Small-quantity lipid-based nutrient supplements, together with malaria and diarrhea treatment, improve growth and development in young Burkinabe children

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Background

Preventive zinc supplementation reduces the incidence of diarrhea and increases growth[1-3]

The impact of zinc is less certain when provided as fortified food or home fortification products[4]

The optimal dose of zinc in lipid-based nutrient supplements (SQ-LNS) remains to be determined

Objectives

To assess the appropriate dose of zinc in SQ-LNS by comparing biochemical and zinc-related functional responses among young children who receive different zinc doses in SQ-LNS or tablets

To compare the same outcomes among children who do or do not receive SQ-LNS and selected health services

Methods

- Community-based, partially double-blind, placebo-controlled, randomized clinical trial in rural Burkina Faso
- Inclusion criteria: 9 mo of age, parental consent
- Exclusion criteria: Hemoglobin (Hb) <50 g/L, weight/length <70% NCHS median, edema, chronic or congenital diseases, history of peanut allergy or anaphylactic reaction
- Cluster randomization of 34 communities to intervention (IC) or non-intervention (NIC) cohort
- Eligible children in IC were randomly assigned by concession to 1 of 4 intervention groups (Figure 1)
- Hemoglobin and rapid diagnostic test for malaria (RDT) at 9 mo
- Length and weight at 9 and 18 mo in both cohorts
- Plasma zinc at 9 and 18 mo in randomly selected sub-group in both cohorts
- Neurobehavioral development at 18 mo in a sub-group (4 grps only)

In intervention groups only:

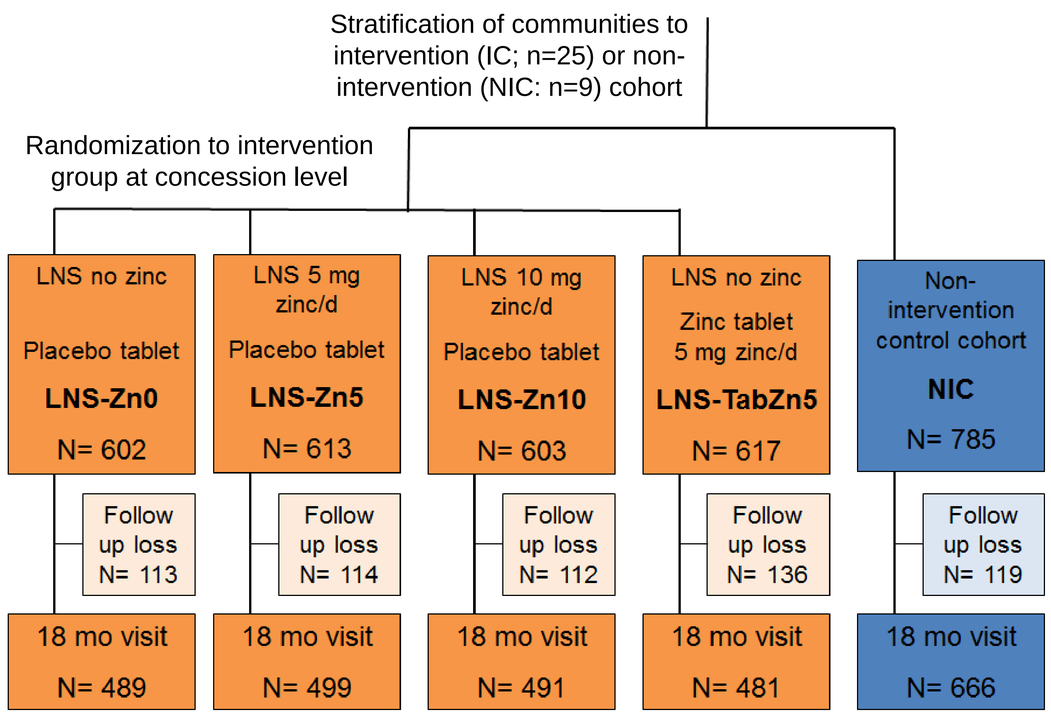
- Weekly home visits for morbidity surveillance and distribution of LNS and tablets
- Free treatment of reported diarrhea, fever and confirmed malaria

References

1.Brown et al, Food Nutr Bull 2009
2.Imdad et al, BMC Public Health, 2011
3.Yakoob et al, BMC Public Health, 2011
4.Das JK, et al. Systematic Reviews 2013

