancy	$Y = 12.8 + 1.66.\ X$
Toxaemia	$Y = 1.2 + 2.66.\ X$
Diabetes during pregnancy	$Y = 6.9 + 1.98.\ X$
Rh-immunization	$Y = 0.8 + 2.25.\ X$

(Regression equation $Y = a + b.x$, where Y = serum ceruloplasmin level, b = rate of rise per week and X = a particular gestational week).

in 1 case lower values were recorded with the development of eclampsia. The results of diabetes and Rh-immunization are in conformity with Schenker *et al* (1969).

The slope of regression can give value information regarding the rate of serum Cp rise if the linearity of regression is good. In the present study, the rate of rise was almost double in cases of toxaemia and Rh-immunization as compared to normal gestation. Higher than normal rate was also seen in cases of diabetes and anaemia, while lower, in cases of prematurity and post-maturity.

The rise of serum Cp and Cu values during pregnancy, have been suggested to be due to the Oestrogen rise (Burrow *et al* 1971; Friedman *et al* 1969; Schenker *et al* 1969; Sinha *et al* 1970) but Ostergard (1973) who reviewed the serum oestriol levels, quoted lower values in all the abnormal pregnancy states, studied in the present series. Von-studinitz and Berizine (1958) also, could not correlate the serum Cu values with the urinary excretion of 17 ketosteroids. The over view of the results in the present study indicate the rise of Cp values during normal and various pathological pregnancy states to be due to the reactivity of the body towards the growing foetus and associated pathology, because, the role of ceruloplasmin as acute phase reactant is well established now (Koj, 1974).

Summary

The serial serum ceruloplasmin estimations were made during last trimester in normal and various pathological pregnancy states, by colorimetric method.

A continuous gradual rise in serum ceruloplasmin was observed during normal pregnancy. In cases of prematurity and postmaturity, the values were lower than those in normal gestation while in cases with any associated pathology, e.g. anaemia, toxaemia, diabetes and Rh-immunization, the values were comparatively high. The cause and significance of rise is discussed.

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