Improving Dietary Intake to Prevent Anemia in Adolescent Girls through Community Kitchens in a Periurban Population of Lima, Peru¹²³

Hilary M. Creed-Kanashiro,¹ Tula G. Uribe, Rosario M. Bartolini, Mary N. Fukumoto, Teresa T. López, Nelly M. Zavaleta and Margaret E. Bentley*

Instituto de Investigación Nutricional, Lima, Peru and *University of North Carolina, Chapel Hill, NC

ABSTRACT — Peru has high rates of iron deficiency anemia. The prevalence is 35% in nonpregnant women of fertile age and 24.7% in adolescent girls in slums of periurban Lima. The major cause of anemia is low intake of dietary iron. A community-based, randomized behavioral and dietary intervention trial was conducted to improve dietary iron intake and iron bioavailability of adolescent girls living in periurban areas of Lima, Peru. Results show that there was a change in knowledge about anemia and improved dietary iron intake in the 71 girls who completed the study compared with the 66 girls in the control group. Although the 9-mo intervention was not sufficient to improve hemoglobin levels significantly, there appeared to be a protective effect in maintaining the iron status of girls in comparison with the control group. J. Nutr. 130: 459S–461S, 2000.

KEY WORDS: • iron deficiency anemia • dietary iron • adolescents

Iron deficiency anemia is a common nutritional problem world-wide, particularly for women of reproductive age in developing countries. In pregnant women, severe anemia increases the risk of maternal and fetal morbidity and mortality, and the risk of premature delivery and low birth weight for the infant (Garn et al. 1981, Murphy et al. 1986). In adolescent girls, it can have an adverse effect on educational performance, productivity and well-being. Preventing iron deficiency and increasing iron stores in adolescent girls can improve their iron status in preparation for pregnancy and benefit their current health and well-being.

Peru has high rates of iron deficiency anemia. From a 1996 national survey, the prevalence in nonpregnant women of fertile age is 35% (Demographic and Health Surveys 1997). A study by Zavaleta (personal communication) found that 24.7% of adolescent girls from low income families participating in community kitchens in periurban Lima were anemic. In a second study (Zavaleta et al., 2000), the prevalence ranged from 9.9–12% in girls from four schools in Lima of different socioeconomic levels.

The major cause of anemia in this population is low dietary iron intake. Strategies for reducing anemia include supplementation, fortification and improving the diet. Stoltzfus (1993) postulated that improving iron bioavailability of diets may have a greater effect than increasing the total quantity of dietary iron consumed. In many developing countries, access to iron-rich foods and/or iron absorption-enhancing foods, such as fruits and vegetables is limited and other strategies are necessary. Although Peruvian diets are typically low in bioavailable iron, in periurban Lima, less expensive heme sources of iron (e.g., chicken offal, blood and fish), beans and sources of vitamin C are available throughout the year. Thus dietary modifications to improve iron status using locally available foods (Layrisse and García-Casal 1997) are possible.

This paper reports on a community-based, randomized behavioral and dietary intervention trial to improve dietary iron intake, iron bioavailability and iron status among adolescent girls in Lima, Peru. The intervention was conducted through local community kitchens (CK) in control and intervention periurban populations of Lima. Formative research assessment formed the basis of the intervention, which consisted of an educational campaign to improve the menus of the community kitchens to provide low cost heme iron sources and the promotion of dietary enhancers (i.e., vitamin C with the meal). The strategy also included motivating adolescent girls to understand their nutritional vulnerability and to improve their diets to benefit their health and well-being.

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To whom correspondence should be addressed.

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RESEARCH DESIGN AND METHODS

The study was a pre/post-comparison between intervention and control communities with similar demographic and socioeconomic characteristics, but geographically separated to prevent contamination of education messages. Eight communities were randomly selected and one CK randomly selected within each community. Adolescent girls were randomly selected from the lists of members and beneficiaries from each of the selected CK. Six adolescents were enrolled in each CK. Criteria for participation included being nonpregnant, nonlactating girls aged 12–17.9 y. Signed consent was given by each participant.

Girls (n = 72) were enrolled initially for the baseline evaluation in the intervention group and 66 in the control; of these, 71 and 50, respectively, accepted having their blood taken and were included in the cohort. In the final evaluation, six girls were lost to follow-up in the intervention group and eight from the control group.

In the formative research stage, in-depth interviews were conducted with 16 girls (two randomly selected from each of the CK) on topics relating to their perceptions of food and nutrition, health and anemia. The interviews were recorded and the expanded notes analyzed by topic using DrSearch software (Arlington VA).

On the basis of the results of the formative research, an educational campaign was designed and implemented for a period of 9 mo; the intervention consisted of participatory training sessions with the adolescent girls and the CK leaders. Iron-rich menus were developed with the CK members. During the first 5 mo, increased accessibility to less expensive sources of heme iron (chicken liver and blood) was facilitated at cost price from a commercial chicken producer. Educational materials included an attractive school folder, pencil case and T-shirt for the adolescents, promoting the relationship between consuming iron-rich foods and iron enhancers and school performance. Posters, recipe booklets and a mobile promoting iron-rich foods were materials used in the CK.

The effect of the intervention was evaluated by estimating dietary intake before and after the education intervention using a quantitative dietary 24-h recall methodology conducted on two successive days by trained nutritionists. The evaluation was conducted during the months of June to August 1996 before the intervention and in the same months in 1997 after the intervention to ensure similar seasonal food availability. Food intake was converted to nutrients using Peruvian food composition tables (Instituto de Investigación Nutricional 1998) and including food composition data from other Latin American and United States tables where necessary. Mean intakes were calculated by averaging the nutrient intake for two consecutive days for each girl and then calculating the mean for all girls in each study group.

