Blood Haemoglobin, Total Protein and Albumin Levels at Different Stages of Gestation

Salamatullah Quazi, Badrun Nahar, Md. Mostafizur Rahman and Sultana Sayeed

Institute of Nutrition and Food Science, University of Dhaka, Bangladesh.

Introduction

Malnutrition is one of the major public health problems in Bangladesh. Infants, growing children, pregnant and lactating women are the most sufferer from the stand point of nutrition (1,2). Pregnancy is a state of physiological stress characterised by profound metabolic and hormonal changes. The alterations in maternal metabolism and the requirements for foetal growth and development imposes additional demands during pregnancy(3). But maternal nutrition is far from satisfactory in Bangladesh. It was observed that diet of the pregnant women are deficient in all nutrients (1,2). Anaemia is common in pregnancy, Nutrition Survey of Rural Bangladesh shows that 82 per cent of the pregnant or lactating women had a haemoglobin level below 12g/dl blood (1,2). In India several nutrition surveys had been carried out among pregnant women and those also revealed widespread prevalence of anaemia (4,5).

There is agreement that protein level in plasma falls in normal pregnancy. Most of this fall can be accounted for, by a reduction in the albumin fraction(6). Studies carried out in pregnant women belonging to the low income groups in South India(7) have also shown that, while serum albumin levels fall during preganancy, the actual serum total protein levels are considerably lower than those reported for Western subjects (8).

Data regarding dietary intake of calorie, protein and iron and blood levels of haemoglobin, total protein and albumin in low socio-economic Bangladeshi women at different stages of gestation is scarce in the literature. So, in the present study, an attempt has, therefore, been made to get those informations in low socio-economic pregnant women at 12-16 weeks, 24-28 weeks of gestation and before delivery. As because the pre-pregnancy nutritional status of the pregnant women was not possible to know, a second group comprising of non-pregnant non-lactaton (NPNL) women with similar socio-economic background was also studied.

Bangladesh Journal of Nutrition Vol-6, Nos. 1 & 2, Dec 1992-June 1993. Printed in Bangladesh. Institute of Nutrition and Food Science, University of Dhaka, Bangladesh.

Materials and Methods

Pregnant women belonging to the low socio-economic group attending the Azimpur Maternity and Child Health Training (AMCHT) Centre, Dhaka for antenatal care are offered an opportunity to participate. With informed consent signed, at 12-16 weeks of gestaton, trained nutritionist obtain essential demographic data and anthropometric measurements. Medical technician drew blood from the mother. Dietary history by recall method was obtained by nutritionist. Gestational age was estimated primarily from the history of each subject recorded in the AMCHT Centre. At 24-28 weeks of gestation and before delivery all informations for those available in the centre were again collected and blood was drawn for the analysis of haemoglobin, total protein and albumin. The study was also conducted on 51 NPNL women from similar socio-economic class to compare results with those of pregnant women. Height and body weight of the subjects were measured using DETECTO-MEDIC weighing scale in which a height scale was also attached. The daily dietary intake of calorie, protein and iron was calculated by using food exchange list. Blood haemoglobin was estimated by total haemoglobin test kit (Sigma Diagnostics, Catalogue No. 525-2) according to the method of Green and Teal[9]. Serum total protein was determined by a commercially available kit (Test-combination Total Protein, Boeringer Mannheim, Germany) by the method of Weichselbaus[10]. Serum albumin was assayed by Albumin Kit (Bio Merieus, France) according to the method of Doumas[11].

All the data were processed in computer. The results were statistically analyzed by Duncan's multiple range test[12].

Table 1 : Comparison of Dietary Intake Between NPNL and Pregnant Women at Different Stages of Gestation.

Subjects	No. of cases	Daily intake		
		Calories (Kcal)	Proteins (g)	Iron (mg)
NPNL Women	51	1561±319*	46.6±9.5	23.2 ± 5.3
Pregnant Women				
at 12—16 weeks	209	1102 ± 240	34.4 ± 9.5	13.3 ± 3.6
at 24—28 weeks	100	1325 ± 225	45.0 ± 10.8	18.0 ± 5.5
before delivery	57	1489 ± 273	53.5 ± 12.3	20.0 ± 4.9

*Mean ± SD. Abbreviation : NPNL, non-pregnant non-lactating

Table 2 : Haemoglobin Concentrations in NPNL and Pregnant Women at Different Stages of Gestation.

Subjects	No. of cases	Blood haemoglobin (g/dl)
NPNL Women	51	11.97 ± 1.36[1a]
Pregnant Women		
at 12-16 weeks	209	11.78 ± 1.16[a]
at 24—28 weeks	89	11.37 ± 1.11[a]
before delivery	28	11.54 ± 1.42[a]

[1]Mean ± SD. Means within a column not followed by the same letter are significantly different ($p<0.001$).

