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Are School Employees Role Models of Healthful Eating? Dietary Intake Results from the ACTION Worksite Wellness Trial

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ABSTRACT

Background Little is known about the dietary intake of school employees, a key target group for improving school nutrition.

Objective To investigate selected dietary variables and weight status among elementary school personnel.

Design Cross-sectional, descriptive study.

Subjects/setting Elementary school employees (n=373) from 22 schools in a suburban parish (county) of southeastern Louisiana were randomly selected for evaluation at baseline of ACTION, a school-based worksite wellness trial.

Methods Two 24-hour dietary recalls were administered on nonconsecutive days by registered dietitians using the Nutrition Data System for Research. Height and weight were measured by trained examiners and body mass index calculated as kg/m^2.

Statistical analyses performed Descriptive analyses characterized energy, macronutrient, fiber, and MyPyramid food group consumption. Inferential statistics (t tests, analysis of variance, χ^2) were used to examine differences in intake and compliance with recommendations by demographic and weight status categories.

Results Approximately 31% and 40% of the sample were overweight and obese, respectively, with higher obesity rates than state and national estimates. Mean daily energy intake among women was 1,862±492 kcal and among men was 2,668±796 kcal. Obese employees consumed more energy (+288 kcal, P<0.001) and more energy from fat (P<0.001) than those who were normal weight. Approximately 45% of the sample exceeded dietary fat recommendations. On average, only 9% had fiber intakes at or above their Adequate Intake, which is consistent with the finding that more than 25% of employees did not eat fruit, 58% did not eat dark-green vegetables, and 45% did not eat whole grains on the recalled days. Only 7% of employees met the MyPyramid recommendations for fruits or vegetables, and 14% of the sample met those for milk and dairy foods.

Conclusions These results suggest that greater attention be directed to understanding and improving the diets of school employees given their high rates of overweight and obesity, poor diets, and important role in student health.

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Little is known about the diets and weight status of school employees, a key target group for improving school nutrition. Instructional staff members provide nutrition and health education in the classroom and cafeteria workers oversee school meal programs. Personnel also serve as role models for students, which is particularly important given the alarming rates of childhood obesity (1,2). Few studies have measured the dietary intake of US school personnel, and these studies either were conducted at least a decade ago or present an insufficient amount of data to draw conclusions about overall dietary intake (3-6).

Although little is known about school personnel, US dietary intake, in general, has room for improvement, especially given that 66.3% of US adults are overweight (body mass index [BMI] ≥25) and 32.2% are obese (BMI ≥30) (1). National survey and food disappearance data indicate that total energy and fat intake have increased in the United States, with concurrent increases in the prevalence of overweight and obesity since the 1970s (7-12). In addition, fewer than 3% of men and only 8% of women in the United States meet the Adequate Intake (AI) for total fiber (13).

Several studies have compared dietary intake to the 2005 Dietary Guidelines for Americans (DGA) and MyPyramid Food Guidance System (MyPyramid) (14-20). None of these studies used physical activity, weight, and height data in determining individual MyPyramid food intake patterns. Furthermore, most used data collected before the release of MyPyramid. Four studies were conducted in children or adolescents, which limits generalizability to adults, and one used food availability data as proxies for actual food consumption. Despite their limitations, these studies suggest that substantial changes in consumption are necessary for the food groups promoted in the DGA and MyPyramid. For example, among 31- to 50-year-old women consuming the 1,800-kcal MyPyramid food intake pattern and men consuming the 2,200-kcal pattern, consumption should increase by at least 100% for fruit, approximately 50% for vegetables, more than 100% for milk and milk products (women), more than 50% for milk and milk products (men), and approximately 300% for whole grains to meet recommendations (14). These findings are not surprising given the long history of noncompliance with federal dietary guidelines in the United States; yet more research is needed on current consumption relative to MyPyramid, especially given the limitations of the most recent studies (21-26).

