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Original Research Article

Effect of nutrition education among pregnant women with low body mass index: a community based intervention

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ABSTRACT

Background: Indian women are chronically undernourished (36%) and anemic (55%) which has consequences on women during their adolescence, pregnancy, and lactation (NFHS-3). The main objectives were to assess the effect of nutrition education on dietary awareness and practice among undernourished pregnant women.
Methods: Phase 1 included key informant interview capturing information on food frequency and dietary diversity (24 hour dietary recall). Based on the key informant interview and anecdotal evidences a hypothesis was generated and an experimental study was planned to test the hypotheses. Fifty pregnant women in their first trimester of pregnancy having body mass index (BMI) less than 18.5 were selected from 12 villages to be part of the intervention group. Non-intervention group comprised of age matched women in first trimester with low BMI selected from the neighbouring villages. Phase 2 effect of nutrition education was assessed on mean weight gain in third trimester of pregnancy practice of minimum meal frequency (3 meals a day), adoption of dietary diversity through 24 hour recall method, proportion of change evidenced in hand washing practice were measured.
Results: Women enrolled in the intervention had a mean weight gain of 8.7 kg, with more than 3 ante natal care (ANC) visits having regular monthly attendance at ICDS center for awareness programs. Behavioral modification was evidenced by practicing a minimum of 3 meals or more during pregnancy, with consumption of vegetables, lentils and greens in their daily diet along with cereals. Regular hand washing before the meals and after using the toilet were self-reported by the women.
Conclusions: Prospective weight gain among women in intervention had significance over those in the non-intervention group by 2.1kg. Women in the intervention group reflected behavioral change by practicing minimum meal of 3 or more, proper hand washing before meals and after toilet and adequate rest. However birth weight on other hand is weakly associated with maternal weight gain between the two arms of the study.

Keywords: AIC, BIC, BMI, GWG, HMIS, IUGR, ICDS, NFHS, SGA

INTRODUCTION

Body mass index (BMI) during pregnancy and gestational weight gain (GWG) are associated with the outcome of pregnancy, which implies on essentiality of improving nutritional status of women during pregnancy. National Family Health Survey (NFHS), conducted during 2005-2006 reflects that 36 per cent of Indian women are chronically undernourished and 55 per cent

are anemic which has consequences on women during their adolescence, pregnancy, and lactation.[1]

Pregnant women are recommended to consume a meal frequency of minimum 3 times a day and practice diet diversity. In addition they should have access to clean water, sanitary environments, and antenatal services during their pregnancy. Undernourished women fail to give birth to healthy babies this in turn increases the burden of inter-generational cycle of under-nutrition.[2] Multiple micronutrient deficiencies during pregnancy are yet another common contributor for decreased BMI and gestational weight gain in developing countries.[3] Women with low pre pregnancy BMI is believed to have minimal tissue nutrient reserves thus they are at high risk for adverse pregnancy outcomes like low birth weight, preterm birth and intrauterine growth retardation (IUGR) moreover persistently leading to infant morbidity and mortality, childhood stunting and cognitive impairment.[4,5]

Essentiality of minimum meal frequency and diet diversity over Iron–folic acid supplementation alone in improving birth weight or other birth outcomes among pregnant women is less advocated however researches have shown that protein and energy supplementation along with micronutrients during pregnancy has a positive effect on birth weight.[6] This paper intend to study and compare the effect of nutritional education among undernourished pregnant women.

METHODS

Bharuch district in Gujarat state has a population of 168,391 as of 2011 India census, with 10 percent of its population under 6 years of age. World Vision India's Bharuch Area Development Program covers 70 villages in Jagadia Block in Bharuch District. As per the Purposive Population Survey conducted by World Vision India in December 2011 in this community, the proportion of pregnant women in project location was 4.2 percent of which only 68.8 percent of pregnant women were registered at a health facility during their past pregnancy. The HMIS data collected during the year 2015 at Bharuch district reflect that only 74.7 per cent of pregnant women had their ANC registration within their first trimester and only 62.9 percent women had at least 3 ANC visits. According to sample registration survey collected during the year 2013, Infant Mortality Rate in rural Gujarat is 45 per 1000 live birth and Maternal Mortality Ratio is 122 per 100,000 live births (SRS 2013).

