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Comparison of Consumed Lunch Nutrient Profiles of 6th-Grade Students Before and After Implementation of the West Virginia School Nutrition Standards

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Please note that this study was published before the implementation of Healthy, Hunger-Free Kids Act of 2010, which went into effect during the 2012-13 school year, and its provision for Smart Snacks Nutrition Standards for Competitive Food in Schools, implemented during the 2014-15 school year. As such, certain research may not be relevant today.

ABSTRACT

This study compared the nutrient profiles from consumed school lunches of 6th-graders before and after the implementation of the West Virginia (WV) School Nutrition Standards. These standards required school lunches to meet the *Dietary Guidelines for Americans* for nutrients such as fat and sodium, and were more rigorous than the existing federal standards. The sample consisted of 173 6th-grade students in WV: 98 students before implementation of the standards (WV before cohort) and 75 students after implementation (WV after cohort).

In order to control for changes in food products and consumer practices over time, nutrient profiles from a cohort of 70 6th-graders from Pennsylvania (PA), whose meals were not governed by such regulations, were collected at the same time as the WV after cohort. Consumed lunch data were collected as part of two 24-hour dietary recalls. The WV School Nutrition Standards were the benchmarks for all evaluations, since the purpose of this study was to ascertain whether nutrient consumption was altered when more healthful lunches were served.

Results from the WV after cohort revealed lower mean values for total fat, saturated fat, and sodium. However, lower mean levels for calories, protein, thiamin, iron, and zinc also were observed in the WV after cohort, and among females, lower mean intakes for vitamin B6 and calcium.

While the percent of students meeting fat, sodium, and cholesterol recommendations improved in the WV after cohort, there was no improvement for saturated fat. Less than 25% of students met the recommendations for calories, vitamin A, thiamin, vitamin B6, calcium, iron, and zinc, indicating that although the WV after cohort was served lunches in compliance with the standards, students were not consuming these offerings. These findings support the need for continued efforts toward assisting school foodservice managers with strategies to increase actual consumption of more healthful school meals.

The hypothesis was that after implementation of the WV School Nutrition Standards (WVSNS), nutrient intake profiles would show a reduction of sodium, as well as total and saturated fat, and an increase in dietary fiber, with no change in vitamin or mineral content.

INTRODUCTION

Childhood is an opportune time to establish lifelong diet and exercise habits, and schools are an ideal environment in which healthful lifestyle habit examples can be modeled and learned. The American Dietetic Association (ADA), the Society for Nutrition Education (SNE), and the American School Food Service Association (ASFSA) recommend that comprehensive school-based nutrition programs be provided to all elementary and secondary school students in the United States, and that such health programs include education in foods and nutrition, an environment that promotes healthful eating and physical activity, and involvement of parents and the community (Position of ADA, SNE & ASFSA, 1995). Likewise, national health objectives include recommendations for improvements in diet and an increase in regular physical activity among children and adolescents; these are important for the prevention of obesity and adulthood chronic diseases such as coronary heart disease (CHD), diabetes, and cancer (U.S. Department of Health and Human Services [HHS], 1990 & 2000).

In the early 1990s, West Virginia (WV) had been reported to lead the nation in heart disease mortality (West Virginia Department of Health & Human Resources [WVDHHR], Bureau of Public Health, 1994). Data from a survey of 45 states indicated that WV remained among the top 10 states with the highest percentage of persons >18 years of age who were overweight (24.8 percent) and who smoked (26.6 percent) (Centers for Disease Control and Prevention [CDC], 1991). In response to these dire health statistics and with a desire to be proactive regarding health promotion, the West Virginia Board of Education (WVBOE) designed its Standards for School Nutrition (WVSNS) in 1993 in an effort to "ensure a healthy school environment that provides for the nutritional well-being for students" (WVBOE, 1994; Stuhldreher et al., 1998). These independently developed standards were implemented before the most recent federal mandates (U.S. Department of Agriculture [USDA], 1995). The objectives of the WVSNS were to: 1) ensure nutrient adequacy of all meals; 2) provide guidelines that target nutrients identified as critical to health promotion and disease prevention; and 3) adhere to standards defined in the *Dietary Guidelines for Americans* (DGAs) (USDA, 1990).

