Energy and Nutrient Intake From Pizza in the United States

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abstract

BACKGROUND AND OBJECTIVE: Pizza consumption is a top contributor to children's and adolescents' caloric intake. The objective of this study was to examine children's and adolescents' pizza consumption patterns and its impact on their energy and nutrient intake.

METHODS: Twenty-four-hour dietary recall data for children aged 2 to 11 and adolescents aged 12 to 19 were drawn from the 2003–2004, 2005–2006, 2007–2008, and 2009–2010 National Health and Nutrition Examination Survey. We tested changes in consumption patterns, including by race/ethnicity, income, meal occasion, and source. Individual-level fixed effects regression models estimated the impact of pizza consumption on total energy intake (TEI) and intakes of sugar, saturated fat, and sodium.

RESULTS: From 2003–2004 to 2009–2010, overall energy intake from pizza declined 25% among children (110 to 83 kcal, $P \leq .05$). Among adolescents, although caloric intake from pizza among those who consumed pizza fell (801 to 624 kcal, $P \leq .05$), overall pizza intake remained unchanged due to slightly higher pizza consumption prevalence. For children and adolescents, pizza intake fell ($P \leq .05$) at dinner time and from fast food. For children and adolescents, respectively, pizza consumption was significantly associated with higher net daily TEI (84 kcal and 230 kcal) and higher intakes of saturated fat (3 g and 5 g) and sodium (134 mg and 484 mg) but not sugar intake, and such effects generally did not differ by sociodemographic characteristics. Pizza consumption as a snack or from fast-food restaurants had the greatest adverse impact on TEI.

CONCLUSIONS: The adverse dietary effects of pizza consumption found in this study suggest that its consumption should be curbed and its nutrient content improved.

WHAT'S KNOWN ON THIS SUBJECT: Among all age groups, children aged 6 to 11 years and adolescents aged 12 to 19 are the most frequent consumers of pizza. Pizza consumption is the second highest source of daily energy among children 2 to 18 years old.

WHAT THIS STUDY ADDS: This study examines changes in children's patterns of pizza consumption by demographic characteristics, source, and meal occasion. Using an individual-level fixed effects model, we examined the impact of pizza consumption on excess energy intake and diet quality.

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Dr Powell conceptualized and designed the study, interpreted the data analysis, and drafted and revised the manuscript; Dr Nguyen undertook the data analysis, interpreted the data, and reviewed and revised the manuscript; Dr Dietz contributed to the interpretation of the data and revised and reviewed the manuscript. All authors approved the final manuscript.

www.pediatrics.org/cgi/doi/10.1542/peds.2014-1844

DOI: 10.1542/peds.2014-1844

Accepted for publication Nov 21, 2014

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

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Excessive energy intake from solid fats and added sugar and sodium among children and adolescents in the United States is a significant public health concern.^{1,2} Poor diet puts US youth at risk for a number of nutrition-related diseases, including type 2 diabetes, hypertension, and obesity.^{3,4} Although obesity among preschool-aged children was recently reported to have fallen from 13.9% to 8.4%, obesity rates remained high at 17.7% and 20.5% among children aged 6 to 11 and adolescents aged 12 to 19, respectively, in 2011–2012.⁵

In 2003–2004, after grain desserts, pizza consumption was the second highest source of energy at 136 kcal per day among children 2 to 18 years old.⁶ In 2007–2010, children aged 6 to 11 and adolescents aged 12 to 19 were the most frequent consumers of pizza; 22% consumed pizza on a given day compared with 14% for young children aged 2 to 5 and 13% for the overall US population aged 2 years and older.⁷ Recent evidence from 2009–2010 found pizza to be the second top contributor to children's calories from school and the third top contributor from fast-food restaurants.⁸ Pizza also ranked as the second highest contributor to children's solid fat intake from both schools and fast-food restaurants.⁸

Average energy intake from pizza consumption declined among children and adolescents aged 2 to 18 from 141 kcal per day in 2003–2004 to 105 kcal per day in 2009–2010,⁹ but whether such changes occurred equally across sociodemographic groups or similarly across food sources and meal occasions remains unclear. Therefore, we explored changes in children's and adolescents' patterns of pizza consumption by demographic characteristics (race/ethnicity and income), source (eg, store, fast food, school cafeteria), and meal occasion (breakfast, lunch, dinner, and snack).

