Current Research

Increasing Frequency of Lower-Fat Entrees Offered at School Lunch: An Environmental Change Strategy to Increase Healthful Selections

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ABSTRACT

Objective A two-phase study was conducted to determine the effect of an environmental intervention aimed to increase the selection of low- and moderate-fat entrees at school.

Design An evaluation of a school-wide intervention followed for two semesters.

Subjects Two schools of similar size and demographic data were randomly assigned to either intervention or control. Participants were the children in these schools.

Intervention In Phase 1, the rotation of existing entrees was modified such that one of three entree choices was low or moderate in fat. In Phase 2, the number of competing high-fat entrees was reduced from two choices to one.

Main outcome measures Data were: (a) entree fat content (determined by a registered dietitian) and (b) the aggregate entree selections compiled from daily selection reports.

Statistical analyses performed Frequency distributions were used to describe entree availability. Two-way analysis of variance indicated differences in the mean daily selection of low-, moderate-, and high-fat entrees.

Results In Phase 1 in the intervention school, the number of days that a low-fat entree was offered increased by 70%, with no increase in the rate of selection of the low- or moderate-fat entrees. In Phase 2, both low- and moderate-fat entrees were selected at a higher rate in the intervention school (32.1% and 26.4%, respectively) than the control school (13.8% and 7.5%, respectively), P<0.01.

Conclusions Increasing the availability of low- and moderate-fat entrees is not sufficient to increase their rate of selection. However, their rate of selection is increased as the availability of high-fat entree choices is reduced.


Childhood overweight is steadily increasing in the United States, with approximately 12% of children at risk for or overweight (1). The increase in childhood body weight is particularly disconcerting because there is growing evidence that this acts as a precursor to adult obesity, with overweight children more likely to become overweight adults (1,2). Although there are numerous contributors (3), it is clear that childhood obesity is related to inappropriate nutritional intake. Specifically, the consumption of more than recommended amounts of dietary fat is closely related to body size (4). With more than 84% of children eating too much fat and more than 91% eating too much saturated fat (1), the increase in childhood overweight is not surprising. In addition, diet quality decreases during childhood (5). It is therefore critical that interventions be designed to improve diet during childhood years.

Environmental interventions have been suggested as a means to increase the availability of healthful foods and reduce barriers to their selection (6). School settings, particularly those with high participation rates in the National School Lunch Program (NSLP), are ideal settings to conduct environmental interventions. One might expect NSLP participants to, at a minimum, eat a healthful lunch. However, despite recent improvements in school lunch entrees after the US Department of Agriculture’s School Meals Initiative in 1995, schools on average still offer lunches that are too high in fat (7-9). This may result from the failure to consistently offer low-fat entrees as a school lunch option.

Whitaker and colleagues (10) examined the existing elementary school lunch menus of 16 schools for a 6-month period. Results indicated that low-fat entrees were only available on 23% of days. However, when low-fat entrees were available, they were selected by 37% of students. Thus, without intervening, one third of the students chose to select the lower-fat entree when given the choice. Building on this observation, Whitaker intervened to increase the availability of low-fat entree options (11). Results indicated that the percent of days with low-fat entrees increased from a mean of 23% to 71%, which decreased the fat content of the average meal selected (11). Thus, in this instance, merely offering lower-fat entrees, with no additional intervention or promotion, was sufficient to reduce the amount of fat consumed as a part of the school lunch.

This conclusion coincides with the American Dietetic Association’s call for schools to limit access to less healthful foods (12). However, the low selection rate of low-fat...
entrees has been consistently cited as a primary barrier to a modification of the school lunch (13). School lunches are generally designed to offer multiple entrees for children to choose. Low-fat foods, when offered, must compete with higher-fat foods that are also often offered as entree choices. Studies have shown that children prefer high-fat foods (14,15), a preference that is associated with overweight (16).

It may be that children’s selection of high-fat entrees will be dependent on the number of high-fat entrees available, regardless of the availability of low-fat entrees. For example, the schools in the Whitaker study (12) provided two entree options. However, in central Texas, it is common to have three entree options. As a result, it may be that simply offering low-fat entrees will be insufficient to modify children’s selection patterns, particularly for overweight children. A successful intervention may need to address both the availability of low-fat entrees, so that motivated children have access to these foods, as well as limiting the availability of higher-fat entrees, so as to reduce competition.

