

Is There Any Association Between U.S. Children Produce Intake and School Grade Groups?

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INTRODUCTION:

About 30 million school children consumed school meals in the school year 2018–19. The school meals are subsidized by the U.S. government to provide free or reduced-price meals to millions of vulnerable children. School children participate in different food assistance programs to acquire and supplement their food. Some of the prominent Federal programs that provide food and nutrition education assistance to children are SNAP (Supplemental Nutrition Assistance Program), Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), and National School Lunch Program (NSLP). NSLP and WIC are targeted primarily towards infants and children (Jones et al., 2025). In 2024, the NSLP and related child nutrition programs (including School Breakfast Program, Child and Adult Care Food Program, and Summer Food Service Program) served 9.3 billion meals, a 4% increase from the previous year. In 2014, 5.1 billion lunches were served under the NSLP program, with over 70% were provided free or reduced-price meals (U.S. Department of Agriculture, Food and Nutrition Services, 2020d).

Since the 2010 Healthy, Hunger-Free Kids Act (HHFKA), meal patterns have emphasized fruit and vegetable variety across distinct grade groups (K–5, 6–8, and 9–12). Yet, little is known about whether these structural changes have translated into measurable differences in children’s actual produce intake. Therefore, it is pertinent to look at national trends to assess if a child’s grade group is related to diet quality. One of the many other changes that came with HHFKA policy implementation was an increased requirement for fruits and vegetables served in school. Not only this, but the type of vegetables offered was also influenced by HHFKA. In addition, HHFKA mandated that maximum and minimum number of meals be served based on the Recommended Dietary Allowances (RDA) for each grade group (K–5, 6–8, 9–12) (Bergman, Englund, et al., 2014; Hager & Turner, 2016; U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2015; U.S. Department of Agriculture & U.S. Department of Health and Human Services, 2020; U.S. Department of Agriculture, Food and Nutrition Service, 2016). Updating nutritional standards put forth by the U.S. Department of Agriculture, Food and Nutrition Service, in NSLP meal pattern identifies specific nutritional requirements of different grade groups (Hayes et al., 2018). Pérez and colleagues assessed differences in dietary intake and meal patterns by grade among Texas school children (Pérez et al., 2007) to assess trends in food intake as well as preferences as it relates to various food groups. According to the U.S. Department of Agriculture, Economic Research Service (USDA ERS) (2024), school meals have shown improved nutritional quality compared to other food sources, especially following policy changes of HHFKA (U.S. Department of Agriculture, Economic Research Service, 2024). The food choices of children are constantly evolving. As children grow older, their food



choices tend to change; thus, it is essential to have readily available information to develop needs assessment or intervention specific to the child's age and grade. These studies demonstrate younger and older students have distinct eating behaviors. It is imperative to have early and constant exposure to all food groups in order to normalize fruit and vegetable acceptance among school-aged children/adolescents. Age is a significant predictor of eating patterns. Also, preschoolers who are picky and fussy eaters tend to have worse food choices, especially low vegetable intake, when they get older (Caton et al., 2014). Also, the USDA ERS report of 2024 concludes that fruit and vegetable intake declines with age, and older students are less likely to participate in school meal programs, especially breakfast, and consume more fast food, sugar, and sweetened beverages. This aligns with theories on behavioral development, food preference formation, and environmental influences, especially social cognitive theory (Bandura, 2012). USDA ERS also notes persistent disparity in fruit and vegetable intake by gender and race/ethnicity (U.S. Department of Agriculture, Economic Research Service, 2024). This helps identify age-specific nutritional gaps.

It is essential to look at national trends to assess if age-grade group and diet quality are related to each other among children. Please note that age/development stages are being used as a proxy for grade groups. NSLP participation is confirmed for each child; however, it is unknown if the student participating as elementary-/middle-/high-school was correctly identified. Therefore, there may be some students who may have been incorrectly classified, given age is used as a proxy for grade groups. This information is of considerable interest to researchers, policymakers, and advocates of public health and nutrition. The purpose of this study was to examine whether differences exist in U.S. children's produce intake across grade level/NSLP meal pattern groups [elementary/K–5 grades), middle/6–8 grades), high-school/9–12 grades)], while controlling for race and family income-to-poverty ratio. Specifically, this study explored whether there are differences among children's grade levels in:

- a) child produce intake diet density estimated using a Healthy Eating Index (HEI) component score; and
- b) child produce intake diet ratio estimated using the Recommended Intake (RI) based on the Dietary Guidelines for Americans (DGA) for respective age-gender-activity groups.