To provide data for the aforementioned research gaps, our research investigated the dietary intake of elementary school personnel and contributes to the limited literature on MyPyramid food group consumption. The following research questions were addressed among a sample of elementary school personnel in southeastern Louisiana: What are school personnel consuming relative to energy, macronutrients, fiber, and MyPyramid food groups; and How does consumption of selected nutrients and foods compare with the Dietary Reference Intakes and MyPyramid recommendations?

METHODS

ACTION Worksite Wellness for Elementary School Personnel (ACTION)

ACTION is a school-based worksite wellness intervention trial to reduce and/or prevent overweight and obesity through individual and environmental approaches that promote healthful eating and physical activity. This group-randomized trial in a suburban parish (county) of southeastern Louisiana is funded by the National Heart, Lung, and Blood Institute and has been specifically described elsewhere (27).

Recruitment

All 55 eligible district elementary schools (publicly funded and not designed as a special population school) were invited to participate in the study during presentations conducted at two meetings of school principals in 2004. Twenty-two principals expressed ongoing interest and their schools were recruited into the study. This article presents cross-sectional data collected at baseline of ACTION, before randomization of schools into intervention and control groups. Participating schools were scattered throughout the school district, had standardized test scores within the overall range of scores in the district, and ranged in staff sizes like all schools in the district.

Sample

In each school, 20 employees were randomly selected for dietary interviews. The total number of employees eligible for dietary recalls was 941, but the number per school ranged from 24 to 93 depending on the school size. Of the 440 randomly selected, 23 were excluded from analysis because they were ineligible (eg, substitute teacher) (n=12), pregnant or breastfeeding (n=7), or had missing or other race/ethnicity data (n=4). An additional 44 participants were identified as underreporters, and thus excluded, based on Huang and colleagues' (28) method for identifying implausible reports of energy intake. Individuals with reported energy intake below a 2.0 standard deviation cutoff of predicted energy were considered underreporters in this study. Predicted energy was determined using estimated energy requirement equations for normal-weight adults and total energy expenditure equations for overweight and obese adults (29). Measured height, weight, and physical activity were used in these equations. Thus, 373 was the final sample size for this study.

Data Collection Methods and Procedures

All baseline measurements were conducted during fall 2006. Protocols were approved by the Tulane University Institutional Review Board and voluntary written consent was obtained from participants, who received a gift certificate at a local retail store for their participation.

Body Composition. Height and weight were measured in duplicate by trained examiners during a physical examination. Height was measured to the nearest 0.1 cm using a portable stadiometer and weight was measured to the nearest 0.1 kg with a calibrated scale. These measurements were repeated if the difference between weights and heights was ≥0.5 kg and ≥1 cm, respectively. Heights and weights were converted into BMI score (30). BMI was used to classify participants as normal weight (BMI <25), overweight (BMI 25 to 29.9), or obese (BMI ≥30).

Surveys. Date-of-birth, race-ethnicity, sex, and tobacco use data were collected via self-report through written surveys distributed at consent or during the physical examination. Job category was obtained from employee rosters provided by the school.

ActiGraph Accelerometer. Physical activity was measured by an ActiGraph uniaxial accelerometer (ActiGraph LLC, Pensacola, FL) worn for 7 days except while sleeping or during water activities. This electromechanical device, worn around the waist, records acceleration and deceleration of movement, time of day, and activity counts. The ActiGraph data, collected approximately 2 weeks before the dietary interviews, were converted into mean minutes per day of moderate-to-vigorous physical activity (31).

Twenty-Four–Hour Dietary Recall. Dietary information was obtained from two in-person 24-hour dietary recalls administered on nonconsecutive days by three registered dietitians using the Nutrition Data System for Research (NDSR) (version 2006, University of Minnesota, Nutrition Coordinating Center, Minneapolis, MN). The 24-hour recall, widely used in dietary studies, allows estimation of absolute nutrient intakes and involves minimal subject burden (32). School personnel were notified of the weeks of the interviews to minimize disruptions, but the day was not revealed to reduce instrument effects. Participants were scheduled for one recall per week and all schools had at least 1 day of data collection on a Monday for recall of a weekend day.

