International Journal of Gastroenterology, Hepatology, Transplant & Nutrition

Original Article

Effectiveness of the sprinkles rich in amino acids and micronutrients (VIAMINOKID) to nutritional status and micronutrients of stunted children under 3 years old in Vietnam

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ABSTRACT

The study aimed to evaluate the effectiveness of the supplementation of VIAMINOKID (a product enriched with amino acids and micronutrients) on stunted children 12-47 months old in 2 communes (Bac Giang Provine) with following objective: To evaluate the effectiveness of VIAMINOKID on anthropometric índices, values of Hemoglobin, Ferritin, zinc, IGF-I, and IgA of stunted children 1 to 3 years old after 9 months of intervention (T9) and 6 months after the intervention completed (T15).

A community-based randomized controlled intervention trial was conducted in 180 stunted children from 12 to 47 months living in 2 communes of Luc Ngan district, Bac Giang province. The intervention last for 9 consecutive months; In the trial, the intervention group received 2 sachets of VIAMINOKID a day for 9 months.

The results showed that the supplementation of VIAMINOKID had improved anthropometric indices of stunted children. Stunting rate reduced significantly in intervention group compared to the control ($p<0.01$): 40% reduction in intervention group and 20% reduction in control group. The supplementation of VIAMINOKID had positive results on several blood and biochemical indicators of stunted children: anemia prevalence reduced significantly (reduced by 31.3 %; $p<0.05$) in intervention group compared to the baseline and the control group. Zinc deficiency prevalence reduced by 46.2 % in intervention group compared to 12.5 % of control group ($p<0.05$).

VIAMINOKID enriched with amino acids, vitamins and minerals is an effective product for the improvement of nutritional status, anemia rate, iron and zinc deficiency; growth and immune indices; reduction of infectious diseases. Therefore, VIAMINOKID is recommended for malnourished children in general and for stunted children in particular.

Key words: *gastric secretion, hypochloridria, proton pump inhibitors (PPI), ranitidine, children*

INTRODUCTION

Undernutrition in children is still an important challenge for public health and development in Asian countries, including Vietnam.[1,2,3] Malnutrition prevalence has been reduced significantly since the last decade; however, stunting prevalence is still at high level and varies greatly among ecological regions in Vietnam: Stunting rate was 43.3% in 2000 and reduced to 29.3% in 2010.[4,5] Micronutrient deficiencies (vitamin A, Iron, Zinc deficiencies) were the health problems among young children in Vietnam.[6] The roles of micronutrients have been emphasized more in the period of nutrition transition as in Vietnam.[5] The effectiveness of micronutrients supplementation has been documented.[6] The supplementation of sprinkles rich in amono acid and micronutrients (VIAMINOKID) to the stunted children was carried out to improve the height of Vietnamese children and reduce stunting rate.

METHODS

Study subject: Stunted children aged 12 to 47 months who live in Giap Son and Tan Hoa communes, Lục Ngan district, Bac Giang Province; healthy, their mother and family agreed to join the research. Exclusion: Children who are suffering from birth defects such as heart diseases, etc; children with severe anemia (Hb<7g/dL); severe malnutrition or overweight/ obesity (Growth Standards of the World Health Organization, 2006)

Research design: Community intervention with control group. Study subjects were randomized into 2 groups:

- Intervention group: the group of children eating normally at home, using VIAMINOKID sprinkles every day for 9 months.
- Control group: the group of children eating at home, and using placebo sprinkles in 9 months.

Sample size and sampling:

The formula for calculating the average sample size comparing 2 groups (7): $n = 2\{(Z\alpha + Z\beta)\delta / \Delta\}^2$

Estimate the difference between the control group and the experimental group on the index of Z-score: $\Delta = 0.5$ cm; $\delta = 0.95$; n = 76 children/group + 20% dropout and total children of 2 groups were 180 children.