The overall goal of the West Virginia Healthy Schools Nutrition Study (WVHSNS) was to determine if the new standards influenced the dietary intake of students in rural areas, which are comprised of a higher percentage of students who rely on school meals to provide the majority of their daily nutrient intake. The specific aims of this report were to:

1. Describe the school lunch intake of a cohort of WV students before implementation and evaluate it against the WVSNS;
2. Compare the lunch intake of a cohort of WV students after implementation of WVSNS with that of a cohort of WV students before implementation; and
3. Compare the lunch intake of the WV after cohort with intakes of a cohort of students from PA during the same time period, which could control for changes in products in the marketplace and dietary influences that might have been attributed to the passage of time.

Methodology

Terminology

For the purposes of this study, the term “standard” refers to the target level of nutrients that the lunch is supposed to offer, according to the WVSNS. These standards will be the benchmarks upon which all cohorts’ nutrient profiles are judged for adequacy. For protein, vitamins, and minerals, the lunch standard was one-third of the gender-specific 1989 Recommended Dietary

Allowance (RDA) value for 11- to 14-year-olds (National Research Council [NRC], 1989). For nutrients included in the DGAs, the lunch standard refers to the following percentages:

- ≤30 percent of calories from fat;
- <10 percent of calories from saturated fat;
- ≤100 mg of cholesterol;
- ≤6 grams of fiber; and
- ≤1,100 mg of sodium.

The term “WV before cohort” refers to dietary intake data collected from students prior to standard implementation. The term “WV after cohort” refers to dietary intake data collected from students during the time period the WVSNS were in place.

Study Design and Population

The WVHSNS was a community intervention study that compared nutrient profiles of cohorts of 6th-grade students before and after implementation (approximately 3 years apart) of WVSNS. Two poverty-stricken counties were chosen to participate, areas from which approximately 70% of students received free or reduced-price meals (WVBOE, 1992).

Because changes in food products and consumer practices could confound the results over time, especially regarding dietary fat, a comparison cohort from rural Pennsylvania (PA) schools was assembled. At the time, federal school lunch guidelines did not require specific levels for fat, saturated fat, cholesterol, sodium, and fiber. The comparison cohort from PA was drawn from areas that would provide a population similar to the WV cohort. In order to obtain a sample size comparable to the WV cohort, the PA sample was drawn from four rural schools.

Human Subjects Approval (IRB) from West Virginia University and the University of Pittsburgh was granted for parental consent and participant assent. Guardians of 6th-graders were sent a letter, which described the study and included consent forms that would grant their children permission to participate. If parents gave consent, students were read assent forms that indicated their willingness to participate. If parents gave consent, students were read assent forms that indicated their willingness to participate. Researchers witnessed each student’s signature. This study had approval from the WV Board of Education and each participating school district in WV and PA.

Dietary Assessment

Identical dietary assessment methods were used for WV after and PA cohorts (Stuhldreher et al., 2000). Briefly, dietetic student researchers were given a one-day training session that included directions on following a standard protocol, which would ensure that everyone used the same format when conducting the 24-hour recalls. Researchers practiced conducting recalls using food models to ascertain portion size. Researchers also were given specific directions regarding their observations of students during school lunch. They were briefed on the protocol for labeling lunch trays, instructed on how to discreetly observe the students eating during lunch, and practiced measuring plate waste.

During the actual data collection, participants in the study were instructed to leave their trays on the tables so that researchers could record the amounts consumed. Trays were labeled at the beginning of the serving line, and observation was performed for every student participant at least once. Data from the observations were compared with the dietary recall of that same lunch to assess the quality of the recall; these data are explained elsewhere (Stuhldreher et al., 2000). Researchers used school menus and the National Dairy Council's standardized food models to assist students during diet recalls. Use of 24-hour dietary recalls has been cited as an acceptable method to use with children (Goran, 1998).

Dietary variables selected for analysis included calories, protein, vitamin A, vitamin C, thiamin, vitamin B6, calcium, iron, zinc, cholesterol, sodium, and dietary fiber. The percentage of calories from total fat and saturated fat also were examined. Although vitamin B6 and zinc were not listed as nutrients to be monitored in either the WVSNS or in the current School Meals Initiative (USDA, 1995), these nutrients were included due to the results of the School Nutrition Dietary Assessment Study that indicated the vitamin B6 and zinc content of school meals as offered and consumed was below 33% of the RDA for select age groups (Burghardt et al., 1993).

Dietary data were analyzed using Nutritionist IV (software version 4.0 for Windows, 1994, First Databank, San Bruno, CA). To ensure accuracy, data were coded and entered by one researcher and verified by another in a blind fashion. Coding records of all data assumptions were kept to provide consistency of data entry procedures.