Several other studies, such as Eat Smart (17) and LUNCHPOWER! (18), have used intervention strategies to modify the nutritional content of the school lunch. However, these programs are labor and time intensive, requiring training foodservice staff and/or changing vendors. Although effective at reducing fat content, potential barriers to adopting these programs include: modifying menu items, training foodservice staff, and changing vendors. An alternative would be to ensure the availability of lower-fat entrees by working within the existing menu structure and vendors of each school. Specifically, a school could identify existing low-fat foods and increase their frequency as entree options. Such an approach would lesson the barriers to participation and may motivate foodservice directors to add healthful entrees.

The present study was designed to address these issues. Two elementary schools with a diverse student enrollment and high participation in the NSLP were selected to examine the effect of increasing the frequency of low-fat entrees and reducing the availability of higher-fat entrees. The current study extends the work of Whitaker and colleagues (11) by: (a) increasing the availability of low-fat entrees without increasing the costs to foodservice, (b) reducing the availability of higher-fat entrees, and (c) applying this paradigm to a more ethnically diverse sample.

**METHODS**

**Participants**

Two central Texas elementary schools (one intervention and one control) were selected because they share a foodservice provider and had comparable school demographics in addition to having a large minority population (76% minority population across both schools). Specific ethnic composition and descriptive data are presented in Table 1. School 1 (n=571 students) was randomly assigned to intervention and School 2 (n=727 students) to control. Individual purchases were not monitored. Data from all children who purchased school lunch, across grades kindergarten to fifth grade, were collected. Data analysis was limited to aggregate data across all students, which were collected from the foodservice director’s reports of entrees offered on a daily basis and the corresponding selections of those entrees.

This study met The University of Texas at Austin Institutional Review Board protocol.

**Procedures**

Phase 1 of the study was designed to assess the impact of increased availability of lower-fat entrees on their selection within the elementary school lunch. To achieve this aim, project staff worked with the foodservice at the intervention school to increase the frequency of days offering at least one lower-fat entree (≤30% of energy from fat). To accomplish this, the foodservice director, his staff, and an independent registered dietitian determined the fat content for each of the entrees that were presently offered by the schools.

Some examples of lower-fat entrees offered included a deli sandwich on wheat bread, spaghetti marinara, yogurt and fruit plate, and chef salad. The foodservice director at the intervention school was then asked to increase the frequency of days that these lower-fat entrees were available. The intervention school offered three entree choices per day, one of which was low or moderate in fat content. There was no change in vendors or preparation methods, nor was there a mandate to increase the availability of any specific entree. Instead, the foodservice director was given the flexibility to choose which items to increase in frequency and when they would be offered.

No change was made to the control school’s menu. The control school offered three entree choices per day, with no study restriction on fat content.

Because both schools share the same foodservice director, their menus were identical prior to the intervention. The change in menu for the intervention school was initiated at the end of the spring semester, with data collection for Phase 1 of the study occurring throughout the entire fall semester. Data were collected from special reports provided by the foodservice director. These reports were completed on a daily basis and indicated the number of students who selected each entree. The use of aggregate data prevents analyses at the student level. However, a benefit is that it prevents any potential alteration in

### Table 1. Ethnic and socioeconomic distribution of participants within intervention and control schools surveyed to determine the effect of an environmental intervention aimed to increase the selection of low- and moderate-fat entrees at school

<table>
<thead>
<tr>
<th>School 1 (Intervention) (n=571)</th>
<th>% White</th>
<th>% Hispanic</th>
<th>% African American</th>
<th>% Other</th>
<th>% FRPL*</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=108</td>
<td>18.9</td>
<td>73.4</td>
<td>6.1</td>
<td>1.6</td>
<td>73.4</td>
</tr>
<tr>
<td>n=419</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School 2 (Control) (n=727)</td>
<td>28.3</td>
<td>63.5</td>
<td>6.7</td>
<td>1.3</td>
<td>60.0</td>
</tr>
<tr>
<td>n=206</td>
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<tr>
<td>n=462</td>
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*FRPL = free or reduced-price lunch.
eating behavior that often comes with direct observation. It also provides a clear insight into the general food choices made by the students over a full semester.

