

# **Randomized trial of home fortification of complementary foods with 3 types of micronutrient supplements in Ghana**

**S Adu-Afarwuah<sup>1</sup>, A Lartey<sup>2</sup>, KH Brown<sup>1</sup>, A Briend<sup>3</sup>, S Zlotkin<sup>4</sup>, KG Dewey<sup>1</sup>**

**1 Prog. Intl. Nutr., UC Davis**

**2 Univ. of Ghana, Legon**

**3 Inst. de Recherche pour le Développement, Paris, France**

**4 Hospital for Sick Children, Univ. of Toronto, Canada**

# Acknowledgments

---

- Nestle Foundation and USAID for funding
- Families of study infants
- Study team /Regional & Municipal Health Adm./ Nurses/ laboratory staff in Koforidua
- Zhenyu Yang/ Diane Vandepoute/ Janet Peerson at UC Davis

# Outline

---

- Situation/ background
- Study design
- Results
- Key messages from study

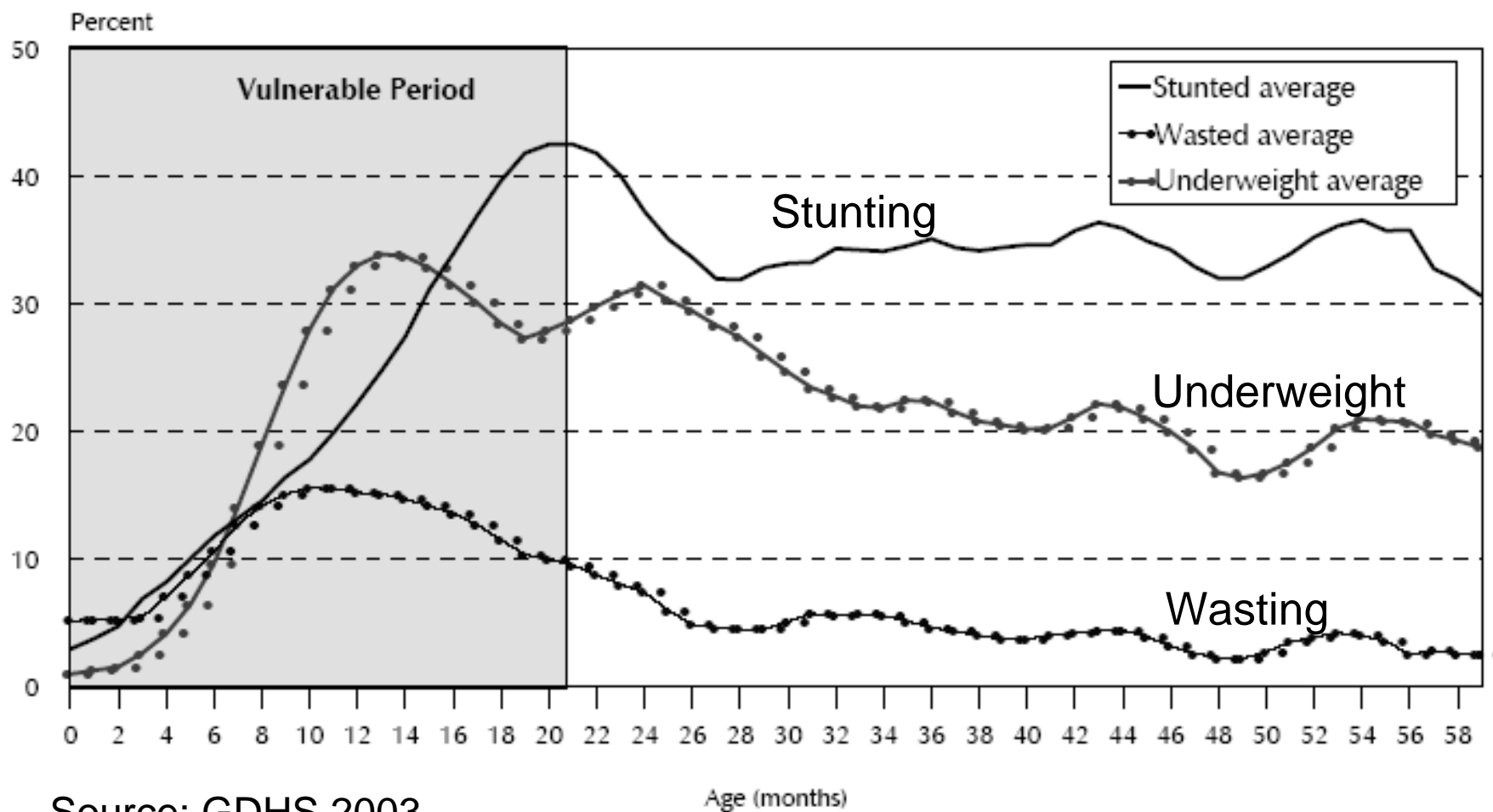
# Situation: malnutrition and micronutrient deficiencies (1)

