Prenatal and postnatal supplementation with lipid-based nutrient supplements reduced anemia and iron deficiency in young Bangladeshi children

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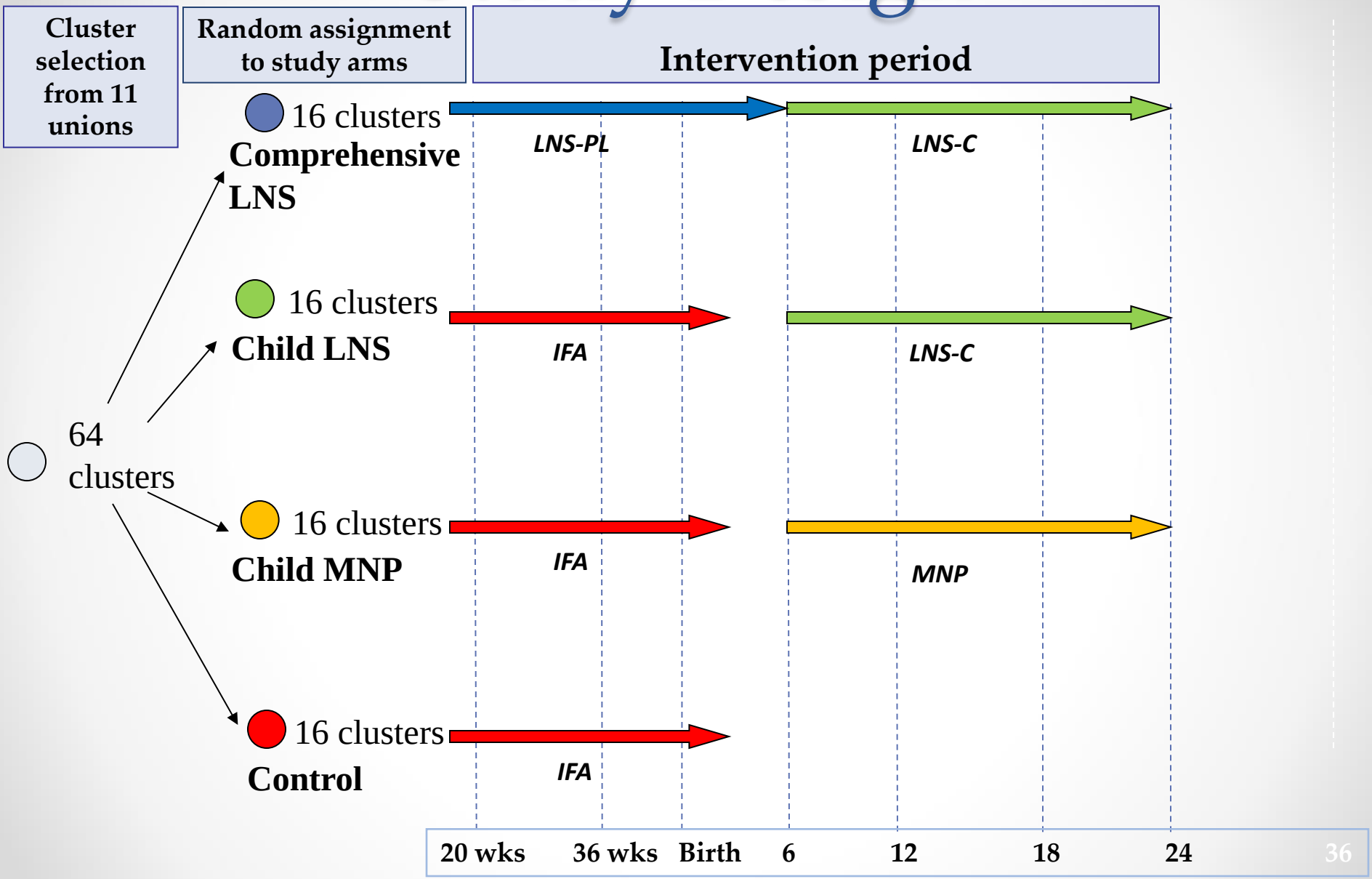
Background

- Anemia is a severe public health problem.
- In Bangladesh, about 52% of children 6-59 months old had anemia; those under 2 y or with an anemic mother were at higher risk (Khan, et al., 2016).
- Micronutrient powder is an effective strategy to reduce anemia and iron deficiency (De-Regil,et al., 2013).
- Lipid-based nutrient supplements are a novel supplementation approach.