Statistical Analysis
Pearson product moment correlations were used to compare observed and recalled lunch intake. For most nutrients, the correlation between the observed and recalled lunches was acceptable ($r>0.70$), thus, dietary recalls were judged acceptable.

Differences in the mean dietary intake of nutrients among the cohorts were tested using Analysis of Variance (ANOVA) separately for males and females. Comparison of the percent of students from each cohort who were in compliance with the standards was evaluated using Chi-square analysis. All analyses were performed using SPSS (SPSS, Inc., version 10.1, Chicago, IL). Statistical significance was defined as $p>0.05$.

Results And Discussion

Participant Characteristics
Of those students enrolled in the two WV and four PA schools from which the sample was drawn, there was a total of 274 WV and 419 PA students enrolled in the 6th-grade. The school foodservice directors estimated that of these students, approximately 60 to 85% usually consumed school meals. This report is based on 71 WV (43 female) students from the initial study (WV before cohort), as well as 98 WV (53 female) and 70 PA (36 female) students from the after observation (WV after cohort and PA cohort). All students were 11 or 12 years of age.

Recalled Lunch Intake in the WV cohorts: Before and After Guideline Implementation
Comparisons between the lunch intakes of WV students before and after implementation of the WVSNS are shown in **<u>Table 1</u>**. Caloric intake was lower for the WV after cohort and was less

than the standard. Although mean protein intakes met the standards, the mean level was lower in the WV after cohort. Among females, mean levels were lower in the WV after cohort for thiamin, vitamin B6, calcium, iron, and zinc. Among males, mean levels were lower in the WV after cohort for thiamin, iron, and zinc. A comparison of the mean as a percent of standard also is listed as an indicator of the magnitude of that contribution. The most noticeable decreases among the WV after cohort were for calories, iron, and zinc, and among females, for vitamin B6 and calcium.

Table 1. Recalled lunch intake mean (± SD) and contribution of school-consumed lunch to lunch standard of WV cohorts before and after implementation of standards and PA comparison cohort

Dietary Component By Gender		WV Lunch Standards[a] By gender	Mean ± SD WV Before Cohort	WV Before Cohort Mean as % of Standard	Mean ± SD WV After Cohort	WV After Cohort Mean as % of Standard	Mean ± SD PA Cohort	PA Cohort Mean as % of Standard
Calories and Nutrients with RDA Standards[b]								
Calories	M[c]***	833.3	731.9 ± 217.0	88	547.0 ± 164.0	66	662.0 ± 122.0	80
	F[c] ***	733.3	606.9 ± 201.5	83	377.0 ± 159.0	51	607.0 ± 179.0	83
Protein (g)	M**	15.0	30.8 ± 10.1	205	26.0 ± 8.0	173	29.0 ± 7.0	193
	F **	15.3	24.2 ± 10.4	158	18.0 ± 9.0	118	25.0 ± 8.0	163
Vitamin A (µg RE)	M	333.3	498.8 ± 494.3	147	447.0 ± 794	134	282.0 ± 207.0	85
	F	266.7	292.3 ± 188.9	110	320.0 ± 546.0	120	212.0 ± 116.0	80
Vitamin C (mg)	M	16.7	21.6 ± 18.3	129	19.0 ± 12.0	114	19.0 ± 13.0	114
	F	16.7	23.8 ± 19.8	120	22.0 ± 15.0	132	18.0 ± 16.0	108
Thiamin (mg)	M**	0.43	0.58 ± 0.36	135	0.40 ± 0.20	93	0.5 ± 0.10	116
	F***	0.37	0.48 ± 0.27	130	0.30 ± 0.20	81	0.50 ± 0.20	135
Vitamin B_6 (mg)	M	0.57	0.49 ± 0.21	86	0.40 ± 0.20	70	0.40 ± 0.1	70
	F***	0.47	0.46 ± 0.22	98	0.30 ± 0.10	64	0.30 ± 0.10	64
Calcium (mg)	M	400.0	401.0 ± 136.8	100	401.0 ± 150.0	100	466.0 ± 132	117

