# Nutritional Status with Regard to Selected Biochemical Indices during Pregnancy in Urban Poor Women of Dhaka

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## Introduction

Low birth weight babies grow and develop less well and have poorer chances of survival than normal birth weight babies[1]. The overall public health importance of low birth weight is determined not only by the subsequent morbidity and mortality, but also how frequently it occurs[2]. In Bangladesh, there is high prevalence of low birth weight babies and high morbidity and mortality among the under five children[3] and it is considered to be a significant public health problem.

A large number of investigations over the past few decades have indicated that the causality of low birth weight is multifactorial[4]. Among the many maternal and environmental factors influencing fetal growth and development, diet and nutritional status play important critical roles. One of the most common and widely prevalent nutritional factors is iron deficiency anaemia. Iron deficiency anaemia during pregnancy may result in premature labour, fetal distress and low birth weight babies[5]. Several studies have reported a lower maternal serum vitamin A level with low birth weight or premature babies[6,7]. Apart from iron and vitamin A, zinc status during pregnancy have also been found to be associated with low birth weight[8]. However, the complexity of the interaction between nutrients and the metabolic demands for growth make it difficult to interpret the relation of a single measurement in isolation[9,10].

The overall knowledge of the nutrition situation during pregnancy in Bangladeshi women is inadequate[11]. This study reports an investigation on the nutritional status in regard to selected biochemical indices at different stages of pregnancy in poor urban women of Bangladesh.

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## Materials and Methods

*Subjects* :The study was of cross-sectional designed and conducted on 240 pregnant women of gestational length from 13 to 40 weeks, aged between 20 and 30 years, who visited the Maternal and Child Health Training Institute, Ajimpur, Dhaka, Bangladesh during May 1993 to January 1994. Length of gestation was calculated from the last menstrual period and expected date of delivery. Subjects who had diastolic blood pressure above 90 mm-Hg, albuminuria (urinary protein above 0.05 g/l), diabetes mellitus, oedema, jaundice or hepatitis; and subjects under long term medication and/or had experienced toxic exposure (cigarette smoking, narcotic addiction) were excluded from the study.

*Development of questionnaire* : A questionnaire was developed to obtain socio-economic, obstetric and antinatal practice related information. The questionnaire was pretested before finalization. After having obtained permission from the clinic authority, the nature and purpose of the study was explained to the pregnant women who registered at the clinic during the period of the study, and only those who gave conscious consent were included.

*Collection of data and specimen* : On receipt of the consent form, health examination of the volunteers was performed and who met the selection criteria was then interviewed for various socio-economic and obstetric information. A sample of 3.0 ml venous blood was collected between 9:00 a. m. and 12:00 noon from each of the participating women. An aliquot of 0.5 ml of the blood was placed in a heparinized tube for measuring haemoglobin concentration. The remaining 2.5 ml was placed in a deionized glass centrifuge tube and wrapped in aluminium foil to protect against degradation of vitamin A by light, and allowed to clot at room temperature for 2 h. After centrifugation at 1000 g for 10 min at room temperature, serum samples were separated and kept frozen at -20°C until further analysis.

*Anthropometric measurements* : Weight of the subjects was measured to the nearest 0.5 kg in minimum clothing and barefoot on a bathroom scale (Kubota, Japan). Height was measured to the nearest 0.1 cm in the standing position in barefoot using a standard scale (Detecto-Medic, Detecto Scales Inc, USA).

*Biochemical measurements* : Haemoglobin and serum albumin concentrations were determined by the Cyanomethaemoglobin and Bromocresol-Green methods respectively using commercial kits (Boehringer

Mannheim, Germany). Serum zinc and copper was measured by atomic absorption spectrophotometry (Pye-Unicam SP9; Philips, Cambridge, UK) using standard methods. Serum retinol (vitamin A) concentration was determined by HPLC according to Bieri *et al.*[12] with modification.

*Statistical analysis* : The data were analyzed using SPSS/PC version 4.1. Means and standard deviations were calculated and the differences between groups were assessed using one way analysis of variance. Multivariate analysis was used to assess the effect of adjustment for other factors on differences between groups. Pearson's correlation test was performed to assess the association between the length of gestation and the levels of selected biochemical indices.

## Results

Of the participants, 62.5% aged between 20-24 years and the rest were from 25 to 30 years. Sixteen per cent of the women were in second trimester (13-24 weeks), 21% in third trimester (25-36 weeks) and 63% were at delivery (37-40 weeks of gestation). About 46% of the participants were primiparae, 30% were of parity 2, 16% parity 3 and only 7.5% were of parity 4 or more. Twenty seven per cent of the respondents were illiterate and 20% completed Secondary School Certificate. About 89% were housewives. Eleven per cent participants' husbands were illiterate and about 20% were university graduates. Nearly 15% of the participants' husbands were day labourers, 32% factory workers, 25% ran small business and about 28% were employed in various government and non-government agencies. Thirty nine per cent of the participants had very low family income (up to Tk. 3000 per month) and the rest (61%) had moderate family income (more than Tk. 3000 per month).

