Daily lipid-based nutrient supplements containing 800 µg Vitamin A increased serum retinol binding protein in lactating but not in pregnant women in rural Bangladesh

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Introduction

- Vitamin A deficiency and low vitamin A status during pregnancy and lactation is common in Bangladesh.
- Lipid-based nutrient supplements (LNS) is a novel way of providing multiple micronutrients and essential fatty acids during pregnancy and lactation.
- LNS contains 10 minerals and 12 vitamins including 800 µg of Vitamin A.

Objective

To evaluate the effect of LNS for pregnant and lactating women (LNS-PL) on vitamin A status.

Methods

- We conducted a cluster randomized controlled effectiveness trial (the Rang-Din Nutrition Study) in which pregnant and lactating women (n=4,011) received daily iron and folic acid (IFA; 60 µg iron and 400 µg folic acid) or LNS-PL (20 g/d, 118 kcal)
- Vitamin A status was assessed in a random subsample of women at enrollment (1125; 621 in the LNS-PL group and 504 in the IFA group), at 36th week of gestation (875; 479 in the LNS-PL group and 396 in the IFA group), and at 6 months postpartum (1,040; 576 in the LNS-PL group and 464 in the IFA group)
- The biomarker for Vitamin A status was Retinol Binding Protein (RBP). Serum samples were analyzed for RBP using sandwich ELISA method. Low vitamin A status and vitamin A deficiency were defined as RBP <1.17 µmol/L and RBP <0.83 µmol/L respectively .
- We carried out logistic regression or ANCOVA to analyze the data for treatment effect. Covariates in the models included age, education, asset quintile, season of enrollment, MUAC, BMI, log of RBP at baseline, ownership of a fishpond.

Table 1. Characteristics of study participants randomized for the assessment of vitamin A status at enrollment.

	LNS-PL (n=640)	IFA (n=520)
Age (y)	21.8 ± 5.0	22.2 ± 5.2
Education (y) [a]	6.5 ± 3.2	6.0 ± 3.3
Nulliparous	42.3%	38.9%
BMI	20.0 ± 2.7	19.9 ± 2.7
MUAC (cm)	24.8 ± 2.6	24.8 ± 2.5
Low BMI (BMI<18.5 kg/m^2)	32.3%	32.7%
Weight (kg)	45.5 ± 7.0	45.2 ± 6.5
Height (cm)	150.7 ± 5.3	150.7 ± 5.4
RBP at baseline (µmol/L)	1.44 ± 0.43	1.41 ± 0.43
CRP [b] >5mg/L at baseline	14.2%	8.9%
AGP [c] >1g/L at baseline	7.7%	6.2%
Gestational age at enrollment	13.1 ± 3.8	12.9 ± 3.7
Food secure	48.1%	46.9%
Severely food insecure	9.4%	10.0%
Asset Index	-0.01 ± 2.2	-0.11 ± 2.2
Own a fishpond	23.0%	24.4%

Means ± SD or proportions (%).
[a] Significantly different by group (p=0.006)
[b] C-Reactive Protein; [c] α-1 Acid Glycoprotein

Table 2. Vitamin A status at 36 weeks of gestation, by intervention group (n=875) [a,b]

Outcome	LNS-PL (n=479) Mean ± SE	IFA (n=396) Mean ± SE	p-value
RBP (µmol/L)			
Unadjusted	1.49 ± 0.02	1.40 ± 0.04	0.041
Adjusted	1.48 ± 0.01	1.42 ± 0.04	0.106
Change in RBP between baseline and 36 weeks [c]			
Unadjusted	0.07 ± 0.02	0.05 ± 0.02	0.283
Adjusted	0.07 ± 0.01	0.04 ± 0.02	0.128

[a] p-values for treatment effect are based on ANCOVA (SAS, PROC MIXED), accounting for union (nested within sub-district) and the random effect of cluster.
[b] Values are mean ± SE, or geometric mean ± estimated geometric SE for log transformed variables.
[c] Analysis was performed using log-transformed values

