Incorporating White Whole Wheat Flour into Traditional Grain Foods in an Elementary School Cafeteria

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Abstract

The introduction of whole grain flour into familiar grain products such as pizza, buns and tortillas may increase whole grain and dietary fiber consumption among children in school foodservice settings. The purpose of this study was to determine whether elementary school-aged children (1st-6th grades) will have an equivalent intake of grain products made with Ultragrain® white whole wheat flour (white WWF) compared to products made entirely with refined wheat flour (RWF).

Partial whole grain pizza crust was a 50/50 blend of white WWF and RWF (16 g white WWF per serving). The control pizza crust was made with enriched RWF. With the exception of flour type and content, similar ingredients and procedures were used to prepare the pizza products.

Baseline pizza consumption was established by serving pizza with RWF crust on the cafeteria line at weeks –2 and 0. Pizza with white WWF crust was served as a component of cafeteria lunches on four occasions during a 6-week period. Wraps, bread sticks, dinner rolls and pastas containing different types and amounts of whole grain flours were also served periodically. Grain product consumption was estimated indirectly by measuring grain food taken or served and the amount left on the trays (plate waste): e.g. pizza taken/served – pizza plate waste = pizza consumption.

- The mean sample size was ~350 children per meal.
- Consumption of pizza with white WWF crust (70%) was similar to pizza with RWF crust (72%).
- Consumption of fajita wraps made with white WWF was 64% while consumption of fajita wraps made with RWF was 58%.
- Consumption was 85% for white WWF bread sticks, 73% for RWF breadsticks, and 57% for red WWF bread sticks.

These data indicate that elementary school-aged children consumed grain products made with white WWF at a similar level as those made with traditional RWF. Because a large proportion of US children eat school meals, the use of white WWF in grain products served in school meals could make a substantial contribution to increasing the overall whole grain intake by children.

Purpose

The purpose of this study was to determine whether elementary school-aged students will have an equivalent intake of pizza / other grain foods made with whole white wheat as compared to pizza / other grain foods made with refined all-purpose flour.

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Methods

Subjects / School setting

Children were in the 1st - 6th grades from the Eisenhower Elementary School in Hopkins,MN. This is the largest of seven elementary schools in the district. In the 2003-2004 school year, total enrollment was 680 children with minority enrollment ranging from 25%-37% for children in grades K-6. This school has a wide range of socioeconomic levels with 22% of students qualifying for the federal free/reduced lunch program. About 100 students are in half-day kindergarten and do not eat meals at school. Another 50 bring a bagged lunch from home, resulting in about 550 meals served per day.

Products

The products and specified level of white whole wheat (Ultragrain®, ConAgra Foods, Omaha, NE) flour:

- ***Refined grain pizza –*** Contains 0% whole grain flour and 100% refined grain flour
- ***~50% whole grain pizza –*** Contains a blend of 50% whole white wheat flour and 50% refined grain flour (16 g WG flour in finished product).
- ***Fajitas, bread sticks, dinner rolls and buns –*** were made with either 0% whole grain flour or ~50% white whole white wheat (Ultragrain®) flour

With the exception of whole grain flour content, ingredients and procedures were used to optimize the product.

White Wheat Dinner Rolls

The Max Pizza

Red White Wheat Subway Bun

Intervention

Pizza dough (crust) containing white whole wheat flour content (***~50% whole grain pizza***) was introduced into lunch meals 4 times (weeks 2, 4, 6, 8) during an 8-week period (Table 1). Baseline consumption was established by serving ***Refined grain pizza*** at weeks –2 and 0. Pizza was served with various menus without the option of choosing a refined grain alternative. If allowed a choice, children may opt not to try the modified product.

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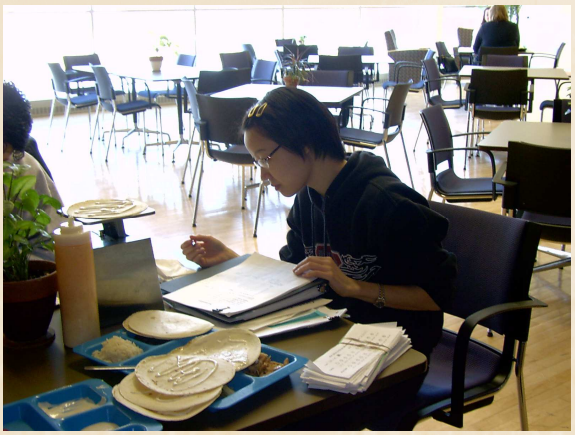
Table 1. Protocol for white whole wheat flour used in pizza as measured by plate waste and sensory testing.

Week	WG* (%)	WG* Servings	Menu Analysis	Plate Waste (%)
-2	0	0	X	X
0	0	0	X	X
2	50	1	X	X
4	50	1	X	X
6	50	1	X	X
8	50	1	X	X

*WG-whole grain, RG- refined grain, Ratio of WG/RG = % whole grain flour content



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Measurement of consumption of modified products

The consumption of pizza / other grain foods was measured each time the products were served. A research assistant tallied the number of sandwich buns or dinner rolls served as children left the cafeteria line by visual observation. Weights of 10 randomly selected food items were determined and used to calculate the total weight of food items served (total number products served is multiplied by mean weight/item).

Plate waste was measured by the actual physical weighing of the returned edible food items . As children returned meal trays, a research assistant placed grain waste in plastic bags according to grade. The bags were weighed and corrected for bag weight to determine plate waste. Consumption was represented as the total weight of food items served minus plate waste. Initial training sessions were conducted with research assistants to assure accuracy of the measurement of plate waste based on both accurate counting of the number of products served and accurate collection of waste from meal trays. Accuracy was monitored regularly throughout the data collection process by having independent observers verify numbers of items served and that all waste was collected.

Results

Table 2. Mean plate waste for grain foods made with refined, white and red whole wheat.

Date	Type	# of Items Served	% PW	Mean %
Pizza				
Feb. 7	White refined	313	24.27	28.00
Feb. 22	White refined	344	31.72	
Mar. 7	Whole grain W	374	27.97	29.75
Mar. 21	Whole grain W	380	27.07	
Apr. 4	Whole grain W	348	34.58	
Apr. 18	Whole grain W	334	29.46	
Fajita				
Feb. 17	White refined	224	41.82	
Apr. 21	Whole grain W	245	36.32	
Bread Stick				
Feb. 17	White refined	205	27.16	
Mar. 1	Whole grain R	279	45.90	43.26
Mar. 8	Whole grain R	162	40.62	
Apr. 12	Whole Grain W	217	15.37	

- W – white
- R – red
- PW - plate waste

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Results, Continued

Table 2. Mean plate waste for grain foods made with refined, white and red whole wheat.

Date	Type	# of Items Served	% PW	Mean %
Dinner Roll				
Feb. 16	White refined	203	31.21	
Mar. 2	Whole grain R	116	59.31	
Mar. 16	Whole grain W	191	42.15	35.78
Apr. 6	Whole grain W	199	29.32	
Apr. 27	Whole grain W	149	35.88	

- W – white
- R – red
- PW - plate waste

Table 3. Mean plate waste by grain flour type

Grain Flour Type	Classes	Mean	SD
Refined Wheat	64	33.73	13.76
White Whole Wheat	120	33.60	14.92
Red Whole Wheat	53	44.72	23.19

*significantly different ($p<0.002$)

Conclusions

The study indicates that children in this elementary school consumed grain foods made with white whole wheat flour at similar levels as those made with traditional refined wheat flour.

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