

Entrée Popularity Affects Nutrient Intake among School-Aged Children Eating School Breakfasts

Min Y. An,^{1)†} Carol W. Shanklin,²⁾ Seunghee Wie³⁾

Foodservice Division,¹⁾ Ricca Newmark Design, Centennial, Colorado, USA

Department of HRIMD (Hotel, Restaurant, Institution Management & Dietetics),²⁾

Kansas State University, Manhattan, Kansas, USA

Department of Family and Consumer Sciences,³⁾ California State University, Sacramento, California, USA

ABSTRACT

The purposes of this study were to investigate the effects of the popularity of menu items in nutrient consumption of school-aged children participating in a School Breakfast Program. The weighed plate waste method was used to determine the nutrient intake of students. The nutrient intake was evaluated based on the popularity of the menu item, gender, and grades. The average intakes of all nutrients except energy, fiber, and sodium were well within the goals. Actual nutrient intake varied based upon the popularity of entrées and the popularity of menu items was a main effect in nutrient content of meals. When the most popular entrées were served, school-aged children's energy intake and School Breakfast Program participation rate increased. Saturated fat and sodium intakes also were higher than the goal when the most popular entrées were served. The significant main effect was grades for total fat ($p < 0.05$) and calcium ($p < 0.05$), which was qualified by the two-way interaction between gender and grades for saturated fat ($p < 0.05$), protein ($p < 0.1$), iron ($p < 0.01$), vitamin C ($p < 0.01$) and carbohydrates ($p < 0.001$). Gender itself was not a significant main effect. Based on the findings, the suggestions for educating school-aged children on more healthful breakfast food choices and reformulating recipes for the popular entrées are made. (*J Community Nutrition* 8(2): 102~106, 2006)

KEY WORDS: school breakfast program (SBP) · entrée popularity · nutrient consumption · school-aged children.

Introduction

The School Breakfast Program (SBP) began in 1966 in response to evidence of malnutrition among children from low-income families in the United States (Pub. L. 89-642 1966). Currently, 8.2 million school-aged children participate in the SBP and approximately 78,000 schools and institutions serve breakfast during a school year (Food and Nutrition Service [FNS] 2004). The effects of eating breakfasts at school on such outcome variables as nutrient intake, school attendance, cognitive ability, and longer-term achievement have been demonstrated by many studies (Burghardt et al. 1995; Cook et al. 1996; Devaney, Fraker 1989; Dwyer et al.

1998; Emmons et al. 1972; Hanes et al. 1984; Hunt et al. 1979; Kleinman et al. 2002; Lytle et al. 1996; Nicklas et al. 1993; Sampson et al. 1995). However, the School Nutrition Dietary Assessment (SNDA) study reported that school-aged children consumed more saturated fat and sodium than the United States Department of Agriculture (USDA) requirements for school breakfasts (American Dietetic Association [ADA] 1999). The quality of children's nutrient intake is important because poor diet and less than optimal nutritional status during childhood may influence later risks for cardiovascular disease and other chronic degenerative disease (ADA 1999). Many studies have reported the impact of school lunch entrées on the nutritional intake of school-aged children. Equal attention, however, has not been given to the nutrient intake of school-aged children in the SBP by entrée popularity. The menu and choices offered are important to students (Meyer 2005) and the popularity of the entrée, gender, and grades may affect the nutrient intake of school-aged children. This study evaluated these variables using the

† Corresponding author: Min Y. An, Foodservice Division, Ricca Newmark Design, 6857 South Spruce Street, Centennial, CO 80112, USA

Tel: (303) 221-0500, Fax: (303) 221-0600

E-mail: man@riccaneumark.com/gemmiest@msn.com

weighed plate waste method to determine nutrient consumption. The results may be useful in evaluating the effectiveness of the school breakfasts in meeting nutrient requirements of children at an important time of day.

Subjects and Methods

Data were collected in rural Kansas in an elementary school with an enrollment of 135 students (Male = 47%; Female = 53%). A total of 696 students ate breakfast at school during the 18-day study. The sample was comprised of 607 students who purchased reimbursable meals during the study. Most (58%) were female. Of those studied, 29% were K-2, 34% were in grades 3-4, and 37% were in grades 5-6.