---

- Many children 6-36 mo in Ghana suffer mild-severe malnutrition (Ghana DHS 2003)
  - Over 26% underweight (WAZ < -2 SD)
  - Approx. 25% stunted (HAZ < -2 SD)
  - Over 80% with Hb < 110 g/L
  - Zn deficiency may follow similar pattern as Fe
  - Intake of essential fatty acids possibly low

# Situation: malnutrition and micronutrient deficiencies (2)

## Stunting, Wasting, and Underweight by Age, Ghana



Source: GDHS 2003

# Hypothesis

---

- Home fortification with multiple micronutrient supplement will:
  - Increase growth (linear and weight gain)
  - Have more effect in presence of added energy from fat

# Underlying advantages with home-fortification

---

- May be low cost
- Home-made food as vehicle is appropriate for infants
- No major dietary changes required
- Full dose of micronutrients obtained
- Multiple micronutrients given at a time

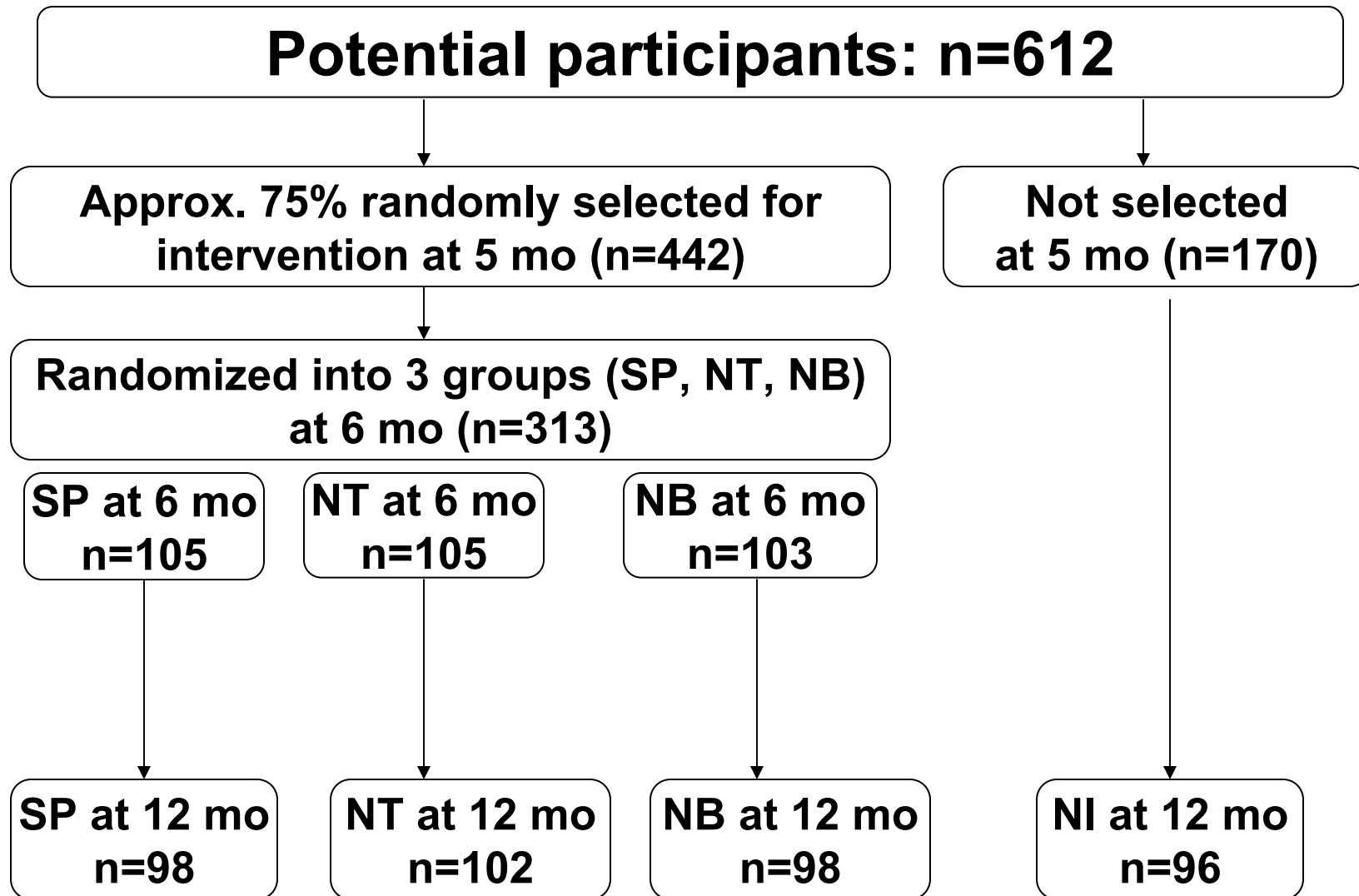
# Supplements used and their composition

