Effectiveness of Micronutrient Powders (MNP) in women and children

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Abstract

Introduction: More than 3.5 [illegible] deficiency [illegible]. Many [illegible]. In the last decade [illegible]. We [illegible] Micronutrient Powders (MNP) [illegible] women and children.

Methods: We [illegible] November 2012 [illegible] MNP. We used a standardized abstraction and grading [illegible] the standard Child Health Epidemiology Reference Group (CHERG) rules.

Results: We included 17 studies in this review. MNP significantly reduced the prevalence of anemia by 34% (RR: 0.66, 95% CI: 0.57-0.77), iron deficiency anemia by 57% (RR: 0.43, 95% CI: 0.35-0.52) and retinol deficiency by 21% (RR: 0.79, 95% CI: 0.64, 0.98). It also significantly improved hemoglobin levels (SMD: 0.98, 95% CI: 0.55-1.40). [illegible] Overall, [illegible] MNP [illegible] (RR: 0.92, 95% CI: 0.81, 1.04), [illegible] (RR: 1.13, 95% CI: 0.91, 1.40), underweight (RR:0.96, 95% CI: 0.83, 1.10), HAZ (SMD: 0.04, 95% CI: -0.13, 0.22), [illegible] IDD. [illegible]

(VAD) affects at least 2.80 million preschool children in over 60 countries, and sub clinical VAD is considered a problem for at least 251 million that includes school-age children and pregnant women [8].

Micronutrients play a critical role in cellular and humoral immune responses, cellular signaling and function, learning and cognitive functions, work capacity, reproductive health and even in the evolution of microbial virulence [9,10]. Infants, children and pregnant women have high demands for vitamins and minerals because of increased growth and metabolic requirements and yet their dietary intake often fails to meet these requirements [3,11]. In children these micronutrient that is attributable to heterogeneity rather than to chance, a low p-value (less than 0.1) or a large chi-squared statistic relative to its degree of freedom and I^2

Table 2 Quality Assessment by Hematologic Outcome

		Quality Assessment				Summary of Findings		
				Directness		No of events		
No of studies	Design	Limitations	Consistency	Generalizability to population of interest	Generalizability to intervention of interest	Intervention	Control	RR / SMD (95% CI)
Anemia: Moderate outcome specific quality of evidence								
Eleven	RCT	Significant heterogeneity, random effect model used	Some studies suggest benefit	All studies were in developing countries	The duration of intervention ranged from 2-12 months and age of children from 6 months-10 years.	1081	1443	RR: 0.66 [0.57, 0.77]
Iron deficiency Anemia: Moderate outcome specific quality of evidence								
Seven studies ([illegible] data available)	RCT	Significant heterogeneity, random effect model used	Four studies suggest benefit	All studies were in developing countries	The duration of intervention ranged from 2-12 months	404	986	RR: 0.43 [0.35, 0.52]
Hemoglobin: Moderate outcome specific quality of evidence								
Fourteen studies (Fifteen data sets)	RCT	Significant heterogeneity, random effect model used	Nine studies suggest benefit	All studies were in developing countries	Studies ranged in duration from 2-12 months.	4571	3783	SMD: 0.98 [0.55, 0.40]
Serum Zinc: Moderate outcome specific quality of evidence								
Three	RCT	Significant heterogeneity was there, random effects model used	One study suggested benefit	All studies in developing countries	One study was conducted in clinic	761	788	SMD: -0.22 [-0.52, 0.09]
Serum Retinol: Moderate outcome specific quality of evidence								
Two	RCT	Significant heterogeneity was there, random effects model used	One study suggest benefit	Both studies from India	Study duration ranged from 6-8 months.	464	504	SMD: 1.66 [-1.60, 4.92]
Serum Ferritin: Moderate outcome specific quality of evidence								
Four	RCT	Significant heterogeneity, random effect model used	Three studies suggest benefit	All studies in developing countries	Studies ranged in duration from 6-12 months	850	884	SMD: 1.78 [-0.31, 3.88]
Zinc Deficiency: Moderate outcome specific quality of evidence								
Two	RCT	No significant heterogeneity, fixed effect model used	None of the studies suggest benefit	All studies were in developing countries	The study duration ranged from 6-8 months.	258	272	RR: 1.02 [0.87, 1.19]
Retinol Deficiency: Moderate outcome specific quality of evidence								
Three	RCT	No significant heterogeneity, fixed effect model used	None of the studies suggest benefit	All studies were in developing countries	The study duration ranged from 6-12 months.	111	145	RR: 0.79 [0.64, 0.98]

less than six years of age, except two studies [30,39] that included children over 6 years of age although the subgroup analysis for children under five did not show any difference in the findings. Clinical heterogeneity was observed due to variations in type of intervention (number of micronutrients used ranged from 3 to 15), duration of the intervention (2-24 months), target population and different time intervals for follow-up. All the MNPs used contained iron in their composition.