	F***	400.0	346.4 ± 130.6	87	269.0 ± 134.0	67	426.0 ± 170.0	107
Iron (mg)	M***	4.0	3.8 ± 1.1	95	2.7 ± 1.2	68	3.8 ± 1.1	95
	F***	5.0	3.3 ± 1.4	66	1.8 ± 0.8	36	3.3 ± 1.3	67
Zinc (mg)	M**	4.0	3.5 ± 1.4	88	2.7 ± 1.3	67	2.5 ± 0.8	63
	F***	4.0	3.1 ± 1.5	78	1.7 ± 0.9	43	2.2 ± 0.9	55
Nutrients with Dietary Guideline Goals[d]								
Fat (% of Calories)	M***	≤ 30	39.5 ± 8.3	132	33.6 ± 7.3	113	32.7 ± 6.8	176
	F*	≤ 30	37.2 ± 9.3	124	31.6 ± 9.3	105	33.3 ± 7.9	111
Saturated Fat (% of Calories)	M*	< 10	12.2 ± 3.1	122	12.5 ± 5.2	109	9.9 ± 3.6	99
	F	< 10	11.6 ± 3.5	116	11.4 ± 5.9	114	11.2 ± 3.6	112
Cholesterol (mg)	M***	≤ 100	76.2 ± 31.9	76	54.0 ± 20.0	54	55.0 ± 17.0	55
	F**	≤ 100	61.1 ± 56.0	61	37.0 ± 29.0	37	47.0 ± 20.0	47
Fiber (g)	M	≥ 6	3.15 ± 1.3	53	2.5 ± 1.8	42	3.1 ± 1.8	52
	F**	≥ 6	3.0 ± 1.5	50	2.2 ± 1.4	37	2.1 ± 1.2	35
Sodium (mg)	M	≤ 1100	1404.4 ± 530.3	128	1162.0 ± 369.0	145	1130.0 ± 398.0	103
	F***	≤ 1100	1245.3 ± 527.4	113	812.0 ± 392.0	102	1167.0 ± 529.0	107

[a]*West Virginia Board of Education (1994)*

[b]*Standards are based on 1/3 of the 1989 Recommended Dietary Allowances for children 11 to 14 years of age (NRC, 1989)*

[c]*Females, n=45 (before) and 51 (after); Males, n=28 (before) and 45 (after)*

[d]*Standards are based on National Research Council's Diet and Health Recommendations (USDA, 1990) and fiber goal is: age + 5 grams/day, as recommended by the American Health Foundation (Williams, Bollella & Wynder, 1995)*

*$p<0.05$

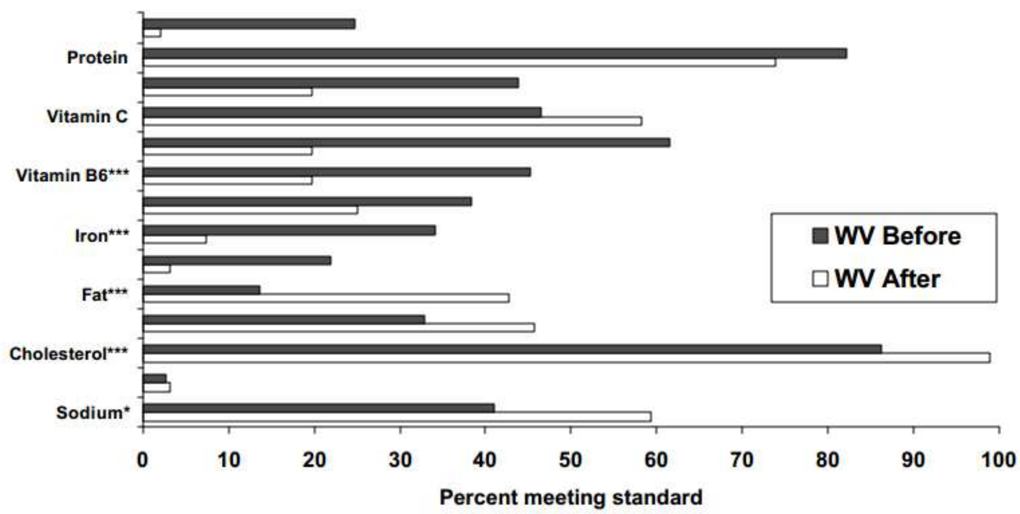
**$p<0.01$

***$p<0.001$

There was an improvement (lowered levels) in cholesterol intake for both males and females in the after cohort, and females consumed a lower mean sodium. Mean total fat as a percent of calories (mean percent of fat) decreased in the WV after cohort, as well. However, no difference in the percent of calories from saturated fat (percent of SFA) between the two time periods was found for either gender. Mean fiber intakes were lower in the WV after cohort for females.