Objective

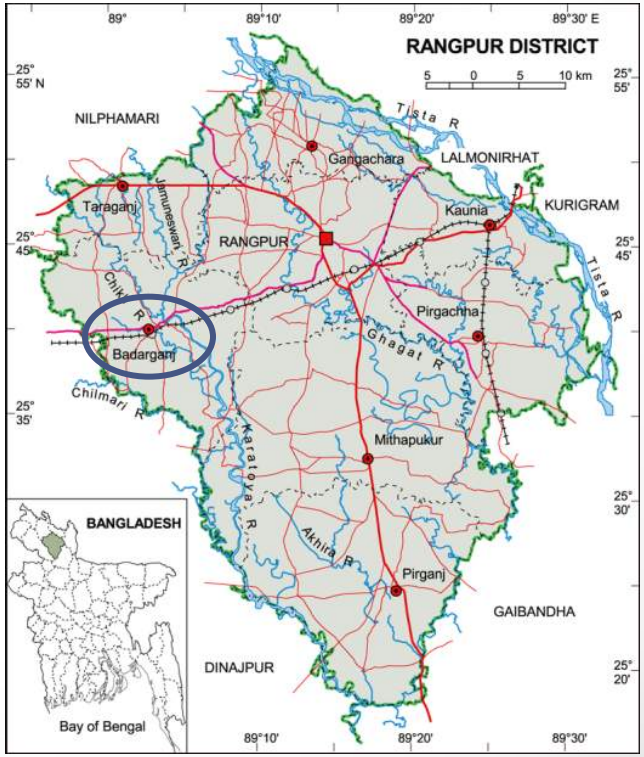
- To examine effects of lipid-based nutrient supplements (LNS) and micronutrient powder (MNP) on anemia, iron deficiency (ID) and iron deficiency anemia (IDA) in 18-month-old rural Bangladeshi children.

Study Design



Enrollment

- Eligibility criteria included:
  - ≤20 weeks of gestation
  - No plans to move out of study area
- n=4,011 pregnant women were enrolled



Nutritional composition of maternal supplements

Nutrient	Unit	LNS-PL	IFA Tablet
Energy	Kcal	118	0
Protein	g	2.6	0
Fat	g	10	0
Linoleic acid	g	4.59	0
α-Linolenic acid	g	0.59	0
Vitamin A	µg RE	800	0
Vitamin C	mg	100	0
Vitamin B1	mg	2.8	0
Vitamin B2	mg	2.8	0
Niacin	mg	36	0
Folic acid	µg	400	400
Pantothenic acid (B5)	mg	7	0
Vitamin B6	mg	3.8	0
Vitamin B12	µg	5.2	0
Vitamin D	IU	400	0
Vitamin E	mg	20	0
Vitamin K	µg	45	0
Iron	mg	20	60
Zinc	mg	30	0
Copper	mg	4	0
Calcium	mg	280	0
Phosphorus	mg	190	0
Potassium	mg	200	0
Magnesium	mg	65	0
Selenium	µg	130	0
Iodine	µg	250	0
Manganese	mg	2.6	0

Nutritional composition of supplements for children

Nutrient	Unit	LNS-C	MNP
Energy	kcal	118	0
Protein	g	2.6	0
Fat	g	9.6	0
Linoleic acid	g	4.46	0
α-Linolenic acid	g	0.58	0
Calcium	mg	280	0
Copper	mg	0.34	0.56
Folate	µg	150	150
Iodine	µg	90	90
Iron	mg	9	10
Magnesium	mg	40	0
Manganese	mg	1.2	0
Niacin	mg	6	6
Pantothenic acid (B5)	mg	2.0	0
Phosphorous	mg	190	0
Potassium	mg	200	0
Riboflavin (B2)	mg	0.5	0.5
Selenium	µg	20	17
Thiamine (B1)	mg	0.5	0.5
Vitamin A	µg RE	400	400
Vitamin B12	µg	0.9	0.9
Vitamin B6	mg	0.5	0.5
Vitamin C	mg	30	30
Vitamin D	µg	5	5
Vitamin E	mg	6	5
Vitamin K	µg	30	0
Zinc	mg	8	4.1

LNS-PL

LNS-C

MNP

Supplement distribution

- A community health program implemented by a local NGO was responsible for supplement distribution via community health workers and village health volunteers.