Although pizza continues to be a significant source of calories, an important question is whether and to what extent it contributes to excess energy intake and poor diet quality. Previous studies have shown that on the days that sugar-sweetened beverages or fast food are consumed by children, overall caloric intake is increased.^{10,11} To explore whether a similar effect exists for pizza, we estimated individual-level fixed effects regression models by using dietary recall data to examine the relationship between any pizza consumption (including by meal occasion and source) and total energy intake (TEI) and indicators of diet quality. We also examined whether

the impact of pizza consumption on overall energy intake differed by gender, race/ethnicity, and socioeconomic status (SES).

METHODS

Data

We used 24-hour dietary recall data from participants in NHANES 2003–2004, 2005–2006, 2007–2008, and 2009–2010. NHANES is an ongoing survey based on a complex, multistage sampling design to be nationally representative of the civilian, noninstitutionalized US population. Data collection procedures and survey design are described elsewhere.¹² Our sample included children aged 2 to 11 and nonpregnant adolescents aged 12 to 19. We examined subpopulations by race/ethnicity (non-Hispanic white, non-Hispanic black, and Hispanic, including Mexican American and other Hispanic) and income (low income defined as families with income <130% of the federal poverty level [FPL], middle income 130%–300% of the FPL, and high income ≥300% of the FPL).

The NHANES included 2 nonconsecutive 24-hour dietary recalls for which respondents reported on all foods and beverages consumed in the preceding 24 hours.

TABLE 1 Prevalence of Pizza Consumption, Energy Intake From Pizza Consumption, and Percentage of TEI From Pizza, by Age Group and Year

	All Years	2003–2004	2005–2006	2007–2008	2009–2010	% Change (2003–2004 to 2009–2010)
Children aged 2–11	<i>n</i> = 7443	<i>n</i> = 1561	<i>n</i> = 1913	<i>n</i> = 1950	<i>n</i> = 2019	
Prevalence of pizza consumption, %	22	23	24	21	20	–13
Energy intake from pizza consumption, kcal	95	110	108	84	83	–25 ^a
% of TEI from pizza	5	6	6	5	5	–17
Energy intake from pizza consumption, conditional on consumption, kcal	437	485	455	402	408	–16 ^a
% of TEI from pizza, conditional on consumption	24	23	23	21	22	–4
Adolescents aged 12–19	<i>n</i> = 6447	<i>n</i> = 1962	<i>n</i> = 2067	<i>n</i> = 1153	<i>n</i> = 1265	
Prevalence of pizza consumption, %	23	21	24	23	23	10
Energy intake from pizza consumption, kcal	166	170	187	163	143	–16
% of TEI from pizza	7	7	8	8	7	0
Energy intake from pizza consumption, conditional on consumption, kcal	726	801	768	719	624	–22 ^a
% of TEI from pizza, conditional on consumption	32	29	30	29	26	–10

^a Change (2003–2004 to 2007–2008) statistically significant at *P* ≤ .05 level. Conditional consumption is conditional on consuming pizza. Summary statistics were weighted by using the NHANES examination weight.

FIGURE 1
TEI from pizza among children and adolescents, by race, 2003–2004 to 2009–2010. The bold legend indicates that the change from 2003–2004 to 2009–2010 is statistically significant at $P \leq .05$.