METHODOLOGY:

Study Design

NHANES records cross-sectional data in two-year cycles. The data for this study came from three NHANES cycles, 2009–10, 2011–12, and 2013–14. All study protocols of NHANES were reviewed and approved by the NCHS Research Ethics Review Board (Centers for Disease Control and Prevention, 2025). Institutional Review Board (IRB) at the XXX also approved this study as exempt.

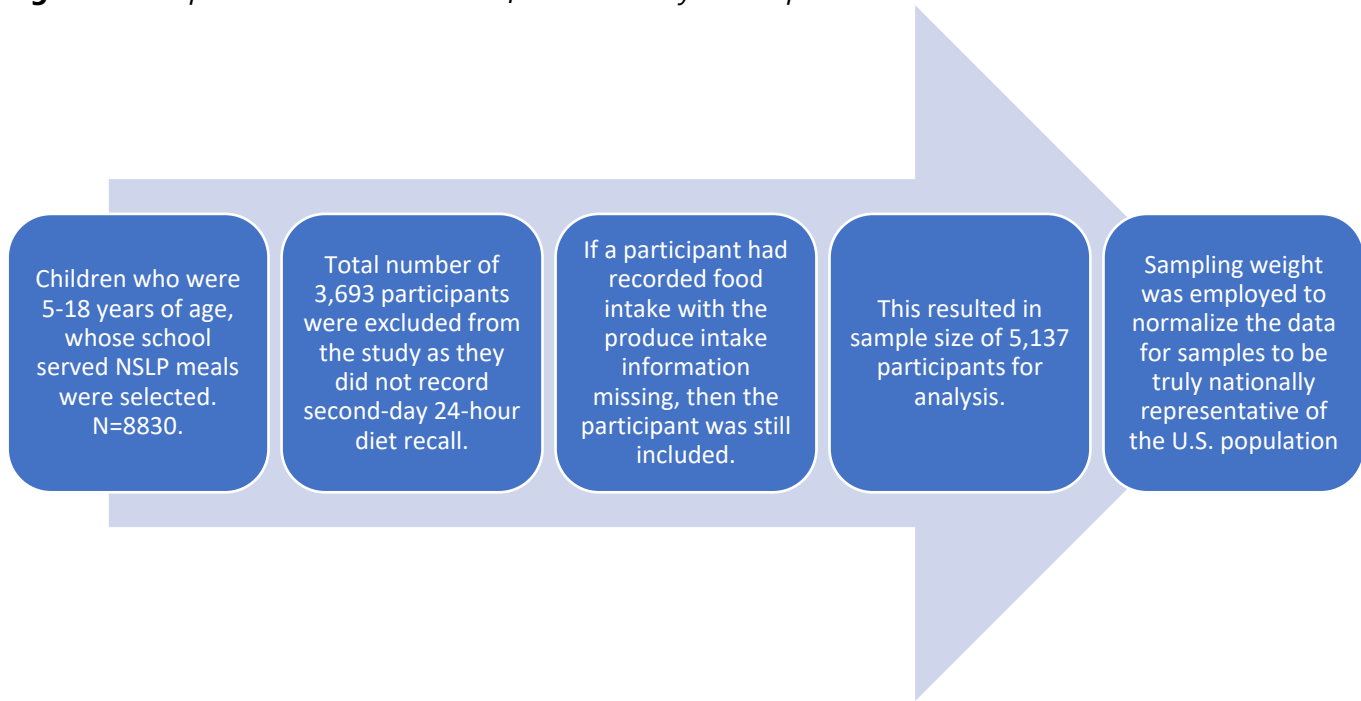
Sample/Setting

Four components of the household questionnaire were screener, relationship, sample participant, and family. After collecting the household interview, data collection took place in Mobile Examination Center (MECs), which included demographic, dietary, and questionnaire (Centers for Disease Control and Prevention, 2025). Dietary interview consisted of two-day 24-hour dietary interview; the first day 24-hour recall was conducted in the MEC, and second-day dietary interview was conducted after the MEC visit, through a telephone follow-up about 3-10 days after MEC visit, also called post-MEC activities. The dietary interview includes the Automated Multi-Pass Method (AMPM), which provides complete and accurate diet recall and reduces interviewer and respondent burden (Centers for Disease Control and Prevention, 2025; U.S. Department of Agriculture, Agricultural Research Service, 2019). NHANES utilized a proxy interviewee, who is preferably the person responsible for preparing a child's meals. A proxy or assisted interview was conducted if the child was less than six years of age. A child aged 6–11 years was asked to provide their own data, who may be accompanied by an adult household member. The child was the main responder if they were 11 years or older (Centers for Disease Control and Prevention, 2010). As previously noted, age/development stages are being used as a proxy for grade groups. NSLP participation is confirmed for each child; however, it is unknown if the student participating as elementary-/middle-/high-school was correctly identified. Therefore, there may be some students who have been incorrectly classified, given that age is used as a proxy for grade groups. Participants provided consent or assent to participate after they understood the entire NHANES process. The average response rate for participants was 82.5% in survey cycle 2009–14 (Centers for Disease Control and Prevention, 2020b).

Analytic Sample

We employed inclusion and exclusion criteria using the following steps:

Figure. Participant Selection Flowchart for Final Analytic Sample



We selected children who were 5–18 years of age, whose school served NSLP meals. A total of 3,693 participants were excluded from the study as they did not record the second-day 24-hour diet recall. If a participant recorded food intake but had missing produce intake information, the participant was included. These exclusions resulted in a sample of 5,137 participants for analysis. Sampling weight was employed to normalize the data for samples to be truly nationally representative of the U.S. population (Centers for Disease Control and Prevention, 2025).