The intervention was mostly reported to be acceptable by the mothers and children and there was no major loss to follow-up reported due to the intervention in any of the included studies. There have been no adverse events identified by any study except one [38] that reported increased diarrhea in the intervention group compared to control.

This review shows that MNPs raise serum hemoglobin levels and reduce anemia significantly, but the evidence on growth is weak, as relatively few studies have evaluated

Table 3 Quality assessment by anthropometric and morbidity outcomes

Stunting: Moderate outcome specific quality of evidence								
[illegible]	RCT	[illegible]	[illegible]	[illegible]		810	838	RR: 0.92 [0.81, 1.04]
Wasting: Moderate outcome specific quality of evidence								
[illegible]	RCT	[illegible]	[illegible]	[illegible]		263	234	RR: 1.13 [0.91, 1.40]
Underweight: Moderate outcome specific quality of evidence								
[illegible]	RCT	[illegible]	[illegible]	[illegible]	[illegible] 3 [illegible] 4-12 [illegible]	671	679	RR: 0.96 [0.83, 1.10]
HAZ: Moderate outcome specific quality of evidence								
[illegible]	RCT	[illegible]	[illegible]	[illegible]	[illegible] 3 [illegible] 6-12 [illegible]	271	253	SMD: 0.04 [-0.13, 0.22]
WAZ: Moderate outcome specific quality of evidence								
[illegible]	RCT	[illegible]	[illegible]	[illegible]	[illegible] 3 [illegible] 6-12 [illegible]	271	253	SMD: 0.05 [-0.12, 0.23]
WHZ: Moderate outcome specific quality of evidence								
[illegible]	RCT	[illegible]	[illegible]					

Figure 3 [illegible] MNP [illegible]

this outcome. Improved hemoglobin and anemia status could be attributable to the iron component in all the MNPs used. Some studies have reported benefits on other developmental outcomes like walking by 12 months but not on growth [22]. This could be due to relatively shorter duration of the intervention to show actual long term impacts. These findings also suggest that multiple micronutrient interventions alone might not improve growth outcomes. To ensure long term impacts and sustainability, health education that aims to modify food habits would be necessary to improve child growth rates. Also, if the intervention initiation coincides with the child's diet transition from breast feeding to complementary feeding, the results may show improved growth.

The finding of significantly increased diarrhea is potentially alarming. It is mainly based on the significant increase in diarrhea observed in one large trial [38]. The association between increased diarrhea with iron supplementation is well recognized in the literature and is also reported in a review on iron supplementation by Gera [40]. However, our finding of excess morbidity and negligible growth benefit cannot be ignored in settings where large scale use of MNPs is being considered. The increased diarrhea burden could be one of the potential explanations for reduced growth benefits of MNPs.

The evidence is weak for any effect of MNPs on growth, as there were very few studies pooled for each outcome. More research is needed and studies need to report the outcomes of stunting, wasting, morbidity and mortality consistently to strengthen the evidence and evaluate its actual impact on growth and morbidity. A major research gap identified was that there were no studies evaluating the impact on women as all the studies targeted children only.

Conclusion

Our analysis of the effect of MNPs in children suggests benefit in improving anemia and hemoglobin however there is lack of impact on growth. Evidence of increased diarrhea requires careful consideration before recommending the intervention for implementation at scale.

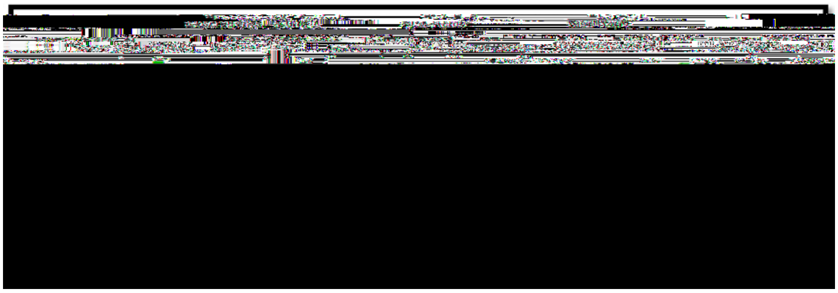

Figure 4 [illegible] MNP [illegible]