The primary dependent variable was the percentage of children selecting entrees of different fat contents: low-fat (≤30% energy from fat); moderate-fat (between 31% to 35% of energy from fat); and high-fat (>35% energy from fat). In addition, the frequency with which low-fat items appeared on the menu was used to assure that differences existed between schools. Finally, although there was no change in vendor, the type of cheese pizza was changed during the study from a high- to a low-fat version. This was a district-wide decision over which we had little control, which presented a dilemma for data analysis. Because pizza, which is usually high in fat, is a popular selection for lunch, including it as a low-fat entree might artificially bias the results toward increased consumption of low-fat foods. As a result, we eliminated 12 days from the analysis when cheese pizza was offered.

Phase 2 of the study was designed to assess the impact of limiting the availability of high-fat entrees on the selection of lower-fat entrees within the elementary school lunch. To achieve this aim, foodservice staff at the intervention school were asked to reduce the available high-fat entree choices from three to two, while maintaining the availability of moderate- and low-fat entrees. No changes were made to the control school. Thus, the intervention school offered two entree choices, one of which would be low or moderate in fat. The control school offered three entree choices, with no study restrictions on fat content. This menu change was initiated at the beginning of the next spring semester, immediately following Phase 1 data collection.

Data collection was identical to Phase 1 of the study, with special reports provided by the foodservice staff. Data collection occurred throughout the full spring semester. Although collecting the data immediately after the intervention increases the possibility that food selections were unduly impacted by the novelty of the change, this timing was to minimize the difference in student body from Phase 1 to Phase 2. Collecting data in the same school year avoided a potential loss of subjects due to turnover that may have occurred in the summer.

The question of interest was: Is the selection of low- and moderate-fat entrees impacted by the number of available entrees? As a result, data were only utilized when either a low- or a moderate-fat entree was paired with at least one high-fat entree. This resulted in the deletion of 16 days for the intervention school and 15 days for the control school, when a moderate- or low-fat entree was unavailable. As in Phase 1, days with the low-fat cheese pizza (n=18 for each school) were eliminated. In sum, of the 90 school days available for data collection, 34 were eliminated from the intervention school and 33 were eliminated from the control school, leaving 56 eligible school days assessed for the intervention school and 57 eligible school days assessed for the control school.

PHASE 1 RESULTS

Frequency of Entree Offerings

Across both schools, a total of 492 entrees were offered during an 83-day assessment (August to December). All

days were analyzed, with the exception of the Thanksgiving meal in November (when only one entree was offered) and any day that offered cheese pizza. Of these total entrees, 24% met the low-fat criteria, 21% met moderate-fat criteria, and 55.3% met high-fat criteria.

In the intervention school, 207 entrees were analyzed. Of these, 32.4% were classified as low-fat (range 23% to 29% energy from fat), 19.8% were classified as moderate-fat (range 31% to 34% energy from fat), and 47.8% were classified as high-fat entrees (range of 37% to 58% energy from fat). The same days were analyzed for the control school. Of these, 15% were classified as low-fat (range 15% to 30% fat), 22.2% were classified as moderate-fat (31% to 35% energy from fat), and 62.8% were classified as high-fat entrees (37% to 58% energy from fat).

Of the 83 days of observation, the intervention school offered a low-fat entree on 51 of those days, compared with only 30 days for the control school, with little difference in the days on which a moderate-fat entree was offered (36 and 38 days, respectively), and for which a high-fat entree was offered (70 and 69 days, respectively).

Selection of Entrees

The percentage of children who selected each type of entree was analyzed via separate two-group analysis of variance. It was predicted that the selection of low- and moderate-fat items would increase in the intervention school because they were offered more often than in the control school. This prediction was not supported. There was a nearly significant group difference for the selection of low-fat entrees, $F_{1,138}=3.20, P=0.07$. There was no significant group difference for the selection of moderate-fat entrees, $F_{1,73} =0.11, P=0.10$. Finally, there was no significant group difference for the selection of high-fat entrees, $F_{1,139}=2.74, P=0.10$. Table 2 includes the percentage of students selecting low-fat, moderate-fat, and high-fat entrees for each school across the two phases of the study.

