

THERE'S IRON IN BREAKFAST CEREAL?

Background

It's true! Breakfast cereals may be fortified with a variety of vitamins and minerals to ensure a completely balanced nutritional meal. In general, a **fortified food** contains ingredient(s) that are not normally found in that food in order to achieve a particular dietary purpose. For example, salt is fortified with iodine (or iodized) in order to prevent goiter. Foods are fortified with iron because it is considered an essential ingredient of the daily diet which must be present for the body to function properly. Approximately 60-70% of the human body's iron is found in hemoglobin, a protein in the blood that transports oxygen. Iron is also present in muscle tissue and some enzymes.

Breakfast cereals are an important source of iron in our diet; in fact, in 1999, Americans consumed an average of 23.6 mg of iron per day, with 53% coming from grains and breakfast cereals. The recommended daily allowance (RDAs) of iron depends on the age and sex of an individual because certain populations require higher amounts of iron, such as children, women before menopause, and pregnant or nursing women. For example, the RDA is 15 mg/day for females age 14-18 and 11 mg/day for males age 14-18. The Daily Value for iron (the value listed on the cereal box) is 18 mg per day. This number is a reference number developed by the Food and Drug Administration (FDA) to help consumers determine if a food contains a lot or a little of a specific nutrient.

Iron can be added to breakfast cereals in several food-grade forms. Some cereal manufacturers prefer to add particles of pure iron metal (called elemental iron or reduced iron) because elemental iron is stable in storage and does not affect the cereal's flavor. Not all cereals contain the same amount of iron, and this information can be found on the Nutrition Facts panel. To fortify a breakfast cereal, the iron, along with other vitamins and minerals, is first mixed in with the grains, salt, water and, if applicable, other flavoring agents and/or sweeteners. This mixture is then cooked. To create flakes, the cooked grains are flattened between rollers under tons of pressure. Once the flakes are made, the iron is well incorporated into the product and cannot be seen by the consumer.



References

- Federal Studies. 2002. Family Economics & Nutrition Review. 41(2): 90.
- Belitz, HD and Grosch, W. 1999. Food Chemistry. Berlin: Springer. 992 pgs.
- Himich Feeland-Graves, J and Peckham, GC. 1996. Foundations of Food Preparation. 6th ed. Englewood Cliffs: Prentice Hall. 750 pgs.
- JCE Editorial Staff. 2004. A Magnetic Meal. Journal of Chemical Education. 81: 1584A.

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Administrator's Guide

PLEASE NOTE: *The cereal slurry should not be consumed.*

Grade levels: 3-12

Estimated Preparation Time: 30 minutes

Estimated Demonstration Time: 30 minutes

Standard Addressed: Content Standard C (The Cell)

Most cell functions involve chemical reactions. Food molecules taken into cells react to provide the chemical constituents needed to synthesize other molecules. Both breakdown and synthesis are made possible by a large set of protein catalysts, called enzymes. The breakdown of some of the food molecules enables the cell to store energy in specific chemicals that are used to carry out the many functions of the cell.

Reference:

JCE Editorial Staff. 2004. A Magnetic Meal. *Journal of Chemical Education*. 81: 1584A.

Objective:

- To demonstrate iron fortification of breakfast cereals

Materials:

- 1 box iron fortified cereal (Total[®] cereal, which contains 100% of the daily value per serving, works best)
- Plastic bags
- Water (warm, if possible)
- Strong magnet
 - Large white stir bar (70 mm) and stir bar retriever rod OR
 - Large neodymium magnet (can be purchased individually from www.stevespanglerscience.com)

Procedures:

1. Pour 1 cup of cereal into a plastic bag and crush the cereal using your hands or a mallet. The cereal can also be crushed using a mortar and pestle, if available.

2. Pour the crushed cereal into a second plastic bag. Fill the bag at least half full with water (warm water will speed up the process). Carefully seal the bag, leaving an air pocket inside.
 3. Mix the cereal and the water by gently shaking the bag until the contents become a brown, soupy mixture.
 4. If time allows, let the bag sit for 30 minutes to an hour.
 5. Open the plastic bag and drop in the large white stir bar. Allow the stir bar to sit in the bag for 2 minutes. Remove the stir bar using the stir bar retriever rod. The iron should be attached to the stir bar.
- OR
6. Place the large neodymium magnet on the outside of the plastic bag. Look closely at the edge of the magnet; you should see tiny black specks on the inside of the bag around the edges of the magnet.



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Student Handout

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Discussion Questions:

1. What happened when the magnet came in contact with the cereal?

2. If iron was present, why don't you normally see it when you eat cereal?