Instruments and Measures

NHANES: Dietary and Questionnaire Data

The questionnaire data were utilized, which included demographic, sociocultural, dietary intake, participation in school meal questions, and physical activity. The average of two-day 24-hour recall was used to estimate the quantity and quality of different types of foods and beverages consumed. Day one 24-hour recall is collected in-person, and the data is meant to be collected for the day before the data collection day, and day 2 dietary recall is collected 3–10 days later in the form of a phone interview. The benefit of using the average of two-day 24-hour recalls is that it is more representative, smooths out random fluctuations, reduces measurement error and improves group-level estimation of the population. External datasets, the What We Eat In America

(WWEIA) and the Food and Nutrient Database for Dietary Studies (FNDDS), are collected by the USDA and the U.S. Department of Health and Human Services (DHHS) and include detailed information on USDA food codes. These food codes, when combined with NHANES, gave dietary intake information (Centers for Disease Control and Prevention, 2020d; U.S. Department of Agriculture, Agricultural Research Service, 2019).

Healthy Eating Index

HEI-2015, a validated measure to estimate diet quality, was utilized in this study (Kirkpatrick et al., 2018; Reedy et al., 2018). Of the thirteen HEI components, the four (total fruits, total vegetable, whole fruits, and greens and beans) related to produce intake were utilized in the study, all scored from 0 to 5, where 0 means no consumption, and 5 means the consumption meeting the DGA's age-specific recommended intake (for example, score of 5 for Total Fruit will be achieved when ≥ 0.7 cup equivalent per 1,000 Kcal is consumed; for whole fruit, ≥ 0.3 cup equivalent per 1,000 Kcal is consumed; for Total Vegetables, ≥ 0.9 cup equivalent per 1,000Kcal is consumed) (Guenther et al., 2013; Kirkpatrick et al., 2018; National Cancer Institute, 2019; U.S. Department of Agriculture, 2019a). Appendix 2 depicts HEI-2015 components and scoring standards.

Recommended Intake (RI%)

The RI% is expressed as the percentage of a nutrient's recommended intake that an individual or population actually consumes. It is calculated by dividing the amount of the nutrient consumed by the recommended intake level (while controlling for age, gender, and activity level) and multiplying by 100. This metric allows researchers to evaluate whether dietary intake meets, exceeds, or falls short of established nutritional guidelines. Recommended intakes were calculated from 2015 DGAs. RI% was estimated using the formula:

$$\text{Recommended Intake \%} = \frac{\text{Consumed equivalents}}{\text{Recommended equivalents}} \times 100$$

RI% was calculated using DGA standards and comparing the actual, per participant intake by averaging a participant's 2-day, 24-hour recall provided through the WWEIA dataset per participant.

