ANEMIA IN PREGNANCY: AN EASILY RECTIFIABLE PROBLEM

SUMMARY: A program emphasizing a greatly reduced intake of fluoride and the inclusion of essential nutrients in the daily diet during pregnancy led to a striking increase in hemoglobin, an improved body mass index, fewer low birth weight babies, and reduced numbers of pre-term deliveries.

Keywords: Anemia; Birth weight; Dietary improvement; Folic acid supplementation; Hemoglobin; Iron supplementation; Pregnancy; Premature birth.

Although anemia (low hemoglobin) can be due to many different causes such as parasites, urinary tract infection, and malaria, in fact poor nutrition and excessive ingestion of a toxic agent like fluoride (F^-) are probably more frequent causes in many countries and are often overlooked and neglected. In the case of pregnancy, iron deficiency is very common, affecting millions of women worldwide. Heavy bleeding during menses results in greater nutritional demands to maintain hemoglobin, but even with a fairly good diet, some women are still anemic owing to deficiencies of vitamin B_{12}, folic acid, and thyroid hormones.

In India, anemia is widespread and is a major health problem that still plagues many communities with low hemoglobin (Hb) in adults (< 11.0 g/dL) and children (< 12.0 g/dL). Unfortunately, many who are afflicted with anemia do not show overt symptoms because the condition often begins with minor ailments that can lead to chronic debilitation. Despite being routinely detected in clinical conditions, low Hb is generally not considered important unless it involves recognition of a severe blood related disorder.

For anemia in pregnancy, however, the Government of India has acknowledged the seriousness of the problem and, as early as 1970,[1] a nationwide program of iron (60 mg/day) and folic acid (500 µg/day) tablet supplementation was instituted for pregnant women as part of their antenatal care during visits to antenatal clinics (1^{st} & 2^{nd} trimesters) throughout the country.

But the hoped-for benefits were not forthcoming. A 1985-86 review of the supplementation program in eleven states of India revealed essentially no significant differences in the often low Hb levels in women of more than 37 weeks of gestation.[2] The dose of iron was then increased to 100 mg/day without changing the dose of folic acid, and this protocol has been in place since 1992.[3] Tragically, maternal and infant mortality related to low Hb remain high in India. When Hb is as low as 5.0 g/dL prior to delivery, a blood transfusion is required but may not be possible in all health care facilities. Loss of blood during parturition is associated with increased maternal mortality. Moreover, anemic mothers frequently give birth to low weight babies (as low as 1.0 to 1.2 kg) with high rates of later disabilities or infant mortality.

In 1998, half of perinatal and one third of all infant deaths in India were directly or indirectly related to low birth weight.[4] In the year 2008, the infant mortality rate was 53 per 1000 live births,[5] and the National Rural Health Mission goal is to reduce this figure to 30 per 1000 live births by 2012. The Millennium Development Goals to reduce early childhood mortality by two thirds and

maternal mortality by three quarters within the next five years will be very difficult to achieve without a concerted effort to implement appropriate guidelines and measures.

Toward meeting these goals, an effective yet simple and easily implemented procedure for enhancing Hb in pregnancy with impressive outcome results has been developed by the writer and her colleagues.[6] · Pregnant women (2055) attending antenatal clinics in one of the Government hospitals in New Delhi were screened over a period of 2.5 years. The initial screening included testing for hemoglobin. All severely anemic pregnant women (< 9.0 g/dL) were tested for urine fluoride. Pregnant women, 205 in number, with severe anemia (Hb 9.0 – 5.0 g/dL) and urine fluoride > 1.0 mg/L constituted the study group. Using computerized random sampling procedure, 90 pregnant women formed the sample group and 115 formed the control group. Among the sample and control group pregnant women, some started attending the antenatal clinics during 1st trimester and others during 2nd trimester. Pregnant women were inducted into the study group up to the 20th week of pregnancy but not beyond that to provide sufficient time for monitoring prior to delivery.