Day 1 interviews were conducted by trained dietary interviewers in a mobile examination center and day 2 interviews were collected by telephone 3 to 10 days later. Participants aged 12 years and older completed their own dietary interviews, children aged 6 to 11 completed proxy-assisted interviews, and proxy respondents reported for children younger than age 6. This study included 7443 observations for children aged 2 to 11 and 6447 observations for adolescents aged 12 to 19 for whom there was complete dietary information for the first 24-hour recall and 6384 and 5775 observations, respectively, for those who completed both recalls.

The key exposure variables in this study were the prevalence of any pizza consumption, mean total energy

(kcal) intake from pizza consumption (ie, total kilocalorie intake from pizza among the entire sample, including those who did and did not consume pizza), and mean total energy (kcal) intake from pizza consumption conditional on consumption (ie, total kilocalorie intake from pizza among those who consumed any pizza) in a given 24-hour recall period. Pizza consumption also was calculated based on meal occasion, including breakfast, lunch, dinner, and snack. Further, based on information about the source of each food item, we examined pizza consumption patterns by source, categorized as store, fast-food restaurant, full-service restaurant, school cafeteria, and other sources. We examined outcomes, including daily total kilocalories of energy intake and nutrient intakes of

grams of sugar and saturated fat and milligrams of sodium. The NHANES draws its nutrition information from the US Department of Agriculture (USDA) Food and Nutrient Database for Dietary Studies.

Statistical Analyses

We documented changes in pizza consumption patterns from 2003–2004 through 2009–2010. Based on the day one 24-hour dietary recall data for children and adolescents, we tested changes over time for the prevalence of pizza consumption, mean energy intake from pizza, mean energy intake conditional on consumption, and the contribution of pizza to daily TEI. We also examined changes in mean energy intake from pizza by race/ethnicity, income, source, and meal occasion.

To examine the impact of pizza consumption on energy and nutrient intake outcomes, we estimated an individual-level fixed effects regression model based on the 2 different days of intake data, equivalent to a first difference estimator based on only 2 observations per person. This model removed the effects of all standard time-invariant observed characteristics, such as age, gender, and race. Given the short time span between the day 1 and day 2 dietary recalls, it also removed the effects of household/parental characteristics, such as marital status, education, and income. Importantly, the individual-level fixed effects model removed the time-invariant unobserved characteristics related to food and beverage preferences.¹³

The regression model for a given outcome, energy or nutrient intake, Y_i , was specified as follows:

$$Y_i = \delta_0 + \delta_1 PIZZA_i + \delta_2 WD_i + \delta_3 D_i + v_i + w_i,$$

where $PIZZA_i$ indicated whether any pizza was consumed in the 24-hour

recall period. The variables WD_i and D_i controlled for whether the recall day was on a weekday versus a weekend and, given differences in data collection methods across days, whether it was on day 1 or day 2, v_i was the constant individual-specific error, and w_i was an SE term. We estimated the equation separately for children aged 2 to 11 and adolescents aged 12 to 19. Additionally, based on the equation, we examined whether the impact of pizza consumption had a differential impact on energy intake across gender, race/ethnicity, and SES. Because this study drew on multiple waves of NHANES data (2003–2004 through 2009–2010) and the recall periods were only 10 days apart within a given wave, the estimates provide average impacts over that time period. To assess whether the impact of pizza consumption differed over this time period, we estimated separate models by wave.

We further specified 2 additional models of energy intake: (1) as a function of pizza consumption at different meal occasions, including multivariate measures for breakfast, lunch, dinner, and snack; and (2) as a function of pizza consumption from different sources, including multivariate measures for store, fast-food restaurant, full-service restaurant, school cafeteria, and other sources. Both models included the control variables shown in the equation. Trend and regression analyses were undertaken by using Stata 12.0 (Stata Corp, College Station, TX) and accounted for the NHANES complex, multistage probability sampling design. This study was approved by the institutional review board of the University of Illinois at Chicago.

