

## ASSESSMENT OF PLACENTAL FUNCTION BY USING SERUM COPPER LEVELS

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### ABSTRACT

**Background:** The simple and accurate method for measuring falling placental function is always been a topic of research for obstetricians. Several researches have been conducted in past years for identifying the simple and reliable tool that aids in the diagnosis of declining placental function. During the antenatal period, many physiological changes are takes place which result in increased serum ceruloplasmin levels and also the increase concentration of serum copper values. **Material & Methods:** In the present prospective observational study 200 Pregnant women were enrolled from outdoor, antenatal clinic and from ward by simple random sampling and divided into two groups of non-pregnant women with normal menstrual cycle and another of Pregnant women in different trimesters of pregnancy. Clearance from Institutional Ethics Committee was taken before start of study. Written informed consent was taken from each study participant. **Results:** Among non-pregnant women the mean value of serum copper levels (mean  $\pm$  S.D.) was  $124 \pm 5.76$   $\mu\text{g/dL}$  and among pregnant women the mean value of serum copper levels (mean  $\pm$  S.D) was  $232.08 \pm 25.3$   $\mu\text{g/dL}$ . Among 1st trimester pregnant women the mean value of serum copper levels (mean  $\pm$  S.D) was  $178 \pm 6.31$   $\mu\text{g/dL}$ , among 2nd trimester pregnant women the mean value of serum copper levels (mean  $\pm$  S.D) was  $224.2 \pm 5.42$   $\mu\text{g/dL}$  and among 3rd trimester pregnant women the mean value of serum copper levels (mean  $\pm$  S.D) was  $265.7 \pm 8.93$   $\mu\text{g/dL}$ . This difference between value of serum copper levels of both these groups was statistically significant (P value  $< 0.05$ ). **Conclusions:** There were higher values of serum copper reported among pregnant women than non-pregnant women. Likewise, this increasing trend also reported in all three trimesters. Hence, serum copper values can be used as an indicator of the normal function of fetoplacental unit, and it is very simple, easy method to determine the functional condition of fetoplacental unit.

**KEYWORDS:** Serum copper levels, Pregnancy, Placental function.

### INTRODUCTION

The simple and accurate method for measuring falling placental function is always been a topic of research for obstetricians. Several researches have been conducted in past years for identifying the simple and reliable tool that aids in the diagnosis of declining placental function. Various biochemical markers have been studied for placental insufficiency such as, levels of ceruloplasmin,

pregnandiol levels, serum chorionic gonadotropin, urinary and amniotic estriol levels and several other markers for the determination of serum enzyme levels of placental origin viz, aminopaptidase, alkaline phosphatase cysteine, di-amino-oxidase and histaminase.(1)

The previous studies reported that there was increase in serum copper levels during antenatal period. It has been recorded that about 95% of that increased serum copper was bound to ceruloplasmin enzyme which exhibit an oxidative effect. Though the serum ceruloplasmin levels can also act as sensitive indicator of normal pregnancy progression and indicator of placental function but the assessment of serum ceruloplasmin levels were expensive, complicated and requires facilities. (2)

During the antenatal period, many physiological changes are takes place which result in increased serum ceruloplasmin levels and also the increase concentration of serum copper values most commonly due to increased levels of serum estrogen and reportedly higher movement by passive transfer across the fetoplacental barrier. (3) several previous studies reported that serum ceruloplasmin levels and serum copper levels were responsible for the oxidizing ability of maternal serum which is helpful in maintaining the bio-viability of fetoplacental barrier and placenta itself. Hence, serum copper levels serve as an adequate indicator for assessing the normal placental function.(4) In present study, we aimed to assessing the normal placental functions by using and evaluation of serum copper levels.

## MATERIALS & METHODS

The present prospective study was conducted at department of obstetrics and gynecology of our hospital. The study duration was of one year from June 2017 to July 2018. A sample size of 200 was calculated at 95% confidence interval at 10% acceptable margin of error by epi info software version 7.2. Pregnant women were enrolled from outdoor, antenatal clinic and from ward by simple random sampling and divided into two groups of non-pregnant women with normal menstrual cycle and another of Pregnant women in different trimesters of pregnancy. Clearance from Institutional Ethics Committee was taken before start of study. Written informed consent was taken from each study participant.

The data were collected by predesigned, multiple response type of questionnaire, general physical and systemic examination, menstrual and obstetric history. Presence of edema at the independent part was also recorded. Blood sample was collected via venipuncture technique for serum copper levels assessment by Eden

and Green method (5). Data analysis was carried out using SPSS v22. All tests were done at alpha (level significance) of 5%; means a significant association present if p value was less than 0.05.

## RESULTS

In the present study, we enrolled 200 pregnant women who were classified in two major groups according to the pregnancy status. Women who were non-pregnant women with normal menstrual cycle enrolled in a control group and Pregnant women in different trimesters of pregnancy were classified in case group. In the present study the age of enrolled pregnant women was ranged from 19 to 40 years. The mean age of the enrolled pregnant women was  $24.18 \pm 5.86$  years. There were no pregnant women in the present study who aged less than 19 years of age. Estimation of serum copper levels was done in both the groups. Among non-pregnant women the mean value of serum copper levels (mean  $\pm$  S.D.) was  $124 \pm 5.76$   $\mu\text{g/dL}$  and among pregnant women the mean value of serum copper levels (mean  $\pm$  S.D) was  $232.08 \pm 25.3$   $\mu\text{g/dL}$ . This difference between value of serum copper levelsof both these groups was statistically significant (P value  $< 0.05$ ). (Table-1)

**Table-1: Distribution of study participants according to serum copper levels.**

Groups	No. of participants	Serum copper level ( $\mu\text{g/dL}$ )	P value
Non-pregnant	100	$124 \pm 5.76$	$< 0.05$
Pregnant	100	$232.08 \pm 25.3$	