Table 3 : Subject vs. Blood Haemoglobin Levels by Number

Subjects	Blood haemoglobin (g/dl)			
	<9	9-10	10.1-10.9	11 and above
NPNL Women	1(2.0 %)[1]	2(4.0%)	6(11.7%)	42(82.3%)
Pregnant Women				
at 12-16 weeks	4(1.9%)	7(3.3%)	33(15.8%)	165(79.0%)
at 24-28 weeks	2(2.2%)	7(7.9%)	20(22.5%)	60(67.4%)
before delivery	1(3.6%)	2(7.2%)	9(32.1%)	16(57.1%)

[1]In parenthesis percent subjects mentioned.

Table 4 : Serum Protein & Albumin Levels in NPNL & Pregnant Women at Different Stages of Gestation.

Subject	No. of cases	Serum	
		Total protein (g/dl)	Albumin (g/dl)
NPNL Women	51	6.65 ± 0.93[1a]	3.02 ± 0.46[b]
Pregnant Women			
at 12-16 weeks	209	6.62 ± 0.83[a]	3.63 ± 0.67[a]
at 24—28 weeks	89	6.47 ± 0.74[a]	3.11 ± 0.50[b]
before delivery	28	6.04 ± 0.80[b]	2.70 ± 0.40[c]

[1]Mean ± SD. Means within a column not followed by the same letter are significantly different ($P<0.01$).

Results

The mean maternal height was 150.2 cm; the maternal weight at 12-16 weeks of gestation was 42.3 kg and final body weight before delivery was 53.2 kg. In the case of non-pregnant non-lactating (NPNL) women the mean height was 148.4 cm and body weight was 41.6 kg. In both the cases 32 to 40 percent are illiterate and more than 68 percent have per capita income more than Tk. 400 per month (data not shown in Table).

Dietary surveys indicate that the average daily dietary intake at 12-16 weeks of gestation was 1102 calories and 34.4g protein (Table 1). The intake was gradually increased as gestational period progressed. Before delivery the intake became 1489 calories and 53.5g protein. Although the protein intake in pregnant women was higher by 14.8 percent, there was still 4.6 percent less calorie intake in pregnant women before delivery than in NPNL women. The daily mean iron intake in pregnant women was also less than in the NPNL women (Table 1).

Mean blood haemoglobin level has a slight decreasing trend as gestational period progressed from 12-16 weeks to 24-28 weeks (12-16 weeks, 11.78; 24-28 weeks, 11.37g/dl), but slightly increased before delivery (11.54g/dl) (Table 2).

It was found that the haemoglobin levels of the pregnant women throughout the gestational period were always lower than the haemoglobin level of NPNL women (Table 2). However, the mean haemoglobin levels found at different stages of gestation were always higher than 11g/dl. But on percent basis we found that 21 percent pregnant women had haemoglobin level below 11g/dl at 12-16 weeks of gestation (Table 3). This percentage increased as gestational period progressed. It was 42.9 percent before delivery. In the case of NPNL women 17.7 percent had haemoglobin level below 11g/dl. None had blood haemoglobin level below 8g/dl.

Table 4 indicates values for serum total protein and albumin at different stages of gestation. These values are compared with those of NPNL women. The mean serum total protein levels at 12-16 weeks of gestation was 6.62, at 24-28 weeks 6.47 and before delivery 6.04g/dl. The difference was statistically significant ($P < 0.01$) only between the values at 12-16 weeks of gestation and before delivery. However, the rate of fall in serum albumin was always higher than that of serum total protein. There were 14.3 and 25.6 percent fall in serum albumin during 24-28 weeks of gestation and before delivery than the level observed at 12-16 weeks of gestation and the differences were always statistically significant ($P<0.01$).

Discussion

The results of the present study indicates that daily calorie intake of both NPNL and pregnant women was

less than the actual requirement. Although the intake of protein before delivery was found 53.5g, but the dietary protein mainly drived from vegetable sources. The diet of Indian urban women of low income group also provide 1400-1600 calories and 30-40g protein[13]. Whereas calorie requirement for nonpregnant women is 2200 and that of pregnant women at second half is 2500[3]. Although calorie intake during pregnancy should be higher than that in non-pregnant state, but it was actually found even less than in pregnant state. Similar finding was also observed in India[14]. Due to ignorance and lack of nutritional knowledge, the diets during pregnancy are often actually worse than in the non-pregnant state. Women also believe that restricted dietary intake during pregnancy would facilitate easy delivery [3]. In our study the iron intake of the pregnant women was also less than in the NPNL women (Table 1). The iron intake of women in poor communities in the tropics is around 18 mg as against recommended allowance of 40 mg of iron during pregnancy[3].

