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Effect of Antenatal Micronutrient Supplementation on Fetal Birth Weight

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Abstract
Objective: *To assess the impact on birth weight and the risk of low birth weight of alternative combinations of micronutrients given to pregnant women.*
Materials and Method: *This is a Prospective Case Control Study done on primigravida women attending the outpatient department of between October 2017 to April 2019. The effect of supplementation of routine iron-folic acid in control group and multiple micronutrients in study group on their respective fetal birth weight assessed during the study period.*
Results: *Birth weight in the study group (2767.5gms) was 114.9gms higher than in control group (2652.5gms). Though an increase in the birth weight has been found with a multiple micronutrient supplement when compared with iron-folic acid, statistical analysis revealed no added benefit of micronutrient supplements compared with iron-folic acid supplementation.*
Conclusion: *Multiple micronutrient supplementation has not been shown to be superior to the routine iron-folic acid supplementation.*

Introduction

Birth weight is closely associated with the health and survival of infants in the developing world. Nearly a third of full-term babies born in India are reported to be of low birth weight (<2.5Kg) giving the impression that India has not much progress in improving the nutritional status of women. Of the maternal causes, maternal nutrition plays a major role in determining the fetal growth. Pre pregnancy weight and pregnancy weight gain are two important variables that affect fetal growth. Poor antenatal care, anemia, heavy physical work until late in pregnancy, smoking and poor diets are other important factors. Poor pre pregnant weight of mothers and poor nutrition status are a reflection of poor status of girls during childhood & adolescence. Diet particularly those of pregnant women are deficient in energy and consequently in several micronutrients. Maternal nutritional status is linked with fetal weight particularly small for gestational age at birth, as a result of presumptive intrauterine growth restriction. Micronutrients are vitamins and minerals required in minute amounts for normal functioning, growth and development. Micronutrient status plays an important role in pregnancy and birth outcomes and their deficiencies have been associated with complications of pregnancy, childbirth or fetal development. combining multiple micronutrients in a single delivery mechanism has been suggested as a cost effective way to achieve multiple benefits. I undertook a trial with the aim

of establishing whether second and third trimester supplementation with a multiple micronutrient regimen at one recommendation daily allowance would increase birth weight.

Methodology

Control group: 30 primigravida supplemented with routine iron-folic acid

Study group: 30 primigravida supplemented with multiple micronutrients listed below.

Prospective study was conducted after evaluation of patient fulfilling the inclusion/exclusion criteria during the study period and consenting to be included for the study were included in the study.60 primigravida attending the antenatal clinic were recruited in the study. They were randomly divided into two groups, containing 30 women in the control group who were supplemented with tablets containing 60mg of elemental iron and 400mcg of folic acid and 30 women in the study group supplemented with the following micronutrients. These amounts adhere to the suggested composition of multiple micronutrient supplements for antenatal use as:

Recommended by food and nutrition board of the institute of medicine national academy of sciences.

Iron	30mg
Folate	400mcg
Vitamin A	800mcg
Vitamin B1	1.5mg
Vitamin B2	1.6mg
Niacin	17mg
Vitamin B6	2.2mg
Vitamin B12	2.2mcg
Vitamin C	75mg
Vitamin D	10mcg
Vitamin E	10mg
Zinc	15mg
Magnesium	300mg
Calcium	1200mg

The procedure was explained and consent was obtained from each patient. Participants received supplements from 13 weeks of gestation to delivery in the second and third trimester. They were adviced to take one tablet daily, preferably after food and at the same time to avoid other supplements and drugs unless recommended. At the initial antenatal visit the routine physical and systemic examination were done. And the routine blood investigations which included the haemoglobin percentage were done. An early USG was done to diagnose IUGR by the serial USG.

At every subsequent visit, these women were examined clinically for fetal growth and maternal weight gain.USG was done at 22-24 wks, 30-32wks and 37-40 wks for fetal growth and IUGR if any. After delivery the fetal growth was assessed by measuring the birth weight, fetal length, chest circumference and head circumference and the comparative study was done between the control and the study group.

Results and Observations

Table 1 Characteristics of pregnant women by treatment group (percentage)

		Iron-folic acid supplemented group	%	Multiple micronutrient supplemented group	%
1	**No. of pregnancies**	30	100	30	100
2	**Age at baseline(yrs)**				
	<20	4	13.33	3	10
	21-29	17	56.67	19	63.33
	>30	9	30.0	8	26.67
3	**Socioeconomic status**				
	Class 4	6	20.0	4	13.33
	Class 5	24	80.0	26	86.67
4	**Parity**				
	Primi	30	100	30	100
	Multi	-		-	
5	**Diet atleast twice a week**				
	Meat /fish	15	50.0	14	46.67
	Fruits /vegetables	20	66.67	22	73.33
6	**Smoking /Alcohol**	-		-	
7	**Place of delivery**				
	Hospital	30	100	30	100
	Home	-		-	

Table 2 Maternal anthropometric measures at gestation at baseline (N=30)

Groups	Iron-folic acid supplemented group		Multiple micronutrient supplemented group		Difference	P value
	Mean	Standard deviation	mean	Standard deviation		
Weight (kg)	50.47	1.28	50.13	1.43	0.34	0.202(P>0.01)
Height (kg)	149.98	1.41	150.23	1.32	0.25	0.547(P>0.01)
BMI	22.41	0.86	22.16	0.57	0.25	0.168(P>0.01)

