

Assessing school lunches as a mediating factor in childhood obesity

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The initial aim of our project was to illuminate possible associations between the eating environment and eating behaviors in school age children. Specifically, we were interested in whether or not offering longer times for lunches would ameliorate the alarming obesity rates of school aged children. Our methodology (below) was simple in nature. Data collection would proceed throughout the school year as we gathered body weights, heights, and other biometric measures of students in school systems that had either long lunch times (>30 minutes) or short lunch times (≤ 25 minutes). Our data set also included survey data as well as observational data on particular eating behaviors. We are pleased to disclose that a significant finding on the relationship between eating environment and biometric measures is being reported here. In fact, this appears to be the first report detailing such effects. A more complete account of our project is provided below.

As often occurs, our project proved to be more complicated than anticipated. The persistence of our student researchers and faculty allowed for the successful completion of the project. However, there were a number of initial proposals that had to be modified during the

grant period. Most notably, even with substantial incentives offered (gift cards and a Wii Fit game system), gathering a representative sample proved challenging. Fortunately, we had the same difficulties obtaining samples with all schools so we can infer that even though not representative of the population in general, our samples from comparative schools were quite similar in nature. Thus, underlying associations may still be detected and at the very least we are able to conclude that our findings underestimate rather than overestimate the relationships we found.

A second methodological obstacle that had to be overcome was the fact that some comparative schools identified at the beginning of the study were not able to fully participate in the project. Specifically, elementary schools were less willing to allow data collection in their facilities once experimentation began and some high schools that confirmed that they had lunches categorized as “long lunch” actually overestimated the amount of time they allowed their students to eat. Thus data from some schools could not be used as originally intended. Still, adequate data was obtained to evaluate our original hypothesis. Overall, we are very pleased with the project and already have begun creating proposals for further research on environmental factors influencing childhood obesity. In fact, Dr. Davidson and Dr. St. John were recently awarded a \$2500 Winter Park Health Institute grant to continue work on this project now that the ACS grant period has ended.

The two main goals we targeted in our proposal involved “carrying out a joint research project” and “partnering with a faculty member on campus or on another campus for a new ... research initiative”. A collaborative effort across colleges was also a priority when developing

our research proposal. This project has certainly offered Dr. Thaw and St. John the opportunity to expand their research beyond animal studies and engage in projects involving human subjects and environmental influences on eating behaviors. Dr. Davidson has also benefitted from this project in that she has now forged a research tract in the area of childhood obesity and peer relationships, an area that she had not previously focused on. It can therefore be stated unequivocally that important professional development opportunities were afforded by this generous funding.

The intended benefit of “Acquiring a new technical skill”, “Acquiring necessary materials for a research project”, and “Devising new ways of fully engaging students” were also fully realized during the course of the research project. The original proposal included the use of pre-established eating questionnaires. However, in the course of creating our surveys, it was determined that the optimal survey findings would result from specific questions being addressed. Thus, the Rollins College researchers created a hybrid survey termed the Rollins College Multi-Dimensional Eating and Exercise Questionnaire (RC-MEEQ). This questionnaire will be used in future research as well to assess student behaviors that are relevant to determining the impact of the environment of eating and exercise. The particular nuances of gaining access to and information from pre-college age students also contains a certain technical aptitude. Specifically, we employed the use of motivating rewards for our student population to encourage participation in the project. Each participant would be placed in a pool of names and at the conclusion of the data collection phase names would be randomly selected to receive gift cards of varying amounts and a grand prize of a Wii Fit console and game. We discovered that the gift cards and Wii fit were not always sufficient to motivate

student participation. However, this setback was quickly resolved by implementing a reward system for certain teachers/employees such as Physiology Class teachers (NorthWest Rankin High School), school nurses (St. Andrews) and administrative personnel (Oakdale, PineLake, NorthWest Rankin High School, Manchester). “Thank You” gift cards from a local department store proved to be sufficient encouragement to motivate these persons to assist fully in our data collection process (see budget below). We were surprised at how difficult it was to coordinate data collection at the schools given that the principals of each school were fully supportive of our project. In fact, it is not an exaggeration to say that without teacher and nurse involvement we may not have been able to obtain an adequate amount of data. This fact will be very useful in the collection of future data as we now know to gain administrative support and then immediately identify teachers/staff who will support the project.