RESULTS

Table 1 shows that in 2009–2010, 20% of children aged 2 to 11 and

23% of adolescents aged 12 to 19 consumed pizza on a given day. Their respective mean caloric intake from pizza in 2009–2010 was 83 and 143 kcal, a decrease from 2003–2004 of 25% ($P \leq .05$) and 16%. Among those who consumed pizza, daily energy intake from pizza was, on average, 408 kcal for children and 624 kcal for adolescents, in 2009–2010, and decreased by 16% ($P \leq .05$) and 22% ($P \leq .05$) from 2003–2004 among the respective age groups. In 2009–2010, for children and adolescents, respectively, pizza comprised 5% and 7% of TEI overall and 22% and 26% of TEI on days when it was consumed.

Figure 1 shows that from 2003–2004 to 2009–2010, energy intake from pizza fell significantly ($P \leq .05$) for both white and black but not Hispanic

children, such that by 2009–2010 children's energy intake from pizza across race was similar. Figure 2 shows that consumption levels remained fairly flat among low-income children. Although pizza consumption fell among children from middle- and high-income families, the changes were not statistically significant. Similar to the pattern for adolescents overall, there also were no significant changes in pizza consumption for any of the racial/ethnic or income adolescent subgroups.

Figure 3 shows that for both children and adolescents, caloric intake from pizza sourced from fast-food restaurants fell significantly ($P \leq .05$) from 2003–2004 to 2009–2010 (from 58 to 29 kcal among children and 93 to 47 kcal among adolescents), whereas pizza caloric intake from

FIGURE 2

TEI from pizza among children and adolescents, by income, 2003–2004 to 2009–2010. The bold legend indicates that the change from 2003–2004 to 2009–2010 is statistically significant at $P \leq .05$.

FIGURE 3 TEI from pizza among children and adolescents, by source, 2003–2004 to 2009–2010. The bold legend indicates that the change from 2003–2004 to 2009–2010 is statistically significant at $P \leq .05$.

stores, school cafeterias, and full-service restaurants did not change significantly over time. Thus, whereas the primary (majority) source of pizza in 2003–2004 was from fast-food restaurants, caloric intake of pizza was much more evenly distributed across sources in 2009–2010.

Figure 4 shows that pizza consumption at dinner decreased ($P \leq .05$) by 40% (from 68 to 41 kcal) for children and by 33% (from 104 to 70 kcal) for adolescents. Whereas in 2003–2004 pizza caloric intake for dinner was, on average, more than twice that of intake for lunch among both children and adolescents, by 2009–2010, caloric intake from pizza at both lunch and dinner was comparable.

The individual-level fixed effects regression estimates for the within-

person daily changes in energy and nutrient intakes were based on the sample for which we had both day 1 and day 2 observations (Table 2). There were no significant differences in sample characteristics by age, gender, race/ethnicity, or income between the sample that completed the day 1 recall and the sample that completed both the day 1 and day 2 recalls. The regression results in Table 3 show that pizza consumption was associated with an increase in total daily energy intake of 84 kcal for children and 230 kcal for adolescents. For both children and adolescents, respectively, pizza consumption significantly increased intake of saturated fat (by 3 g and 5 g), and sodium (by 134 mg and 484 mg), but had no significant impact on sugar intake. These estimates are based on our full sample (2003–2004 to 2009–2010). Although pizza

consumption fell over time for children, stratified regression analyses by year (not shown in tables) revealed that when pizza was consumed, its impact on energy and nutrient intake was not significantly different from 2003–2004 to 2009–2010.

Examining the impact of pizza consumption on energy intake by subpopulations revealed limited significant differences across groups. Pizza consumption was associated with significantly higher additional energy intake among black compared with Hispanic children (147 vs 23 kcal), but no other racial/ethnic differences were significant (Table 4). The impact of pizza consumption on excess energy intake did not differ across gender or SES.