Figure 1 shows a comparison of the percent of students in the before and after cohort who met the standards. The percentage of students in the WV after cohort who met the fat, cholesterol, and sodium standards all increased. However, the percent that met the standard for vitamins and minerals, except vitamin C, dropped. In fact, fewer than 25% of the WV after cohort met the standards for vitamin A, thiamin, vitamin B6, calcium, iron, and zinc. The frequency of those compliant for these nutrients dropped and this decrease was disturbing, especially for iron (34% to 7%), zinc (22% to 3%) and thiamin (62% to 20%).

Figure 1. Percent of 6th-graders who met the WV Nutrition Standards[a]: Comparison of the WV before cohort with the WV after cohort



[a]All cohorts were judged against the WV standards
**p<0.05*
****p<0.001*

Critics opposed to reducing the fat content of children's diets have raised the concern that such reductions typically are accompanied by a reduction in nutritional quality (Joint Working Group, 1993; Lifshitz & Tarim, 1996; Olson, 1995). A study conducted during the time in which the WV standards were drafted reported that students who self-select diets lower in fat have shown a reduction in intakes of micronutrients (Nicklas et al., 1992). Stuhldreher et al. (2001) examined the nutritional intake of children living in low-income areas of southern WV. These researchers reported that while most children met nutritional guidelines for cholesterol and vitamin C, less than adequate intakes were noted for fiber, calcium, and iron. Furthermore, excesses were found for most children in total and saturated fat intake.

Examination of changes in food selections may give a plausible explanation for the reduction in nutritional quality. For example, the standards require that five servings of bread and bread products per week contain at least 33% whole grain. In one of the districts in the study, the foodservice staff baked fresh rolls in compliance with these regulations. In spite of the appetizing appeal of fresh baked bread, acceptance of the part-whole-grain product was not great, and could explain the low compliance for thiamin, vitamin B6, and zinc. A study by Shanklin and Wie (2001) found that the grain/bread component of the school lunch provided the most energy [calories], sodium, iron, total fat, and saturated fat per penny. When nutrient density was compared with cost, these researchers reported this group provided the most energy, protein, and carbohydrate per penny.

Keeping in mind that the WVHSNS study population came from very needy families, it is plausible that it is more economical for those families to serve refined bread products in the home; thus, whole-grain products are unfamiliar to these students. This also would explain the lack of an increase in dietary fiber intake over time. Furthermore, the changes in items served from the meat group may account for the lower mean and number of students meeting the standards in the after cohort. Less of the iron-rich meats, such as ground beef and other more fatty red meats, would be on the menus after implementation of the standards. This, plus the lower acceptance of whole-grains, could explain the reduction in iron, vitamin B6, and even zinc intakes seen in the WV after cohort.

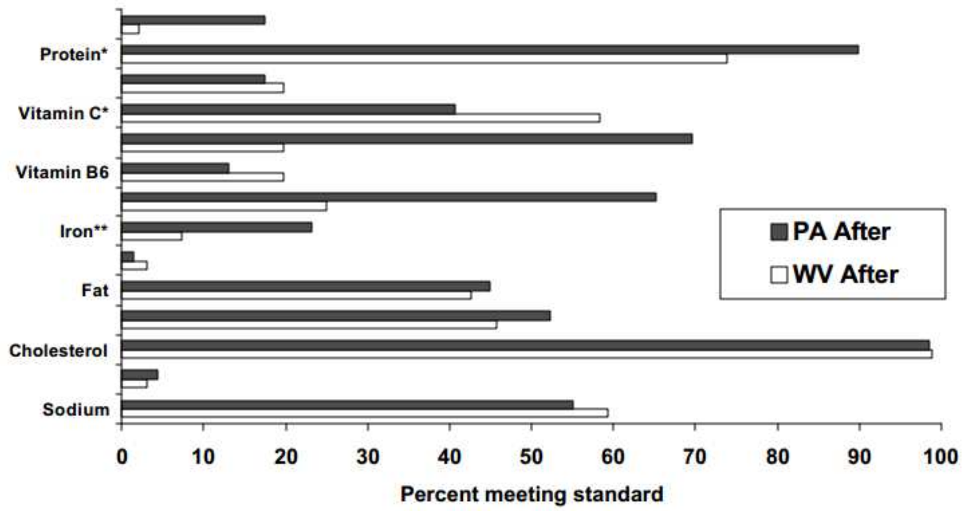
The reduction in mean calcium intake among girls and the lower percent meeting this standard in the WV after cohort could be explained by a failure to consume lower fat (2%) and skim milk and by a reduction in the amount of cheese used in school meals. These findings would be consistent with the results of the Bogalusa Heart Study, which indicated that groups of students with higher fat intakes consumed more meat and dairy products than those with lower fat intakes (Nicklas et al., 1992). A study by Johnson et al. (1998) found calcium intakes were achieved only when milk was included at the noon meal.