---

- Sprinkles (SP)
  - Fe, Zn, Vit A, Vit C, folic acid
- Nutritabs (NT) = FoodLET
  - Nutrients listed for SP, plus pantothenic acid, vitamins B1, B2, B3, B6 and B12, Ca, K, Cu, Se, I
- Nutributter (NB) = Highly fortified Plumpy'nut
  - Nutrients listed for NT, plus P, Mg, Mn and fat; 108 kcal/d

# Study design

---



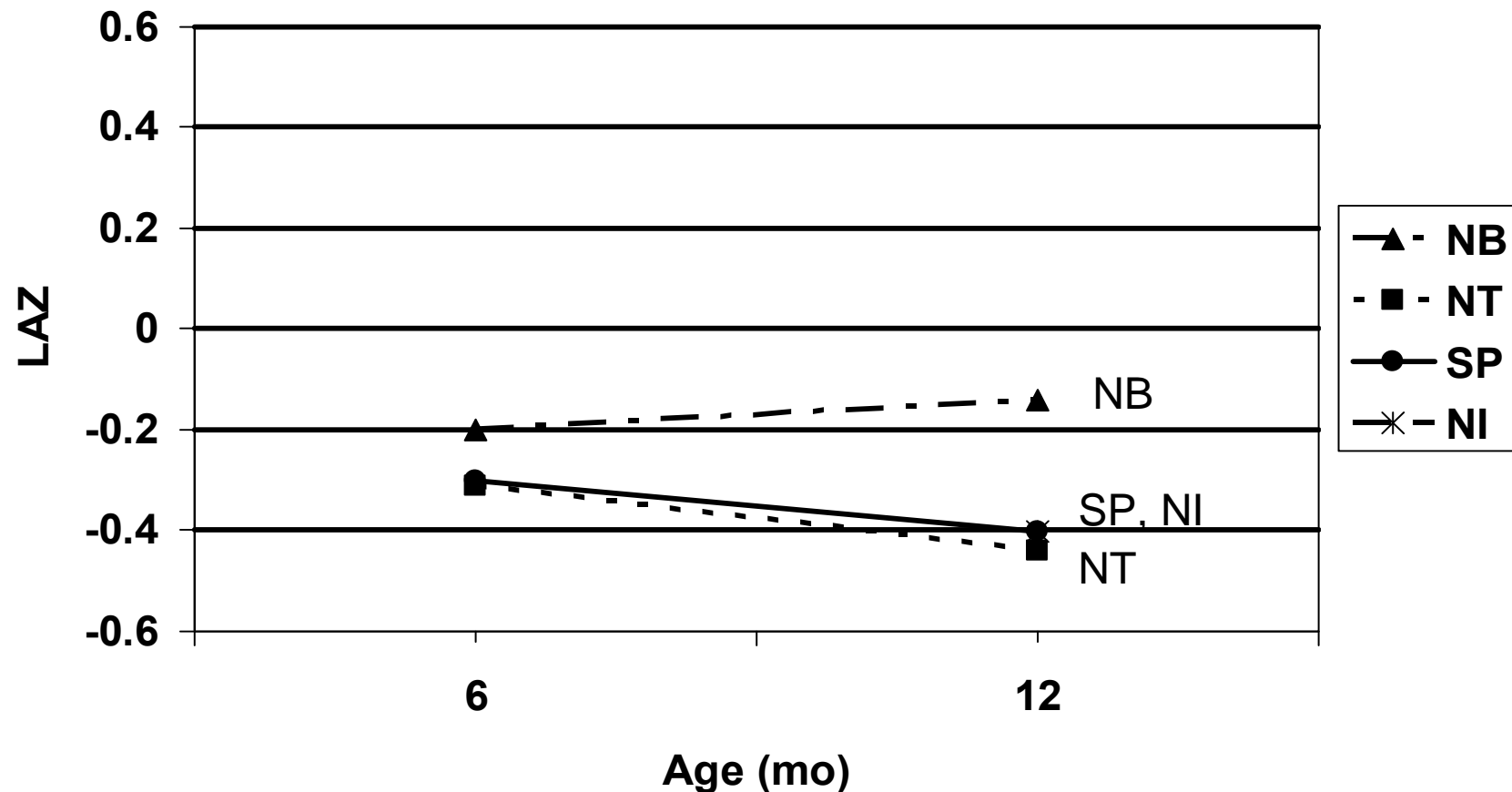
Groups: SP= Sprinkles, NT=Nutritabs, NB= Nutributter, NI=Non-intervention<sup>9</sup>

# Growth and energy intake from CF, 6-12 mo

	SP (n=96)	NT (n=101)	NB (n=97)	p
Wt gain (kg)	1.39 ± 0.50 <sup>ab</sup>	1.35 ± 0.48 <sup>a</sup>	1.57 ± 0.73 <sup>b</sup>	0.02
Ln gain (cm)	7.9 ± 1.4 <sup>ab</sup>	7.8 ± 1.4 <sup>a</sup>	8.3 ± 1.4 <sup>b</sup>	0.04
Energy from CF (kcal/d, 7-12 mo)	139 ± 76 <sup>a</sup>	133 ± 69 <sup>a</sup>	224 ± 71 <sup>b</sup>	<0.0001