Based on our model specifications that included a multivariate assessment of pizza consumption by meal occasion and by source, Table 5 shows that pizza consumption as a snack was found to have the largest adverse impact on energy intake for both children (202 higher kcal) and adolescents (365 higher kcal), although it was significantly higher than other meal occasions only compared with lunch for children. Pizza consumption from restaurants was associated with the largest net increase in children's and adolescents' energy intake. In particular, pizza consumed from fast-food restaurants was associated with a 323-kcal increase in total daily energy intake for adolescents (significantly higher [$P \leq .05$] compared with estimated impact of pizza consumption sourced from the school cafeteria). Pizza consumption from school cafeterias was not associated with higher energy intake for either age group.

DISCUSSION

Pizza constitutes an important source of total and excess calories in the diets of children and adolescents. On

FIGURE 4 TEI from pizza among children and adolescents, by meal occasion, 2003–2004 to 2009–2010. The bold legend indicates that the change from 2003–2004 to 2009–2010 is statistically significant at $P \leq .05$.

days that it is consumed, pizza contributes an average intake of 408 kcal for children and 624 kcal for adolescents and net daily TEI is higher by 84 kcal among children and 230 kcal among adolescents. These findings are similar to the excess total caloric intake associated with fast-food consumption for children and adolescents (126 and 310 kcal, respectively).¹⁰ In both cases, other sources of caloric intake are not

sufficiently reduced to balance overall calories. The effect of pizza on total excess caloric intake was found to be consistent across gender, race, and income, with the exception that it was significantly higher for black compared with Hispanic children.

In addition to its adverse impact on energy intake, and similar to the effects of fast-food consumption,^{10,14–16} pizza consumption is associated with

poorer diet quality among both children and adolescents. On the days when they eat pizza, children and adolescents consume more saturated fat and sodium, although in contrast to fast-food consumption,^{10,15} pizza consumption is not associated with significantly higher sugar intake.

The adverse impact of pizza consumption on energy and nutrient intake is an important concern given that its consumption remained highly prevalent among children (20%) and adolescents (23%) in 2009–2010. A decline in energy intake from pizza consumption among children aged 2 to 18 was recently documented.⁹ This present study showed that energy intake from pizza declined significantly (–25%) among children aged 2 to 11 from 2003–2004 to 2009–2010. However, among adolescents aged 12 to 19, although caloric intake among those who consumed pizza on a given day fell significantly (–22%), overall consumption, on average, did not change significantly from 2003–2004 to 2009–2010 due to a slight increase in its consumption prevalence.

For both children and adolescents, in 2009–2010, most pizza continued to be consumed at lunch or dinner, although caloric intake from pizza fell significantly at dinner time. Pizza consumption at lunch time and from school cafeterias remained unchanged. Although pizza consumption at lunch time was associated with higher total caloric intake for adolescents, pizza consumption from school cafeterias did not significantly affect total caloric intake, likely because it may not be that nutritionally different from other school entrées. Policies, such as the recent USDA nationwide nutrition standards governing competitive school food/beverage sales effective in school year 2014–2015,¹⁷ will help to improve the nutritional content of all school offerings, including pizza. Although

TABLE 2 Summary Statistics for Day 1 and Day 2 Dietary Recall Estimation Sample, 2003–2004 to 2009–2010

	Children Aged 2–11, <i>n</i> = 6384	Adolescents Aged 12–19, <i>n</i> = 5775
Prevalence of pizza consumption, %	17	20
TEI, kcal	1777	2064
Total sugar, g	119	129
Total saturated fat, g	23	27
Total sodium, mg	2757	3351

Summary statistics were weighted by using the NHANES examination weight.