The recommended intake values vary by age, gender, and activity level. Several questions assess the physical activity behavior of the participants. For the age group 11 years or younger, if the participants were physically active all seven days for at least 60 minutes, they were categorized as a vigorous/high activity group; otherwise, they were categorized as sedentary. Participants who were 12 years or older were categorized into three different activity levels: vigorous-intensity, moderate-intensity, and sedentary. Children in the vigorous-intensity group were involved in vigorous-intensity activities such as paid or unpaid work, studying or training, household chores, yard work, sports, fitness, and other recreational activities for at least 10 minutes continuously, requiring hard physical effort and causing a significant increase in breathing or heart rate. Further, children were categorized in the moderate-intensity group if their work included moderate-intensity work, sports, fitness, or recreational activity that causes a slight increase in breathing or heart rate, such as brisk walking, carrying light loads,

bicycling, swimming, or golf, for at least 10 minutes. Lastly, children were categorized as sedentary if they sat at work, at home, getting to and from places, traveling in a car or bus, reading, playing cards, watching television, or using a computer, not including time spent sleeping. If children did not spend at least 10 minutes doing vigorous- or moderate-intensity work, they were categorized as sedentary (Centers for Disease Control and Prevention, 2020a, 2020c; National Health and Nutrition Examination Survey, 2011; Sisson et al., 2009). Based on a participant's age, gender, physical activity, and energy requirement, the required produce intake (in cup equivalents per day) was calculated (U.S. Department of Health and Human Services & U.S. Department of Agriculture, 2015).

Regression Equation

$$\text{Outcome}_i = B_0 + B_1 \text{MF}_2_i + B_2 \text{MF}_3_i + B_X_i + \epsilon_i,$$

where outcomes were HEI fruit, HEI vegetable, HEI whole fruit, and HEI greens and beans; RI fruit and RI vegetable; B_1 , B_2 are coefficients; MF_2 and MF_3 are predictor variables.

Variables and Covariates

The following variables and covariates were utilized:

- 1) One discrete predictor: school age-grade groups/NSLP meal pattern groups,
- 2) multiple continuous dependent variables: HEI and RI;
- 3) covariates: race (Mexican American/ Other Hispanic/ Non-Hispanic white/ Non-Hispanic Black/ Other races (including mixed races)) and family income-to-poverty (ratio of family income-to-poverty categories of <130%, 130–185%, and > 185%) were included.

Data Analyses

Stata/IC was used to tabulate data and conduct analyses (StataCorp, 2025). Descriptive statistics were reported to summarize the demographic qualities of participants. A p -value of less than .05 was utilized to identify statistical significance. Ordinary least squares (OLS) regression was conducted, followed by post-estimation tests. The Chi-squared analysis was utilized to test whether the recommended fruits and vegetables were met or not met. Dietary day-two sample weight for each survey cycle was applied before the analysis.

RESULTS AND DISCUSSION:

Participants ($n=5,137$) were 11 ± 4 years of age. Participants were predominantly Non-Hispanic White ($n=1,418/5,137$, 27.60%), male ($n=2,588/5,137$, 50.38%), family income-to-poverty ratio of 2 ± 1.6 . The descriptive statistics for the covariates and outcome variables are reported for different school grade groups in Tables 1 and 2. Table 3 presents OLS regression results on produce intake dietary intake quality. Table 3 shows that HEI fruit, HEI vegetable, HEI whole fruit, RI fruit, and RI vegetable were significantly different across the three grade groups. Compared to those in elementary school, middle and high school children demonstrated differences in produce-related diet quality. Table 4 describes whether fruit and vegetable intake was adequate and met the recommendations.

In the final step of analysis, a postestimation test was performed. The postestimation test ($B1=B2?$) showed a difference in HEI fruit, HEI whole fruit, and RI fruit. $B1-B2$ (HEI fruit), $F(1,4803)= 11.76^{***}$, $B1-B2$ (HEI whole fruit), $F(1,4803)= 19.48^{***}$, and $B1-B2$ (RI fruit), $F(1,4771)= 6.67^{**}$. Upon running OLS regression, when comparing middle- to high-school students, HEI fruit [$t=-3.43$, $p<.01$, Coeff= $-0.39(0.11)$]; HEI whole fruit [$t=-4.41$, $p<.001$, Coeff= $-0.54(0.12)$]; and RI fruit [$t=-2.58$, $p<.01$, Coeff= $-10.17(3.94)$] was lower in high-school students when compared to middle-school students.

