An Action Research Study Investigating the Impact of Iron-Rich School Nutrition on Lexile Scores of Middle Grades Students

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Abstract

This action research study examined the feasibility of an iron-rich school nutrition program on student Lexile scores while controlling for gender, race, and socioeconomic status. The study employed a quasi-experimental research design in which independent intact groups served as either comparison group (students not exposed to the implementation of the iron-rich menu) or treatment group (students enrolled in the school in the 2016–2017 academic year during the implementation of the iron-rich menu). Four hundred and fifty middle-school students from southeast Georgia participated in the study (189 in the treatment group and 261 in the comparison group). The school developed, implemented, and promoted a new iron-rich menu for the students. Lexile data were collected from the Georgia End of Grade English Language Arts Assessment. A one-way ANCOVA was conducted while controlling for gender, race, and socioeconomic status. The findings resulted in a significant increase in Lexile score for students exposed to the iron-rich nutrition program compared to the comparison group of students not exposed to the iron-rich menu, even after controlling for the statistical effect of gender, race, and socioeconomic status. This study addressed gaps in the research connecting a school nutrition program that offers iron-rich food to academic growth as measured by Lexile scores on a middle grades reading assessment.

Keywords: nutrition, poverty, middle level education, reading, student health
Introduction

Achievement gaps between low-socioeconomic status (SES) students and their peers is a national education crisis, and while dropout rates in the United States have decreased in recent years, rates for students in the lowest income quartile have continued to be greater than rates for students in higher income quartiles (Kena et al., 2016). Interventions to increase academic performance for low SES students such as scholarships, community programs, and mentors have tended to help a small portion of the population but have failed to make a widespread impact on achievement and graduation rates. Nevertheless, low SES students are expected to perform at the same levels as other subgroups.

While there may be many reasons for the gap in achievement between students from low SES backgrounds and their peers, nutrition is a possible factor. Iron deficiency, prominent in low SES groups, has been shown to impair cognitive abilities of adolescents even in the absence of overt anemia, and supplementing the diet with iron may have an impact on cognitive performance (Douong et al., 2015; Murray-Kolb & Beard, 2007). Research has shown that food and beverages consumed at school contribute to an average of 35% to 51% of the total dietary intake of children and adolescents and, on a typical school day, 25% of the calories consumed by American children comes from low nutrient, high calorie food or beverages (Lucarelli et al., 2014).

The purpose of this action research study was to examine the impact of the implementation of an iron-rich school nutrition program on reading comprehension of middle grades students while controlling for the effects of SES and two other demographic variables associated with differences in reading comprehension: gender and race. Thus, this research addresses the need to challenge school nutrition policies and programs to support students’ healthy minds and bodies as recommended in the middle level literature (Association for Middle Level Education [AMLE], 2010). The study used a quasi-experimental research design to explore the effect of this pilot iron-rich nutrition program on achievement of students from low SES groups. Data were collected from the Georgia Milestone End of Grade Assessment for the 2015–2016 and 2016–2017 academic years prior to and after the implementation of the iron-rich nutrition program. The following research question guided the study: What is the effect of an iron-rich school nutrition program on eighth-grade students’ reading comprehension performance, as measured by Lexile scores? We hypothesized that students who were exposed to the iron-rich nutrition program would exhibit significantly increased Lexile scores compared to students in the comparison group, even after adjusting their mean Lexile scores based on gender, race, and SES.

Poverty, Student Health, and Reading Performance

Poverty and Nutritional Disparities

Race, poverty, and nutrition are connected within a child’s upbringing (Eibel et al., 2019; Owens, 2017). Child poverty in the United States is persistent. According to the National Center of Education Statistics, the percentage of all children under age 18 living in poverty in 2014 was not measurably different from the percentage of children living in poverty in 2009 (Musu-Gillette, 2017). Students who experience lower socioeconomic living conditions are less likely to succeed in elementary and secondary schools and to attend a higher education institution, and children from low SES backgrounds are more likely to suffer health and safety issues, such as malnutrition, exposure to environmental hazards, and insufficient health care (Jensen, 2009). These risk factors are damaging to the physical, social-emotional, and cognitive well-being of children and their families.