PHASE 2 RESULTS

Frequency of Entree Offerings

Across both schools, a total of 438 entrees were available during a 92-day period of observation (January to May). Following the elimination of days described earlier, 112 entrees were assessed in the intervention school. Of these, 28.6% met low-fat criteria, 21.4% met moderate-fat criteria, and 50% met high-fat criteria. Within the control school, a total of 166 entrees were analyzed. Of these, 26.5% met low-fat criteria, 15.7% met moderate-fat criteria, and 57.8% met high-fat criteria.

Also of interest was whether school lunch entree sales would decrease as a result of the increase in the frequency of low-fat entrees and decrease in competing high-fat entrees. A mean of 419 children selected a school lunch at the intervention school prior to the intervention. A mean of 446 and 472 children selected the school lunch during Phase 1 and Phase 2, respectively. Thus, participation in school lunch not only was maintained, it increased slightly from pre-intervention to intervention.

Selection Rates of Entrees

The percentage of children who selected the entrees was analyzed via separate two-group analysis of variance. It
reduction in competing entrees. This prediction was sup-
ported. There was a significant group difference for the
selection of low-fat entrees, \( F_{1,113} = 71.06, P < 0.01 \). There
was also a significant group difference for the selection of
moderate-fat entrees, \( F_{1,46} = 34.77, P < 0.01 \). Finally, there
was significant group difference for the selection of high-
fat entrees, \( F_{4,113} = 67.22, P < 0.01 \). Table 2 includes
percentage of students selecting low-fat, moderate-fat, and
high-fat entrees for each school by phase.

Table 2. Percent of students selecting low-, moderate-,
and high-fat entrees: Intervention vs control, within Phase 1 and Phase 2 of
study to determine the effect of an environmental intervention
aimed to increase the selection of low- and moderate-fat entrees at
school

<table>
<thead>
<tr>
<th></th>
<th>Selected low-fat entrees</th>
<th>Selected moderate-fat entrees</th>
<th>Selected high-fat entrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention 1</td>
<td>15.4</td>
<td>16.2</td>
<td>80.2</td>
</tr>
<tr>
<td>Control</td>
<td>11.3</td>
<td>18.6</td>
<td>86.4</td>
</tr>
<tr>
<td>Phase 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intervention 2</td>
<td>32.1*</td>
<td>26.4*</td>
<td>70.4*</td>
</tr>
<tr>
<td>Control</td>
<td>13.8</td>
<td>7.5</td>
<td>86.9</td>
</tr>
</tbody>
</table>

*Refers to significant difference at the \( P < 0.01 \) level.

was predicted that the selection of low- and moderate-fat
items would increase in the intervention school due to the
reduction in competing entrees. This prediction was sup-
ported. There was a significant group difference for the
selection of low-fat entrees, \( F_{1,113} = 71.06, P < 0.01 \). There
was also a significant group difference for the selection of
moderate-fat entrees, \( F_{1,46} = 34.77, P < 0.01 \). Finally, there
was significant group difference for the selection of high-
fat entrees, \( F_{4,113} = 67.22, P < 0.01 \). Table 2 includes
percentage of students selecting low-fat, moderate-fat, and
high-fat entrees for each school by phase.

DISCUSSION

This study was designed to assess the impact of an envi-
ronmental change to support the selection of lower-fat
foods as a part of the elementary school lunch. In Phase 1
of the study, the frequency of offering existing low-fat
foods was increased to enhance their availability as en-
tree choices. Although the intervention was successful at
increasing the frequency that low-fat entrees were of-
f ered, there was no appreciable difference in the selection
of these entrees between the intervention and control
schools. Specifically, on those days when a low-fat entree
was available, 15% of children in the intervention school
selected this entree compared with 11% of children in the
control school, a difference that was not statistically sig-
ificant.

This result, however, is promising. Given the consist-
tent selection rates, offering low-fat entrees at a more
frequent rate resulted in increased selection of these en-
trees during the course of the semester. As a result, those
children who are motivated to select a low-fat entree had
an increased opportunity to do so and seemed to act on
that opportunity. These effects coincide with earlier work
suggesting that some children will select low-fat entrees
when offered (17,18). In contrast, these data differed from
the results of Whitaker and colleagues (11), who found
that the increased offering of low-fat entrees produced an
increase in the selection rate of these foods. However,
although the schools in the present study provided three
entree options, the schools in the Whitaker study pro-
vided only two entree options. Thus, these studies dif-
fered in the number of choices that were available in
competition with the lower-fat entrees. Phase 2 of the
present study was designed to address this issue.