LNS-C use messages

- Give 2 packets every day
- Do not give more than 2 packets a day
- Mix the entire packet with 2-3 spoonfuls of already-prepared food
- Do not cook the supplement with the food
- Feed the whole mixture of food and supplement at a time

MNP use messages

- Mix 1 packet with child's food every day
- Do not give more than 1 packet in a day
- Mix the entire packet with 2-3 spoonfuls of already-prepared food
- Feed the child the whole mixture of food and supplement at a time
- Do not mix supplement with extremely hot food or liquids

Measurements

- Capillary blood was collected in a randomly selected subsample of children (n=1,128)
- HemoCue used for hemoglobin (Hb; g/L)
- Serum ferritin (µg/L) and soluble transferrin receptor (sTfR; mg/L)
- Inflammation biomarkers (CRP and AGP)
- Analysis by a combined sandwich ELISA method

Definitions

- Anemia: Hb <110 g/L
- ID: ferritin <12 µg/L or sTfR >8.3 mg/L
- IDA: ferritin <12 µg/L or sTfR >8.3 mg/L
  and Hb <110g/L

Statistical analysis

- Intention to treat analysis
- Cluster-adjusted analyses using mixed regression models
- Random effects:
  - cluster (nested within treatment group)
  - union (nested within sub-district)
- Inflammation correction of ferritin, following Thurnham's approach
- Transformation of variables, if needed

Baseline characteristics (n=1128)

Variable	LNS-LNS n=294	IFA-LNS n=260	IFA-MNP n=300	IFA-Control n=274
Gestational age (wk)	13 ± 4	13 ± 4	13 ± 4	13 ± 4
Age (y)	22 ± 5	22 ± 5	22 ± 5	22 ± 5
Years of education	7 ± 3	6 ± 3	6 ± 3	6 ± 3
SES index	0 ± 2	0 ± 2	-0.1 ± 2	0 ± 2
Food insecure	51%	54%	50%	53%
Nulliparous	38%	38%	38%	37%
Height (cm)	151 ± 5	151 ± 6	151 ± 5	151 ± 6
BMI, kg/m^2	20 ± 3	20 ± 3	20 ± 3	20 ± 3
Female child	53%	50%	48%	52%

Values are means ± SD, unless otherwise stated.

