Maternal Nutrition Supplementation and Neonatal Birth Weight: A Basic, Yet Indispensable Intervention

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The September issue of *Indian Pediatrics*, in 1973, featured original research articles from heterogenous topics, but predominantly pertaining to maternal-neonatal health issues including perinatal mortality, maternal nutrition, gestational age estimation score, and necrotizing enterocolitis. We selected a paper regarding the effect of maternal nutrition supplementation on the birth weight of the newborn. The objective was to revisit the importance of a basic and cost-effective intervention with potential of huge public health impact.

THE PAST

The Study

The research paper by Qureshi, et al.[1] was a quasi-experimental interventional study of dietary supplementation in pregnant women of low socioeconomic status on their newborn's birth weight. This prospective study assigned the intervention in the form of nutrition supplements to 76 pregnant mothers in addition to their home diet from 20 weeks till term: Group I received iron (60 mg/day) and folic acid (0.5 mg/day) supplementation daily; Group II received a standardized nutrition supplement powder carrying 500 calories and 20 g protein per day along with similar iron-folic acid dosage. The study outcomes included neonatal birth weight and gain in maternal weight. Both groups were also compared to a control group who did not receive any antenatal care or dietary supplement (this would have been unethical in the current era!). Mean (SD) birthweight of babies born to Group I, Group II, and controls was 2.78 (0.27), 3.32 (0.47) and 2.51 (0.25) kg, respectively. Birth weight was statistically higher in Group II as compared to Group I; and higher in both Group I and II as compared to controls. Although maternal weight gain was also higher in Group II with standardized supplement, the serum albumin was comparable in both Group I and Group II, which was possibly due to utilization of extra supplemented protein for fetal growth. Authors concluded that better antenatal care and nutrition supplements to the pregnant mothers will improve pregnancy outcome and neonatal health.

The Background

Awareness regarding the influence of maternal nutrition for healthy pregnancy can be traced back to the medical literatures of ancient civilizations like Indus valley civilization (*Sushruta* and *Charaka Samhita*), Greeks (*Corpus Hippocraticum*), Romans (*Natural History*) and in subsequent medieval European civilizations [2]. In the early nineteenth century, it was common perception that large size of babies was a result of over-nutrition; this also led to practice of restriction in maternal food intake. Average gestational weight gain was approximately 9.1 kg in published studies till 1940s. Davis, in 1921, advocated the use of maternal weight gain as an indicator of maternal nutrition, which in turn influences the fetal weight gain. Increase in average birth weight (from 3100 g to 3600 g) was observed with increasing gestational weight gain (from 7 kg to 13.6 kg) [3]. During 1970-80s, different nutritional committees from Food and Nutrition Board (FNB), American College of Obstetricians and Gynaecologists (ACOG), and American Dietetic Association (ADA) emphasized on linear weight gain in addition to total weight gain. Over the span of 50 years between 1930s to 1980s, the recommended gestational weight gain has almost doubled from 6.8 kg to 15.9 kg, which reflects the standard practice change from restricting to encouraging weight gain during pregnancy. Data from Western countries show an increase in average weight gain of 3.6 to 4.5 kg in 1980s as compared to 1940s [4]. Food supplementation programs for underprivileged groups were initiated in the

1970s in USA, and in India from the year 1975 onwards, under different schemes like Integrated Child Development Services Scheme (ICDS), and Special Nutrition Programs (SNP). Iron and folic acid supplementation for pregnant mothers was incorporated as a routine policy practice following the launch of National Nutritional Anemia Control Program in India in the year 1970.

THE PRESENT

Nutritional interventions during pregnancy have been studied in detail for their impact on infant health in the last 50 years. Maternal undernutrition along with micronutrient deficiency (e.g., anemia) have been linked with poor outcomes like low birth weight, preterm birth, and increased maternal and childhood mortality. Balanced protein and energy, Iron-folic acid (IFA) and multi-micronutrient (MMN) supplementation are hypothesized to decrease the risk of being born as low birthweight (LBW) [5]. A systematic review of trials from low- and middle-income countries showed that balanced energy protein supplement can contribute to a 61% reduction in stillbirth [RR (95% CI), 0.39 (0.19-0.80)], 40% reduction in LBW [RR (95% CI) 0.60 (0.41-0.6)], 29% reduction in small for gestational age (SGA) [RR (95% CI) 0.71 (0.54–0.94)] and increased birth weight by 107.28 g [MD (95% CI) 107.28 g (68.51-146.04)] [6]. In addition to balanced protein and calorie supplementation, importance of multi-micronutrient supplementation has been stressed upon in the last two decades, as pregnant women are deficient in micronutrients and macronutrients alike. Multi-micronutrient supplement comprises of multiple elements including antioxidants, minerals, and vitamins, besides IFA. United Nations Inter-national multiple micronutrient preparation is one of such standardized preparation containing 15 different micronutrients at their RDA level [7]. These nutrients have the potential to improve fetal outcome through modulation of placental inflammation, oxidative stress, and multiple enzymatic pathways. Significant negative impact of their deficiency on fetus, which extends to their adulthood, has led researchers to focus on the role of multi-micronutrient supplementation in pregnancy. Gupta, et al. [8] observed a 70% decrease in low birthweight and 58% decrease in risk of early neonatal morbidity with MMN supplement in undernourished pregnant mothers, which highlights its relevance in resource constrained countries like India. A meta-analysis of similar studies from multiple low-income countries showed that decrease in multiple micronutrient deficiency led to an increase in mean birthweight [MD (95% CI) 22.4 g (8.3-36.4)], a decrease in proportion of low birth weight [OR (95% CI) 0.89 (0.81-0.97] and SGA birth [OR (95% CI) 0.90 (0.82-0.99)] as compared to routine IFA supplementation. This positive effect was not seen in mothers with low body mass index, which indicates that micronutrients are not optimally utilized in the presence of a negative energy balance [9,10]. This observation may suggest for recommending the replacement or augmentation of routine IFA supplementation with MMN supplementation.

A recent two-stage meta-analysis by Smith, et al. [11] tried to address this issue. They included data from 17 randomized controlled trials conducted in 14 low-income and middle-income countries, comparing MMN supplements containing IFA and IFA alone in 1,12,953 pregnant women. The results indicated that antenatal MMN supplements improved survival for female neonates, and resulted in greater reductions in low birthweight, small for gestational-age births, and 6-month mortality in infants born to anemic mothers. The benefit was maximum if the supplementation is started early (before 20 weeks gestation) and high compliance (≥95%) can be ensured.

CONCLUSION

Infant health is directly and indirectly related to pre pregnant, pregnant, and lactating mother nutrition. Although, burden of malnutrition and underweight infants has improved over the last four decades, around one-fifth women of reproductive age group, and neonates are still undernourished. Further community-based research on protein, calorie and MMN supplement in combination, and calcium, zinc, and fortification of staple food with micronutrients, is needed to improve maternal-child health. Research on MMN supplementation needs to focus on infant health, considering the maternal nutritional status.

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