For HEI fruit, when comparing elementary to middle school students, there was a 0.42 units decrease, and when comparing elementary to high school students, there was a 0.81 decrease, holding all other variables constant. For HEI vegetables, when comparing elementary to middle school students, there was a 0.15 units increase, and when comparing elementary to high school students, there was a 0.18 units increase, holding all other variables constant. For HEI whole fruit, when comparing elementary to middle school students, there was a 0.31 units decrease, and when comparing elementary to high school students, there was a 0.81 unit decrease, holding all other variables constant. For RI fruit, when comparing elementary to middle school students, there was a 21.86 units decrease, and when comparing elementary to high school students, there was a 32.04 units decrease, holding all other variables constant. For RI vegetable, when comparing elementary to high school students, there was a 4.85 units decrease, holding all other variables constant.

Findings from this study suggest that there were differences in diet quality when comparing school age-grade groups/NSLP meal pattern groups. Fruit intake diet quality (HEI fruit and HEI whole fruit) was found to be better in elementary school children than middle- and high-school students. However, diet quality in terms of HEI vegetable was better in the middle- and high-school students when compared to elementary school children. In terms of RI vegetable, when accounting for age-gender-activity level, it was found to be better in elementary school children in comparison to high school students. When comparing HEI fruit, HEI whole fruit, and RI fruit, fruit intake diet quality was estimated to be better in middle school students when compared to high school students. Therefore, this study confirms that there were significant grade-based differences in student diet quality, including HEI fruit, HEI whole fruit, HEI vegetable, and RI vegetables. Unexpected finding of this research is connected to HEI vegetable, where older students (middle- and high-schoolers) are observed to be having better HEI score as compared to elementary school students, which is in contrast to findings of

previous studies which indicate that older students generally have worse HEI scores (Caton et al., 2014; Pérez et al., 2007). However, USDA (2023) HEI 2015 report shows similarities of findings to our study with older children depicting better vegetable intake.

Previous results, as investigated by Pérez and colleagues as well as Caton and colleagues, found differences in dietary intake and meal pattern by age-grade groups. Food choices of children constantly evolve; As children grow older, their food choices tend to change (Caton et al., 2014; Pérez et al., 2007). Lorson and colleagues (2009) show that younger children (2–5 years) are more likely to have a higher intake of fruits and vegetables than older children (6 to 18 years old) (Lorson et al., 2009). Contrary to the findings of Lorson and colleagues, we found that the diet quality of middle- and high-school students in terms of HEI vegetable was better when compared to elementary school children. Our findings align with previous research on fruit intake, where younger children have better HEI fruit, HEI whole fruit, RI fruit, and RI vegetable intake. It is, therefore, important to have readily available information about the eating patterns of children in different age-grade groups to develop interventions specific to children's age and grade. This study provides this information related to produce intake diet quality of children in different age- grade groups in a nationally representative population.

Age is a significant predictor of eating preferences. Preschoolers who are picky and fussy eaters tend to have worse food choices, especially low vegetable intake, when they get older (Caton et al., 2014). If child nutrition professionals have a better idea about the eating patterns of school-aged children, they can better plan and execute effective produce-related interventions for specific age-grade groups. This study helps to bridge produce related diet quality of children in different age-gender groups.

Considering produce intake recommendations, as mentioned in DGAs, in general, it was found that the majority of school students do not meet their fruit and vegetable intake. We also found similar findings related to school-aged children not meeting their recommended intake levels (Table 4). We found that only about 30% of elementary students, 18% of middle school students and 14% of high school students are meeting their fruit recommendations. Also, shockingly, only about 2% elementary students, 3% of middle-school students and 2% of high school students meet their vegetable recommendations.

Specifically, a higher percentage of high school students (86.13%) in comparison to middle (82.40%) and elementary school students (70.32%) were not meeting fruit recommendations. For vegetable intake, all three grade groups, i.e., high (97.72%), middle (97.40%), and elementary school students (97.63%), have an almost similar percentage of not meeting the recommendations.

Although using NHANES renders limitations such as the inability to establish causation, the cross-sectional nature of NHANES can help to establish correlation instead. Dietary intake, physical activity, and some health behaviors are self-reported; therefore, these findings may be subject to recall bias and social desirability bias. There are many advantages of using NHANES, including a large sample size and various variables, which help to account for various factors, thus strengthening the analysis.