Table 3 Maternal weight gain (N=30)

Groups	Iron-folic acid supplemented group		Multiple micronutrient supplemented group		Difference	P value
	Mean	Standard deviation	mean	Standard deviation		
12-14wks	50.47	1.28	50.13	1.43	0.34	0.202(P>0.01)
24-26wks	50.20	1.37	53.27	1.23	1.07	0.003(P<0.01)
30-32wks	55.67	1.97	58.17	2.51	2.5	0(P<0.01)
>37wks	61.60	2.91	63.0	3.11	1.4	0.070(P>0.01)

Table 4 USG EFW (gms) at Term gestation (N=30)

Groups	Iron-folic acid supplemented group		Multiple micronutrient supplemented group		Difference	P value
	Mean	Standard deviation	mean	Standard deviation		
Weight	2657.83	274.95	2755.77	316.91	97.93	0.178(P>0.01)

Table 5 Fetal indices (N=30)

Groups	Iron-folic acid supplemented group		Multiple micronutrient supplemented group		Difference	P value
	Mean	Standard deviation	mean	Standard deviation		
Birth weight(gms)	2652.63	252.23	2767.53	306.96	114.90	0.084(P>0.01)
Fetal length(cm)	47.417	0.624	47.412	108.93	0.013	0.158(P>0.01)
Chest circumference(cm)	30.850	0.663	30.957	0.545	0.107	0.463(P>0.01)
Head circumference(cm)2	32.957	0.808	33.083	0.614	0.127	0.460(P>0.01)

Table 6 IUGR

IUGR	Iron-folic acid supplemented group		Multiple micronutrient supplemented group	
	N	Percentage	N	Percentage
Yes	4	13.33	3	10.0
No	26	86.67	27	90.0
Total	30	100.0	30	100.0

P=0.6876(P>0.01) Not Significant

Discussion

The effect of maternal supplementation with micronutrients on birth weight is compared with the effects of routine iron-folic acid supplementation in primigravida attending Govt Mohan kumaramangalam medical college, Salem.

Birth weight in the study group (2767.5gms)was 114.9gms higher than in control group (2652.5gms). Chest circumference of 0.107cm and head circumference of 0.127cm was also higher in the study group as compared with the control group. There was no difference in the fetal length.

As expected, the increase in birth weight among the study group translated into modest reduction in the proportion of low birth weight babies (<2500gms) among study group (10%) as compared to the control group(13%).However there was no discernable effect on preterm births. Analysis also showed no significant impact on the risk of perinatal mortality either in the iron-folic acid or in multiple micronutrient groups.

Maternal weight gain was significantly higher in the multiple micronutrient supplemented group compared with the iron-folic acid group. Weight

gain of about 1.07kg was higher in the study group than the control group in the second trimester and about 2.5kg in the third trimester. The total weight gain during the antenatal period was about 1.4kg higher in the study group compared with control group. When compared with supplementation of iron-folic acid, micronutrient supplementation resulted in an increase in the birth weight of the infants. However these differences lost statistical significance when multiple micronutrient supplementation was compared with iron-folic acid supplementation alone. No statistical significant differences were shown for the outcomes of intra uterine growth restriction or low birth weight babies in any of the comparisons.

Though an increase in the birth weight has been found with a multiple micronutrient supplement when compared with iron-folic acid, statistical analysis revealed no added benefits of multiple micronutrient supplements compared with iron-folic acid supplementation.

However, the findings should be interpreted with caution, since it is limited to a small number of study groups. Thus we stress the need for further research to find out the beneficial maternal and fetal effects of such supplementation.

Christian P et al assessed the impact on birth weight risk of low birth weight of alternative combinations of micronutrients given to pregnant women by conducting a double blind cluster randomised trial in south eastern Nepal. They found that supplementation with iron-folic acid increased mean birth weight by 37g and reduced the percentage of low birth weight babies from 43% to 34%. Multiple micronutrient supplementation increased birth weight by 64g and reduced the percentage of low birth weight by 14%. They concluded that multiple micronutrients confer no benefit over folic acid-iron in reducing the incidence of low birth weight.

The controversy: Some authors have questioned the effectiveness of multi micronutrient supplements due to possible interactions among nutrients resulting in their impaired absorption. Studies have shown that higher doses of iron impair the absorption of Zinc and vice versa. Manganese affects iron absorption in a way that indicates that the intestine cannot differentiate between manganese and iron. Similarly, high dose zinc supplements reduce the indices for iron and copper status.

Hence it is reasonable to conclude that multiple micronutrient supplementation during pregnancy might not confer additional benefits when compared to iron-folic acid supplementation alone. Moreover, there are concerns regarding the possible interactions between the multiple nutrients and the adverse effects with such supplementation.

Conclusion

Antenatal multiple micronutrient supplementation thought to be a logical approach in improving the nutritional status of mothers, has not been shown to be superior to the routine iron-folic acid supplementation in improving either the birth weight of the infants or the low birth weight rates. Hence it cannot be recommended as a standard practice at present, unless otherwise indicated. Further research is needed to find out the beneficial effects of such supplementation as my interpretations were limited by a small number of study populations.

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