Data collection and evaluation criteria:

a. At 4 times of investigation (the baseline survey (M0), after 5 months (M5) and after 9 months (M9), and 6 months after intervention) collected the following data:

- Gather the information through interviews: Interview mothers of children with pre-designed questionnaire to collect general information about families and eating habits, health status, knowledge and childcare practices.
- Nutritional status of the children through anthropometric data collection and classify children's nutritional status by Growth Standards of the WHO, 2006.[8] Underweight: weight for age Z-scores < -2; Stunting: height for age Z-score < -2.
- Micronutrient status by collecting serum sample and blood tests:
  + **Collect blood tests:** All the children were taken 2 ml venous blood in the morning of the investigation day. To determine the concentration of Hb, serum Ferritin, serum Zinc, IGF-I).
- Hb was determined by cyanomethemoglobin method, was measured at 540 nm wavelength by Spectrophotometer machine. Identifying anemia children aged 7-15 months when Hb< 110 g/L.
- Serum ferritin was determined by the enzyme-linked immune-sorbent assay (ELISA). Serum ferritin < 12ug/L as iron stores are depleted.
- The amount of serum Zinc was determined atomic absorption method. The index of lack of serum zinc is <10.7 umol/L.
- IGF-I was determined according to Chemiluminescence Immunoasay.

RESULT

The effectiveness of Vinaminokid to the anthropometric indicators (Z-score) and stunting rate.

Table I shows the W/A Z-score were improved significantly in intervention group, at the time after 5 months and especially after 9 months intervention is -1,65 ± 0,64 at the fifth month and is -1,55 ± 0,79 at the 9 month, higher than the beginning point (-1,78 ± 0,91, p<0,05) and lower compared to the control group (-1,88 ± 0,71 at the fifth month and -1,80 ± 0,64 at the ninth month; p<0,05).

The Height for Age Z-score was also higher than the beginning point and compared with the control group after 5 months and 9 months, with p<0.05 (Table I). The increased level of Z-score height for age of the intervention group was higher than the control group with the statistical significance (p<0,05) and this statistically significant increased levels maintain until the ninth month and the fifteenth month.

Table I: The changes in the W/A and H/A Z-scores of the intervention and the control group (mean ± SD)

Index	Time	The experimental group[#]	The control group[#]
Weight/ Age Z-score	M0	-1,84 ± 0,88	-1,78 ± 0,91
	M5	-1,88 ± 0,71	-1,65 ± 0,64[*,a]
	M9	-1,80 ± 0,64	-1,55 ± 0,79[*,b]
	M15	-1,73 ± 0,64	-1,57 ± 0,58[b]
Height/ Age Z-score	M0	-2,68 ± 0,54	-2,65 ± 0,53
	M5	-2,58 ± 0,56	-2,39 ± 0,60[*,a]
	M9	-2,46 ± 0,65	-2,30 ± 0,56[*,a]
	M15	-2,39 ± 0,58	-2,14 ± 0,51[*,b]

**, p< 0,05, comparing with the experimental group, t-test*
[a], p<0,05; [b], p<0,01; comparing pre and post intervention in the same group, paired t-test.#, n=80 (M0, M5, M9) và n=68 (M15)

Table II: The differences of stunting rates of the intervention and the control groups

Index	Time	The Control group [#]	The Intervention group [#]
Stunting rates (%)	M0	80 (100)	80 (100)
	M5	67 (83,8)	54 (67,5)[*,b]
	M9	64 (80,0)	48 (60,0)[**,b]
	M15	51 (75,0)	34 (50,0)[*,b]
	Real intervention effect at the ninth month		**20,0%**

**, p< 0,05, **, p<0,01 compared with the experimental group (χ2 test)*
[a], p<0,05; [b], p<0,01;compared with M0 (χ2 test)
#, n=80 (M0, M5, M9) and n=68 (M15)

Table II shows that the rate of stunting of the intervention group had decreased from 100% to 67.5% (M5), to 60.0% (M9) and dropped to 50.0% after 6 months of intervention; while the control group decreased from 100% to 83.8% (M5); 80.0% (M9) and 75.0% at the fifteenth month (decreased 25.0%); the intervention group had greater reduction of stunting compared to those of the control group ($p<0.05$) and still maintained the impact after intervention (M15).