The study used convenience sampling methodology for the selection of both groups. Pregnant women with low BMI is defined as those pregnant women whose weight/height^2 is less than 18.5 in first trimester as on their ANC registration. These women were picked up through routine surveillance by a community development coordinator with assistance from ICDS. A line list of pregnant women with low BMI was prepared after an active weight and height measurements of pregnant women. Fifty pregnant women in first trimester with BMI less than 18.5 from Simodra cluster covering 12 villages in Jagadia block were selected in the intervention group. Non-intervention group comprised of age matched women in first trimester with low BMI selected from neighbouring villages. Establishing a good rapport was so essential in proceeding with the intervention for which an introductory session was arranged.

Phase 1: It included key informant interview with 5 pregnant women, 3 ASHA and 3 volunteers, which captured information on food frequency and dietary diversity (24 hour dietary recall). Based on the key informant interview and anecdotal evidences a hypothesis was generated and an experimental study was planned to test the hypotheses. In the intervention group, pregnant women with low BMI received nutrition education based on a field tested flip book along with demonstration session on hand washing and meal preparation for a mean of 18 hours over 9 months however the non-intervention group received regular entitlements through ICDS.

Anganwadi workers and volunteers were trained using the flip book on antenatal care and nutrition. Pregnant women in intervention group were then educated and followed up by a health volunteer from their own community in random to ensure that they practice minimum meal frequency and diversity. Women gathered monthly at a common facility for weight and height measurement. A health and nutrition calendar in Gujarathi was printed and given to them.

Phase 2: Effect of nutrition education was assessed based on practice of minimum meal frequency (3 meals a day), adoption of dietary diversity through 24 hour recall method, proportion of change evidenced in hand washing practice and mean weight gain in third trimester.

Informed consent was obtained from all the subjects and monthly anthropometric measurements were recorded till child birth. Descriptive statistics and chi square test for any association of nutrition education on optimal weight gain in third trimester was done.

RESULTS

Initial data analysis gives a brief description on the intervention and non-intervention group. The mean age of the pregnant women enrolled into the intervention was 23.2 years (SD: 3.4) and non-intervention group 24.8 years (SD: 3.7). Weight gain is the difference in weight before labor and weight as on first ANC visit, gestational weight gain in the intervention arm was significant over those in the non intervention arm. Women enrolled into the intervention had a mean weight gain of 8.7 kg, however those in the non intervention group had a mean weight gain of 6.8 kg (Table 1). Birth weight was observed in 94 observations and recorded, in which low

birth weight was identified as birth weight less than 2.5kg. On comparing two arms for difference in proportion for low birth weight it was not significant by calculating column percentages and a two sided Fisher's Exact test (Table 2).

Table 1: Mean value of variables.

Variables	Intervention group Mean±SD	Non-intervention group Mean±SD
Age in years	23.2±3.4	24.8±3.7
Weight on first ANC visit, kg	43.7±6.4	44.1±4.1
Weight before labor, kg	52.4±7.0	50.9±4.2
Weight gain, kg	8.8±2.0	6.9±1.4
Birth weight*, kg	2.5±0.4	2.6±0.4

Table 2: Observations birth weight and SGA.

	Birth weight ≥ 2.5 kg	Low birth weight	Weight not available	Grand Total
Intervention	31 (58.50%)	13 (37.14%)	5	49
Non intervention	22 (41.51%)	22 (62.86%)	1	45
Grand Total	53	35	6	94

Equality of variances test indicates that there is a significant difference in variances (F=2.00, p=0.0215) between the two groups (Table 3) further on the Satterthwaite method the two groups are significantly different (t=-5.43, p<0.0001) (Table 4). On linear mixed-effects model a fitting model 3 (Table 6) was selected based on Akaike Information Criterion (AIC) and Bayesian information criterion (BIC) comparison (Table 5), when adjusting for the effects of age and weight and allowing for variation in village, weight gain in intervention group is significantly higher than non-intervention group by 2.1 Kg. However birth weight was found weakly associated with changes in mothers' weight.

The key informant interview conducted before the intervention found that the minimal meal frequency among women were compromised to twice a day, moreover on 24 hour recall it was observed that diversity in their daily diet was minimal comprising of either rice or chapathi and dhal with reduced intake of green leafy vegetables.