Mean body weight and height of the respondents at different stages of pregnancy are shown in Table 1. Table 2 shows the prevalence of anaemia, low serum albumin and serum vitamin A levels of the participants. About 8% of the women in second trimester, 10% in third trimester and nearly 20% at delivery (37-40 weeks of gestation) were found to be anaemic (Hb <11.0 g/dl). About 10% of the women in second trimester and 20% in third trimester were found to have low serum albumin (<4.0 g/dl); while at dilivery this figure was raised to 50%.. Nearly 33% of the women at delivery, about 5% in second trimester and 14% in third trimester had low serum vitamin A (< 30 µg/dl).

**Table 1. Mean body weight and height of the respondents at different stages of pregnancy.**

| | Second trimester (13-24 Weeks) n=39 | | Third trimester (25-36 Weeks) n=50 | | At delivery (37-40 Weeks) n=151 | |
|---|---|---|---|---|---|---|
| | Mean | ±SD | Mean | ±SD | Mean | ±SD |
| Body Weight (kg) | 46.3 | 5.7 | 50.3 | 7.4 | 50.9 | 7.0 |
| Height (cm) | 148.9 | 5.5 | 151.6 | 4.8 | 151.3 | 5.0 |

**Table 2. Distribution of the participants by prevalence of anaemia, low serum albumin and vitamin A levels at different stages of pregnancy.**

| | Second trimester (13-24 Weeks) n=39 | | Third trimester (25-36 Weeks) n=50 | | At delivery (37-40 Weeks) n=151 | |
|---|---|---|---|---|---|---|
| | No | % | No | % | No | % |
| Anaemia (Hb <11.0 g/dl) | 3 | 7.7 | 5 | 10 | 30 | 19.9 |
| Serum Albumin (< 4.0 g/dl) | 4 | 10.3 | 10 | 20 | 75 | 49.7 |
| Serum Vitamin A (< 30.0 µg /dl) | 2 | 5.1 | 7 | 14 | 49 | 32.5 |

Pearson's correlation test showed significant negative associations between the length of gestation and the levels of haemoglobin, serum albumin, serum vitamin A and zinc; while it was positively associated with serum copper level (Table 3).

Table 4 shows the mean concentrations of selected biochemical measures of nutritional status at different stages of pregnancy and the values were within the normal range. There were statistically significant decreases in haemoglobin, serum albumin, vitamin A and zinc levels with the progress of pregnancy; while serum copper level was found to increase.

**Table 3.** Relationship between the length of gestation and the levels of various biochemical indices

| | Correlation (r) | p-value |
|---|---|---|
| Length of gestation and albumin | -0.40 | 0.0000 |
| Length of gestation and haemoglobin | -0.12 | 0.057 |
| Length of gestation and vitamin A | -0.36 | 0.0000 |
| Length of gestation and zinc | -0.33 | 0.0000 |
| Length of gestation and copper | 0.18 | 0.005 |

**Table 4.** Mean concentrations of selected biochemical indices of nutritional status at different stages of pregnancy.

| | Second trimester (13-24 Weeks) n=39 | | | Third trimester (25-36 Weeks) n=50 | | | At delivery (37-40 Weeks) n=151 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Unadj. Mean | ±SD | Adj.* Mean | Unadj. Mean | ±SD | Adj. Mean | Unadj. Mean | ±SD | Adj. Mean | Adjusted P-value |
| Haemoglobin (g/dl) | 12.8 | 1.3 | 13.4 | 13.1 | 1.5 | 13.3 | 12.3 | 1.7 | 12.1 | 0.0001 |
| Serum albumin (g/dl) | 4.8 | 0.7 | 4.7 | 4.5 | 0.6 | 4.5 | 4.1 | 0.7 | 4.1 | 0.003 |
| Serum Vit. A (µg/dl) | 53.3 | 16.1 | 56.2 | 48.1 | 16.1 | 50.1 | 37.9 | 15.3 | 36.6 | 0.0001 |
| Serum Zinc (µg/dl) | 57.5 | 14.8 | 57.7 | 55.4 | 12.7 | 55.2 | 48.8 | 9.2 | 48.9 | 0.0001 |
| Serum Copper (µg/dl) | 207.3 | 48.0 | 197.2 | 222.1 | 46.6 | 215.9 | 230.7 | 50.8 | 234.8 | 0.001 |

**Adjusted for participants' age, education, family size, family income, husband's education and occupation, parity and supplementation of iron and folate tablets.*

Adjusting the values of all the biochemical indices for participants' age, education, family size, family income, husband's education and occupation, parity and supplementation of iron and folate tablets did not alter the findings.