SP = Sprinkles; NT= Nutritabs; NB = Nutributter; CF = Complementary foods. 10

# Length-for-age z-scores of intervention (SP, NT, NB) and non-intervention (NI) groups

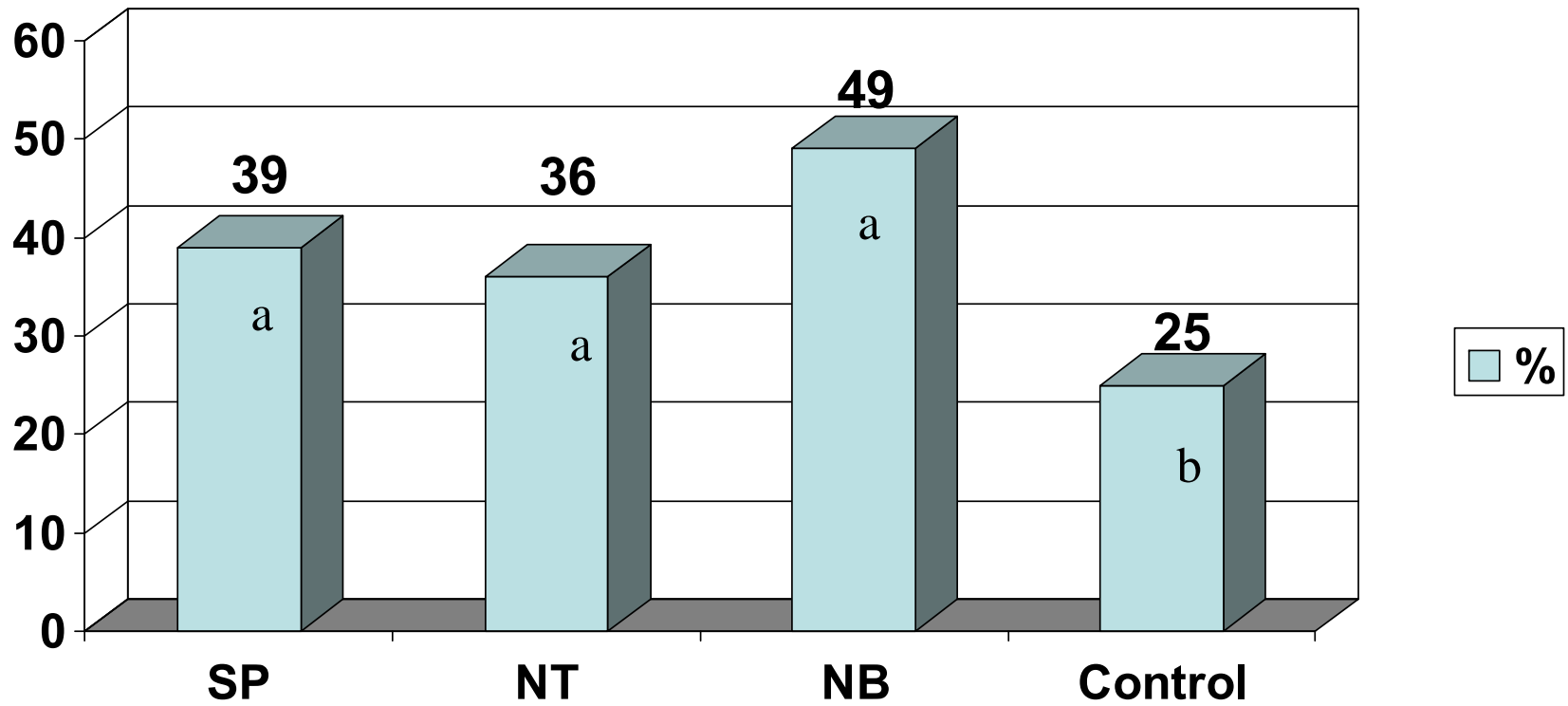


SP=Sprinkles; NT=Nutritabs; NB=Nutributter; NI=Non-intervention

Growth reference: WHO Child Growth Standards 2006

# Motor development: % walking at 12 mo

---



Bars with different letters are significantly different (chi sq, 0.05)