In the present study, as we find calculate among pregnant woman the mean value of serum copper levels (mean  $\pm$  S.D) was  $232.08 \pm 25.3$   $\mu\text{g/dL}$ . Therefore, on further estimation of mean value of serum copper levels according the semester of the pregnancy we further divide then in three groups, 28 pregnant women were in the 1st trimester, 35 pregnant women were in the 2nd trimester and 37 pregnant

women were in the 3rd trimester. Among 1st trimester pregnant women the mean value of serum copper levels (mean  $\pm$  S.D) was  $178 \pm 6.31 \mu\text{g/dL}$ , among 2nd trimester pregnant women the mean value of serum copper levels (mean  $\pm$  S.D) was  $224.2 \pm 5.42 \mu\text{g/dL}$  and among 3rd trimester pregnant women the mean value of serum copper levels (mean  $\pm$  S.D) was  $265.7 \pm 8.93 \mu\text{g/dL}$ . This difference between value of serum copper level of both these groups was statistically significant (P value  $< 0.05$ ). (Table-2)

**Table-2: Distribution of pregnant women according to serum copper levels.**

Groups	No. of cases	Serum copper level ( $\mu\text{g/dL}$ )	P value
<b>I Trimester</b>	28	$178 \pm 6.31$	$< 0.05$
<b>II Trimester</b>	35	$224.2 \pm 5.42$	$< 0.05$
<b>III Trimester</b>	37	$265.7 \pm 8.93$	$< 0.05$

## DISCUSSION

In the present study we aimed to study role of serum copper levels in the assessment of normal placental function. Serum copper found as the integral constituent of cell and has a comparable biological value as of hormones and vitamins. Majority of serum copper is present in circulation bound with ceruloplasmin. Copper has a vital value as micro-nutrient during antenatal period in either normal or abnormal pregnancy. The fetoplacental barrier leads to higher concentration of copper towards later stages than earlier stages of pregnancy. In the present study, we enrolled 200 pregnant women who were classified in two major groups according to the pregnancy status. Women who were non-pregnant women with normal menstrual cycle enrolled in a control group and Pregnant women in different trimesters of pregnancy were classified in case group. In the present study the age of enrolled pregnant women was ranged from 19 to 40 years. The mean age of the enrolled pregnant women was  $24.18 \pm 5.86$  years. There were no pregnant women in the present study who aged less than 19 years of age. Similar results were reported in a study

conducted by Vukelicet in 2012 among pregnant women of different trimesters.(6)

In the present study, estimation of serum copper levels was done in both the groups. Among non-pregnant women the mean value of serum copper levels (mean  $\pm$  S.D.) was  $124 \pm 5.76 \mu\text{g/dL}$  and among pregnant women the mean value of serum copper levels (mean  $\pm$  S.D) was  $232.08 \pm 25.3 \mu\text{g/dL}$ . This difference between value of serum copper levels of both these groups was statistically significant (P value  $< 0.05$ ). Similar results were reported in a study conducted by Izzeld in et al in 2015, among pregnant women of different trimesters and found that the mean value of serum copper levels among pregnant women  $250.2 \mu\text{g/dL}$  (7). Similar results were reported in a study conducted by Kapoor et al among pregnant women of different trimesters and found that higher mean value of serum copper levels among pregnant women than non-pregnant women(8). However, contrary results were reported in a study conducted by R. Janghorban et al in 2006, among pregnant women of different trimesters and found non-significant association of mean value of serum copper levels among pregnant women and non-pregnant women (9).

In the present study, as we find calculate among pregnant woman the mean value of serum copper levels (mean  $\pm$  S.D) was  $232.08 \pm 25.3 \mu\text{g/dL}$ . Therefore, on further estimation of mean value of serum copper levels according the semester of the pregnancy we further divide then in three groups, 28 pregnant women were in the 1st trimester, 35 pregnant women were in the 2nd trimester and 37 pregnant women were in the 3rd trimester. Among 1st trimester pregnant women the mean value of serum copper levels (mean  $\pm$  S.D) was  $178 \pm 6.31 \mu\text{g/dL}$ . Similar results were reported in a study conducted by AG ma et al in 2004, among pregnant women of different trimesters and found that the higher mean value of serum copper levels among pregnant women belongs to 1st trimester in comparison to non-pregnant women (10).

In the present study, among 2nd trimester pregnant women the mean value of serum copper levels (mean  $\pm$  S.D) was  $224.2 \pm 5.42 \mu\text{g/dL}$  and among 3rd trimester pregnant women the mean value of serum copper levels (mean  $\pm$  S.D) was  $265.7 \pm 8.93 \mu\text{g/dL}$ . This difference

between value of serum copper levels of both these groups was statistically significant (P value < 0.05). Similar results were reported in a study conducted by Vashchenko Get al in 2013, among pregnant women of different trimesters and found that statistically higher mean value of serum copper levels among pregnant women belongs to 2nd trimester in comparison to 1st trimester pregnant women and non-pregnant women(11). Similar results were reported in a study conducted by versieck J et al, among pregnant women of different trimesters and found that statistically higher mean value of serum copper levels among pregnant women belongs to 3rd trimester in comparison to 2nd, 1st trimester pregnant women and non-pregnant women(12).

## CONCLUSION

We concluded from the present study that there was increase in the mean values of serum copper levels as the pregnancy progress. There were higher values of serum copper reported among pregnant women than non-pregnant women. Likewise, this increasing trend also reported in all three trimesters. Hence, serum copper value can be used as an indicator of the normal function of fetoplacental unit, and it is very simple, easy method to determine the functional condition of fetoplacental unit

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