CONCLUSIONS AND APPLICATION:

The key findings from this study are that the HEI fruit, HEI whole fruit, and RI fruit were better in elementary school children when compared to middle- and high-school students. RI vegetable was better in elementary school children when compared to high school students. No differences were found in HEI greens and beans. Also, HEI fruit, HEI whole fruit, and RI fruit are better in the middle- when compared to high-school students. However, HEI vegetable was better in the middle- and high-school students when compared to elementary school students. Child nutrition professionals should organize programs and policies which are age and grade specific. Interventions that can increase fruit and whole fruit consumption in the middle- and high-school students and increase vegetable consumption in elementary school children can have promising results. Also, as the results have shown that the recommendations were consistently not met across all age-grade groups, interventions that can increase produce intake of all school children are required. Child nutrition professionals can prioritize more fruit consumption in higher grade groups, which can help increase HEI fruit, HEI whole fruit, RI fruit in the middle-and high-school students; and more vegetable consumption in elementary school students, which can help increase HEI vegetable in elementary-school students. Also, fruits (79.62%) and vegetable (97.58%) intake were consistently not met across the board, but some groups had a higher percentage of not meeting the recommendations as compared to other, as was the case in meeting fruit recommendations by high-school students (86.13%) was higher than middle- (82.40%) and elementary-school (70.32%) students. Child nutrition professionals can target specific nutrition education initiatives, while partnering with teachers and librarians, and implement interventions in different age-grade groups.

Evidence from previous research suggests that there may be strategies to enhance fruit and vegetable acceptance and consumption include providing early and repeated exposure to a variety of produce and incorporating fruits and vegetables into main dishes and snacks. Initiatives such as celebrating “Fruit and Vegetable Weeks” and offering taste-testing opportunities in multiple forms can further encourage acceptance. Careful menu planning combined with targeted marketing can also increase intake. Integrating nutrition science into classroom examples helps normalize produce consumption (FoodMASTER Initiative, 2025). Additionally, parent-child and child-focused nutrition education programs may be beneficial. Collaboration between school nutrition professionals and teachers to implement reward-based interventions can further promote fruit and vegetable intake among students.

Given the chronic disease rate among the youth related to low produce intake, it should be a priority to enhance fruit and vegetable consumption in children specific to their age-grade groups (World Health Organization, 2023; National Institutes of Health, 2021). Adding/revising Family and Consumer Science (FCS) as well as Healthy Eating Education into school curriculum could help.

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Table 1. *Descriptive Covariate Table: Frequency and Percentage of Total*

	Frequency	Percent (%)
Income-to-Poverty Ratio Classification		
< 130%	2,382	46.37
130–185%	661	12.87
> 185%	2,094	40.76
Race Classification		
Mexican American	1,199	23.34
Other Hispanic	553	10.77
Non-Hispanic White	1,418	27.60
Non-Hispanic Black	1,310	25.50
Other races- Including Multi-Racial	657	12.79

Table 2. Produce Intake Diet Quality (HEI and RI) of School Children According to School Grade Groups

	Mean (SD)	Minimum	Maximum
	HEI (%)		
HEI Fruit	2.43 (1.74)	0	5
Elementary	2.83 (1.66)		
Middle	2.24 (1.73)		
High	1.96 (1.72)		
HEI Vegetable	1.39 (1.12)	0	5
Elementary	1.37 (1.08)		
Middle	1.38 (1.16)		
High	1.44 (1.15)		
HEI Whole Fruit	1.98 (1.83)	0	5
Elementary	2.36 (1.82)		
Middle	1.86 (1.80)		
High	1.51 (1.74)		
HEI Greens and Beans	1.07 (1.42)	0	5
Elementary	1.09 (1.41)		
Middle	1.10 (1.48)		
High	1.02 (1.39)		
	RI (%)		
RI Fruit (%)	63.35(69.65)	0	1294.72 [♦]
Elementary	79.52 (71.78)		
Middle	54.40 (67.94)		
High	45.59 (61.68)		
RI Vegetable (%)	24.48 (24.59)	0	255.90 [♦]
Elementary	27.35 (27.09)		
Middle	22.93 (23.20)		
High	21.28 (20.85)		

Note. Number of participants=5,137. SD= Standard Deviation. HEI= Healthy Eating Index. Sc.= School. RI fruit and RI vegetable intake were calculated using the formula [(consumed intake/recommended intake)*100].

