

**REPORT OF THE 2004
INTERNATIONAL NUTRITIONAL
ANEMIA CONSULTATIVE GROUP
SYMPOSIUM**



**IRON DEFICIENCY
IN EARLY LIFE:
CHALLENGES AND
PROGRESS**

**LIMA, PERU
18 NOVEMBER 2004**

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18 NOVEMBER 2004**

**RAPORTEURS:
MS. HILARY CREED-KANASHIRO
MS. BOITSEPO GIYOSE**

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in May 2003. A baseline evaluation was conducted from April to June 2003 as part of the GOI/HKI-NSS Nutrition and Health Surveillance System, and the final evaluation was conducted in the same households June to July 2004. The total sample size at baseline was 600 households, of which approximately 75% could be revisited one year later. Distribution to warehouses started in May 2003, and from the surveys among the neighborhood stores it appears that full market saturation was reached in October 2004. Households thus consumed fortified sauce for 6 to 9 months before the end of the survey.

The consumption of soy sauce was found to be related to maternal education level, which is a good indicator of socioeconomic status. Those of higher socioeconomic status consumed more soy sauce from bottles. Even among the sachet users, it appears that those of lower socioeconomic status consumed less soy sauce than those from higher strata.

Comparison of anemia levels at baseline and at follow-up showed that among mothers who consumed 1.5 mL or more of soy sauce from sachets per day, anemia prevalence dropped from 36% to 20% ($p < 0.05$). Among the other groups that consumed less or no soy sauce from sachets, anemia prevalence remained stable at 10% to 25%. It was also found that the mothers who consumed at least 1.5 mL of soy sauce from sachets per day had the highest prevalence of anemia at baseline and were therefore most in need of fortification. It was found that the sachets were preferred by the poorer segments of the population who are most in need of iron fortification because of the higher anemia prevalence.

While an impact was found among mothers, no impact was found among children aged 12 to 59 months at baseline, which may be for two reasons. First of all, anemia prevalence among children decreased considerably over the follow-up period, which makes it less likely that a small additional effect of the fortified soy sauce could be detected. In addition, the consumption of soy sauce among children is lower than among adults because it is

added to the family meal, of which they consume a smaller share.

Note that an intake of 1.5 mL per adult per day is equivalent to one 16-mL sachet per household every other day (assuming 5 to 6 household members). The fact that EDTA enhances the absorption of other iron in a meal may be responsible for part of the observed effect.

Recommendations formulated by Dr. de Pee and her colleagues as a result of this study are:

- For young children, other strategies to reduce anemia, such as in-home fortification, need to be explored;
- Another iron-fortified soy sauce intervention study using different dosage levels of NaFeEDTA should be done to better understand the observed impact of this low dosage;
- Where the prevalence or risk of anemia among older children and adults is high, there should be a carefully controlled and rigorously monitored expansion of the fortification of soy sauce with NaFeEDTA.

Baobab Fruit Pulp (*Adansonia digitata L.*) Improves Iron Status in Nigerian Children

Dr. Ngozika Nnam, of the University of Nigeria, in Nsukka, Nigeria presented a study to show how the baobab fruit can be used to improve iron status in Nigerian children (Th90). In some regions of Nigeria, iron deficiency anemia rates in children are as high as 50%. About 90% of the total dietary supply of iron in Nigeria comes from plants, which contain non-heme iron that is poorly absorbed. There is a need for an intervention program in Nigeria promoting locally available foods within the reach of the communities to enhance bioavailability of dietary iron.

Baobab (*Adansonia digitata L.*) is a tree plant belonging to the family bombacaceae. The tree produces numerous fruits varying from ovoid to oblong and irregular in length

(up to 40 cm long in West Africa). The fruit is composed of a woody, very hard outer part (epicarp) and an inner part (endocarp), which constitutes the pulp of the fruit. When ripe, the inside of the fruit is dry and floury with numerous seeds embedded in the pulp, which has a whitish, powdery appearance. The fruit pulp is rich in ascorbate, containing 337 mg of vitamin C per 100 g of pulp (about six times the level in citrus fruit). The pulp is used to prepare a drink that is consumed either cold or hot or added to cereal porridges. The fruit is locally available in rural communities in Nigeria.