NDSR is a computer-assisted software program developed and maintained by the University of Minnesota's Nutrition Coordinating Center (NCC) for standardized dietary recall and record collection. The three dietary interviewers were trained to use the software and two were certified by NCC. NDSR combines dietary data collection and data entry, and has a database containing more than 18,000 foods. Items not found in the database, such as missing or regional foods, were submitted to NCC for resolution if no appropriate substitution was identified. NDSR features the multiple-pass approach with prompts to help users collect data in a thorough manner, thus providing multiple opportunities for respondents to recall items consumed to reduce underreporting (33). The study protocol provided standardized probes and prompts to further reduce recall bias. Standardized measurement aids and visuals, such as two- and three-dimensional food models, were used to assist respondents in quantifying reported foods and beverages.

Definition of Key Variables

Total energy intake (in kilocalories), the percentage of kilocalories from macronutrient sources, and total dietary fiber intake (in grams) were calculated from foods and beverages in the 24-hour recall.

MyPyramid food group consumption was calculated from the NCC Food Group Serving Count System. The latter, first introduced in NDSR 2006 for food-based dietary analysis, assigns a serving size to each food. NCC serving counts are reported in terms of servings from a food subgroup (eg, citrus fruit), which can then be summed with other subgroups for the number of servings of a food group (eg, fruit subgroups to a total fruit group). Because MyPyramid recommendations are expressed as cup or ounce equivalents rather than servings, it was necessary to convert the NCC serving counts into MyPyramid cup or ounce equivalents. The NCC subgroups matching MyPyramid groups of relevance were first identified (14,34,35). The NCC subgroup serving sizes were then compared to the MyPyramid cup or ounce equivalent (14,35). NCC subgroup counts needed either a simple conversion (ie, divide all fruit and vegetable counts by two) or no conversion (ie, all other food groups) to generate approximate MyPyramid cup or ounce equivalents. This overall approach is comparable to other fruit and vegetable studies (36). Dry beans and peas can be assigned to two MyPyramid food groups: meat and beans or total vegetables. To avoid double counting, they were assigned to the latter. Whole-grain consumption was also calculated, defined by NCC as grain products with a whole-grain ingredient listed as the first ingredient on the food label.

Statistical Analysis

Dietary analyses were based on averaging dietary intake from two 24-hour dietary recalls. For the 7.5% of participants (n=28) who completed only one recall, data from this single recall were used.

Descriptive statistics were generated for key variables, including intakes of energy, macronutrients, fiber, and food groups. Differences in intake were examined through *t* tests (for sex, race-ethnicity, and job category) and analysis of variance for age group and BMI category. Least significant difference multiple comparison tests were used if the analysis of variance was significant ($P<0.05$). Because of the small number of Hispanics in the sample, inferential statistics by race-ethnicity were performed between whites and African Americans only. Hispanics were included in all other analyses. Intakes of fruit and milk were not normally distributed; therefore, statistical tests for fruit and milk intake were based on log-transformed intakes. Macronutrient and fiber intake were also compared to the Acceptable Macronutrient Distribution Range (AMDR) and AI recommendations, respectively (29). Differences in compliance were tested using χ^2 analysis. Statistical analyses were performed using SPSS for Windows (version 14.0.1, 2005, SPSS Inc, Chicago, IL).

Each participant was assigned to one of nine MyPyramid food intake patterns using two methods to compare consumption to MyPyramid recommendations. MyPyramid includes 12 patterns, but the 1,000-, 1,200-, and 1,400-kcal patterns are not recommended for adults because they provide insufficient energy to meet nutritional needs (37). The first assignment approach (A1), simulating a consumer's MyPyramid Web site experience, was based on the energy needed to maintain current weight assessed by estimating total energy expenditure. This was calculated using the total energy expenditure equations for normal, overweight, and obese adults and then rounding to the nearest 200-kcal MyPyramid food intake pattern between 1,600 and 3,200 kcal (29). For the second approach (A2), individuals were assigned to a pattern based on their current energy intake, as estimated from the 24-hour recall data. Mean energy intake was rounded to the nearest 200-kcal pattern between 1,600 and 3,200 kcal.

