ABSTRACT

In developing nations, infant foods often have low iron bioavailability. We developed & tested infant porridges with lyophilized meat powder & fortified foods via 1) ingredient-screening for cultural appropriateness (recipe trials with Peruvian mothers) & in vitro iron bioavailability for flour combined with chicken liver, & 2) acceptability testing with mothers & infants. Flour combined with chicken liver & fortified wheat flour increased iron bioavailability more than flour alone (P<0.05). Vitamin A content of chicken liver powder approached infant Tolerable Upper Intake Level (UL). Mothers' acceptability scores of porridges were acceptable/marginally acceptable; no pesticide residues were detected. With respect to iron bioavailability, we tested three porridges: no-meat, chicken thigh (3 g of meat powder), and chicken liver (1 g of meat powder). Compared to the no-meat porridge, the chicken thigh porridge had more bioavailable iron (P=0.01), whereas the chicken liver porridge was the same (P>0.05). The chicken thigh porridge had higher Caco-2 cell ferritin formation than the liver porridge. Methods and results: To increase infants' iron intake, we produce an infant food that combines lyophilized chicken powder with fortified wheat flour and iron-fortified foods. Developed iso-caloric recipes for meat contributes nutrients often limiting in the diets of infants in developing countries: iron, zinc, vitamin B12. Peruvian infants consume meat and iron-fortified foods. Therefore, to increase infants' iron intake, produce an infant food that combines lyophilized chicken powder with an iron-fortified meal.

METHODS AND RESULTS (continued)

1. Develop the concept

Lyophilized beef powder added to a FeSO₄-fortified whole wheat gruel increased by 85% the absorption of non-heme iron (Hallberg et al., Pediatrics 2003). Meat contributes nutrients often limiting in the diets of infants in developing countries: iron, zinc, vitamin B12. Peruvian infants consume meat and iron-fortified foods. Therefore, to increase infants’ iron intake, produce an infant food that combines lyophilized chicken powder with an iron-fortified meal.

2. Screen ingredients

Based on -Cultural acceptability (via recipe-creation exercises) -Price (via market survey) -In vitro iron bioavailability (via in vitro digestion / Caco-2 cell method)

Selected as the principal ingredients -Fortified wheat flour -Chicken liver -Chicken thigh

METHODS AND RESULTS (continued)

3. Create and test acceptability of porridges

A. Recipe-creation Exercises

Objective: Create palatable recipes that combine lyophilized chicken powder with fortified wheat flour

Convenience sample: 21 women of infants <12 months

Findings:

- More milk helps mask taste of meat
- Developed iso-caloric recipes for

B. Maternal Acceptability

Objective: Determine porridge acceptability using sensory methods

Sample: 90 women with infants 5-11 months

Method: Scored porridges for smell, color, taste, texture, consistency and overall

C. Infant Acceptability

Objective: Assess acceptability based on in-home intake of porridges (3 porridges X 3 days each)

Sample: 53 mother-infant pairs (age 6-9 months)

Intake adjusted for:

- Time since last food/drink/breastfeed
- Infant's appetite
- Infant’s age
- Infant had previously eaten meal

SUMMARY

- Using laboratory- and field-based methods, we developed
  -Safe porridges with culturally appropriate ingredients for Peruvian infants
  - Meat-containing porridges that were more acceptable to infants than mothers
  -Porridges with less chicken powder and iron concentration than hoped
  - A chicken thigh porridge with more bioavailable iron than the no-meat porridge due to an enhancing effect of the thigh
  - A chicken liver porridge with comparable iron bioavailability as the no-meat porridge

CONCLUSIONS

- Maternal acceptability does not predict infant acceptability of food
- The chicken thigh porridge can provide more bioavailable iron to infants’ diets
- Addition of liver to the liver porridge may increase its bioavailable iron

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REFERENCES

Hallberg et al., Pediatrics 2003

METHODS AND RESULTS (continued)

4. Evaluate safety of porridges

Objective: Evaluate the safety of the porridges and their ingredients

Methods: Presence of pesticide residues (Covance Lab, Inc.) and microbiological quality (IIN laboratory)

Results:

- Organochlorinated and organophosphates: Not detected
- Microbiological quality (IIN laboratory)

5. Assess in vitro iron bioavailability of porridges

METHODS AND RESULTS (continued)

Iron Concentration (mg/100 g Cooked Porridge)

Table 1: Iron concentration of selected porridges

No meat Thigh low Thigh high Liver low Liver high

Flour 9 7 7 8 8
Brown sugar 6 7 7.5 7.2 7.7
Vanilla powder 0.02 0.04 0.06 0.06 0.08

In vitro digestion / Caco-2 cell method

Figure: A. Compared to the no-meat porridge, the chicken thigh porridge had more bioavailable iron, whereas the chicken liver porridge was comparable. B. More cell ferritin was formed per unit iron for the chicken thigh porridge compared to the no-meat and liver porridges.