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Nutritional evaluation of HIV positive and exposed children from the Takalik Abaj region of Guatemala

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ABSTRACT

As part of a feeding study undertaken in Retalhuleu, 6 HIV positive and 41 HIV exposed children 6-72 month of age in Coatepeque were nutritionally evaluated. Anthropometric and biomarker data were collected to calculate the prevalence of acute and chronic malnutrition, muscle mass depletion, chronic inflammation, anemia, and deficiency of iron, zinc, folic acid, vitamin B_{12} and iodine. Feeding patterns for children under 36 months were also established. The results revealed that 7.2% of the children presented acute malnutrition (WAZ <-1) and 53.6% had chronic malnutrition (HAZ <-1). Muscle mass depletion, using WHO standards for MUAC, was found in 33.2% and anemia in 20.3% of the children. Nutritional deficiencies were noted for serum folate (45%), erythrocyte folate (5.4%), vitamin B_{12} (8.7%), zinc (50%), iodine (41.3%) and iron (34.1%). The prevalence of chronic inflammation (AGP > 1g/L) was 11.3%. The feeding pattern of these children consisted of: corn tortilla, noodles, rice, oranges, bananas, sausage, chicken, eggs, black beans, sugar, water, coffee and natural beverages. In conclusion, HIV positive and exposed children in southwestern Guatemala are at high risk of developing malnutrition. Nutritional compromise may burden an already challenged immune system, decrease quality of life and decrease the likelihood of a favorable prognosis.

INTRODUCTION

The Takalik Abaj region in the southwestern part of Guatemala includes four departments that are part of the epidemiological corridor of Human Immunodeficiency Virus (HIV): Suchitepéquez, Retalhuleu and the coastal areas of San Marcos and Quetzaltenango. In this location, the prevalence of vertical transmission of HIV (4%) is more than 2 times higher than in the rest of the country (1.7%) [1]. Moreover, malnutrition in this region remains a problem of high concern (chronic malnutrition=54.0%, acute malnutrition=2.0%, anemia=44.4% and zinc deficiency = 44.4 %) [2-5].

A randomized controlled trial was designed to compare the effectiveness of two nutrition interventions in children from 6 to 72 months of age with malnutrition and exposed/positive for HIV through a community-based feeding program, where children are receiving a daily dose of an atole fortified with 21 vitamins and minerals (Chispuditos®) or an equivalent dose of lactose-free powdered milk. The results from the baseline data collection for this ongoing study are reported.

In addition to anthropometrics and biomarkers, a food frequency questionnaire was administered to parents or caretakers of the study participants that were from 6 to 36 months of age.

METHODS

This report presents the baseline results of a 24-month randomized control trial approved by the Ethics Committee of the University Francisco Marroquín. Nutritional screenings were conducted by measuring weight, height and mid-arm circumference following World Health Organization (WHO) guidelines. A total of 51 children from 6 to 72 months of age were included in this substudy. Inclusion criteria consisted of being positive for HIV infection and/or being born to seropositive woman, and having one or more indications of malnutrition (WHZ, WAZ, HAZ, MUAC Z scores <-1SD) at the time of screening. Most participants were referred from the HIV clinic at the Juan Jose Ortega Hospital with signed informed consent from mothers or caretakers. After the first screening process, 4 participants withdraw from the study.

Biochemical markers (serum zinc, serum ferritin, serum vitamin B12, serum folate, serum alpha-1-acid glycoprotein (AGP), erythrocyte folate, hemoglobin and urinary iodine) were taken and processed in the field following validated procedures and sent to the laboratories of the Institute of Nutrition of Central America and Panama (INCAP) and the University of Colorado for analysis. Hemoglobin was determined on whole blood by a local laboratory. Cutoff points for deficiency and marginal deficiency are shown in Table 1 [4, 8-9].

Table 1. Cutoff points for biomarker classification as "Deficiency" or "Marginal Deficiency"

Biomarker	Deficiency	Marginal Deficiency
Zinc	< 70 µg/dL	-
Vitamin B12	<148 pmol/L	148 - 221 pmol/L
Serum Folate	< 3 ŋg/mL	3 - 6 ŋg/mL
Erythrocyte folate	< 140 ŋg/mL	140 - 160 ŋg/mL
Ferritin	< 12 µg/L [1] - < 30 µg/L [2]	12-30 µg/L
Hemoglobin	<11.0 g/dL	
Iodine	< 20µg/L Severe, 20-49µg/L Moderate, 50-99 µg/L Mild	
[1]AGP≤1g/L, [2] AGP>1g/L		

To identify food consumption patterns of the participants, a food frequency questionnaire was applied to the children's caretakers to characterize dietary intake seven days prior to the survey. Foods were classified in groups as indicated by FANTA [10] and two more groups were added to classify the foods that were not in the protocol. The food products in groups 9 and 10 were considered either appropriate or inappropriate based on the nutritional content.

RESULTS

Table 2. Anthropometric Z-scores

Z Score Interval	% of Children			
	WHZ	HAZ	WAZ	MUAC
> +3.00	0.0	4.8	2.6	N/A
+2.00 to +3.00	9.8			
+1.00 to +1.99	70.7	4.8	47.3	68.3
-0.99 to +0.99	12.1	36.6	34.2	29.20
-1.99 to -1.00	4.8	19.5	15.8	2.4
-2.00 to -3.00	2.4	34.1	0.0	0.0

Weight-for-height (WHZ), Height-for-age (HAZ), Weight-for-age (WAZ) and Middle-Upper Arm Circumference (MUAC).