In Phase 2, the enhanced availability of lower-fat foods
was maintained, but the number of alternative, higher-
fat entrees was reduced to equal the number of lower-fat
options. Thus, in Phase 1, children in the intervention
school could select from among three entree offerings, one
of which was lower in fat; while in Phase 2, those children
could select between two entree offerings, one of which
was lower in fat. Results indicated that a reduction in
available choices had a significant impact on the selection
patterns of elementary school children. Specifically, low-
fat entrees were selected more than twice as often when
they were paired with one rather than two alternative
entrees. A similar pattern of effects occurred for moder-
ate-fat entrees. As a result, there was a 20% reduction in
the selection of high-fat foods in the intervention school
compared with the control school. This result, which
coincides with the findings of Whitaker and colleagues (11),
occurring despite no difference in selection rates between
these schools during the previous semester as outlined in
Phase 1. Thus, while this is a quasi-experimental design, it
does seem that the difference between schools is due to the
intervention and not some unmeasured, nuisance variable.

Taken together, the results of this study indicate that a
minimal intervention to decrease the number of compet-
ing, high-fat, popular entree options (eg, hamburgers,
fried chicken nuggets) is sufficient to increase children's
selection of low- or moderate-fat entrees. Rather than
change vendors or preparation methods, the intervention
sought to increase the frequency with which existing
low-fat entrees were offered. This approach minimizes
the barriers to participation by the foodservice director by
selecting foods that already appear on school menus and,
as a result, fit within their cost structure. It also allowed
the foodservice director to set the menu specifics, dictat-
ing only the availability of some version of the lower-fat
foods and limiting the number of higher-fat entree op-
tions. This is an easily adoptable, minimal intervention to
increase the selection of lower-fat foods at school.

Although the intervention was designed to overcome
barriers to implementation, some concerns exist. The de-
cision of foodservice directors is limited by participation
rates, which are often adversely affected by the inclusion
of low-fat entree options (13). Our data do not support
this concern. Purchases of school lunch increased slightly
from pre-intervention to intervention. Although the data
are insufficient to state that the intervention increased
participation rates, it clearly demonstrates that increases
in low-fat entree options did not reduce participation
rates. However, these students were overwhelmingly par-
ticipants in the NSLP. As such, they may have been
restricted in their ability to select other lunch options (eg,
bring lunch from home, purchase a la carte items). The
intervention must be replicated with other demographic
groups before these results can be generalized.

The data for this study were based on foodservice re-
ports of daily selections from the cafeteria offerings at
lunch. Unfortunately, aggregated data do not allow for an
examination of individual choices. Although these data
were collected from an ethnically diverse group of stu-
dents in grades kindergarten through fifth grade, they

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are insufficient to test for moderating effects of socioeconomic status, sex, age, or ethnicity. In addition, they are limited to food selection, not consumption. Although students were more likely to select the lower-fat entrees in the intervention school, it is not clear that they actually consumed these foods. Future research must be designed to track the foods that are consumed by individual children during the school day.

Finally, only two schools were used for the study, with days as the unit of analysis. Ideally, numerous schools would have been utilized and randomly assigned to condition. This would allow for a hierarchical analysis and an improved ability to partition variance in food selection/consumption. Although this approach was beyond the scope of these studies, such a design represents an important extension of this work.

Despite the limitations, these data indicate that a minimal intervention may be sufficient to modify the food selection of elementary school children. This approach is advantageous in that it minimizes the costs of offering lower-fat foods, thereby reducing the barriers to participation by foodservice directors, which should bring about a more timely change in school lunch offerings.

**CONCLUSIONS**

In a time when funding is scarce, it is imperative to use strategies that work within the existing cost structure of the foodservice provider. These results provide interested school districts, teachers, and parents with a low-cost strategy to lobby for change in their menu offerings. It is a strategy that targets barriers to acceptance by controlling costs due to purchasing and retraining. As a result, it increases the likelihood that efforts to reduce the fat content of the school lunch can become institutionalized.

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**References**