Nutrient intake data were collected, following a pilot study. The "offer vs. serve" option was available at breakfast. According to school policy, students were to select at least three of the items served. Using participation data and input from the foodservice director, entrées were selected and categorized as the most popular, moderately popular, and least popular. Six breakfast menus were selected and categorized based on their popularity (Table 1). Most entrées, except for the sausage-cheese biscuit and breakfast burritos, were convenience products. Each day, students could choose either the entrée special or cereal. Both options were served with juices and milk. Participant count and the number of paid, reduced, and free breakfasts served were obtained from the cash register receipt.

The data were collected three times for each breakfast menu. The nutrient data file from NutriKids™ (Release 7.1, Rochester, NY) was used to determine the nutrient content of each menu item. Three sample trays selected at random during meal service were used to determine the average serving size for each menu item. Each menu item was weighed using an electronic scale (OHAUS Model No. LS200). A name card identified each student participating in the study. Breakfast menu items selected by each student were recorded. The students left their trays on the tables when they went to their classrooms. The amount of beverage remaining in the milk and juice cartons was determined using calibrated measuring cups. All other uneaten menu items were weighed. Milk left in the cereal bowl was drained, and the weights of milk and cereal were determined. The weight of the wet cereal was later converted to the dry weight cereal by using regression equations.

For each breakfast, the following nutrients were calculated: energy, total fat, saturated fat, protein, calcium, iron, vitamin A, vitamin C, cholesterol, sodium, fiber, and carbohydrates. Descriptive statistics summarized the data. A three-way ANOVA using the Statistical Analysis System (SAS, Release 6.12, Cary, NC) tested the statistical significance of nutrient intake by gender, grades, and popularity of entrée. The average nutrient intake and the effects of gender, grades, and popularity of entrée on nutrient intake were examined. The independent variables were gender, three grades (K-2, 3-4, and 5-6), and the popularity of entrée (most popular, moderately popular, least popular). The dependent variable in the study was nutrient intake by students. The results were compared to the USDA requirements for the SBP (7CFR, 220.8 1995), the Dietary Guidelines for Americans (DGA) goals (Departments of Health and Human Services [DHHS] 2000), and other recommendations (National Research Council [NRC] 1989; Dwyer et al. 1996).

Results and Discussion

On average, 39 students per day, or 29% of total enrolled students, participated in this study. Participation rates were higher in this study than the Bogalusa Heart, Child and Adolescent Trial for Cardiovascular Health (CATCH), and SNDA studies (Dwyer et al. 1996; FNS 2001; Gleason 1995; Nicklas et al. 1998). Our results support those of the SNDA-I study, which found that students living in rural areas were more likely to eat a school breakfast than students in urban areas (Gleason 1995). More females (58%) and students in higher-grade levels (K-2 = 29%; 3-4 = 34%; 5-6 = 37%) participated in this study. The participants did not reflect the profile of students in other studies, which reported male students were more likely to participate in the SBP (Hurd-Crixell, Friedman 1997; Kennedy, Davis 1998; Nicklas et al. 1995; Sampson 1995). On average, 54% of participants in the study qualified for free or reduced-price school meals, which was similar to the SNDA-I and II studies (42% and 59%, respectively) (FNS 2001; Kennedy, Davis 1998).

The popularity of the entrée affected participation in the SBP. The number of reimbursable meals sold increased on the days when the least popular entrées were served. In other words, students were more likely to select three or more items when the least popular items were served. The participation rate increased 10 or 11% when the most popular

Table 1. Nutrient Intake based on the popularity of entrée (n = 607)