# What is responsible for improved growth in the Nutributter group?

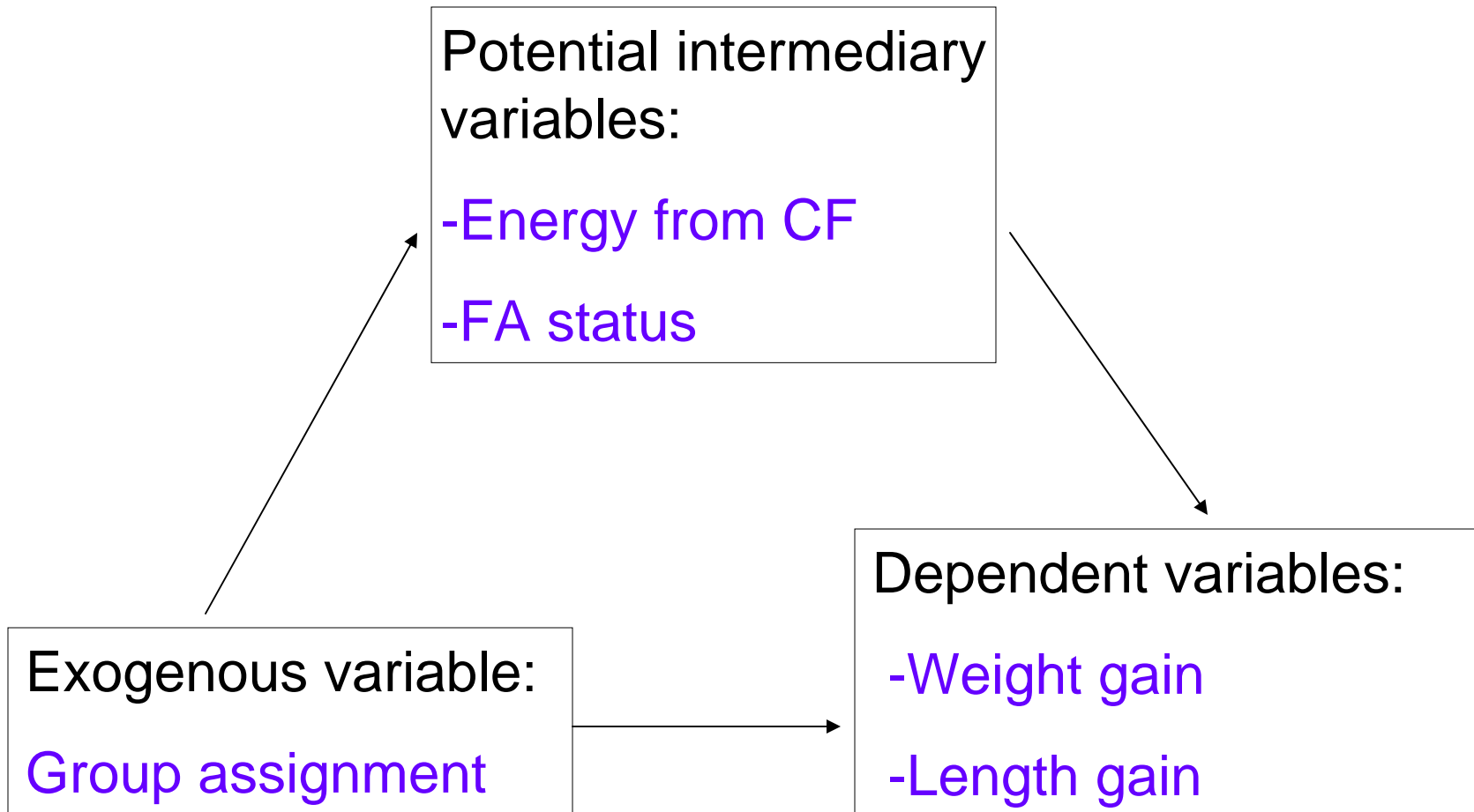
---

Possible explanations:

- Increased energy intake
- Favorable essential fatty acid profile
- Inclusion of milk

# Path analysis of observed effects

---



# Summary of potential explanations

---

- Path analysis suggests that:
  - Increased energy intake from CFs explained (part of) the impact on weight gain, but not length gain
  - The shift in plasma FA explained (part of) the impact on length gain, but not weight gain
- However, growth effect could also be due to milk content

# Acceptability

---

- Supplement consumption (% of days, 6-12 mo): SP 86%, NT 88%, NB 88%
- Child accepted food “well” when mixed with supplement: SP 90%, NT 78%, NB 86%
- > 97% of mothers in all 3 groups a) liked giving the supplement, b) thought it helped child’s health & c) wanted to purchase in future

# How much willing to pay? (US cents/day)

---

	SP	NT	NB
~5 cents/d	93%	89%	99%*
~8 cents/d	69%	53%	81%**
Mean (SD)	8 (5)	8 (5)	10 (7)**

\*  $p < 0.05$ ; \*\*  $p < 0.01$

# Summary of results

---

- All 3 supplements were well accepted
- All 3 supplements improved iron status compared to the Non-Intervention group
- Only Nutributter improved growth
- Motor development was improved by all 3 supplements, but the effect was largest with Nutributter
- Providing a larger set of micronutrients in a lipid-based product (with milk powder?) confers benefits beyond those of providing just a few selected key micronutrients