TABLE 3 Individual-level Fixed Effects Regression Estimates of Impact of Pizza Consumption on Total Energy and Nutrient Intakes, by Age Group, 2003–2004 to 2009–2010

	TEI	Sugar	Saturated Fat	Sodium
Children aged 2–11, <i>n</i> = 6384	84.2*** (21.9)	0.4 (2.0)	2.8*** (0.4)	134.3*** (41.1)
Adolescents aged 12–19, <i>n</i> = 5775	229.6*** (37.6)	0.1 (2.9)	5.4*** (0.7)	484.3*** (71.0)

Pizza consumption is any pizza consumption in the 24-hour dietary recalls. All analyses are weighted by using the NHANES examination weight. TEI is measured in kilocalories, sugar and saturated fat are measured in grams, and sodium is measured in milligrams. Control variables include indicators for whether the dietary recall observation was on a weekday versus the weekend and whether it was on day 1 versus day 2. SEs are reported in parentheses and are robust. Impact on total energy and nutrient intakes significant at *** $P \leq .001$.

pizza consumption as a snack was infrequent, its impact on net caloric intake was substantial, suggesting that such practices should be discouraged.

In 2003–2004, more than half of children's and adolescents' calories from pizza were obtained from fast food. Although significantly lower by 2009–2010, fast-food restaurants remained the main source of pizza for children (34%, followed by stores at 24%) and the second top source for adolescents (33%, with stores in the top spot at 34%) in 2009–2010. Further, the regression results from

this study showed that pizza consumption sourced from fast-food restaurants had the greatest adverse impact on energy intake among adolescents. Although there have been a number of regulatory^{18,19} and voluntary^{20,21} efforts to set standards for the nutritional content of meals obtained from restaurants, a recent evaluation of nutrients in pizza from the leading top 2 national fast-food pizza chains revealed a significant increase in sodium content in thin-crust cheese pizzas between 2003 and 2010.²² Furthermore, although new USDA standards will help to

improve the nutritional content of competitive foods obtained within schools, they will not affect the competitive food market just outside of schools. Fast-food restaurants are clustered around schools, particularly high schools and those in low-income neighborhoods,^{23–25} and fast-food availability around schools has been associated with higher consumption and body weight.²⁶ The Children's Food and Beverage Advertising Initiative does not include any pizza fast-food restaurant members, although 2 such restaurants have been identified as being among the top 10 fast-food advertisers on television to whom youth are exposed.²⁷

This study is subject to several key limitations. First, the 24-hour dietary recall data were obtained via self-report and are subject to underreporting.^{28,29} Second, heterogeneity in serving sizes of pizza slices may not be accurately captured. Third, there can be significant heterogeneity in nutrient content even within different types of pizza (ie, among different brands of cheese pizza) and the Food and Nutrient Database for Dietary Studies nutrition data are limited in their capacity to capture variation in nutritional content by brand. Our analyses by source helped to account for some of this heterogeneity. Fourth, our analyses could not account for time-varying confounders, such as physical activity or other unobserved factors that might affect food preferences day to day. Nonetheless, all time-constant confounders were accounted for in the individual-level fixed effects regression.

CONCLUSIONS

The higher net total energy, saturated fat, and sodium intake associated with children's and adolescents' consumption of pizza demonstrates the importance of implementing policies and practices aimed at curbing its consumption and

TABLE 4 Individual-level Fixed Effects Regression Estimates of Impact of Pizza Consumption on Total Energy Intake, by Age Group and Gender, Race/Ethnicity, and Income, 2003–2004 to 2009–2010

	Children Aged 2–11, <i>n</i> = 6384	Adolescents Aged 12–19, <i>n</i> = 5775
By gender		
Girl	56.8 (29.4)	155.9*** (42.0)
Boy	110.3*** (32.2)	284.6*** (58.1)
By race		
Non-Hispanic white	97.1** (32.7)	234.0*** (54.0)
Non-Hispanic black	147.2*** ^a (37.7)	257.5*** (56.4)
Hispanic	22.6 (29.3)	216.7*** (57.8)
By income		
Low income	73.4* (35.0)	270.3*** (60.6)
Middle income	138.5** (46.0)	26.01*** (63.7)
High income	62.8 (35.6)	185.0** (67.4)

Pizza consumption is any pizza consumption in the 24-hour dietary recalls. All analyses are weighted by using the NHANES examination weight. TEI is measured in kilocalories. Control variables include indicators for whether the recall was on a weekday versus the weekend and whether it was on day 1 versus day 2. SEs are reported in parentheses and are robust. Impact on TEI significant at * $P \leq .05$; ** $P \leq .01$; *** $P \leq .001$.