Results

Figure 1: Flow diagram for the study participants



Results

Table 1: Baseline characteristics

N	3220
Age (mo)	9.4 ± 0.4
Boys (%)	50.3
LAZ	-1.21 ± 1.10
WAZ*	-1.42 ± 1.15
WLZ*	-0.99 ± 1.05
Hemoglobin (g/L)	89 ± 15
Malaria RDT (% positive)	61.4
Low plasma zinc (<65 µg/dL; %)	35.2

LAZ, length-for-age Z-score; WAZ, weight-for-age Z-score; WLZ, weight-for-length Z-score, RDT, rapid diagnostic test
Results shown as mean ± SD or percentage (%)
* Significantly different by group

Results

Table 2: Hemoglobin and plasma zinc

	IC	NIC	P-value
Hemoglobin concentration (g/L) [1]			
N	2435	785	
At 9 mo	89 ±15	88 ±16	0.417
at 18 mo	97 ±15	88 ±16	<0.0001
Adjusted plasma zinc concentration (µg/dL) [1,2]			
N	310	93	
at 9 mo	69.6 ±1.2	67.0 ±1.2	0.090
at 18 mo	64.6 ±1.2	64.1 ±1.2	0.659

[1] Adjusted for baseline value and cluster randomization
[2] Also adjusted for presence of inflammation (CPR, AGP)

At 18 mo, change in Hb was greater in IC than NIC (+8 vs -1 g/L, p<0.0001), but 79% of IC were still anemic (vs. 91% in NIC).

Results

Table 3: Length, weight and stunting and wasting prevalence at 18 mo

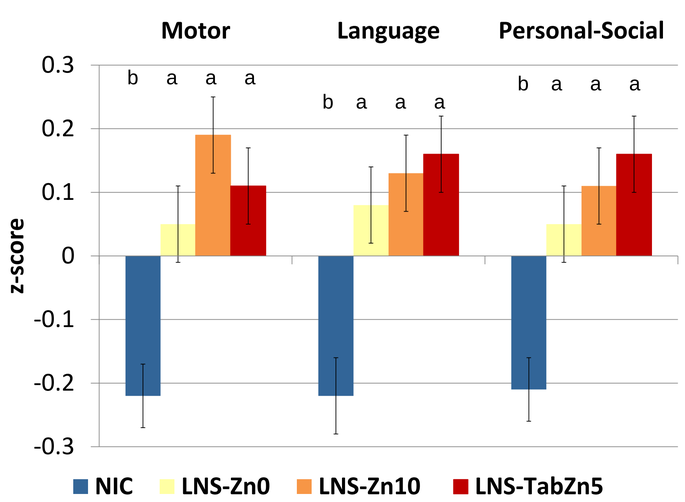
	LNS-Zn0	LNS-Zn5	LNS-Zn10	LNS-TabZn5	NIC	P-value
Length 18 mo (cm)	77.7 [a] ±3.0	77.7 [a] ±3.0	77.7 [a] ±3.1	77.7 [a] ±2.9	76.9 [b] ±3.4	P_I< 0.0001 P_G=0.974
Stunting (%)	29.9 [a]	30.1 [a]	32.8 [a]	24.4 [a]	39.3 [b]	P_I<0.0001 P_G=0.536
Weight 18 mo (kg)	9.29 [a] ±1.00	9.30 [a] ±1.09	9.29 [a] ±1.11	9.32 [a] ±1.05	9.02 [b] ±1.18	P_I< 0.0001 P_G=0.907
Wasting (%)	7.2 [b]	8.9 [ab]	13.2 [a]	5.4 [b]	13.5 [a]	P_I=0.0003 P_G=0.003

Same letters not significantly different
Adjusted for cluster randomization (village, concession), baseline value, age and potential co-variates, when applicable.

- **P_I :** for comparison between **intervention** and **non-intervention** cohorts
- **P_G :** for comparison among **4 intervention groups**

Results

Figure 2: Neurobehavioral development score in randomly selected sub-sample at 18 mo



Same letters not significantly different

Conclusion

SQ-LNS along with malaria and diarrhea treatment reduced stunting prevalence from 39% to 29%, decreased wasting and anemia prevalence and resulted in higher motor, language, and personal-social development scores compared with the non-intervention cohort.

Lack of impact on plasma zinc concentration suggests inadequate adherence to zinc tablet and/or inadequate absorption.

Unable to answer original research question on optimal dose of zinc because biochemical and functional responses to zinc were not detected.

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