Comparison of West Virginia Versus Pennsylvania

Comparisons between the gender-specific mean school lunch nutrient intake of the WV and PA after cohorts also are shown in **Table 1**. Mean calorie and protein levels were higher in the PA cohort than the WV after cohort. Although neither gender consumed a sufficient number of calories at lunch to meet the standard, protein intake did surpass the school lunch standard. Higher mean values for thiamin, calcium, and iron were observed among the PA cohort. Mean zinc intakes were higher for the PA cohort among females. The PA cohort consumed greater than 33% of the RDA for vitamin C, thiamin, and calcium but not for vitamin A, vitamin B6, iron, or zinc. WV after cohort means fell short of the lunch standard for thiamin, vitamin B6, calcium (females only), iron, and zinc.

Examination of the means as percent of standard showed that intakes of protein, vitamin A, vitamin C, thiamin, and calcium were at or above 100% of the standard in the PA cohort. In the WV after cohort, male mean calcium intake met the lunch standard. Lower values of the means as percent of standard are seen for thiamin, iron, and zinc in the WV after cohort and among females for calcium. As shown in **Figure 2**, a greater percentage of the PA cohort met the goals for calories, thiamin, calcium, iron, and protein than the WV after cohort. Conversely, a greater percent of the WV after cohort met the standard for vitamin C.

Figure 2. Percent of 6th-graders who met the WV Nutrition Standards[a]: Comparison of the WV after cohort with the PA cohort



*p<0.05
**p<0.01
***p<0.001

A comparison of the nutrients with standards derived from the DGAs revealed that male students in the WV after cohort consumed a higher percentage of calories from total fat and saturated fat than males in the PA cohort. No significant differences in the percent meeting the standards derived from the DGAs were observed (**Figure 2**).

It may be possible that the WV after cohort was less familiar with lowfat and whole-grain foods; thus they were less accepting of them. It also was noted that there are unique differences in PA and WV food patterns. The acceptance of cornbread and beans is typically seen in southern WV, whereas the PA Dutch influence is evidenced in PA schools. Further exploration of these influences may yield clues suggesting the differences in nutrient values are a result of diversity in food acceptance patterns.

Conclusions And Applications

The WV Healthy Schools Nutrition Study is the first evaluation of the actual nutritional intakes of students against the WVSNS. Although it would have been interesting to survey the same group of students before and after implementation of the new school nutrition standards, it would have been challenging to retain them in the study for the three-year period. In addition, the impact of the adolescent growth spurt would have introduced another source of variability.

This report is limited to a comparison of nutrient profiles from lunch intake only; therefore, the specific influence of other foods eaten during the day on nutrient intake was not assessed.

Despite these limitations, however, there are some important lessons to be learned. Although the mean percent of calories from fat decreased over time, there was no difference between the cohorts in the percent that met the saturated fat recommendations. Mean levels (as well as the mean as a percent of standard for thiamin, iron, and zinc, and among females for calcium and vitamin B6) all were lower in the WV after cohort. Correspondingly, fewer students in the WV after cohort met these recommendations.

These are not reasons to conclude that lower fat consumption compromises nutritional quality. Quite the opposite has been demonstrated in the Child and Adolescent Trial for Cardiovascular Health (CATCH), which indicated that changes made in school nutrition to lower fat and sodium content were accompanied by a retention of high levels of other nutrients, such as vitamins and minerals. CATCH study results indicate the importance of a combined effort of school- and family-based interventions (Nicklas et al., 1992). Likewise, reports from the Bogalusa Heart Study indicated that children with high fiber intakes consumed less fat, particularly saturated fat, than did children with low fiber intakes (Nicklas et al., 1995). And results from the Dietary Intervention Study in Children (DISC) found lower fat intakes were adequate for growth and normal levels of nutritional biochemical measures (Obarzanek et al., 1997). Thus, achievement of both goals--meeting the standards for protein, vitamins, and minerals, as well as those from the DGAs--is attainable.