The results of haemoglobin in our study are in agreement with those reported for Indian urban pregnant women of low income group[15]. The minium fall in the mean haemoglobin level was found in 24-28 weeks of gestation among the Indian urban low income group. Data from the cross-sectional studies on haemoglobin levels in pregnant women indicated that the maxium fall in haemoglobin level is seen by the end of second trimester when haemodilution is maxium[16]. Again, the mean haemoglobin levels at different stages of gestation were always higher than 11g/dl (Table 2). However, on percent basis some pregnant women had haemoglobin level below 11g/dl (Table 3). The WHO expert group recommended anaemia could be considered to exist when the haemoglobin levels in females during pregnancy were below 11g/dl[17]. In india several nutrition surveys had been carried out among pregnant women and those revealed widespread prevalence of iron deficiency anaemia [4,5]. More than half of the pregnant women in poor Indian communities have haemoglobin levels less than 10g/dl[3]. In our study, we found only 10.8 percent pregnant women have haemoglobin level within 10g/dl even before delivery (Table 3). All the subjects in our study used to take iron rich tablets and multivitamins throughout the gestational period supplied by AMCHT Centre. Although the dietary iron intake was not enough, this may be the reason for which subjects of our study had better haemoglobin levels during gestation than that was reported for Indian low income pregnant women.

Both serum total protein and albumin levels fell as gestational period progressed (Table 4). But, the rate of fall in serum albumin was always

higher than those of serum total protein. It is reported that plasma protein concentration falls in normal pregnancy and most of this fall can be accounted for, by a reduction in albumin fraction[6]. Our data are in agreement with the results reported by Gopalan[18] for Indian low income pregnant women. He reported 3.2g/dl mean serum albumin in first trimester, and 2.4g/d1 in the last trimester. The lower levels of serum albumin found in our study subjects and also the results reported from India are considerably lower than those reported for Western subjects[8]. This may be due to poor diet intake of both Bangladeshi and Indian low income women during pregnancy. Present results indicate that Bangladeshi pregnant women of the low income group subsist on diets grossly deficit in calories and other nutrients. The poor nutritional status of the pregnant women is reflected on the lower values of some blood constituents measured in pregnant women. Serum total protein and albumin concentrations were also gradually reduced as gestational period progressed. As haemoglobin, total protein and albumin levels in blood show a socio-economic gradient, education in nutrition with a view in correcting the faulty dietary habits which tend to aggravate the defficiencies, and supplementation of iron, folic acid, vitamin A and B-complex during pregnancy should receive equal emphasis.

Summary

An attempt was made to investigate the blood levels of haemoglobin, total protein and albumin at different stages of the low income Bangladeshi urban women. The results showed that the diets of these pregnant women were inadequate in calories and iron and even worse than in non-pregnant non-lactating state. The mean blood haemoglobin levels were 11.78, 11.37 and 11. 54g/dl at 12-16 weeks, 24-28 weeks of gestation and before delivery, respectively. Serum mean total proteins (12-16 weeks, 6.62; 24-28 weeks, 6.47; before delivery, 6.04g/dl) and serum albumin (12-16 weeks, 3.63; 24-28 weeks, 3.11; before delivery, 2.70g/dl) levels were reduced as gestational period progressed but the reduction in serum albumin was greater than in the former.

Acknowledgements

We thank physicians and all other staff members of Azimpur Maternity and Child Health Training Centre, Dhaka for their invaluable cooperation. We also thank Mr. Nazrul Islam and Mrs. Nadira Khatun of INFS for their assistance in computer programming statistical analysis.

References

1. Nutrition Survey of Bangladesh. 1975-76. Institute of Nutrition and Food Science, University of Dhaka. 1977.
2. Nutrition Survey of Rural Bangladesh. 1981-82. Institute of Nutrition and Food Science, University of Dhaka. 1983.
3. Gopalan, C. and Rao, K. S. J. Nutrition in pregnancy. Tropical Doctor. 1972. 2:1.
4. Gopalan, C. Malnutrition among infants and young children in India. J. Trop. Pediat. 1957. 3:3.
5. Gopalan, C. Maternal and infant nutrition in underdeveloped countries. J. Am. Dietetic assoc. 1961. 39:129.
6. Iyenger, L. Effects of dietary supplements late in pregnancy on the expectant mother and her newborn. Ind. J. Med. Res. 1967. 55:1.
7. Gopalan, C., Jayalaxmi, V. T. and Ramanathan, M. K. Studies on the blood of poor Indian newborn babies and their mothers. Ind. J. Med. Res. 1957. 45:605.
8. Pabby, P. Changes in serum proteins during pregnancy. J. Obst. Gym. Brit. Emp. 1960. 67:43.
9. Green, P. and Teal, C. F. J. Modification of the cyanmethemoglobin reagent for analysis of haemoglobin in order to avoid precipitation of globulins. Am. J. Clin. Path. 1959. 32:216.
10. Weichselbaum, T. E. Biuret method for the determination of serum total protein. Am. J. Clin. Path. 1946. 16:40.
11. Doumas, B. In : Standard Methods of Clinical Chemistry. Academic Press Inc. N. Y. 1972. p. 175.
12. Duncan, D. B. Multiple range and multiple F tests. Biometrics. 1955. 11:1.