Hemoglobin and iron indicators at 18 months

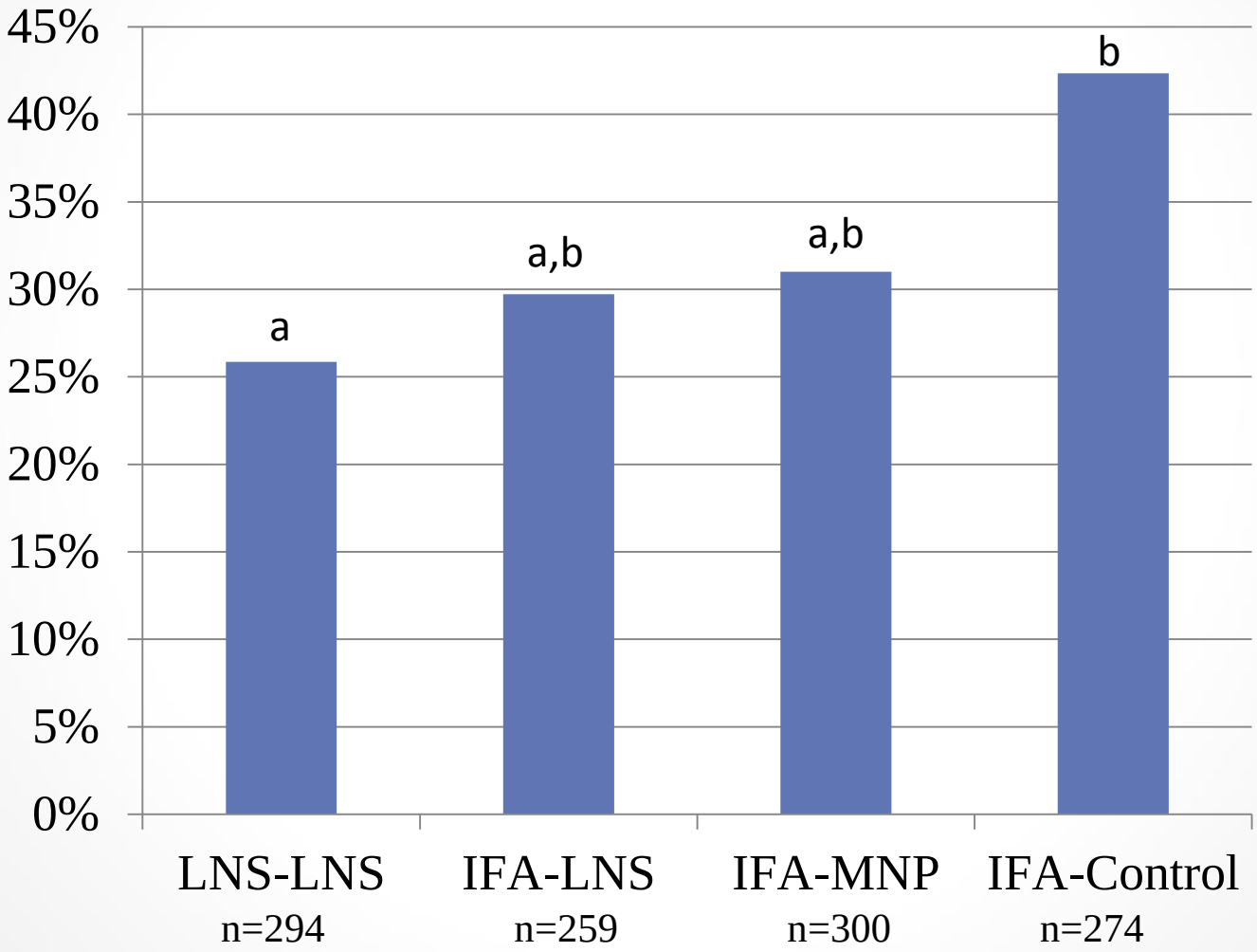
	LNS-LNS n=294	IFA-LNS n=260	IFA-MNP n=300	IFA-Control n=274	P-value
Hemoglobin (g/L)	117 ±13[a]	116 ± 13[a]	115 ± 13[a,b]	112 ± 14[b]	0.001
Ferritin (µ/L)*	37 ± 2[a]	40 ± 2[a]	38 ± 2[a]	25 ± 2[b]	<.001
Corrected ferritin (µ/L)*	34 ± 2[a]	36 ± 2[a]	34 ± 2[a]	23 ± 2[b]	<.001
sTfR (mg/L)*	7.9 ± 1.3[a]	8.4 ± 1.4[a,b]	8.5 ± 1.4[b]	9.5 ± 1.5[c]	<.001

Values are means (or geometric means) ± SD

[a,b,c]Groups that do not share a common superscript differ from each other (p<.05)