The major focus of the investigation of the sample group was to eliminate ingestion of F^- as much as possible. Those drinking and cooking in high fluoride contaminated water, i.e., > 1.0 mg/L, were shifted to safe water sources and these women were then monitored until delivery. The rationale for eliminating F^- rests on evidence that F^-:

> (1) decreases production of erythrocytes (red blood cells) by the bone marrow and other hemopoietic tissues and increases erythrocyte abnormalities resulting in premature death of RBCs. Owing to F^- induced thyroid hormone deficiency an adequate stimulus was also lacking for erythrocyte production.
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> (2) reduces blood folic acid activity.
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> (3) diminishes beneficial microbial growth in the gut and inhibits production of vitally needed vitamin B_{12}.
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> (4) causes loss of microvilli (brush border) in the intestinal lining, resulting in poor absorption of nutrients critical for the biosynthesis of Hb.

The sample group was counseled to avoid consumption of F^- containing food, water, and other substances. Repeated reminders during visits to antenatal clinics were considered necessary. The sample group was then counseled to ensure an adequate intake of essential nutrients, viz., calcium, vitamins, and anti-oxidants from dairy products, fruits, and vegetables. The women in the control group were not introduced to counseling (interventions), but the women in both sample and control groups received the standard iron and folic acid tablets from the hospital. The investigating team kept a record on tablet consumption, and it was found that everyone was consuming the tablets. This check was necessary, as it is believed

that in spite of iron and folic acid supplementation, the lack of achievement in rectifying anemia is attributed to non-compliance.

Laboratory analyses for the women in the sample and control groups during monitoring included Hb testing and F^- determinations in their urine. To gauge nutritional improvement, height and weight measurements were made to calculate body mass index (BMI).

Urine F^- in the first trimester sample group decreased by 67% from the initial level to the time of delivery and by 53% in the second trimester sample group. For the same periods, Hb increased by 73% and 83% in these sample groups, whereas among the first and second trimester controls, urine F decreased by 49% and 37%, and the Hb increased by 59% and 54%. In the first and second trimesters, low birth weights among the sample groups were less than half (20% and 23%) those of the controls (51% and 53%). In the combined sample groups, improvements in the various categories of the BMI by the time of delivery were considerably better than in the control group, suggesting that the sample groups were absorbing nutrients more efficiently than the controls.

A striking impact of these interventions for improving the gestation period was also noted. Pre-term delivery (< 34 weeks gestation) was only 2 out of 90 (2%) in the combined sample groups, whereas it was 9/115 (8%) or four times higher in the control group. Full term deliveries were also higher (68% vs. 50%) in the sample than in the control group. Furthermore, there were two stillbirths in the control group but none in the combined sample group.

It is instructive to compare these results with those of earlier reports from China,[7,8] Bangladesh,[9] Nepal,[10] Indonesia,[11] Guinea Bissau,[12] and Mexico.[13] Unlike our work,[6] which is grounded on an adequate nutritional program and lowering toxic levels of F intake to reduce anemia in pregnancy and to increase birth weight, those studies, which were relatively unsuccessful, were based primarily on micronutrient supplementation. Our findings support the view that iron and folic acid at the levels currently in use are effective in reducing the risk of low birth weight, provided they are accompanied by good nutrition and decreased F intake. On the other hand, studies supplementing iron and folic acid with 14 micronutrients in rural Nepal show no improvement in low birth weight,[14] and in South Asia and Sub-Saharan Africa they indicate little or no amelioration of low BMI (< 18.5), which is a key risk factor for poor pregnancy outcome.[15] This low BMI was present in 24% of women in our study in the initial stages of pregnancy, but it was reduced to a mere 2% at the time of delivery after introduction of our interventions.