SES is strongly associated with several indicators of a child’s cognitive ability, including achievement tests, grade retention, and literacy skills. Data from the Infant Health and Development Program showed that 40% of children living in chronic poverty had deficiencies in at least two areas of function, language, and emotional responsiveness (Jensen, 2009). According to research by the Series on Child Development in The Lancet, “the links between poverty and inequities in child development are mediated by biological factors including child undernutrition and micronutrient deficiencies” (Trans, 2016, p. 418).

Many children have nutritional deficiencies due to food insecurity. A household has low food security if its members experience food shortages and reductions in food quality due to a lack of household resources or access (Burke et al., 2018). Lack of resources and access could be a result of living in “food deserts” and having no transportation to get to food sources. Food insecurity disproportionally affects African American households, and African American
households with children are twice as likely to experience food insecurity than White households with children (Burke et al., 2018). This lack of access to adequate food resources in the African American community is an “opportunity gap” (Iruka, 2017) that exacerbates achievement gaps.

**Reading Gaps**

Research has shown that as early as 18 months of age low SES children begin to fall behind in literacy skill development due to environmental factors (Corvington, Benedict, & Maldonado, 2016). Children who read proficiently by the end of third grade are more likely to graduate from high school and become economically successful in adulthood (Annie E. Casey Foundation, 2016), yet the mean reading score of a student can be predicted by rates of childhood poverty. A Northwest Evaluation Association Research study published in 2018 examining the relationship between poverty and student achievement, based on decades of research, supported a negative relationship between the level of poverty in a school and student achievement, and the study found the relationship to be stronger than typically identified (Hegedus, 2018). The National Assessment of Educational Progress (NAEP) reported that 80% of low-income fourth graders were not proficient in reading (National Assessment of Educational Progress [NAEP], 2018). In addition to reading gaps based on SES, there is also a noticeable gap between White and Black student achievement; the National Assessment of Educational Progress (NAEP) reported that 45% of White fourth graders were proficient in reading, compared to 18% of Black fourth graders (NAEP, 2018).

**Nutrition and Cognitive Development**

Maturing of neural pathways depends on input from the child’s environment, and adequate nutrition is an aspect of the environment that is important to normal cognitive development. Poor nutrition is more likely to harm cognitive development if the deficiency occurs during a time when neural development is high (Prado & Dewey, 2014), and research suggests that early adolescence is the biggest burst of brain development following infancy (AMLE, 2010). As a child approaches adolescence, the prefrontal cortex continues to mature, with a significant spurt of growth just before puberty. Teens undergo a burst of “synapses pruning,” as important connections are strengthened while unnecessary ones are discarded (Sukel & Reed, 2015). As the adolescent brain undergoes this important developmental reorganization, nutrition provided from the student’s environment is key. Malnutrition reduces motivation, curiosity, and exploratory activities, which weakens mental and cognitive development (Garkal & Shete, 2015). In contrast, the nutritionally healthy child is better able to interact with his or her family and environment, and these interactions provide the experiences necessary for optimum brain development. Brain development for all children, regardless of economic status, requires healthy nutrition.

A recent nutrition study found a correlation between impaired cognitive function and malnutrition in primary school children in India (Garkal & Shete, 2015). The results showed a progressive reduction in intelligence quotient (IQ) development as the degree of malnutrition advanced. The study concluded that nutritional and socioeconomic status significantly affect the development of IQ in school children. Likewise, Murray-Kolb and Beard (2007) found a relationship between iron status and cognitive abilities in young women. After treatment with an iron supplement, cognitive skill score increased and the time to complete the test decreased. Also, research revealed that adolescent women with iron deficiency anemia might experience negative cognitive function, decreased audiovisual reaction time, and decreased physical performance. Symptoms decreased rapidly with iron supplements (Doung et al., 2015). Additionally, this study concluded that more research is needed to better identify anemia risk factors specific to adolescents (Sekhar et al., 2016). Therefore, a closer look at school nutrition programs may reveal information regarding health and nutrition factors for adolescents.