Investigators are often interested in usual intake, which refers to the long-term daily average of dietary intake by an individual (38). Usual intake distributions are important in determining the proportion of a population that meets or exceeds a given dietary standard. Estimates based on intake distributions from 24-hour recalls, however, can be biased, since within-person variation in daily intake is sizable. This bias can be reduced by collecting data from a large number of days, which is often impractical and unsatisfactory, or by using a statistical modeling method for estimating usual intake distributions (39). To test the potential bias in the our sample, usual intake distributions were generated for fat and fiber using the National Research Council and Institute of Medicine's modeling method outlined by Dodd and colleagues (39).

RESULTS

Sample Characteristics

Key demographic characteristics are presented in Table 1. The sample was predominantly female, between 30 and 59 years of age (mean age 47.7±10.6 years), white, and instructional personnel. Approximately 70% of the sample was overweight or obese, with a mean BMI of 29.1±6.6. Approximately 91% did not smoke and 99.7%

Table 1. Demographic characteristics and mean energy, percent of energy from fat and carbohydrate, and fiber intake among elementary school personnel (the ACTION Worksite Wellness for Elementary School Personnel study)[a]										
			Energy (kcal)		% Energy from Fat		% Energy from Carbohydrate		Total Dietary Fiber (g)	
Characteristic	**n**	**%**	**Mean±SD[b]**	***P* value**	**Mean±SD**	***P* value**	**Mean±SD**	***P* value**	**Mean±SD**	***P* value**
All	373	NA[c]	1,916±555	NA	34.7±7.3	NA	49.5±9.0	NA	15.0±5.5	NA
Sex										
Women	348	93.3	1,862±492	<0.001	34.6±7.3	0.134	49.7±9.1	0.062	14.8±5.3	0.006
Men	25	6.7	2,668±796		36.8±7.3		46.3±7.7		19.1±7.1	
Age group										
<30 y	23	6.2	1,760±395	0.212	34.6±7.5	0.943	49.9±8.5	0.589	12.6^{x}±2.9	0.003
30-39 y	78	20.9	1,924±516		34.4±6.4		50.6±8.5		13.6^{x}±4.9	
40-49 y	93	24.9	2,015±654		34.3±7.4		49.6±9.3		15.0^{xy}±5.0	
50-59 y	137	36.7	1,895±525		35.1±7.4		48.6±9.2		16.0^{y}±6.0	
60+ y	42	11.3	1,838±541		35.1±8.1		50.1±8.8		16.1^{y}±6.0	
Race/ethnicity										
White[d]	295	79.1	1,896±532	0.075	34.7±7.4	0.366	49.1±9.3	0.251	15.3±5.5	0.129
African American[d]	68	18.2	2,030±663		35.6±6.7		50.5±7.8		14.1±5.5	
Hispanic	10	2.7	1,740±233		30.4±6.0		53.4±7.0		15.4±3.6	
Personnel type										
Instructional	303	81.2	1,903±513	0.332	34.4±7.3	0.118	49.6±9.0	0.573	15.1±5.5	0.860
Non-instructional	70	18.8	1,974±710		35.9±7.3		48.9±9.2		14.9±5.5	
Weight status										
Normal weight	111	29.8	$1{,}758^{x}$±545	<0.001	32.5^{x}±7.1	<0.001	52.2^{x}±8.6	<0.001	15.3±5.9	0.874
Overweight	114	30.6	$1{,}903^{y}$±513		34.0^{x}±6.9		49.3^{y}±9.3		14.9±5.4	
Obese	148	39.7	$2{,}046^{z}$±565		36.9^{y}±7.2		47.6^{y}±8.6		15.0±5.2	

[a]Least significant difference multiple comparison tests were run when the main factor (eg, age and weight status) was significantly related to nutrient intake ($P<0.05$). In these cases, mean values that share a common superscript (^{x,y,z}) were not significantly different from each other.
[b]SD=standard deviation.
[c]NA=not applicable.
[d]Comparisons by race/ethnicity were performed for whites and African Americans only.

were sedentary (ie, engaged in <30 minutes of daily moderate-to-vigorous physical activity as estimated by the ActiGraph accelerometer) (not shown).