The objective of the study was to determine the effect of baobab leaf pulp on iron status in children using hemoglobin concentration and serum ferritin level as indicators. Three hundred schoolchildren 6 to 8 years of age were drawn by sampling from a rural community primary school and screened for the study; 142 children with hemoglobin levels less than 11 g/dL were selected. The children stayed in a metabolic unit at the University of Nigeria's Department of Home Science and Nutrition for the duration of the study. The 142 children were de-wormed and divided into equal groups of 71 children each. One group served as the control. The hemoglobin levels of each group were comparable. The test group was fed 250 mL of baobab fruit pulp drink (BFPD), which provided 60 mg ascorbate per day after a cereal/legume/vegetable-based meal for 3 months. The other group was fed the meal only. The hemoglobin and serum ferritin levels of both groups were estimated before and after the intervention period.

In reporting the results of the study, Dr. Nnam indicated that the intervention group had a mean hemoglobin of 10.85 g/dL (control group mean = 10.86 g/dL) at baseline and 65% had serum ferritin below 12 µg/L (control group = 68%). After 3 months of intervention with BFPD, the mean hemoglobin of the test group increased to 12.92 g/dL and 23% had serum ferritin below 12 µg/L. The control group had only a slight increase in hemoglobin (10.86 to 11.01 g/dL) and no change in serum ferritin.

The significant increase in hemoglobin of the children from 10.85 to 12.92 g/dL was indicative of improved iron status due most likely to the added BFPD in the diet. BFPD is high in ascorbate, which promotes absorption of iron, possibly by chelation or by reducing the iron to the ferrous state. The slight increase in mean hemoglobin of the control group was probably due to improved dietary habits during the experimental period.

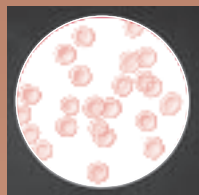
The decrease in the prevalence of children with serum ferritin below 12 µg/L (65% to 23%) showed that there was a significant improvement in the iron status of the children during the intervention with BFPD.

In conclusion, Dr. Nnam stated that baobab fruit is an inexpensive, natural, and nutritious source of vitamin C, which could be used to improve the iron status of children. The fruit pulp is locally available in rural communities and could be incorporated into many dishes to diversify and improve the bioavailability of iron.

A study conducted in Indonesia to investigate the effectiveness of consuming acceptable and affordable locally available meals rich in iron, especially heme-iron, from natural foods in improving the iron status of adolescent girls had a similar outcome as that of Dr. Nnam (Th30). The conclusion was that foods naturally rich in iron can contribute to reducing the prevalence of anemia among adolescent girls. It increased hemoglobin concentration and reduced the prevalence of anemia significantly.

Integrated Programming, Including Home-Based Fortification Using "Sprinkles" is an Effective Strategy for Addressing Anemia in Mongolian Children

Dr. Solongo Altangerel, of World Vision International, in Ulaanbaatar, Mongolia, opened her presentation by introducing the geographical and population landscape of Mongolia (Th91). In this landlocked country of 2.5 million inhabitants, the



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The ILSI Research Foundation's Human Nutrition Institute serves as the INACG Secretariat.



**BAOBAB FRUIT PULP
(ADANSONIA DIGITATA L)
IMPROVES IRON STATUS
IN NIGERIAN CHILDREN**

BY

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2004 INACG SYMPOSIUM, LIMA PERU, 18TH NOVEMBER 2004

AETIOLOGY OF IRON DEFICIENCY IN DEVELOPING COUNTRIES



- **POOR ABSORPTION OF DIETARY IRON**
- **LOW BIOAVAILABILITY OF IRON**
- **HIGH RELIANCE ON PLANT FOODS THAT CONTAIN NON HEAMIRON**

FACTORS FAVOURING IRON ABSORPTION



- **ACIDS (HCL, ASCORBATE, AMINO ACIDS)**
- **THE FORM OF IRON (FE²⁺)**
- **IRON DEFICIENCY**
- **INCREASED ERYTHROPOIESIS**

BAOBAB TREE (*ADANSONIA DIGITATA* L.)