Table 3. Incidence of Nutritional Deficiencies

Biomarker	% of Children		
	Deficiency	Marginal Deficiency	n
Zinc	50.0	---	50
Vitamin B_{12}	8.7	21.7	46
Serum Folate	45.0	40.0	40
Erythrocyte folate	5.4	2.7	37
Ferritin	34.1	27.2	44
Hemoglobin	20.3		44
Iodine	41.3*	---	46

*Severe deficiency
Alfa-1-acid glycoprotein (AGP-1) was elevated >1.0 g/L in 11.3% of the individuals.

Tables 2 and 3 reflect the severity of the nutritional status of Guatemalan children exposed or positive for HIV infection. Historically, the Takalik Abaj region has not been prioritized in governmental public health or nutritional programs to address HIV or micronutrient deficiency.



Table 4. Food frequency consumption by age and food group.

FOOD GROUPS	Age Group in Months					
	6 to 12	13 to 18	19 to 24	25 to 30	31 to 36	>36
Grains, Roots or Tubers	-Tortilla	-Tortilla	-Tortilla	-Tortilla -Rice -Noodles	-Tortilla -Rice -Noodles	-Tortilla -Rice -Noodles
Other Fruits and Vegetables	*	-Orange -Banana	*	-Orange -Banana	-Orange -Banana	*
Meat, poultry, fish and seafood	*	*	*	-Boiled Chicken	- Cured meats -Boiled Chicken	- Cured meats -Boiled Chicken
Eggs	-Hen eggs	-Hen eggs	-Hen eggs	-Hen eggs	-Hen eggs	-Hen eggs
Legumes and dried fruit	*	*	-Beans	-Beans	-Beans	-Beans
Sugar	-Sugar	-Sugar	-Sugar	-Sugar	-Sugar	-Sugar
Not in IDDS grouping, considered appropriate	-Natural Juice -Water	Water	-Natural Juice -Water	-Natural Juice -Water	-Natural Juice -Water	Water
Not in IDDS grouping, considered inappropriate	-Canned Juices	*	*	-Coffee	*	*
*consumption was less than 3 times per week and/or foods were consumed by less than 75% of the participants.						

DISCUSSION

Children positive for HIV or at risk of vertical transmission are a particularly vulnerable population since the daily caloric and micronutrient requirements are higher than their HIV-negative counterparts [11]. Chronic diarrhea and opportunistic infections are frequent and can have a significant effect on their health. Malnourished children with HIV are at a higher risk of dying of severe acute malnutrition as opposed to HIV-negative children [12] which highlights the importance of early stage malnutrition detection and subsequent treatment as well as the implementation of preventive nutritional strategies in at risk populations.

Zinc deficiency was the most frequent (50%), followed closely by serum folate (45%) and iodine (41%) deficiencies. Folate and iodine are two micronutrients that are part of mass fortification strategies in Guatemala (salt is currently fortified with iodine and flour with folate, iron, niacin, and thiamine).

An interesting finding is the discrepancy between erythrocyte and serum folates. Erythrocyte folate deficiency was very low (~5%) as opposed to serum folate deficiency (45%). A possible explanation is that the abundance of green leafy vegetables is more abundant during the cold season, which was the trimester prior to the collection of samples.

Only 20% of the children were found to have low hemoglobin levels. This particular finding was surprising since low hemoglobin levels are often associated with the high prevalence of other micronutrient deficiencies that were observed in this population. The research team investigated possible reasons for this hemoglobin response and discovered that participants had received a 30mL bottle of ferrous sulfate at a concentration of 125mg/mL to be administered on a daily basis prior to the initiation of the study.

A positive finding was that participants were consuming eggs more than three times per week across all ages. Eggs are an excellent source of high biological value proteins and other micronutrients like choline and vitamin B12.

Chronic malnutrition is frequent among children from 6 months to 7 years of age and that are either HIV+ or have a clinical history of exposure to the virus in the Southwestern region in Guatemala. Table 2 shows that 34% of these children are stunted (HAZ≤-2).

CONCLUSIONS

- Children with HIV or with a history of exposure are not consuming an appropriate diet.
- High rates of chronic malnutrition and micronutrient deficiencies were common in this population.
- The food frequency questionnaire showed that for the most part diets were monotonous .
- Several nutrition opportunities were identified to target interventions that could improve this vulnerable population's nutrition. These include:
  - Developing education programs targeted to families and caretakers that promote adequate nutrition.
  - Improving complementary feeding practices by increasing age-appropriate foods and more diversity in the diet.
  - Incentivizing the consumption of animal products that are readily available in the region.
  - Developing partnerships with local stakeholders to help improve children's nutrition by providing free/low cost foods that are rich in nutrients and/or fortified foods as part of their multidisciplinary treatment.
- There is a need to pay closer attention to this vulnerable population and improve their nutrition to achieve better health outcomes, improve response to treatment, decrease comorbidities and increase survival. Findings on this study question the effectiveness of mass fortification strategies of salt and flour in this population.

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