Much of the recent research on adolescent nutritional needs and school nutrition programs has focused on reducing obesity and body mass index. These studies addressed the school lunch offerings compared to stringent nutritional criteria of portion size and calorie intake (Lucarelli et al., 2014). Other research uncovered the impact of poor nutrition and student health on school attendance and grade retention but did not address cognitive function. Limited research has addressed increasing the iron provided to students during the school day and its impact on achievement in schools.

**Nutrition Interventions**

Nutritional deficiencies may be mediated with interventions such as food aid and iron supplements, which are associated with increased birth weight and reduced premature births. When children are
a healthy height and weight for their age, they may start school on time, progress through school on schedule, have improved cognitive skills, and have higher school achievement (Purcell & Gershoff, 2015). Nutrition interventions have long been recognized as an investment in the potential for economic productivity. For example, the United States created the Women, Infant and Children Food and Nutrition Service (WIC) in 1972 to provide federal grants to states for supplemental foods, health care referrals, and nutrition education for low-income pregnant, breastfeeding, and non-breastfeeding postpartum women, and to infants and children up to age five who are found to be at nutritional risk (Halim et al., 2015). In addition, school breakfast and lunch programs can be a constant for all children and should be particularly nutrient rich for our students of low SES.

The Iron-Rich Nutrition at School Intervention

Martin Middle School (MMS, a pseudonym) developed, implemented, and promoted a new iron-rich menu for the students, beginning with the 2015–2016 academic year. Research has shown that a diet rich in iron is linked to higher academic performance (Doung et al., 2015). According to the Guidelines for Adolescent Nutrition Services (Story & Stang, 2005), children ages 9–13 years of age should consume 8 milligrams a day (mg/d) of iron; by ages 14–18 years the recommended daily intake increases to 11 mg/d for males and 15 mg/d for females. Before the intervention described in this study, only seven out of 131 items available for the school’s breakfast and lunch menus contained half of the recommended daily intake of iron; the other items contained far less or no iron at all.

The goal of this action research was to impact school nutrition in such a way that it could expand and last for many years to come, so we applied Kotter’s (1996) Eight Stage Process to Creating a Major Change. The steps in Kotter’s process are establishing a sense of urgency, creating the guiding coalition, developing a vision and strategy, communicating the change vision, empowering a broad base of people to take action, generating short-term wins, consolidating gains and producing even more change, and institutionalizing new approaches in the culture.

The principal (and lead author/researcher) built a team, or coalition, that was able to effect change in school nutrition. The team included district and school cafeteria staff, teachers, students, and parents who met and discussed school nutrition and academic achievement. The coalition’s research and discussion led the way to the hiring of a full-time nutritionist for the school system who had the responsibility to research menu items that had more protein and iron. The principal included the school nutrition staff as a part of this whole-school effort and worked to change the perception of the role of school nutrition programs in supporting the academic gains of the students. This was important because the “structural silos” between the nutrition program and the academic program could undermine the coalition’s efforts (Kotter, 1996, p. 103).

The focus was on revising the food choices to make them higher in protein, which would increase the iron students received. The goal was to develop and serve at least one menu item a day that contained at least half of the recommended amount of iron; thus, the food offering goal amount was 5 milligrams of iron. Prior to the menu change in 2015–2016, MMS breakfast and lunch options were carbohydrate-based. Breakfast included honey buns, cereal, and pastries while lunch options included breaded chicken nuggets, pasta, and Turkey sandwiches. During the 2017 school year, however, MMS students received breakfast and lunch items that were more iron-rich, and these choices were made available more often during the week. Items richer in iron included scrambled egg bowls and yogurt parfaits, which replaced carbohydrate-based breakfast items. Similar menu items were replaced with more iron-rich products (see the Appendix for more detailed information on the typical school menu prior to and after the iron-rich intervention).

During 2017, an average of 83% of the population visited the cafeteria and ate free breakfast and 75% ate school lunch. Thus, these students ate the improved iron rich school breakfast and lunch items, as they were not given other options. However, there were no specific signs or advertisements that informed students which items were more iron-rich or improved and which were not when they proceeded through the lunch lines. In some cases, a student could choose an iron-rich breakfast and lunch, and in turn, receive the daily recommended allowance of iron.