- FOUND IN SOME AFRICAN COUNTRIES SOUTH OF SAHARA
- BELONGS TO THE FAMILY BOMBACACEAE
- BEARS NUMEROUS FRUITS

The Baobab Fruit



- ❖ Ovoid to oblong-cylindrical shape
- ❖ Irregular in length
- ❖ Woody, hardy
outer part-epicarp
- ❖ Inner part-
endocarp (pulp)

BAOBAB FRUIT PULP



- **DRY, WHITISH POWDERY APPEARANCE**
- **RICH IN ASCORBATE – 337 mg VIT C/100g PULP**
- **ABOUT 6 X HIGHER THAN THAT OF CITRUS FRUIT**
- **CHEAP AND LOCALLY AVAILABLE IN NIGERIA**
- **USED TO PREPARE REFRESHING DRINK**

OBJECTIVE OF THE STUDY

- **TO DETERMINE THE EFFECT OF BAOBAB LEAF PULP DRINK ON IRON STATUS OF CHILDREN USING:**
 - **HB CONCENTRATION**
 - **SERUM FERRITIN LEVEL**

METHODS

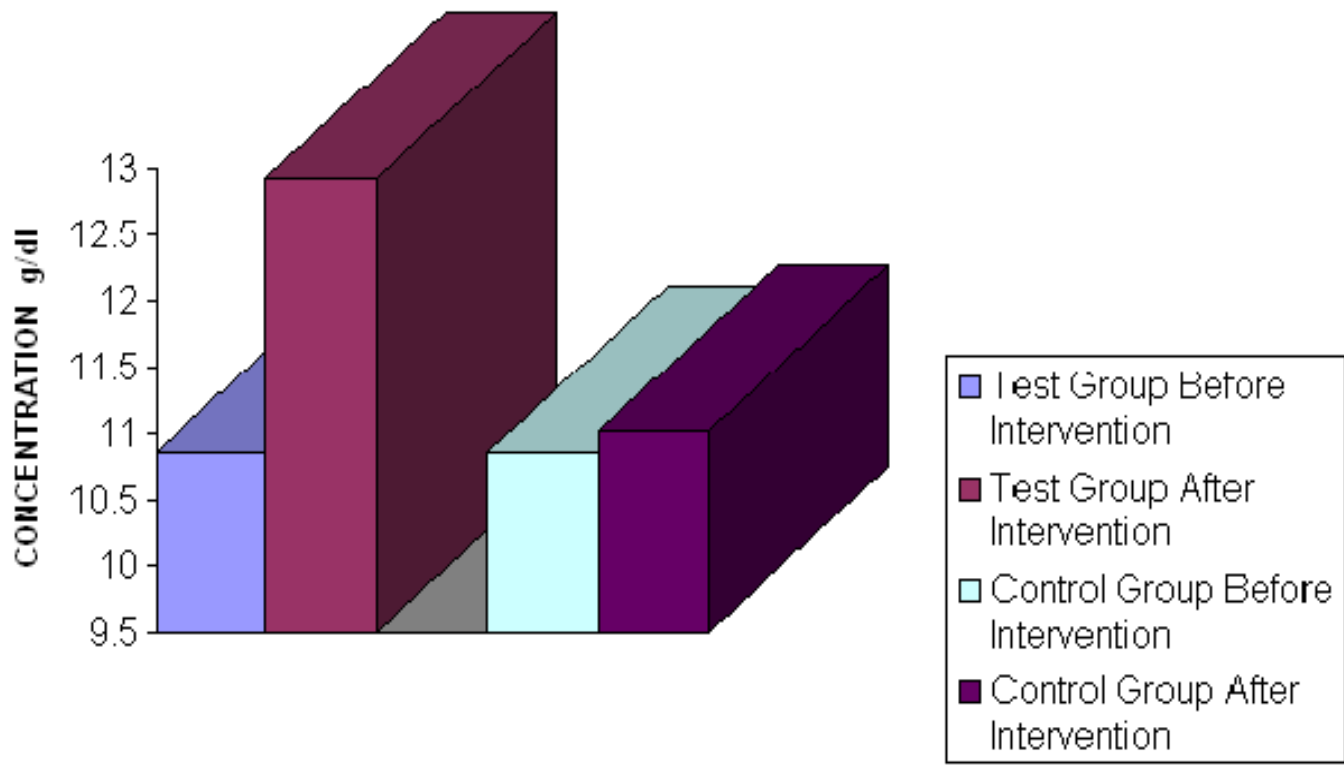