The effectiveness of the product to the index of hematology and biochemistry

Table III: The differences of the biochemistric indices (Hb, Ferritin, Serum Zn, IGF-1 and IGA) between 2 groups

Index	time	The control group #	The Intervention group #
Hemoglobin (g/L)	M0	108,1 ± 11,6	108,8 ± 11,4
	M5	114,0 ± 11,8 [a]	117,7 ± 12,1 [a]
	M9	117,5 ± 10,7 [a]	123,4 ± 11,1 [*,b]
	M15	118,9 ± 10,4 [a]	120,8 ± 10,3 [b]
Ferritin (µg/L)	M0	41,3 ± 30,1	45,0 ± 32,5
	M9	43,7 ± 23,4	59,1 ± 36,0 [**,b]
	M15	48,9 ± 22,9	69,9 ± 38,9 [**,b]
Serum zinc (µmol/L)	M0	9,9 ± 1,9	9,8 ± 2,1
	M5	10,2 ± 2,2	11,4 ± 3,2 [**,b]
	M9	10,7 ± 2,0 [a]	12,0 ± 1,4 [**,b]
	M15	10,6 ± 2,4 [a]	11,3 ± 2,7 [b]
IGF-1 index (ng/mL)	M0	84,6 ± 37,6	81,9 ± 34,3
	M9	95,0 ± 25,4	110,0 ± 26,2 [*,a]
	M15	97,8 ± 27,4	116,4 ± 24,3 [a]
IgA index (mg/dL)	M0	80,6 ± 35,9	79,8 ± 33,7
	M5	83,7 ± 45,0	94,2 ± 41,8 [a]
	M9	81,9 ± 31,8	90,7 ± 29,5 [a]
	M15	86,2 ± 29,1	88,3 ± 34,6 [a]

**, p< 0,05, **,p<0,01 compared with the experimental group, t-test*

[a], p<0,05; [b], p<0,01; compared pre and post intervention in the same group, paired t-test

#, n=80 (M0, M5, M9) and n=68 (M15)

The results in Table III shows that after 5 months of intervention, the hemoglobin concentration, serum zinc had increased significantly in the intervention group compared with the baseline data ($p<0.05$); At the ninth month (M9), all the biochemical indices were checked, completed hemoglobin concentration, zinc, ferritin, IGF-1, IgA and serum albumin of the intervention group were significant increased compared with the baseline data ($p<0.05$); while in the control group, only Hb concentration and zinc level increased. At the fifth month (M15), the Hb concentration, serum zinc of the intervention group were higher than those of the control group ($p<0.05$).

Table IV: The changes in the rates of anemia, iron deficiency, zinc deficiency, low IGF-I; Low IgA of the intervention and the control groups (n,%)

Index	Time	The control group#	The intervention group#
Anemia (<110g/L)	M0	30 (37,5)	33 (41,3)
	M5	23 (28,8)	16 (20,0) [a]
	M9	16 (20,0)	8 (10,0) [*,a]
	M15	10 (14,7) [a]	8 (11,8) [a]
Zinc deficiency (<9,9 µmol/L)	M0	38 (47,5)	44 (55,0)
	M5	32 (40,0)	24 (30,0) [a]
	M9	28 (35,0)	7 (8,8) [*,a]
	M15	26 (38,2)	10 (14,7) [*,a]
Low IGF-I index (<50 ng/mL)	M0	20 (25,0)	19 (23,8)
	M9	12 (15,0)	6 (7,5) [a]
	M15	10 (14,7)	3 (4,4) [*,a]
Index IgA <70 mg/dL	M0	17 (21,3)	15 (18,8)
	M5	18 (22,5)	7 (8,8) [*,a]
	M9	12 (15,0)	3 (3,8) [*,a]
	M15	10 (14,7)	2 (2,9) [*,a]

** P <0.05 compared with the experimental group; [a,] p <0.05, compared with M0 □□ 2 test)*

#, N = 80 (M0, M5, M9) and n = 68 (M15)

Table IV shows that, after 5 months, and 9 months of intervention, the rates of anemia, iron deficiency, zinc deficiency, low IGF-1 and low IgA of the intervention group had significantly decreased comparing to baseline data and the control group ($p<0.05$). Up to ninth month (M9), the rate of anemia had decreased from 41,3% to 10%; zinc deficiency decreased 55% to 8.8%; While the prevalence of anemia was reduced less in control group (Anemia from 37.5% to 20% and Zn deficiency from 47.5% to 35%).

CONCLUSION

Supplementation of the sprinkles "VIAMINOKID" (rich in amino acids and micronutrients) for stunted children aged 12-47 months improved nutritional status (H/A and W/A Z-scores) and reduced stunting rates among intervention group (20% efficiency). The anemia prevalence of the intervention group was also reduced more compared to those of the control group ($p<0.05$).

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