^a Significant difference between black versus Hispanic at the $P \leq .05$ level.

TABLE 5 Individual-level Fixed Effects Regression Estimates of Impact of Pizza Consumption on Total Energy Intake, by Meal Occasions and by Pizza Sources, by Age Group, 2003–2004 to 2009–2010

	Children Aged 2–11, n = 6384	Adolescents Aged 12–19, n = 5775
Impact of pizza consumption by meal occasions		
Any pizza consumption at breakfast	39.7 (78.0)	296.7 (200.3)
Any pizza consumption at lunch	56.5 (31.0)	186.5*** (45.0)
Any pizza consumption at dinner	92.3** (29.7)	236.6*** (53.3)
Any pizza consumption as a snack	201.8** ^a (65.5)	365.3*** (113.5)
Impact of pizza consumption by pizza sources		
Any pizza consumption from a store	80* (37.3)	228.4*** (69.4)
Any pizza consumption from a fast-food restaurant	64.2 (35.7)	322.8*** ^b (55.6)
Any pizza consumption from a full-service restaurant	132.1* (63.7)	218.0* (90.9)
Any pizza consumption from a school cafeteria	45.3 (42.4)	79.9 (59.2)
Any pizza consumption from other sources	130.3 (71.2)	227.0 (126.1)

Pizza consumption includes any pizza consumption in the 24-hour dietary recalls. All analyses are weighted by using NHANES examination weight. TEI is measured in kilocalories. Control variables include indicators for whether the dietary recall observation was on a weekday versus the weekend and whether it was on day 1 versus day 2. SEs are reported in parentheses and are robust. Impact on TEI significant at * $P \leq .05$; ** $P \leq .01$; *** $P \leq .001$.

^a Significant difference between estimate for snack versus lunch at the $P \leq .05$ level.

^b Significant difference between estimate for fast-food restaurant versus school cafeteria at the $P \leq .05$ level.

improving its nutrient content. Dietary strategies to address and treat obesity should focus on the

principal sources of calories in the diet, particularly from foods that contribute to excess caloric intake.

Dietary counseling is more likely to be effective if it focuses on specific foods rather than nutrients. Pizza is the second largest contributor to caloric intake in children and adolescents⁶ and, as we have shown in this study, pizza is frequently consumed. In addition, on the days that it is consumed, pizza contributes more than 20% of the daily intake of calories, and total caloric intake is significantly increased compared with caloric intake on days when pizza is not consumed. These observations emphasize that pizza, like sugary drinks, may be a significant contributor to excess caloric intake and obesity, and should become a target for counseling for the prevention and treatment of obesity in pediatric practice. Furthermore, because children and adolescents obtain pizza from varied sources, continued efforts are needed on multiple fronts to improve the nutritional content and related marketing of pizza served in schools and restaurants and supplied through stores.

FINANCIAL DISCLOSURE: The authors have indicated they have no financial relationships relevant to this article to disclose.

FUNDING: Dr Powell gratefully acknowledges research support from the National Cancer Institute (1R01CA138456) and from the Robert Wood Johnson Foundation through the Bridging the Gap program. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Cancer Institute, National Institutes of Health, or the Robert Wood Johnson Foundation. Dr Powell had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Funded by the National Institutes of Health (NIH).

POTENTIAL CONFLICT OF INTEREST: The authors have indicated they have no potential conflicts of interest to disclose.

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