Table 3. Vitamin A status at 6 months postpartum, by intervention group (n=1,040) [a,b]

Outcome	LNS-PL (n=576) Mean ± SE	IFA (n=464) Mean ± SE	p-value
RBP (µmol/L)			
Unadjusted	1.58 ± 0.02	1.48 ± 0.02	0.008
Adjusted	1.57 ± 0.01	1.48 ± 0.02	0.007
Change in RBP between baseline and 6 months postpartum[c]			
Unadjusted	0.12 ± 0.02	0.07 ± 0.02	0.098
Adjusted	0.12 ± 0.01	0.06 ± 0.02	0.005

[a] p-values for treatment effect are based on ANCOVA (SAS, PROC MIXED), accounting for union (nested within sub-district) and the random effect of cluster.
[b] Values are mean ± SE, or geometric mean ± estimated geometric SE for log transformed variables.
[c] Analysis was performed using log-transformed values

Table 4. Prevalence and odds ratios of low RBP (low vitamin A status) at 36 weeks of gestation (n=875) and 6 months postpartum (n=1,040)

Outcome	LNS-PL % (95% CI)	IFA % (95% CI)	OR (95% CI)	p-value	AOR (95% CI)	p-value
RBP <1.17 µmol/L (36 week)	23.4 (19.0 – 27.8)	27.5 (23.1 – 31.9)	0.77 (0.55, 1.08)	0.121	0.84 (0.57, 1.24)	0.374
RBP <1.17 µmol/L (6 month postpartum)	12.3 (10.9 – 13.8)	16.6 (14.8 – 18.4)	0.66 (0.46, 0.97)	0.033	0.68 (0.45, 1.03)	0.069

Results

At 36 weeks of gestation

- At 36 weeks, the mean unadjusted RBP concentration was significantly higher (p=0.041) in the LNS-PL group than in the IFA group, but after adjustment for baseline RBP, RBP concentration was not significantly different between the groups.
- Mean unadjusted and adjusted changes in the RBP concentration in the LNS-PL group were not significantly different from those in the IFA group.
- The prevalence of low RBP was also not significantly different between the groups.

At 6 months postpartum

- At 6 months postpartum, the mean unadjusted and adjusted log of RBP concentration was significantly higher (p=0.008 for the unadjusted; and p=0.007 for the adjusted) in the LNS-PL group than in the IFA group.
- Mean unadjusted change in the RBP concentration in the LNS-PL group was not significantly different (0.098) from those in the IFA group but the adjusted change in the RBP concentration was significantly different between the groups (0.005).
- The unadjusted prevalence of low RBP was significantly different between the groups (0.033) .

Conclusions

- About one-fourth of women in rural Bangladesh had low-vitamin A status in late pregnancy and about one-sixth of women had low-vitamin A status at 6 months postpartum.
- LNS-PL supplementation containing 800 µg vitamin A increased mean RBP at 6 months postpartum but not at late pregnancy (36 weeks of gestation).
- LNS-PL supplementation decreased prevalence of low-vitamin A status from 17% to 12% at 6 months postpartum. However, the decrease was not statistically significant in the adjusted analysis.
- The prevalence of low vitamin A status at late pregnancy was lower than the prevalence reported in the earlier studies carried out among pregnant women in Bangladesh (Lee et al. 2008).
- Our results are consistent with a study that provided 600 µg of vitamin A (retinol activity equivalents) per day to non-pregnant and non-lactating women in Bangladesh and failed to improve vitamin A status (Jamil et al. 2012).
- Lack of significant differences in low-vitamin A status between the LNS-PL and IFA groups may be explained by the relatively low prevalence of vitamin A deficiency at baseline (4.0 percent in the LNS-PL group and 3.8 percent in the IFA group; RBP < 0.83 µmol/L).
- Daily vitamin A supplementation of pregnant and lactating women may showed an impact only in postpartum period when baseline prevalence of vitamin A deficiency is low.

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