Energy, Macronutrient, and Fiber Intake

For the full sample, mean energy intake was 1,916±555 kcal and the proportion of energy from fat and carbohydrate was 34.7±7.3% and 49.5±9.0%, respectively (Table 1). Mean energy intake per employee ranged from 979 kcal to 5,279 kcal (not shown). Mean protein consumption was 15.8±3.8% and mean alcohol consumption was 1.6±4.3% of energy intake, with 44.0% consuming no alcohol on recalled days (not shown). Men consumed more energy than women, a greater proportion of energy from fat, and a smaller proportion of energy from carbohydrate, though the latter two differences were not statistically significant. African Americans consumed less protein than whites (14.7% vs 16.0%, P=0.013) (not shown). Individuals with obesity consumed significantly more energy and energy from fat and significantly less energy from carbohydrate than those who were normal weight. Mean fiber intake was 15.0±5.5 g across the sample. Significantly greater dietary fiber intakes were observed for men compared to women, and intake increased with increasing age group.

More than 45% of the sample exceeded the fat AMDR and 31% fell below the carbohydrate AMDR (Table 2). Approximately 96% were within the protein AMDR (not shown). Dietary fat intake was above the AMDR for approximately one third to one half of employees across most demographic categories. More than 42% of overweight and 54% of obese employees consumed fat in excess of the AMDR, compared to 37% of normal weight employees. Conversely, carbohydrate intake was below the AMDR for approximately one quarter to one third of individuals in most categories. About 8.8% had fiber intakes at or above their AI.

MyPyramid Food Group Intake

School employees, on average, consumed approximately ½-c equivalents of fruit, 1⅓-c equivalents of vegetables, 6-oz equivalents of grains, 5½-oz equivalents of meat and beans, and 1½-c equivalents of milk (Table 3). Men consumed more from all food groups compared to women, with significant differences for fruits, grains, and meat and beans. African Americans consumed significantly more meat and beans than whites, but less milk. Normal weight employees had significantly lower grain and meat and beans consumption than obese employees. No significant differences were observed by job or age category except that younger age groups consumed fewer fruits.

Table 4 presents the number and proportion of employ-

Table 2. Approximate compliance with the Acceptable Macronutrient Distribution Ranges (AMDR) for fat and carbohydrate and Adequate Intake (AI) for fiber among elementary school personnel (the ACTION Worksite Wellness for Elementary School Personnel study)[ab]

		AMDR for Fat		AMDR for Carbohydrate		AI Total Fiber	
Subject characteristic	**n**	**% Above**	***P* value**	**% Below**	***P* value**	**% Below**	***P* value**
All	373	45.3	NA[c]	30.8	NA	91.2	NA
Sex							
Woman	348	44.3	0.127	29.3	0.018	90.8	0.712
Man	25	60.0		52.0		96.0	
Age group							
<30 y	23	47.8	0.933	26.1	0.499	100.0	0.004
30-39 y	78	48.7		24.4		97.4	
40-49 y	93	46.2		30.1		96.8	
50-59 y	137	43.1		35.8		83.9	
60+ y	42	42.9		31.0		85.7	
Race/ethnicity							
White[d]	295	47.1	0.375	32.2	0.495	90.5	0.344
African American[d]	68	41.2		27.9		94.1	
Hispanic	10	20.0		10.0		90.0	
Personnel type							
Instructional	303	44.6	0.543	29.4	0.205	90.8	0.577
Non-instructional	70	48.6		37.1		92.9	
Weight status							
Normal weight	111	36.9	0.017	19.8	0.001	86.5	0.075
Overweight	114	42.1		28.9		91.2	
Obese	148	54.1		40.5		94.6	

[a]AMDR for fat is 20% to 35% of energy from fat; AMDR for carbohydrate is 45% to 65% energy from carbohydrate.