Bioavailable dietary iron was calculated using the algorithm of Tseng et al. (1997) in which absorbable iron is calculated for each meal. Heme iron absorption was assumed to be 25%, due to the presence of iron deficiency in this population. An adaptation of the formula of Tseng et al. (1997) was used for calculating the bioavailability of nonheme iron, including enhancer factors, ascorbic acid and flesh food protein, and tea and infusions as an inhibitor factor. The inhibiting potential of phytate was not included in the calculation because of the lack of available data from local food tables.

Iron status was evaluated by blood hemoglobin (Hb) and serum ferritin (SF). Hb was analyzed using the cyanomet-hemoglobin method. SF was measured according to the RIA method (double antibody Ferritin $^{125}$I RIA) using a commercial kit. The use of this method for serum was compared with ELISA from a subsample of nine adolescent girls, yielding a correlation of $R^2 = 0.997$. Anemia in girls was defined as Hb <120 g/L and iron deficiency as SF levels <12.0 µg/L.

Socioeconomic characteristics, knowledge and exposure to the campaign were evaluated by questionnaire. Heights and weights were obtained before and after the intervention. Descriptive statistics were calculated for each variable for baseline and postintervention data, and comparisons made between study groups. Paired comparisons were made between pre-and postintervention data for each study group. The Mann-Whitney nonparametric test was used to test the hypothesis that the medians of the variables of interest between independent groups were different. The Wilcoxon test was used for paired comparisons in which the variables did not have a normal distribution.

RESULTS

A majority of the girls stated that anemia is associated with (9 girls) a poor diet (9), poor quality of diet or lack of vitamins (1), inadequate amounts consumed and not keeping to meals (3). Symptoms of anemia are not clearly identified by the girls. "Paleness" was most mentioned, although other girls associated anemia with "weakness," tiredness, thirst, vomiting, excessive perspiration and body aches. Anemia was not mentioned as being related specifically to blood, but rather to a general state of the body. The principal treatment of anemia was to improve the diet by eating good foods "containing vitamins," keeping to mealtimes, and eating foods considered specifically "good for anemia" such as liver, spleen and beetroot (the red color was associated with the blood). Diet, considered a "natural" treatment, was perceived to be "better" than the clinical treatments such as use of vitamins or tonics.

Foods were selected for promotion on the basis of availability, accessibility, acceptability, and cost-nutritional benefit. The "best buys" for iron included blood, spleen, beans and liver. For vitamin C, the "best buys" included oranges, papaya, cabbage, mandarin orange and lemon.

As a result of a behavioral analysis, in which each behavior was evaluated for potential nutritional effect and feasibility of adoption, the primary dietary recommendations selected for the intervention were to increase heme iron food sources in stews prepared in the CK and increase consumption of vitamin C–rich salads and/or drinks with meals containing nonheme iron sources (mostly beans).

No differences were found between the intervention and control groups at baseline on sociodemographic characteristics or dietary intake. Knowledge regarding what foods to eat to improve iron status was higher in the intervention group, particularly with respect to key messages referring to the timely preparation of vitamin C–containing drinks and salads and their consumption with beans at meal times.

Total daily iron intake increased significantly in the intervention group ($P < 0.01$) from 7.75 ± 3.5 to 9.42 ± 5.0 mg/d after the campaign, whereas in the control group there was no change (Fig. 1). Interestingly, intake of heme iron tripled in the intervention group, from 0.21 ± 0.17 to 0.66 ± 1.35 mg/d, and was significantly higher than that of the control group after the campaign (Fig. 2). There was also a significant increase in total ascorbic acid intake from 44 ± 39.6 to 67 ± 45 mg/d in the intervention group, with no change in the control group (41 ± 34.6 pre and 40 ± 27.6 mg/d post). There was a small but significant increase in absorbable iron intake (Fig. 3) in the intervention group, from 0.33 ± 0.16 pre to
The campaign in intervention and control communities. *P < 0.01 for pre- vs. postintervention in intervention group.

FIGURE 1 Total dietary iron intake (mg/d; mean ± sd) before and after the campaign in intervention and control communities. *P < 0.01 for pre- vs. postintervention in intervention group.

There was no significant change in anemia prevalence among the girls in the intervention group (pre 14.1%, post 12.3%), although there was a large and significant (P < 0.01) increase in the control group between baseline and final evaluations (pre 14%, post 37.5%). A similar effect in iron deficiency as measured by SF was also demonstrated, in which a small but nonsignificant reduction was observed in the intervention community (pre 21.1%, post 18.5%) and a tendency to increase in the control community (pre 14%, post 25%).

FIGURE 2 Dietary hemoglobin (mg/d; mean ± sd) before and after the campaign in intervention and control communities. *P < 0.01 for pre- vs. postintervention in intervention group; **P < 0.05 postintervention for intervention vs. control.

The 9-mo intervention period was not sufficient to improve hemoglobin levels significantly. Nevertheless, there appeared to be a protective effect from the intervention in maintaining the iron status of the girls in comparison with the control group.

This study shows that dietary change to improve iron intake is possible in this sample of adolescent girls. A multidietsary strategy using an educational campaign combined with identifying and promoting best buys for iron is required to increase consumption of animal sources of iron and vegetables sources with iron absorption enhancers such as vitamin C. These strategies are potentially applicable in urban populations such as Lima where 70% of the country's population is located and access to a variety of cheaper sources of these nutrients is possible. The results from this study with the adolescent girls were extremely encouraging. The education, campaign and materials used captured the girls’ interest and stimulated their motivation to influence their health, nutrition and diet. The potential of applying this experience through schools and other organizations reaching adolescent girls provides an exciting and feasible opportunity.

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LITERATURE CITED