Method

Setting and Participants

MMS is a rural Title I school in southeast Georgia serving Grades 7–8. The 2013 Gini Index reported
Georgia as one of eight states with higher income inequality than the national average (Mather & Jarosz, 2014), and the county in which MMS is located exhibits a high-income inequality. At the time of this study, MMS served approximately 680 students with 60% of students eligible for free or reduced-price lunch (FRPL), a proxy for low SES. The school food and nutrition staff fed 72% of the school’s students breakfast and 87% of the school’s students lunch, and all low SES students at MMS ate both breakfast and lunch at school.

The eighth-grade class serving as the comparison group had approximately 269 students ages 11 to 14 (comparison group age: \( M = 12.80, SD = 1.33 \)) while the eighth-grade class serving as the treatment had approximately 225 students (treatment group age: \( M = 12.34; SD = 1.96 \)). However, only 261 students in the comparison group and 189 students in the treatment group had complete Lexile data, and hence, they represent the actual sample (\( N = 450 \)). No change in the reading instruction was implemented during the study to avoid confounds.

The sample was comprised of 222 males and 228 females, of which 271 were considered low SES students. Of the sample, 77 students were diagnosed with learning disabilities. Regarding racial makeup of the sample, 171 identified as Black, 225 as White, 36 as Hispanic and 18 as Multi-Racial. Eligibility for receipt of free or reduced-price lunch served as the proxy variable for determining socioeconomic status; thus, those who were eligible to receive free or reduced-price lunch were considered low SES for the purposes of this study (Nicholson et al., 2014). Further, we consolidated racial identity by splitting students who identified as White from all other racial categories (i.e., we combined all racial categories other than White into one, which we labeled “Person of Color” for the purposes of this study) and gender remained a dichotomous covariate (male, female).

**Research Design**

The researchers used a quasi-experimental research design with intact groups (one serving as the comparison and one serving as the treatment) using nonrandom, convenience sampling procedures in an action research framework. In education, action research typically occurs in schools and classrooms and it is a deeply reflective practice in which practitioners are challenged to make direct changes to enhance their professional practice through systematic procedures (Johnson & Christensen, 2017). The goal in this action research study was to learn about the connection between nutrition and reading performance and use the information to inform school menu choices.

**Instrumentation**

The ELA component of the Georgia Milestone End of Grade Assessment (EOG) was used to extract Lexile scores for each student. The EOG assessment is a standardized, norm-referenced test of achievement administered by the Georgia Department of Education to all public middle school students in Georgia (see Georgia Department of Education [GaDOE], 2020, for psychometric information). The Lexile® Framework for Reading is an educational tool that links text complexity and readers’ ability on a common metric known as the Lexile scale. The Lexile score is a number that should increase as the student progresses in independent reading and comprehension. National Lexile user norms determine typical Lexile scores by grade. The expected proficient Lexile by the end of Grade 8 is 1010 (Williamson, 2006). The score provided by the EOG helps educators in Georgia determine students in need of reading interventions, which is normal school activity and is not something implemented for the sake of this study.

**Procedure**

The researchers collected students’ Lexile scores based on their performance on the ELA portion of the EOG as reported by the Georgia Department of Education (GaDOE, 2020). School administrators have access to their assigned school scores, and both current and historic assessment data were obtained through the Georgia Department of Education Administrative Portal. Data are released within two weeks of the assessment and remain available in a secure portal within four weeks. We only had access to data for MMS. The portal is equipped with search filters to select assessment years, strand, and demographics. We first obtained a list of eighth-graders who were present at MMS during 2016–2017 academic year and a separate list of those not present. Next, we collected both groups’ Lexile scores. The data included gender, current grade, race, and SES.

**Data Analysis**

Student Lexile growth was examined from two independent groups, students who were not exposed to the iron-rich nutrition program (comparison group) and those enrolled in the school during the academic year in which the iron-rich menu was available (treatment group). We employed gender (i.e., male, female), race (i.e., White, Person of
Color), and socioeconomic status (SES; i.e., students who receive free or reduced-price lunch and those who do not) as covariates in the analysis to more clearly examine the effect of the iron-rich menu on Lexile scores. Prior to data analysis, data screening and assumption testing procedures were conducted. The data met requisite statistical assumptions, including normality, linearity, homogeneity of variance, and homogeneity of regression coefficients. In addition, no extreme outliers were detected that would otherwise undermine the trustworthiness of the data, and thus, data analysis proceeded without making any adjustments to the data with all 450 participants.