In summary, we see no short-cut way for improving Hb in pregnancy and birth weight other than focusing on optimal, non-toxic nutrition with iron and folic acid supplementation. For decades in India and many other nations, the role of F^- as a risk factor in pregnancy by preventing the adequate absorption of iron and folic acid has been unrecognized. Where the use of F has been promoted, women who

are pregnant may find our protocol equally beneficial for preventing anemia and ensuring a normal, healthy birth outcome.

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REFERENCES

1 Prophylaxis against nutritional anemia among mothers and children. Technical information MCH No. 1. New Delhi: Ministry of Health and Family Welfare, Government of India; 1970. p. 3.
2 Evaluation of National Nutritional Anemia Prophylaxis Programme: report of task force study. New Delhi: Indian Council of Medical Research; 1989.
3 Field supplementation trial in pregnant women with 60, 120 and 180 mg of iron and 500 µg of folic acid. Report of a Task Force Study. New Delhi: Indian Council of Medical Research; 1992.
4 Deskmukh JS, Motghare DD, Zodpey SP, Wadhwa SK. Low birth weight and associated maternal factors in an urban area. Indian Pediatrics 1998;35:33-7.
5 The IMR (Infant Mortality Rate), rural and urban, per thousand live births. New Delhi: Registrar General of India; 2008.
6 Susheela AK, Mondal NK, Gupta R, Ganesh K, Brahmankar S, Bhasin S, et al. Effective interventional approach to control anemia in pregnant women. Current Science 2010;98(10):1320-30. Abstract in this issue of *Fluoride* on page 165.
7 Zeng L, Dibley MJ, Cheng Y, Dang S, Chang S, Kong L, et al. Impact of micronutrient supplementation during pregnancy on birth weight, duration of gestation, and perinatal mortality in rural western China: double blind cluster randomised controlled trial. BMJ 2008;337:a2001. doi: 10.1136/bmj.a2001. Erratum in: BMJ. 2008;337:a2522.
8 Zhou LM, Yang WW, Hua JZ, Deng CQ, Tao X, Stoltzfus RJ. Relation of hemoglobin measured at different times in pregnancy to preterm birth and low birth weight in Shanghai, China. Am J Epidemiol 1998; 148(10):998-1006.
9 Arifeen SE, Black RE, Caulfield LE, Antelman G, Baqui AH, Nahar Q, et al. Infant growth patterns in the slums of Dhaka in relation to birth weight, intrauterine growth retardation, and prematurity. Am J Clin Nutr 2000;72(4):1010-7.
10 Osrin D, Vaidya A, Shrestha Y, Baniya RB, Manandhar DS, Adhikari RK. Effects of antenatal multiple micronutrient supplementation on birth weight and gestational duration in Nepal: double-blind, randomised controlled trial. Lancet 2005;365(9463):955-62.
11 Shankar AH, Jahari AB, Sebayang SK, Aditiawarman, Apriatni M, Harefa B, et al. Effect of multiple micronutrient supplementation on fetal loss and infant death in Indonesia: a double-blind cluster-randomised trial. Lancet.19 Jan 2008;371(9608):215-27.
12 Kæstel, P, Friis H. Effects of prenatal multimicronutrient supplements on birth weight and perinatal mortality: a randomised, controlled trial in Guinea-Bissau. European J Clinical Nutr 2005;59:1081-9.
13 Ramakrishnan U, Neufeld M L, González-Cossío T, Villalpando S, García-Guerra A, Rivera J, et al. Multiple micronutrient supplements during pregnancy do not reduce anemia or improve iron status compared to iron-only supplements in semirural Mexico. Am J Nutr 2004;134:898-903.
14 Christian P, Khatry SK, Kalz J, Pradhan EK, Leclerq SC, Shrestha SR, et al. Effects of alternative maternal micronutrient supplementation on low birth weight in rural Nepal: double blind randomized community trial. BMJ 2003;326:571-6.
15 Hiremath G. Micronutrient Supplementation in pregnancy in developing countries [editorial]. BMJ 2008;337:a1942.