Dietary Component	Goal ¹⁾	Popularity of entrée			F ⁵⁾
		Most popular (n = 238) ²⁾	Moderately popular (n = 195) ³⁾	Least popular (n = 174) ⁴⁾	
mean ± standard error					
Energy (cal.)	554	480.16 ^a ± 7.83	428.32 ^b ± 9.74	370.77 ^c ± 11.18	33.06 ^{***}
Total Fat (g)	18.47 (≤ 30%)	18.10 ^a ± 0.35	10.58 ^b ± 0.44	5.88 ^c ± 0.50	220.14 ^{***}
Saturated Fat (g)	6.16 (≤ 10%)	6.42 ^a ± 0.15	2.80 ^b ± 0.19	1.58 ^c ± 0.22	203.64 ^{***}
Protein (g)	10	18.46 ^a ± 0.43	14.29 ^b ± 0.54	14.42 ^b ± 0.62	23.99 ^{***}
Calcium (mg)	257 (325) ⁶⁾	321.50 ^a ± 8.89	310.98 ^a ± 11.06	242.67 ^b ± 12.69	13.62 ^{***}
Iron (mg)	3	3.25 ^a ± 0.18	4.36 ^b ± 0.22	5.18 ^b ± 0.25	20.99 ^{***}
Vitamin A (RE) ⁷⁾	197	217.00 ^a ± 13.54	289.05 ^b ± 16.85	324.75 ^b ± 19.33	12.07 [*]
Vitamin C (mg)	13	18.08 ^a ± 1.68	24.30 ^b ± 2.09	24.30 ^b ± 2.40	3.64 [*]
Cholesterol (mg)	75	36.52 ^a ± 1.41	23.89 ^b ± 1.75	13.03 ^c ± 2.00	48.62 ^{***}
Sodium (mg)	600	984.44 ^a ± 16.40	559.29 ^b ± 20.41	331.00 ^c ± 23.42	298.11 ^{***}
Fiber (g)	3.34	1.59 ± 0.08	1.58 ± 0.10	1.61 ± 0.12	0.02
Carbohydrates (g)	76 (≥ 55%)	60.44 ^a ± 1.20	69.63 ^b ± 1.49	69.09 ^b ± 1.71	14.96 [*]

¹⁾For energy, total fat, saturated fat, protein, calcium, iron, vitamin A, and vitamin C, the recommended amount represents USDA requirements for the SBP. Recommendations for cholesterol and sodium are based on 1/4 of the upper daily limits of 300 mg/day and 2,400mg/day, respectively that reflects the Dietary Guidelines for Americans (DGA). Recommendation for fiber is based on "age+5g/day"; calculations are based on 1/4 the average recommended amount for the mean age of each group. Recommendation for carbohydrates is based on "more than 55% of energy from carbohydrates."

²⁾Most popular entrees: Sausage Cheese Biscuit and Breakfast Pizza.

³⁾Moderately popular entrees: Cinnamon Tasteries and Breakfast Burrito.

⁴⁾Least popular entrees: Mini Honey Buns, Pop Tarts, Granola Bars, and Assorted Cereal.

⁵⁾Mean nutrient contents among three categories are significantly different from each other.

*: Significant difference at $p \leq 0.05$, ***: Significant difference at $p \leq 0.001$.

⁶⁾The recommended values for calcium are based on the Dietary Reference Intakes, which are 800mg/day for ages 4 – 8 and 1,300mg/day for ages 9 – 13.

⁷⁾RE: retinol equivalents.

entrées were served (36%). Similarly, Smith et al. (1992) found that the SBP participation was affected by the variety of food offered and the appearance of the food.

Results presented in Table 1 illustrate that the average intakes of all nutrients except energy, fiber, and sodium were well within the goals (7CFR, 220.8 1995; DHHS 2000; NRC 1989; Williams 1995). An interaction was found between gender and grades. Significant differences were found for saturated fat ($p < 0.05$), protein ($p < 0.01$), iron ($p < 0.01$), vitamin C ($p < 0.01$), and carbohydrates ($p < 0.001$) (Fig. 1). Protein and carbohydrates intake was highest in female students in grade K-2, whereas, females in grades 5 – 6 had the lowest intake. Females in grade 3 – 4 consumed more saturated fat than males in the same grades and females in other grades. Males in K-2 consumed more saturated fat, less protein and less carbohydrates than females in the same grades. In addition, they had highest saturated fat intake for the same gender. Males in grades K-2 and 5 – 6 consumed more saturated fat and less vitamin C than did males in grades 3 – 4. Males in grades 3 – 4 consumed less iron than males in other grades and females in the same grade.

The popularity of entrée had a significant effect on nutrient intake for school-aged children. Nutrient intake met the goals for total fat, protein, iron, vitamin A, vitamin C, and cholesterol regardless of the popularity. Intake of these nutrients significantly increased as the popularity increased. All categories of the popularity of entrée failed to provide 554 Kcal. Saturated fat and sodium intakes exceeded the recommendation of these nutrients when the most popular entrées were consumed. Mean calcium intake was less than 1/4 of the RDA when the least popular entrées were served. When calcium intake data were compared to the Dietary Reference Intakes (DRI) for calcium (FNB 1997), the calcium intake did not meet the goal (325mg) in all categories.