- **300 SCHOOL CHILDREN (6-8 YRS) SCREENED**
- **142 (HB < 11g/dl) WERE SELECTED & DEWORMED**
- **SUBJECTS WERE DIVIDED INTO 2 EQUAL GROUPS (CONTROL AND TEST GROUPS, N = 71)**
- **TEST GROUP FED CEREAL/LEGUME/VEGETABLE + 250 ml BAOBAB FRUIT PULP DRINK**
- **CONTROL GROUP FED CEREAL/LEGUME/VEGETABLE**
- **Hb AND SERUM FERRITIN OF BOTH GROUPS WERE ESTIMATED BEFORE AND AFTER THE STUDY**

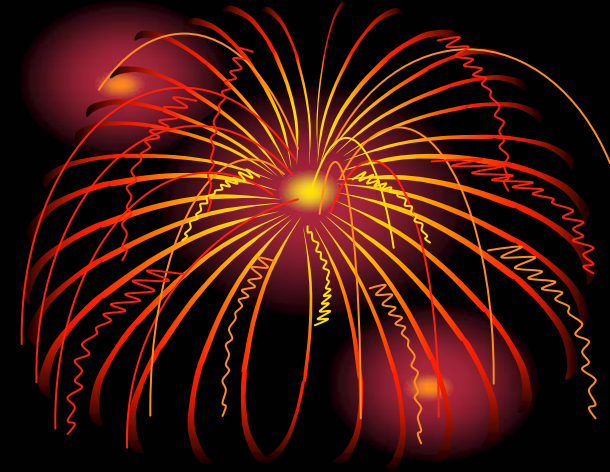
RESULT



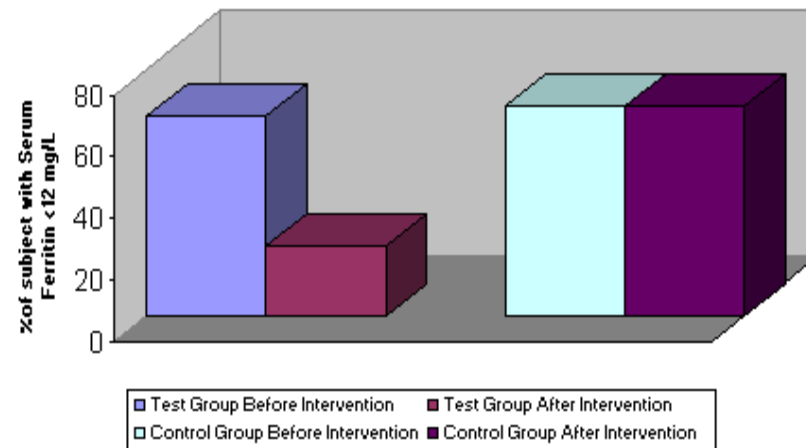
Hb CONCENTRATION



RESULT



Changes in Percentage of Children with Serum Ferritin < 12 mg/l



CONCLUSION



- **BAOBAB FRUIT PULP COULD BE INCORPORATED INTO MANY DISHES TO IMPROVE IRON ABSORPTION !!!**



Thanks for your time!

**I'm Sure It's Been a Very
Wonderful Time !!**