[b]Pearson χ^2 tests or Fisher's exact tests were conducted for the proportion above the AMDR for fat, below the AMDR for carbohydrate, and below the AI for fiber. For fiber compliance by age group, comparisons were made among those younger than age 40 y to those aged 40 y and older.

[c]NA=not applicable.

[d]Comparisons by race/ethnicity were performed for whites and African Americans only.

ees consuming no foods from MyPyramid food groups and subgroups on the days preceding the interviews. Approximately one quarter consumed no fruits and almost half consumed no whole grains. All employees consumed some vegetables; however, 57.6% consumed no dark-green vegetables, 47.7% no orange vegetables, and 72.7% no dry beans and peas.

Whether the assignment approach was based on current weight (A1) or current energy intake (A2), the majority of employees were not meeting recommendations based on separate analyses (not shown). Approximately 7% of employees met fruit or vegetable recommendations. Approximately 14%, 40%, and 45% of participants met recommendations for milk, grains, and meat and beans, respectively. No participants younger than age 30 years met fruit recommendations, and no African Americans met milk recommendations. MyPyramid also recommends consuming half of grains from whole grains, but only 5.6% achieved this recommendation (35). Finally, in comparing assignment approaches (A1 or A2), compliance was comparable for fruits, meat and beans, and milk, but somewhat more variable for vegetables and grains, particularly by age and BMI categories.

For all means, frequencies, and statistical tests presented, the results did not change substantially when men were excluded from the analysis, although energy intake decreased across most groups in Table 1 after excluding men.

Usual Intake of Fat and Fiber

Assessment of the percent above and below nutrient standards (Table 2 results) could be biased if within-person variation is large. To assess this potential bias, statistical methods were used to estimate usual intake distributions for the percentage of energy from fat and for fiber. This was done for female respondents; cell sizes were too small to reliably estimate distributions for men. Using a distribution based on mean intakes, rather than usual intakes, had a negligible effect on the results (not shown). Overall, approximately 44% of women exceeded the AMDR for fat and few met or exceeded the fiber AI.

DISCUSSION

This study is one of the first to examine dietary intakes of elementary school personnel. Dietary fat intake was high, whereas fiber intake was low for this group with high rates of overweight and obesity. Fruit, vegetable, whole grain, and milk intake were also poor. The DGA report suggests that for women aged 31 to 50 years, a large proportion of our sample, consumption needs to increase to meet recommendations by 0.8 c for fruits, 0.9 c for vegetables, 1.6 c for milk and milk products, and 2.2 oz for whole grains among those consuming the 1,800-kcal food intake pattern (14). Other studies among adults also highlight poor consumption relative to MyPyramid (15-17,40). This study, which addressed some of the method-

Table 3. Mean MyPyramid food group intake among elementary school personnel (the ACTION Worksite Wellness for Elementary School Personnel study)[a]