♦ signifies an outlier, which may occur in NHANES data. Given the formula of (consumed/recommended)×100, the outlier value of 1294.72 signifies that a child/a few children consumed 12.94 times the recommended amount of that food group. Such data appears in NHANES as a child/few children may be consuming a very large portion of a produce item, for example, an unusually large smoothie/juice/composite foods.



Table 3. Effect of School-Grade Groups on Produce Intake Diet Quality

	HEI			RI		
	HEI Fruit	HEI Vegetable	HEI Whole Fruit	HEI Greens and Beans	RI Fruit	RI Vegetable
Elementary Sc. (Reference group)
Middle Sc. (Coeff (S.E.; <i>p</i> -value))	-0.42 (0.10; <.001)***	0.15 (0.07; 0.04)*	-0.31 (0.11; 0.004)**	0.18 (0.09; 0.06)	-21.86 (3.56; <.001)***	-3.15 (1.66; 0.06)
High Sc. (Coeff (S.E.; <i>p</i> -value))	-0.81 (0.09; <.001)***	0.18 (0.07; 0.01)**	-0.85 (0.10; <.001)***	0.04 (0.08; 0.65)	-32.04 (3.50; <.001)***	-4.85 (1.47; 0.001)**
F	15.7***	2.34*	20.87***	3.14**	18.09***	2.72**
R-squared	0.07	0.01	0.06	0.01	0.06	0.01

Notes: Number of participants=5,137. Coeff=Coefficients; S.E.= Standard error; Coeff and S.E. from weighted OLS regressions. RI= Recommended Intake. F= F-test. Sc.= School. Controls variables included race and ratio of income to poverty categories, and their coefficients were suppressed. **p*<.05, ** *p*<.01, *** *p*<.001.

Table 4. Children Participants in School Lunch Program Meeting or Not Meeting Their Fruit and Vegetable Recommendations According to Their School Grade Groups

School grade group	Fruit recommendations (<i>p</i> <.001)		Vegetable recommendations (<i>p</i> =.68)	
	Met (%)	Not met (%)	Met (%)	Not met (%)
Elementary Sc.	29.68	70.32	2.37	97.63
Middle Sc.	17.60	82.40	2.60	97.40
High Sc.	13.87	86.13	2.28	97.72

Note. RI% fruit and RI% vegetable intake were calculated using the formula [(consumed intake/recommended intake)*100]. Recommended intake was calculated for different age-gender groups based on the energy level according to the participant's physical activity level. Recommendations were met if RI was ≥100; otherwise, they were categorized as not met. Sc.= School.

ABSTRACT

PURPOSE/OBJECTIVES

The objective of this study was to examine differences across children's grade levels/National School Lunch Program meal groups [elementary/K–5 grades, middle/6–8 grades, high-school/9–12 grades] in child produce intake diet density estimated using a Healthy Eating Index (HEI) component score; and child produce intake diet ratio estimated using Recommended Intake (RI) based on Dietary Guidelines for Americans for respective age-gender-activity groups.

METHODS

The 2009–14 National Health and Nutrition Examination Survey (NHANES) data were utilized. A nationally representative sample of children aged 5–18 whose school served lunches was selected. Demographic and interview data from NHANES included sociodemographic characteristics, dietary intake (2-day 24-hour recall), participation in school meals, and physical activity. STATA/IC was utilized to conduct ordinary least squares (OLS) regression.

RESULTS

Participants (n=5,137) were predominantly non-Hispanic White (27.60%), 5–18 years old (mean=11±4 years), male (50.38%), with an average family income-to-poverty ratio of 2± 1.6. HEI fruit and whole fruit as well as RI fruit in middle school [$p<.001$; $p<.01$; $p<.001$] and high school students [$p<.001$; $p<.001$; $p<.001$] was lower when compared to elementary school children; HEI vegetable in middle [$p<.05$] and high school students [$p<.05$] was higher when compared to elementary school students; RI vegetable of high school students [$p<.01$] was lower when compared to elementary school students, holding all other variables constant. When comparing middle- to high-school students, HEI fruit [$p<.01$]; HEI whole fruit [$p<.001$]; and RI fruit [$p<.01$] was lower in high-school students when compared to middle-school students.

APPLICATIONS TO CHILD NUTRITION PROFESSIONALS

These results can inform modifications to programs and policies targeted to different grade groups. Nutrition-education related to fruit and whole fruit for middle and high school students is warranted. Similarly, nutrition education related to vegetable intake is warranted for elementary school students. Highlighting menu options with various food groups in weekly menus is suggested.

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