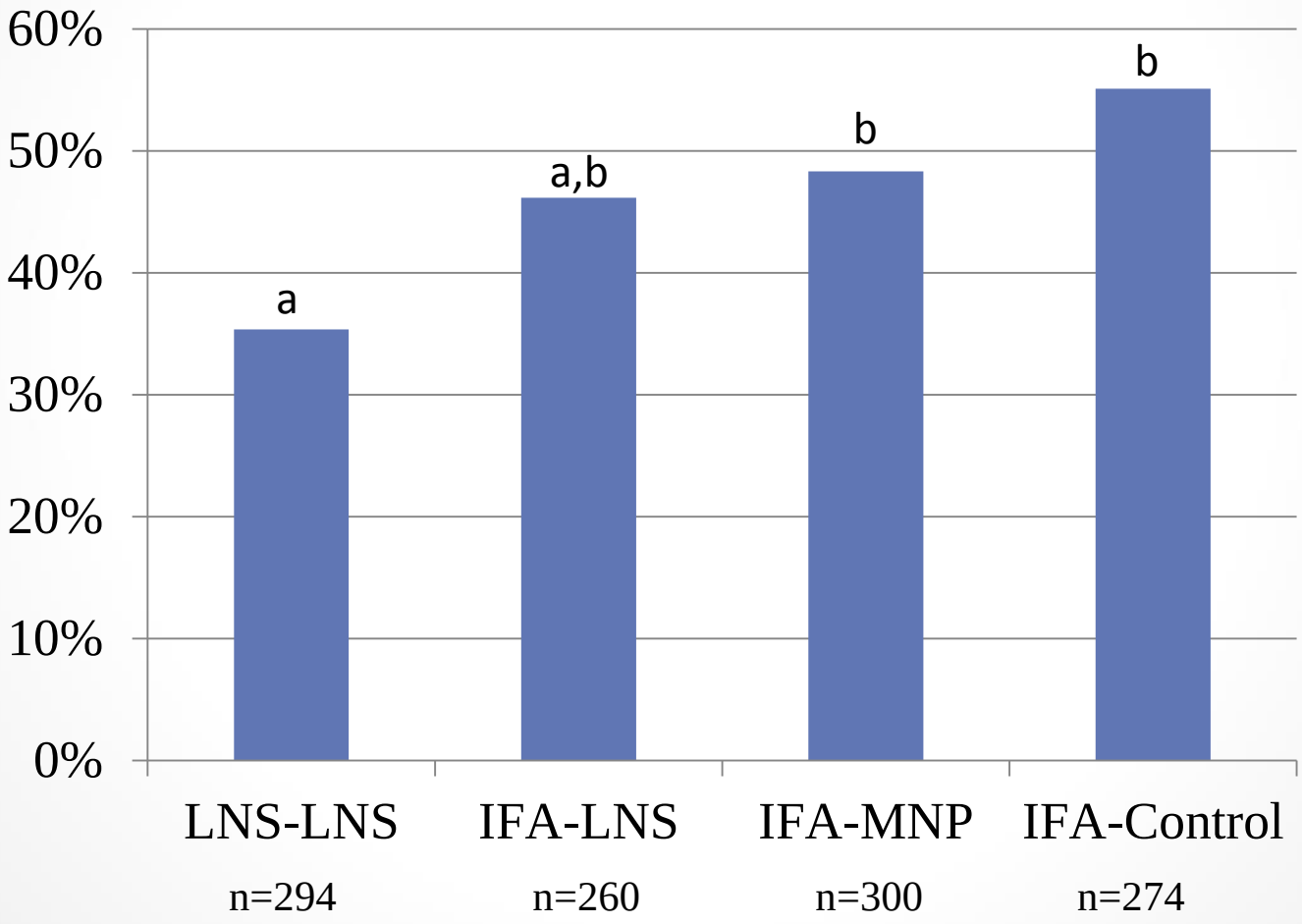
*Hypothesis testing was done using transformed values; estimates were calculated by back transformation