We answered our research question by conducting a one-way analysis of covariance (ANCOVA), with group (treatment, comparison) serving as the between-subjects independent variable and Lexile score serving as the outcome. Gender, race, and SES served as covariates in the analysis. Statistical significance for the omnibus ANCOVA results were interpreted using less than .05 as the cutoff value ($p < .05$). All effect sizes for the ANCOVA were interpreted as partial $\eta^2$ ($\eta^2_p$). Cohen (1988) provided the following interpretive guidelines for $\eta^2_p$: $<.010$ as a small effect; $.010 - .059$ as a medium effect; and $\geq .140$ as a large effect.

**Results**

**Main Analyses**

**Descriptive statistics.** Descriptive statistics separated by group (initial and adjusted means) are reported in Table 1. The average Lexile difference between the comparison group and the treatment group was 252.84.

**One-way ANCOVA.** The covariates exerted a significant effect on Lexile score—gender, $\eta^2_p = .036$; race, $\eta^2_p = .061$; and SES, $\eta^2_p = .057$—thereby justifying the need to statistically control for these variables. There was a statistically significant main effect for group, $F_{(1,446)} = 105.40, p < .0001, \eta^2_p = .164$, demonstrating that students in the treatment group, who were enrolled in the school during the implementation of the iron-rich nutrition program, outperformed the comparison group students, even after statistically controlling for the effect of the covariates. Table 1 depicts descriptive statistics, including adjusted means after statistically controlling for the covariates.

**Discussion and Implications**

The findings of the present investigation support our hypothesis. Students who were exposed to the iron-rich nutrition menu exhibited significantly higher Lexile scores than the students who served as the comparison group with the adjusted mean difference in Lexile score between groups being 252.84. Of special importance to the present investigation, this finding was evident even after statistically controlling for the effects of key demographic variables that have been shown to influence reading comprehension as covariates in our analysis —namely gender, race, and SES. Thus, even though we cannot definitively conclude that the iron-rich nutrition program was the sole contributor to the difference in Lexile scores between the two groups, we can tentatively claim that the Lexile difference is at least partially attributable to the iron-rich nutrition program. This finding has implications for the local context and general implications for practice and research.

**Local Implications**

One lasting outcome of this action research study was the addition of a school system nutritionist. This position was created as a direct result of this study’s coalition formed to improve the nutrition program at MMS. In the past, menus were not planned with a focus on protein and iron; instead, they were designed based on the USDA guidelines of low fat, low salt, and low sugar. The nutritionist has addressed

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**Table 1**

*Descriptive Statistics (Initial and Adjusted Means and Standard Errors) of Lexile Scores by Group*

| Variable | Comparison ($n = 261$) | Treatment ($n = 189$) |
|----------|------------------------|-----------------------|
|          | $M$ | $M_{\text{adjusted}}$ (Std. Error) | $SD$ | $M$ | $M_{\text{adjusted}}$ (Std. Error) | $SD$ |
| Lexile   | 906.03 | 898.20 (9.08) | 233.01 | 1126.90 | 1151.04 (8.59) | 220.57 |

$N = 450$. The adjusted mean difference in Lexile score between the comparison group and the treatment group was 252.84.
the protein and iron offerings at MMS and throughout the school district.

**Implications for Policy and Practice**

Children who are not well-nourished are at risk for weakness in their ability to form cognitive, motor, and socioemotional skills. Therefore, cohesive strategies addressing the many risk factors, particularly nutrition, are needed so all children can achieve their developmental potential (Prado & Dewey, 2014). Children are at school for almost half of their waking hours, and most eat two meals a day in the school setting (Ball et al., 2015). School food and beverages make up 35% to 51% of total dietary intake of children, and these percentages tend to be even higher for children of low SES. However, school food programs do not regulate micro or macronutrients such as iron; rather, schools are required to regulate calories, saturated fat, and salt. According to the Guidelines of Adolescent Nutrition Services, teens need up to 11 milligrams a day of iron and 15 milligrams a day for menstruating females. Unfortunately, school nutrition programs offer less than half of the daily requirement of iron. Therefore, schools may not be providing the proper nutrients required for cognitive development.