Subject characteristic	Fruits (Cup Equivalents)		Vegetables (Cup Equivalents)		Grains (Ounce Equivalents)		Meat and Beans (Ounce Equivalents)		Milk (Cup Equivalents)	
	Mean±SD[b]	*P* value[c]	Mean±SD	*P* value	Mean±SD	*P* value	Mean±SD	*P* value	Mean±SD	*P* value[c]
All	0.53±0.67	NA[d]	1.30±0.73	NA	5.95±2.46	NA	5.55±3.00	NA	1.59±1.28	NA
Sex										
Woman	0.50±0.62	0.030	1.27±0.69	0.067	5.80±2.39	<0.001	5.31±2.68	0.001	1.58±1.29	0.629
Man	0.93±1.05		1.69±1.07		8.01±2.51		8.82±4.86		1.64±1.16	
Age group										
<30 y	0.26[x]±0.37	0.005	1.17±0.62	0.418	5.90±2.32	0.095	4.25±2.55	0.055	1.76±1.31	0.881
30-39 y	0.42[x]±0.65		1.25±0.69		6.16±2.57		5.15±2.64		1.48±1.25	
40-49 y	0.51[xy]±0.66		1.31±0.74		6.39±2.47		5.98±3.39		1.66±1.55	
50-59 y	0.61[y]±0.66		1.38±0.76		5.51±2.34		5.81±3.05		1.61±1.17	
60+ y	0.69[y]±0.79		1.17±0.74		6.04±2.53		5.18±2.52		1.46±1.06	
Race/ethnicity										
White[e]	0.52±0.64	0.666	1.31±0.72	0.505	5.85±2.45	0.266	5.36±2.92	0.004	1.75±1.33	<0.001
African American[e]	0.61±0.80		1.24±0.80		6.22±2.48		6.53±3.31		0.89±0.72	
Hispanic	0.44±0.31		1.50±0.42		6.93±2.30		4.37±1.57		1.64±1.38	
Personnel type										
Instructional	0.55±0.68	0.895	1.28±0.71	0.358	5.96±2.44	0.937	5.51±2.91	0.596	1.59±1.32	0.612
Non-instructional	0.48±0.64		1.37±0.80		5.93±2.56		5.72±3.37		1.60±1.12	
Weight status										
Normal weight	0.69±0.83	0.084	1.31±0.76	0.479	5.47[x]±2.51	0.032	4.51[x]±2.61	<0.001	1.63±1.21	0.773
Overweight	0.43±0.52		1.23±0.65		5.99[xy]±2.36		5.42[y]±2.65		1.63±1.52	
Obese	0.49±0.62		1.34±0.77		6.28[y]±2.45		6.41[z]±3.27		1.52±1.14	

[a]Least significant difference multiple comparison tests were run when the main factor (eg, age and weight status) was significantly related to food intake ($P<0.05$). In these cases, mean values that share a common superscript ([x,y,z]) were not significantly different from each other.
[b]SD=standard deviation.
[c]Because intakes of fruit and milk were not normally distributed, statistical tests for fruit and milk intake were based on log-transformed mean intakes.
[d]NA=not applicable.
[e]Comparisons by race/ethnicity were performed for whites and African Americans only.

Table 4. Number and percent of elementary school personnel respondents who did not eat items from the MyPyramid food groups (the ACTION Worksite Wellness for Elementary School Personnel study)

MyPyramid food group or subgroup	n	%
Fruits	95	25.5
Total vegetables	0	0
Dark-green vegetables	215	57.6
Orange vegetables	178	47.7
Dry beans and peas	271	72.7
Starchy vegetables[a]	54	14.5
Other vegetables[b]	8	2.1
Total grains	1	0.3
Whole grains	169	45.3
Meat and beans	2	0.5
Milk	13	3.5

[a]Includes fried varieties; excluding fried varieties results in 21.2% (n=79) consuming no starchy vegetables.
[b]Includes fried varieties; excluding fried varieties results in 2.4% (n=9) consuming no other vegetables.

ologic limitations in previous research, provides evidence that fruit, vegetable, whole grain, and milk consumption needs to increase substantially among this sample to meet recommendations.

Approximately 40% of elementary school personnel in this sample were obese, which is higher than the national estimate (32%), based on measured height and weight (1). It is also higher than state (27.1%) and local (31.5%) estimates based on self-reported height and weight (41). The prevalence of overweight and obesity in the United States and in Louisiana generally increases with age, which may account for the high rates here considering the mean age of 48 years (1,41).

The high prevalence of obesity in the our study sample could also be attributed to a number of dietary factors observed, including high fat and low fiber intake. Historically, low-fat diets have been promoted to reduce the risk of chronic disease and obesity, and are also associated with successful, long-term weight loss maintenance (14,42-44). Dietary fat is more energy dense and palatable than other nutrients, which could lead to the overconsumption of energy (45). Conversely, diets high in fiber may reduce body weight or energy intake by increasing satiety and satiation and reducing hunger (46-49). All but one employee was sedentary based on an objective physical activity measure, which also likely contributed to the obesity rates.