Anemia at 18 months



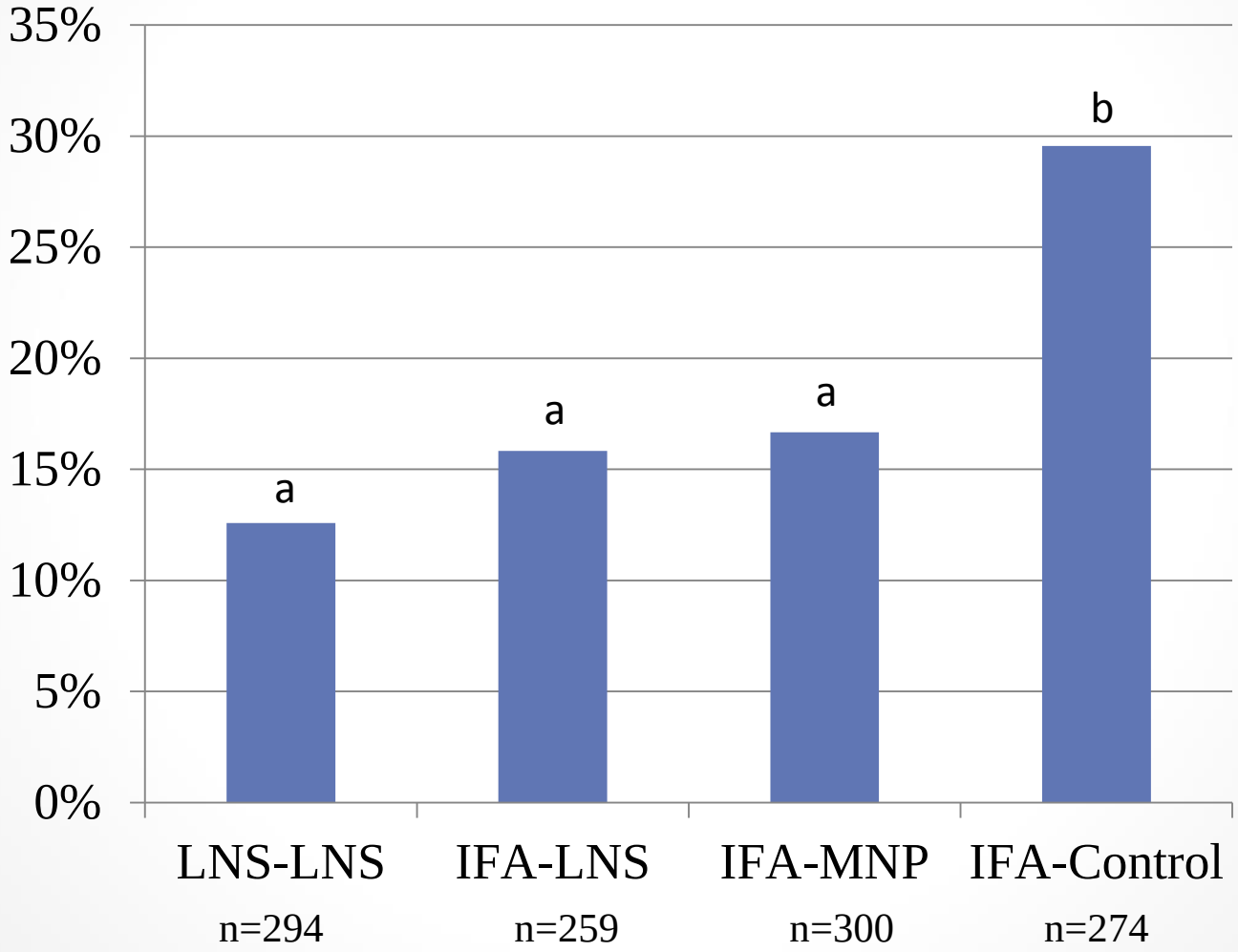
Overall p=0.0079

Iron Deficiency (ferritin <12 µg/L or sTfR >8.3 mg/L) at 18 months



Overall p=0.0002

Iron Deficiency Anemia (ferritin<12 μg/L or sTfR>8.3 mg/L and Hb<110 g/L) at 18 months



Overall p=0.0002

Summary (1)

In this population of young Bangladeshi children:

- Comprehensive LNS (LNS-LNS) and Child LNS (IFA-LNS) increased hemoglobin
- All 3 interventions (LNS-LNS, IFA-LNS and IFA-MNP) increased ferritin and reduced sTfR
- Comprehensive LNS reduced iron deficiency by 36%
  - ID prevalence in the Comprehensive LNS group was also lower than that in the Child MNP group

Summary (2)

Intervention group	Reduction in anemia[a]	Reduction in IDA
Child MNP	27%[b]	44%
Child LNS	30%[b]	46%
Comprehensive LNS	39%	57%

[a]Reduction reported by DeRegil et al. 2013 for MNPs was 31%
[b]Non-significant

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Thanks!