Another significant main effect was grades for total fat ($p < 0.05$) and calcium ($p < 0.05$). Students in higher-grade levels consumed more total fat although these differences were not significant among the grades (K-2 = 10.77g; 3 – 4 = 11.59g; 5 – 6 = 12.21g). Students in grades K-2 consumed more calcium than students in other grades (K-2 = 314.66mg; 3 – 4 = 285.62mg; 5 – 6 = 274.87mg). When calcium intake was compared to the DRI for calcium (325mg for ages 9 –

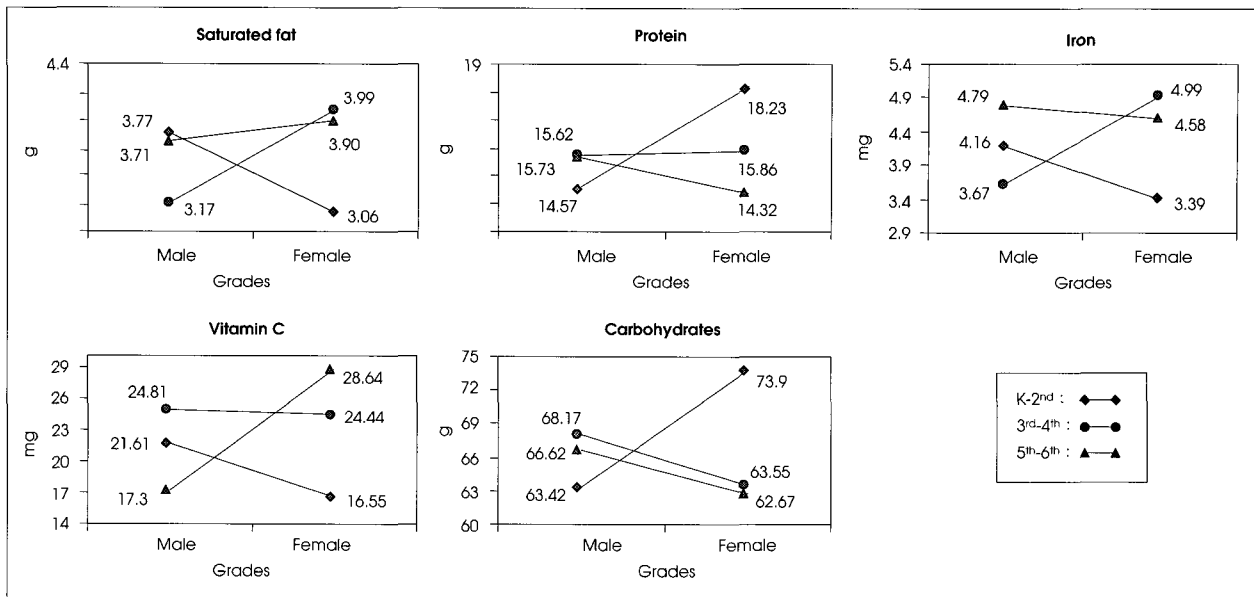


Fig. 1. Interaction effects between gender and grade levels in nutrient intake.

13), intake of 5 – 6 graders failed to meet recommendations (FNB 1997).

Gender was not a significant main effect for nutrient intake. Although nutrient intake for all nutrients showed no significant gender difference, female students consumed more nutrients than male students.

Summary and Conclusion

Actual nutrient intake varied based upon the popularity of entrées. When the most popular entrées were served, elementary school-aged children's energy intake and SBP participation rate increased. Saturated fat and sodium intakes also were higher than the DGA goal when the most popular entrées were served. To reduce saturated fat and sodium content, school service directors should reformulate recipes for the popular entrées. Student acceptability of reformulated products should be evaluated before introducing the items.

There was an interaction effect for nutrient intake between gender and grades. There were nutrient intake problems for both male and female within specific grade levels, such as low intake in protein, carbohydrates and higher intake of saturated fat. This higher intake of saturated fat may increase the risk of obesity and chronic disease later in their lives. Therefore, it is important to educate school-aged children on more healthful breakfast food choices and on the importance of balancing their nutrient intake so that it approaches

current requirements and recommendations (7 CFR, 220.8 1995; DHHS 2000; Georgiou et al. 2005; NRC 1989; Williams 1995). Huang et al. (2006) suggested integrating healthy breakfast choices in SBP that can meet student preferences. In addition, nutrition education for the parents should encourage them to provide nutritious choices and teach their children about healthful choices at home and school. Future studies should examine the effect of intervention of reformulated recipes for popular entrées and nutrition education on food choices and nutrient intake.

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