END

THANK YOU

# Appendices

## Does increased energy from CFs explain effect of Nutributter on weight and length gain?

	Mean Diff. from NB		Mean Diff. from NB, with CF energy in model		% Diff. due to CF energy
	Mean	p	Mean	p	%
Weight gain, kg <sup>1</sup>					
SP group	-0.18	0.04	-0.10	0.28	43
NT group	-0.20	0.02	-0.11	0.25	46
Length gain, cm <sup>1</sup>					
SP group	-0.39	0.04	-0.46	0.03	N/A
NT group	-0.44	0.02	-0.50	0.02	

Controlling for baseline values, child sex and maternal height.

SP=Sprinkles, NT=Nutritabs, NB=Nutributter.

**Answer: Yes (partially) for weight gain; No for length gain**

# Plasma $\alpha$ -linolenic acid (mg/L) at 12 mo

NI	SP	NT	NB	p
3-group comparison <sup>1</sup>				
n/a	5.5 $\pm$ 4.9** (n=70)	5.2 $\pm$ 2.9** (n=74)	7.3 $\pm$ 5.0 (n=70)	0.03
4-group comparison <sup>2</sup>				
6.2 $\pm$ 5.5* (n=72)	5.6 $\pm$ 5.5** (n=76)	5.6 $\pm$ 5.5** (n=78)	7.9 $\pm$ 5.6 (n=71)	0.05

<sup>1</sup> Mean  $\pm$  SD adjusted for baseline values, mean BF frequency at 6-12 mo and sex; <sup>2</sup> Mean  $\pm$  SD adjusted for BF frequency in the week prior to 12 mo and sex.

\*\* Different from NB, p < 0.05; \* Different from NB, p < 0.08.

## Plasma saturated fatty acids (% total) at 12 mo

NI	SP	NT	NB	p
3-group comparison <sup>1</sup>				
n/a	38.3 ± 2.1** (n=70)	38.4 ± 2.1** (n=72)	37.5 ± 2.1 (n=68)	0.0 2
4-group comparison <sup>2</sup>				
38.5 ± 2.2** (n=72)	38.2 ± 2.2 (n=76)	38.6 ± 2.2** (n=77)	37.7 ± 2.2 (n=71)	0.0 9

<sup>1</sup> Mean ± SD adjusted for baseline values, mean BF frequency at 6-12 mo and sex; <sup>2</sup> Mean ± SD adjusted for BF frequency in the week prior to 12 mo and sex.

\*\* Different from NB (p < 0.05).

## Correlations of plasma fatty acids at 12 mo with weight and length gain 6-12 mo

Fatty acids	Length gain	Weight gain
18:3n3 (mg/L)	0.20 [p = 0.003]	0.03 [p = 0.61]
SFA (% of total)	-0.13 [p = 0.05]	-0.10 [p = 0.45]

<sup>1</sup> Pearson correlation coefficient for all children in intervention groups. Adjusted for baseline FA values, mean BF frequency at 6-12 mo of age and child sex 24

## Do changes in fatty acid status explain the effect of Nutributter on growth 6-12 mo?

	Mean Diff. from NB		Mean Diff. from NB with ALA in model		% Diff. due to ALA	Mean Diff. from NB with SFA in model		% Diff. due to SFA
		p		p	%		p	%
Length gain,cm <sup>1</sup>								
SP group	-0.39	0.04	-0.12	0.60	69	-0.16	0.49	59
NT group	-0.44	0.02	-0.29	0.19	34	-0.35	0.12	21
Weight gain,kg <sup>1</sup>								
SP group	-0.18	0.04	-0.19	0.06	N/A	-0.20	0.05	N/A
NT group	-0.20	0.02	-0.24	0.02		-0.27	0.01	

Controlling for baseline values, child sex and maternal height.

SP=Sprinkles, NT=Nutritab, NB=Nutributter

**Answer: Yes (partially) for length gain; No for weight gain**