After the intervention, anecdotes show that women had a minimum of 3 ANC visits with regular attendance at ICDS center every month. Women in the intervention group adopted practicing a minimum of 3 meals or more during pregnancy and adopting a serving of vegetables, lentils and greens into their daily diet along with cereals. Women also developed the habit of regular hand washing before meals and after toilet which was recorded through self reporting. They had enough rest and avoided hard labor during pregnancy, it could be possibly due to the participation of mother in laws in this intervention.

Table 3: Unadjusted T-test for weight gain equality of variances.

Variable	Method	Num DF	Den DF	F Value	Pr >F
Weight gain	Folded F	48	44	2.00	0.0215

Table 4: T-test for weight gain.

Variable	Method	Variances	DF	t Value	Pr>|t|
Weight gain	Satterth waite	Unequal	86.505	-5.43	<.0001

Table 5: Linear mixed effects model: AIC and BIC comparison.

Fixed effects	Random effect		AIC	BIC
M1	Intervention, birth weight	Village	334.2	340.3
M2	Intervention, birth weight, first weight	Village	334.8	342.1
M3	Intervention, birth weight, age	Village	332.4	338.5
M4	Intervention, birth weight, first weight, age	Village	333.5	340.8

Table 6: Linear mixed-effects model.

	Model 1			Model 2			Model 3			Model 4		
Variable	**Estimate**	**SE**	**P value**	**Estimate**	**SE**	**P value**	**Estimate**	**SE**	**P value**	**Estimate**	**SE**	**P value**
Non-intervention	-1.95	0.33	<.001	-1.95	0.33	<.00	-2.0562	0.3294	<0.0	-2.05	0.32	<.001
First weight	---	---	---	0.03	0.03	0.24	---	---	---	0.03	0.03	0.32
Birth weight	0.88	0.41	0.03	0.79	0.42	0.06	0.91	0.41	0.03	0.84	0.41	0.04
Age	---	---	---	---	---	---	0.05	0.044	0.18	0.05	0.04	0.23

DISCUSSION

In India 75 percent of women are anemic and most of them gain an average of 5 kg during pregnancy which is less when compared to the worldwide average of close to 10kg however findings observe underweight pregnant women may gain weight rather freely.[2] Observations from our intervention show that those women who adhere to minimal meal frequency and a maintained diversity attained gestational weight gain a little above the national average.

Study relied on information on weight and height of pregnant women in first trimester recorded through ICDS and followed gestational weight gain through monthly gathering of pregnant women at ICDS. Prospective weight gain among women in intervention had no significance over those in the non intervention group however the mean weight gain was fairly better among the intervention group. However studies have shown that women with low BMI at large acquire significant weight when their behavior and nutritional status is improved.[4,7]

It was observed that women who were continually followed up throughout their pregnancy motivated themselves in accessing ANC visit and made them available at ICDS sessions on maternal and child health. It was also evident to witness that these women were served a minimum meal of 3 times or more at home and were restricted from engaging themselves in laborious activities. On interviewing these pregnant women, they expressed that even their mother in laws had their perceptions altered with respect to antenatal care. They communicated that, they were less imposed to practice traditions and ill beliefs and they felt more comfortable at home during their pregnancy. Women also pointed out that, those perceptions that existed on imposing dietary restrictions on certain food products earlier, were changed. For e.g. women were restricted to take less food so as to reduce heaviness in stomach moreover intake of certain food products like curd, lentils, green gram etcetera were considered unhealthy during pregnancy. This resulted to witness significant weight gain in the intervention group than non-intervention group by 2.1kg when adjusted for the effects of age and birth weight and allowing for variation in village.

Birth weight on the other hand is weakly associated with maternal weight which was not found to be statically different between the two arms of the study. However a meta analysis point out that supplementation of pregnant women with multiple micronutrients increases birth weight and substantially reduce the rates of Low Birth Weight (LBW) and Small for Gestational Age (SGA) births. This can be made possible by consuming locally available raw materials like lentils, green gram, cotton oil, jaggery, multi grain flour, groundnut etc... Which are rich in micronutrients, in their daily dietary intake.[4]

Screening and referral treatment based on maternal anthropometry is a feasible alternative followed by regular surveillance of is a cost effective approach. In addition household level follow up would benefit pregnant women in achieving all ANC indicators along with its better out come on maternal and new born health.[8]

Limitations

Anthropometric variables and covariates were recorded during registration of pregnancy in first trimester at the ICDS, differential exposure misclassification (e.g., recall bias) could have had happened as there is scanty records on pre pregnancy data. Study had only 50 low BMI women enrolled into the intervention which proved to be a limitation due to scattered households and feasibility in gathering them to a common unit.

