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RESEARCH

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Acceptance of Two US Department of Agriculture Commodity Whole-Grain Products: A School-Based Study in Texas and Minnesota

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ABSTRACT

Whole-grain intake among children and adolescents is below national recommendations, prompting efforts to increase intake in schools. The purpose of this study was to compare the acceptance of whole-grain pancakes and tortillas to refined grain counterparts when served as part of the school meal. Data were collected at 10 schools in Minnesota and seven schools in Texas during the Spring and Fall semesters of 2009. Three pancake and two tortilla products of varying red or white whole-wheat flour content were each served an average of four times per school. Aggregate plate waste was collected and percent consumption used to assess acceptance. Students rated each product on overall liking, taste, color, and softness on 5-point (elementary schools) or 9-point hedonic scales (middle and high schools). Analysis of covariance was used to compare intake and rating scores of all products. For all children, intake of whole-grain products was substantial (percent consumption ranging from 67% to 75%). No differences were noted in consumption of whole-wheat pancakes compared to refined wheat pancakes, while consumption of whole-wheat tortillas was lower than refined products. In elementary schools, overall liking scores of pancakes made with red whole-wheat and both types of whole-wheat tortillas were lower than refined products. However, in middle and high schools, overall liking scores of 100% red whole-wheat pancakes and 66% white whole-wheat tortillas were similar to refined products. Substituting refined grain with whole-grain options represents a viable approach to increasing consumption of whole-grain products in schools.

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Diets high in whole grains are associated with reduced risk of chronic disease (1-3). The 2010 Dietary Guidelines for Americans recommend that three whole-grain servings be consumed daily (4). However, most children and adolescents do not consume the recommended daily servings (5,6). National Health and Nutrition Examination Survey data (1999-2004) indicated that children and adolescents ate 0.59 to 0.63 mean daily servings of whole grains, which is far below the recommended amounts (7). Only about 4% ate three daily servings, while 45% did not consume whole grains on the recall days.

Preference is a key factor affecting food selection and intake among children and adolescents (8-10). Adults commonly believe that children prefer foods made with refined grains over whole grains (11,12). As children have an innate dislike of foods that are bitter (13,14), the bitter taste of foods made with whole-wheat flour is thought to explain the low preference for whole-grain foods. School foodservice personnel suggested that darker color and coarser texture were also barriers to whole-grain intake among school children (15). The lighter color of white whole-wheat flour could increase acceptability of whole-grain products among children. Lukow and colleagues (16) reported that children preferred the appearance and taste of bread made with white whole wheat over red whole wheat. However, studies that examine effects of sensory attributes on whole-grain intake in children are currently lacking.

Schools are an important setting for efforts to increase whole-grain intake because children and adolescents obtain a large proportion of daily calories from school meals (17). However, availability of whole-grain foods for school

meals is limited in some areas of the United States (18,19). Data from the third School Nutrition and Dietary Assessment indicated that of the schools surveyed, only 5% served whole-grain breads and rolls during lunch (18). Increasing whole grains in school meals is consistent with a recent Institute of Medicine report recommending that half of the bread/grain offerings be whole grain (20). Efforts to align school meals with national dietary policy should be supported with the introduction of foods that children would consume (21).

Substitution of refined-grain foods with whole-grain options in school breakfast and lunch could potentially lead to a one-serving increase in daily whole-grain intake among children and adolescents. The simplicity of this approach is advantageous compared to multiple component interventions and is particularly suited to whole-grain foods. Previous studies have reported that serving whole-grain foods in school lunch meals increased child and adolescent whole-grain intake (22-24). However, the number of these studies and variety of products tested are limited. Most (75%) of the whole grains in the United States are consumed as yeast breads, ready-to-eat cereals, and hot cereals (5). Other grain foods are less common sources of whole grains, including pancakes and tortillas. As children tend to have a lower preference for foods presented in an unfamiliar form (25), testing acceptance of novel whole-grain foods in school meals, particularly for the breakfast meal, is important in determining ways to improve whole-grain intake.

Another challenge to serving whole-grain foods in schools is the higher cost. In a recent study conducted by the School Nutrition Association, 75% of school foodservice programs reported that one of the coping mechanisms for constraining food costs in school meals was to replace menu items with lower-cost products and limit whole grains (26). The US Department of Agriculture (USDA) School/Child Nutrition Commodity Program allows schools participating in the National School Lunch Program to receive commodity foods at a prescribed value for each lunch served (27). A wide variety of commodity foods are available to schools, including whole-grain products. Two novel whole-grain products, pancakes and tortillas, became available during the 2008-2009 school year. However, their acceptance had not been previously tested. If accepted, they were intended to be included in the Commodity Food Program as an important, economical source of whole-grain foods. Therefore, the purpose of this study was to compare the acceptance of whole-grain vs refined pancakes and tortillas in school meals according to sensory attribute ratings and intake. It was hypothesized that acceptance of whole-grain pancakes and tortillas would be lower than that of refined-grain products.

METHODS

Participants and Recruitment

This study was conducted in school districts receiving USDA pancake and tortilla commodity products in the Minneapolis/St Paul, MN, metropolitan and central Texas areas. Selected school districts were balanced by setting (urban, suburban, and rural), and one to two schools with the highest proportion of students eligible for free and reduced-price meals within each district were selected to ensure high student participation in the National School Lunch Program and School Breakfast Program (SBP). School administrators and foodservice directors from these schools were contacted for possible inclusion of their schools in the study. All selected schools agreed to be a part of this study. This study was approved as exempt from committee review by the University of Minnesota and Texas A&M University Institutional Review Boards because the research did not involve personal identifiers.

Whole-Grain Products

Three varieties of whole-grain pancakes and two varieties of whole-grain tortillas containing differing proportions of red or white whole-wheat flour were used. Of these, the 100% red whole-wheat pancake and the 66% and 100% white whole-wheat tortillas were obtained through the USDA Commodity Foods Program. All pancakes were manufactured by Echo Lake Foods (Burlington, WI). Each pancake weighed 34 g. Tortillas were manufactured by Catallia Mexican Foods, LLC (Eagan, MN) and Santa Fe Tortilla Company (Santa Fe, NM). Tortillas had an 8-inch diameter and weighed 42.5 to 44 g per serving. All products were delivered frozen, with no specific instructions for thawing, heating, and serving.

Study Design

Whole-grain products were tested over the Spring and Fall school semesters in 2009. Whole- and refined-grain products were each served an average of 4 times (range=1 to 7 times) at each school. Students were first served the refined-grain products for 2 months, after which whole-grain products were served for the remaining 2 to 3 months of the school semester in Minnesota. In Texas, whole-grain products were randomly substituted throughout the testing time period. Pancakes and tortillas were incorporated into existing menus. Pancakes were served with syrup as part of the SBP, while tortillas were served as soft tacos with meat filling as part of the National School Lunch Program or as breakfast tacos as part of the SBP (in Texas schools). Alternative entrée options and accompanying menu items were kept consistent for each meal. In some schools, foodservice directors made slight modifications to breakfast and lunch menus so that pancakes and tortillas were served twice each month. Pancakes were not tested at the middle and high schools in Minnesota due to low participation in the SBP.

Aggregate plate waste was collected each time pancakes and tortillas were served. Percent consumption was used as a measure of acceptance of whole-grain and refined products based on the proportion that was consumed of what was served, where:

$$\%\text{consumption} = \frac{(\text{Weight per serving} \times \text{No. of servings}) - \text{Total plate waste}}{(\text{Weight per serving} \times \text{No. of servings})} \times 100\%$$

Ten random samples of each product were weighed each time data were collected and an average weight obtained