The low fiber intake, and to some extent the high fat intake, can be explained by low fruit, vegetable, and whole grain intake, with <10% of the sample meeting their fruit or vegetable recommendations and fully 45% eating no whole grains at all on recalled days. Clearly health promotion efforts are needed to increase consumption of these foods. Greater fruit and vegetable intake reduces the risk of heart disease, diabetes, some cancers, and other chronic diseases and can be effective for weight management (14,50,51). Whole grains, like fruits and vegetables, are important sources of dietary fiber, which may reduce the risk of heart disease, diabetes, and some types of cancer (14,29,52). Prospective cohort and cross-sectional studies also offer evidence that greater fiber or whole-grain intake is inversely related to weight gain or BMI (53-58).

Milk, like fruits, vegetables, and whole grains, is strongly encouraged in the DGA, but only 16% of whites and no African Americans met milk recommendations (not shown). Although African Americans tend to have a high prevalence of lactose intolerance, MyPyramid promotes nondairy alternatives (59). Foods in the MyPyramid milk group should be encouraged because they are important for bone health and sources of potassium, calcium, and vitamin D, nutrients that are of growing concern in the United States (14,60,61).

There are several potential limitations to this study. Although elementary schools in the sample employed personnel with diverse demographic, educational, and socioeconomic backgrounds, the sample was restricted to southeastern Louisiana. Thus, the findings may have limited generalizability in that residents of southern states generally have poorer diet quality and higher rates of overweight and obesity compared to those in other regions of the country (22,41,62).

Underreporting is a common problem for assessing dietary intake, and overweight and obese participants are more likely to underreport energy consumption than lean participants (63-66). This is especially a concern here given the high rates of overweight and obesity; however, the recall methodology in this study was designed to minimize underreporting and underreporters were removed from the analysis using accepted, objective methods.

The 24-hour dietary recall interviews were scheduled during the school week, thus no dietary intake data were collected for Friday or Saturday. Continuing Surveys of Food Intake by Individuals data indicate that people consume more energy, fat, and alcohol on the weekend (Friday through Sunday) than weekdays (Monday through Thursday) (67). The omission of Friday and Saturday intake could affect the results, particularly by underestimating energy, fat, and alcohol intake; however, 43.7% (n=163) of the sample did report dietary intake for Sunday, thus accounting for intake on 1 weekend day.

One other limitation of the 24-hour dietary recall method is that it does not capture usual intake, and thus does not account for the potentially sizable within-person variation in daily intake. By collecting 2 days of dietary intake for a large proportion of the recall sample, it was possible to estimate the usual intake of fiber and the proportion of energy from fat using accepted statistical methods (39). The results indicate that the proportion below or above recommendations for fat or for fiber did not differ substantially when using mean intake or usual intake distributions.

CONCLUSIONS

Elementary school personnel educate students on healthful eating in the classroom and school cafeteria, and serve as role models. Yet, in this locality, they have high rates of overweight and obesity and consume too much fat and too little fiber. In addition, the majority of employees were not meeting MyPyramid recommendations, and compliance was particularly poor for fruits, vegetables, whole grains, and milk. Targeting efforts to improve the health promotion of staff is one of the eight components of a coordinated school health program (68), and the results presented here suggest the need for this type of intervention. Unfortunately, few worksite wellness programs have been developed and evaluated for use in the school setting despite the fact that schools across the country employ 6.7 million teachers and staff (69). School employee health is critical to student health and academic achievement, yet school-based health promotion efforts typically focus on students (2). One exception to this was a well-designed study that measured the influence of a 2-year teacher wellness program on physiological and behavioral outcomes in teachers, as well as students (6). The study found no evidence of an effect of the program. The authors attributed this to factors specific to the school setting; that is, participation in a wellness program required staying after school and extending the workday. These results suggest that greater attention be directed to understanding how to improve the diets of school employees, not only for their own health status but also to improve their effectiveness as role models for their students.

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