Keeping in mind that there were no competitive foods sold during the instructional day in the WV after cohort, and that a high percentage of students in all the cohorts received financial assistance for lunch, it is highly probable that lunch intake makes an important contribution to the overall dietary quality of these students. On a positive note, the mean values for vitamins A and C and the percent in compliance with the standard suggest that meals were heading in the right direction. The results for vitamin A were not significant, probably because of the wide variation (seen in the standard deviation) in intake levels. The values for vitamin C may have been positively affected by the changes attributed to the increase in the number of fresh fruits and vegetables required in the WV standards. The role of fresh fruits and vegetables on dietary quality is consistent with findings from a study of three schools in metropolitan Atlanta (Baranowski et al., 1997).

As with any new lifestyle practice, change takes time. The WVBOE implemented these standards in tiers (Stuhldreher et al., 1998). However, the time period (approximately three years) may not have provided sufficient time for students to adapt to the changes, especially if these dietary patterns were not reinforced at home. This report should be viewed as an opportunity for further nutrition education and the development of strategies to encourage students to try and learn to accept healthful foods. Perhaps an examination of the barriers to new food acceptance or the involvement of parents may help tailor nutrition education programs that would encourage acceptance of different foods. Helpful suggestions, such as making healthful food taste and look better and changing social norms to make it “cool” to eat healthfully, have been reported from adolescent focus-group research (Neumark-Sztainer et al., 1999).

The results of this WV study should not thwart the efforts to continually improve the nutritional quality of school meals. It is important that schools not only teach patterns of good nutrition in the classrooms, but also offer such patterns in their school cafeterias.

Translation of nutrition knowledge into behavior is complex. Guidelines for school health programs to promote lifelong healthful eating (CDC, 1996) included seven recommendations, two of which are applicable to this report. The first recommendation is a "policy that promotes healthy eating through classroom lessons and a supportive school environment." The sixth recommendation, which stresses the importance of family and community involvement to reinforce nutrition education, underscores the vision and significance of efforts such as those in WV.

WV was one of the first states to prohibit sales and service of non-nutritious foods and beverages to students during the school day (School Nutrition Policy Committee, 1992). Implementation of these new standards long before the changes were required by the federal government is an indicator of the WVBOE's concern for the health of students. Development and passage of such standards was only possible by assembling a team of experts in education, nutrition, and health, plus food industry partners. These results should be compared with those from other school nutrition programs in an attempt to find successful strategies that improve nutritional intake. The WVBOE and other WV nutrition support personnel should be commended for their leadership in school nutrition. The researchers recommend replicating this study to determine if the acceptance has improved with the passage of time.

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REFERENCES

Baranowski, T., Smith, M., Hearn, M.D., Lin, L.S., Baranowski, J., Doyle C., Resnicow, K., & Wang, D.T. (1997). Patterns in children's fruit and vegetable consumption by meal and day of the week. *Journal of the American College of Nutrition, 16*(3), 216-223.

Burghardt, J., Gordan, A., Chapman, N., Gleason, P., & Fraker, T. (1993). *The school nutrition dietary assessment study: School foodservice, meals offered and dietary intakes*. Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Office of Analysis and Evaluation.

Centers for Disease Control and Prevention. (1991). Behavioral risk factor surveillance, 1986-1990. *Morbidity & Mortality Weekly Report, 40* (SS-4), 1-23.

Centers for Disease Control and Prevention. (1996). Guidelines for school health programs to promote lifelong healthy eating. *Morbidity & Mortality Weekly Report, 45* (RR-9), 1-41.

Goran, M.I. (1998). Measurement issues related to studies of childhood obesity: Assessment of body composition, body fat distribution, physical activity, and food intake. *Pediatrics, 101*, 505S-518S.

Johnson, R.K., Panely, C., & Wang, M.Q. (1998). The association between noon beverage consumption and the diet quality of school-age children. *The Journal of Child Nutrition & Management, 22*(2), 95-100.

Joint Working Group of the Canadian Pediatric Society and Health Canada. (1993). *Nutrition recommendation update: Dietary fat for children.* Ottawa, Canada: Author.

Lifshitz, F., & Tarim, O. (1996). Considerations about dietary fat restrictions for children. *Journal of Nutrition, 126*(4 Suppl), 1031S-1041S.

National Research Council. (1989). *Recommended Dietary Allowances* (10th ed). Washington, DC: Author.