CONCLUSION

In conclusion findings and anecdotes insist timely education and counseling with regular follow up on maternal growth anthropometry, house visits, food demo sessions, minimum meal practice of 3 or more, proper hand washing before meals and after toilet and adequate rest had contributes to healthy pregnancy and outcome.

Intervention also provided change in perceptions on food habits and health seeking behavior among women and their household members especially among mother in laws.

Recommendations

Interventions should target women in reproductive age in their pre pregnancy stage which helps them to prepare themselves to achieve recommended parameters prior to pregnancy thus contributing to healthy pregnancy and birth outcome. These intervention studies can be replicated with wider sample for future, incorporating timely targeted counseling model and widen the horizon beyond pregnancy to first 1000 days can be effective to combat malnutrition and morbidity.

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REFERENCES

1. UNICEF, Child Undernutrition in India: A Gender Issue. http://unicef.in/ Story/ 108/ Child-Undernutrition-in-India-A-Gender-Issue.
2. The World Bank. Helping India Combat Presistently High Rates of Malnutrition. 2013. http://www.worldbank.org/en/news/feature/2013/05/13/helping-india-combat-persistently-high-rates-of-malnutrition.
3. Christian P, Jiang T, Khatry SK, LeClerq SC, Shrestha SR, West KP Jr. Antenatal supplementation with micronutrients and biochemical indicators of status and subclinical infection in rural Nepal. Am J Clin Nutr. 2006;83(4):788-94.
4. Fall DH, Fisher DJ, Osmond C, Margetts BM, Maternal Micronutrient Supplementation Study Group. Multiple micronutrient supplementation during pregnancy in low-income countries: A meta-analysis of effects on birth size and length of gestation. Food Nutr Bull. 2009;30(4 Suppl):S533-46.
5. Chen A, Klebanoff MA, Basso O. Pre-pregnancy body mass index change between pregnancies and pre term birth in the followung pregnancy. Paediatr Perinat Epidemiol. 2009;23(3):207-15.
6. Merialdi M, Carroli G, Villar J, Abalos E, Gülmezoglu AM, Kulier R, et al. Nutritional Interventions during pregnancy for the Prevention or Treatment of Impaired Fetal Growth: An Overview of Randomized Controlled Trials. J Nutr. 2003;133(5 Suppl 2):1626S-1631S.
7. Agarwal S, Agarwal A, Bansal AK, Agarwal DK, Agarwal KN. Birth weight patterns in rural undernourished pregnant women. Indian Pediatr. 2002;39(3):244-53.
8. Cnattingius S, Bergström R, Lipworth L, Kramer MS. Prepregnancy Weight and the Risk of Adverse Pregnancy Outcomes. N Engl J Med. 1998;338(3):147-52.
9. Allen LH, Peerson JM, Maternal Micronutrient Supplementation Study Group. Impact of multiple micronutrient versus iron-folic acid supplements on maternal anemia and micronutrient status in pregnancy. Food and Nurtition Bulletin. 2009;30(4 Suppl):S527-32.
10. Kramer MS, Haas J, Kelly A. Maternal anthropometry-based screening and pregnancy outcome: a decision analysis. Trop Med Int Health. 1998;3(6):447-53.
11. Wise LA, Palmer JR, Heffner LJ, Rosenberg L. Pre pregnancy body size, gestational weight gain and risk of preterm birth in African-American women Epidemiology. 2010;21(2):243-52.
12. Lundqvist A, Johansson I, Wennberg A, Hultdin J, Högberg U, Hamberg K, et al. Respond dietary intake in early pregnant compared to non pregnant women- a cross sectional study. BMC Pregnancy Childbirth. 2014;14:373.
Bhutta ZA, Ahmed T, Black RE, Cousens S, Dewey K, Giugliani E, et al.What Works? Intervention for maternal and child undernutrition and survival. Lancet Elsevier. 2008;371(9610):417-40.

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