**Discussion**

The present study reports an investigation on the nutritional status with regard to selected biochemical indices at different stages of pregnancy in poor women of Dhaka city. An appropriate design would require following same individuals for the whole period of pregnancy till delivery to assess the overall nutritional status of pregnant women. Since a large proportion of the pregnant women who register at an early stage of pregnancy do not turn up at the clinic for delivery, the study was designed cross sectionally to assess the selected biochemical measures of nutritional status of pregnant women in the second (13-24 weeks) and third (25-36 weeks) trimesters and at the time of delivery (37-40 weeks). It was not possible to include women in the first trimester of pregnancy, since most pregnant women reported at the clinic after two three months of conception.

Mean haemoglobin level of the women at different stages of pregnancy did not reflect the extremely low level as most of them received iron and folate tablets supplementation. In the present study, there was significant decreasing trend in mean haemoglobin level with the progress of pregnancy. Further, the prevalence of anaemia (Hb<11.0 g/dl) was found to increase with the progress of pregnancy; being highest at delivery. Although mean concentration of serum albumin at different stages of pregnancy were within normal range, about 50% of the women at delivery had low level (< 4.0 g/dl) and thus indicating a poor maternal protein status. A number of studies have reported decrease in serum albumin level with the progress of pregnancy; being lowest at labour[11,13], as found in our study. We also observed a significant negative correlation between the length of gestation and the level of serum albumin of the pregnant women. Mean concentrations of serum vitamin A (retinol) at different stages of pregnancy were within normal range, however, about 32.5% of the participants at delivery had values below the adequate level of 30 µg/dl. There was significant declining trend in serum vitamin A level as pregnancy progressed and reached lowest value at delivery. Further using simple correlation

test, a negative association between serum vitamin A and length of gestation was observed. Many studies have focused on the changes in vitamin A status during pregnancy. Most of them indicated decline in plasma vitamin A in third trimester and thus the findings of the present study support other reports [14,15]. There has been a suggestion that this decrease may be due to poor nutritional status of the mother, since a sharp decline was not observed in Indian women of high socio-economic status[15]. A normal physiological trend of increasing serum copper and decreasing serum zinc level was observed as the pregnancy advanced and confirm earlier reports[14,16]. Giroux *et al*[17] suggested that the hypozincemia commonly reported during pregnancy could be caused, in part, by hypoalbuminemia. In the present study, we also found a lowering trend in serum albumin level with the progress of pregnancy. Possible explanations for the decreases in haemoglobin, serum vitamin A and albumin levels with the progress of pregnancy are increased water retention, presence of infection, dietary inadequacy and poor maternal nutritional status. We exclude the possibility of hydration because none of our subjects had oedema. We also exclude infection since volunteers suffering from any overt diseases were not recruited for this study. Therefore lack of adequate diet and poor maternal nutritional status in addition to physiological stress during pregnancy seems to play important role for declining trends in the levels of biochemical measures studied. However, in the present study we do not have any information regarding the dietary nutrient intakes by the study participants.

Several factors, such as socio-economic conditions, personal characteristics, dietary insufficiency, haemodilution and/or obstetric factors may independently affect the level of serum nutrients [18,19]. Therefore, the effect of various confounding factors were taken into account and were adjusted by using mutiple analysis of variance. On adjusting the data for various factors, the findings remained similar to the unadjusted values.

In conclusion, the declining trends of selected biochemical measures of nutritional status may indicate the poor nutritional status of these women. Though this trend may also be seen in some well nourshised pregnant women, the extent of the trend is less obvious. In Bangladesh, many women still deliver at home

and the pregnant women who participated in the study may not be true representative of the whole population from which they were drawn as there may be substantial difference between the poor pregnant women who attend maternity clinics for delivery and those who deliver their babies at home. Therefore, some caution should be exercised in generalization of these findings.


## Summary

A cross-sectional study was carried out to investigate the nutritional status in relation to selected biochemical indices at different stages of pregnancy in poor urban population of Dhaka. The study was conducted on 240 pregnant women of gestational length from 13 to 40 weeks, aged between 20-30 years, who attended the Maternal and Child Health Institute, Ajimpur, Dhaka during May 1993 to January 1994. Socioeconomic and anthropometric data, obstetric history and blood samples were collected at the time of interview. At delivery (37-40 weeks of gestation), nearly 20% of the women were found to be anaemic, about 50% had low serum albumin and nearly 33% had low serum vitamin A levels. Simple correlation test revealed inverse associations between the length of gestation and the levels of haemoglobin ($r=-0.12$; $p=0.06$) serum albumin ($r=-0.40$; $p=0.0001$), serum vitamin A ($r=-0.36$; $p=0.0001$), and Zinc ($r=-0.33$;$p=-0.0001$); while it was positively associated with serum copper level ($r=0.18$; $p=0.005$). Mean concentrations of selected variables were calculated for different stages of pregnancy and compared. There were statistically significant decreases in haemoglobin, serum albumin, vitamin A and zinc levels with the progress of pregnancy; while serum copper level was found to increase. Adjusting the values of all the biochemical indices for participants' age, education, family size, family income, husband's education and occupation, parity and supplementation of iron and folate tablets did not alter the findings.



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