For this reason, school is a valuable place to initiate nutritional behavior changes. To create this type of program, schools should develop short-term and long-term goals to address health and achievement needs of children (Oser et al., 2014). Children need to be educated on what healthy choices are, and an improved health-focused setting makes those choices easier (Ball et al., 2015). However, research has shown that the implementation of strategies for educating students about nutrition and physical fitness is not enough. Schools should address the macronutrient allowance provided to students, and then expand the educational approach to include why these nutritional changes may help students’ cognitive development (Oser et al., 2014). Thus, middle level schools should not only strive to meet the academic needs of adolescents, but also strive to address the whole child through coordinated health programs (AMLE, 2010). While factors that interfere with adolescent learning are often from the environment outside school, wellness programs should do all they can to provide a healthy environment within schools.

**Implications for Future Research**

Future research should collect data on multiple years using cohort studies to better examine the long-term effect of an iron-rich school nutrition program (e.g., Is the change across time linear or curvilinear?). A long-term study on improving nutrition in schools would yield powerful information on nutrition’s impact on reading achievement through Lexile growth. Another approach would be to collect data from multiple grades (i.e., elementary, middle, and high school). Research has shown that third and fifth grades are key years for reading readiness (Hiebert, 2015), so future research should include these grades. Studying a variety of grades might also reveal the grade bands in which an iron-rich nutrition intervention would have the greatest impact. Even as the adolescent brain is reorganizing, elementary school students’ brains are still developing and may show benefits from a school-wide iron-rich school nutrition program. In addition, experimental work on the effects of enhanced nutrition, such as by implementing a quasi-experimental study between schools or districts that do and do not employ enhanced nutrition programs, would also help in strengthening causal links.

Further, our research did not attempt to evaluate biomarkers, as objective measures, to determine if the student population at MMS was malnourished or iron deficient. It is difficult to have invasive studies such as these for ethical reasons; however, biomarkers to determine iron deficiencies would be very valuable. Further research, especially quasi-experimental work addressing the effect of iron-rich food on malnutrition and academic outcomes, would influence educational leaders to address those specific nutritional needs for the students.

**Methodological Reflections and Limitations**

As with all studies, especially those with human participants, there were limitations to this study. A small number of students in the nonrandomized sample often brought their lunch to school, and all these students fell in the *not identified low SES* subset. The nutrition value of the lunch they brought from home was not within our control, and hence, may have impacted the results. Also, students who received school breakfast and lunch may not have selected the most iron-rich choices and may not have eaten all the serving on a given day. The primary author observed throughout the study that low SES students tended to select the most filling items dense in carbohydrates and not rich in protein. Also, this study only included those students who attended MMS. Thus, the results may not be readily generalizable due to the inclusion of only one school.
Despite the various limitations of our study, we wish to underscore two strengths. First, the research occurred in an ecologically valid setting (i.e., in an actual school setting), so our conclusions are more contextually valid than a study conducted in a contrived setting (i.e., a laboratory). Second, we employed a robust sample size making the results more stable than studies with smaller sample sizes. Finally, albeit by no means ideal, the present study employed a quasi-experimental research design with two intact groups of students, one serving as the comparison group. Therefore, we believe our study represents a worthy contribution to the literature on these topics.

Conclusion

Few studies have examined the influence of macronutrient health on educational outcomes, even though it is widely recognized that minerals are critical to cognitive development (Douong et al., 2015). This research is significant, as educational leaders have a moral obligation to promote health and social justice for all students. As a result of the findings from this study, one goal of the MMS leadership was to change and improve school nutrition in such a way that it can expand and be sustained. This study addressed gaps in the research connecting a pilot school nutrition program that offers iron-rich food to academic growth as measured by Lexile scores on a middle grades reading assessment. The findings provide new insights about adolescent nutrition as intended to contribute to current research, specifically on academic outcomes of students’ experiencing a multitude of changes. A one-year intervention of an iron-rich menu showed significant, albeit tentative, adjusted mean Lexile improvement of eighth-grade students at MMS compared to a comparison group. Additional research over time and of multiple grades will benefit schools across the country to better inform school and system leaders how to best meet the needs of the ever-increasing high-risk low SES student populations.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix

### Lunch Menu Items Replaced with More Iron-Rich Items

| Item                                               | Iron-Rich Item                                              |
|----------------------------------------------------|-------------------------------------------------------------|
| **Pork BBQ sandwich (Brand B)**                    | • Protein – 25.00 grams per serving                          |
|                                                    | • Iron – 2.74 milligrams per serving                         |
| **Pepperoni Pizza (Brand A)**                     | • Protein – 20.00 grams per serving                          |
|                                                    | • Iron – 1.80 milligrams per serving                         |
| **Spaghetti with Meatballs (Brand T&E)**           | • Protein – 14.87 grams per serving                          |
|                                                    | • Iron – 2.49 milligrams per serving                         |
| **Spicy Chicken Strips (Brand H)**                | • Protein – 13.93 grams per serving                          |
|                                                    | • Iron – 1.99 milligrams per serving                         |
| **BBQ sandwich (District Recipe)**                 | • Protein – 29.07 grams per serving                          |
|                                                    | • Iron – 3.10 milligrams per serving                         |
| **Pizza (Brand N)**                                | • Protein – 20.0 grams per serving                           |
|                                                    | • Iron – 2.0 grams per serving                               |
| **Spaghetti with Meat Sauce (District Recipe)**    | • Protein – 17.69 grams per serving                          |
|                                                    | • Iron – 5.41 milligrams per serving                         |
| **Spicy Chicken Strips (Brand H)**                | • Protein – 19.59 grams per serving                          |
|                                                    | • Iron – 2.05 milligrams per serving                         |

### Breakfast Menu Items Replaced with More Iron-Rich Items

| Item                                               | Iron-Rich Item                                              |
|----------------------------------------------------|-------------------------------------------------------------|
| **Whole Grain Honey Bun (Brand F)**                | • Protein – 4 grams per serving                              |
|                                                    | • Iron – 1.8 milligrams per serving                          |
| **Ultimate Breakfast Round (Brand H)**             | • Protein – 6 grams per serving                              |
|                                                    | • Iron – 3.6 milligrams per serving                          |

### New Iron-Rich Lunch Menu Items Added

| Item                                               | Iron-Rich Item                                              |
|----------------------------------------------------|-------------------------------------------------------------|
| **Beef Soft Tacos w/ Black Beans (District Recipe)**| • Protein – 30.29 grams per serving                          |
|                                                    | • Iron – 5.37 milligrams per serving                         |
| **Brunswick Stew w/ Grilled Cheese Sandwich (District Recipe)** | • Protein – 33.02 grams per serving                          |
|                                                    | • Iron – 6.11 milligrams per serving                         |
| **Double Cheeseburger w/ Broccoli Salad (Brand H)** | • Protein – 38.60 grams per serving                          |
|                                                    | • Iron – 5.82 milligrams per serving                         |
| **Fish Sandwich w/ Cheese and Potato Wedges (Brand H)** | • Protein – 15.09 grams per serving                          |
|                                                    | • Iron – 2.45 milligrams per serving                         |
| **Meatball Sub and Side Salad (Brand H)**          | • Protein – 25.67 grams per serving                          |
|                                                    | • Iron – 2.81 milligrams per serving                         |
| **Salisbury Steak w/ Lima Beans and Mashed Potatoes (Brand H)** | • Protein – 25.57 grams per serving                          |
|                                                    | • Iron – 4.93 milligrams per serving                         |

### New Iron-Rich Breakfast Menu Items Added

| Item                                               | Iron-Rich Item                                              |
|----------------------------------------------------|-------------------------------------------------------------|
| **Breakfast - Greek Yogurt Parfait w/ Blueberries (District Recipe)** | • Protein – 10 grams per serving                            |
|                                                    | • Iron – 8.40 milligrams per serving                         |
| **Grits, Eggs, and Turkey Sausage Bowl (District Recipe)** | • Protein – 18 grams per serving                            |
|                                                    | • Iron – 5 milligrams per serving                            |