Neumark-Sztainer, D., Story, M., Perry, C., & Casey, M. (1999). Factors influencing food choices of adolescents: Findings from focus-group discussions with adolescents. *Journal of the American Dietetic Association, 99,* 929-934, 937.

Nicklas, T.A., Farris, R.P., Myers, L., & Berenson, G.S. (1995). Dietary fiber intake of children and young adults: The Bogalusa heart study. *Journal of the American Dietetic Association, 95*(5 Pt 2), 209-214.

Nicklas, T.A., Reed, D.B., Rupp, J., Snyder, P., Clesi, A.L., Glovsky, E., Bigelow, C., & Obarzanek, E. (1992). Reducing total fat, saturated fatty acids, and sodium: The CATCH eat smart school nutrition program. *School Food Service Research Review, 16*(2), 114-121.

Nicklas, T.A.,Webber, L.S., Koschak, M.L., & Berenson, G.S. (1992). Nutrient adequacy of lowfat intakes for children: The Bogalusa Heart Study. *Pediatrics, 89*(2), 221-228.

Obarzanek, E., Hunsberger, S.A., Van Horn, L., Hartmuller, V.A., Barton, B.A., Stevens, V.J., Kwiterovich, P.O., Franklin, F.A., Kimm, S. Y.S., Lasser, N.L., Simons-Morton, D.G., & Lauer, R.M. (1997). Safety of a fat-reduced diet: The dietary intervention study in children (DISC). *Pediatrics, 100*(1), 51-59.

Olson, R.E. (1995). The dietary recommendations of the American Academy of Pediatrics. *American Journal of Clinical Nutrition, 61*(2), 271-273.

Position of the American Dietetic Association, Society for Nutrition Education, and American School Food Service Association. (1995). School-based nutrition programs and service.*Journal of the American Dietetic Association, 95*(3), 367-369.

Shanklin, C.W., & Wie, S. (2001). Nutrient contributions per 100 kcal and per penny for the 5 meal components in school lunch: Entree, milk, vegetable/fruit, bread/grain, and miscellaneous. *Journal of the American Dietetic Association, 101*(11), 1358 -1361.

Stuhldreher, W.L., DeGrave, M.A., & Bowen, E.P. (2001). Does the summer foodservice program (SFSP) make a difference?: A comparison of home and SFSP lunch nutrient content in West Virginia children. *Journal of Consumer & Family Studies, 93*(1), 54-58.

Stuhldreher, W.L., Jordan, B.B., & Head, M.K. (2000). Building a case for changes in school nutrition standards: A profile of two rural West Virginia Counties. *The Journal of Child Nutrition & Management, 24*(1), 13-19.

Stuhldreher, W.L., Koehler, A.N., Harrison, M.K., & Deel, H. (1998). The West Virginia standards for school nutrition. *The Journal of Child Nutrition & Management, 22*(2), 79-86.

U.S. Department of Agriculture. (1995). National school lunch program, school meals initiative for healthy children. *Federal Register, 60*(113), 31187-31222.

U.S. Department of Agriculture & U.S Department of Health and Human Services. (1990). *Nutrition and your health: Dietary Guidelines for Americans* (3rd ed., Home and Garden Bulletin No. 232). Washington, DC: U.S. Government Printing Office.

U.S. Department of Health and Human Services, Public Health Service. (1990). *Healthy people 2000: National health promotion and disease prevention objectives* (DHHS Publication No. PHS 91-50213). Washington, DC: U.S. Government Printing Office.

U.S. Department of Health and Human Services. (2000). *Healthy people 2010: Understanding and improving health* (2nd ed.). Washington, DC: U.S. Government Printing Office.

West Virginia Board of Education. (1992). *West Virginia child nutrition program, percentage of needy students (by school) report*. Charleston, WV: Author.

West Virginia Board of Education. (1994). *Standards for school nutrition* (Title 126, Legislative Rule, Chapter 18-2, Series 86, Policy 4321.1). Charleston, WV: Author.

West Virginia Department of Education. (1992). *Committee report.* Charleston, WV: School Nutrition Policies Committee.

West Virginia Department of Health and Human Resources [WVDHHR]. (1994). *Behavioral risk factor survey: A report on the lifestyle behaviors affecting the health of West Virginians.* Charleston, WV: Author.

Williams, C.L., Bollella, M., & Wynder, E.L. (1995). A new recommendation for dietary fiber in childhood. *Pediatrics, 96*(5 Pt 2), 985-988.

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