Acquiring materials to carry out a research project is often an arduous venture, especially when new areas are being explored. We intentionally devised a research project that would require a minimum of new materials and at the very least, materials we determined we could readily obtain. The majority of our materials consisted of copies of surveys and information on our project. We did require more precise means of measuring body weight and estimating body fat, body muscle and visceral fat. A sophisticated, portable scale was employed for all of our measures with the exception of waist circumference (which was measured with a flexible tape). The commercially available scale was used by both institutions to ensure comparable data.

The student involvement and research design component of the grant were clearly a prominent aspect of our project. There were a total of 19 students involved in the research (Millsaps, 8; Rollins, 11). This represents 10% of Millsaps Psychology majors and 7% of Rollins Psychology majors. Furthermore, some students took lead roles in aspects of the project. For example, two Millsaps students took on the data collection aspect of the study as part of an Honors Project which resulted in a Poster Presentation at the Mississippi Academy of Sciences professional conference this winter (Mississippi Academy of Sciences, Hattiesburg, MS, Feb 2011). Two Rollins College students earned internal funding (via the Student-Faculty Collaborative Research Program) to enable them to work full-time with Dr. Davidson and Dr. St. John in the summer of 2010 to develop both the RC-MEEQ and observational data collection methods, and to meet local school administrators and staff and scout data collection locations. One of these Rollins student projects resulted in an Honors thesis.

Student involvement in research is critically important for small colleges such as Rollins and Millsaps as most of our students aspire to attend postgraduate colleges/professional schools and need experiences that enhance their education while preparing them for the rigors beyond a bachelors degree. As we described in our original proposal, the Advanced Developmental class at Rollins College has historically had a strong research component, as has the Experimental Research course at Millsaps College. The involvement of students in the current project is important primarily due to the advanced level of commitment required to fulfill the objectives of the grant. Given the very specific goals of our project it was possible to introduce students to the methodology, involve them in project evaluation and data collection, and allow them to be fully involved in the research. As mentioned above, we have already had

one presentation at a scientific conference and will be submitting our full results at an international conference next spring. Furthermore, we fully expect continued research in this area and at least one additional project has already been funded by the Millsaps College Ford Fellows Program investigating the possible use of environmental cues to enhance weight loss in college students (Meghan Redhead, "Environmental cues enhance weight loss in college students"). Results from this new study will be presented at the Experimental Biology conference in San Diego, CA (Spring, 2012).

Results

We predicted that increased BMI would be seen in schools with short lunch periods while schools with longer lunches would see a minimal increase in the percent of overweight/obese BMI measures compared to the elementary school baseline data. As stated above, obtaining adequate samples posed a formidable challenge. This was mainly due to limited participation on the part of our student subjects. Yet our data set may be more representative than suspected. The Mississippi school districts used in our study contain mostly upper-middle class demographics, as does the private K-12 school in Florida. In contrast, the public elementary school and public high school in Florida contain a sample of children similar to the average demographics for the state (43% of children qualified for free/reduced lunch in the public elementary school and 38% qualified in the public high school compared to 49.6% for the state). The overall State BMI reports show much higher BMI's for teenagers (MS =44.5%; FL =,33.2%) but it is likely that our participant schools simply consisted of a population from the lower end of the overall scale. Still, no differences in BMI were detected between short and

long lunch school (Table 1). There were no differences in height, weight, or waist circumference either (Table 1). However, we did find a consistent difference in Body Fat, Total Time Eating and an interaction of lunch length on predicted body fat (Table 1 and Figure 2). In other words, the longer lunch periods correlated well with overall lower body fat, slower eating, and less body fat for female students when compared to our short lunch groups. The finding of body fat differences was found even after controlling for grade in school and sex of the children, whether or not the school was public or private, and whether or not the school was in Mississippi or Florida, indicating an environmental factor instead of a cultural factor was playing a role.

Conclusions

A significant environment effect of school lunch times on Body fat was discovered in both sites for our present study. No other biometric index differences were detected. This may be the result of obtaining unrepresentative samples from our schools (10-15% overweight population versus a reported statewide overweight high school population of 33.2% for Florida and 44.5% for Mississippi...see Tables 3 and 4 – reproductions provided by the *Child and Adolescent Health Measurement Initiative*), including school districts with lower overall BMI, or a combination of these factors. Also, identifying schools with extended lunches was complicated by the fact that some schools exaggerated their lunch time period by as much as 20 minutes. Jim Hill High School in Jackson MS reported to us a lunch period of 40+ minutes. Once data collection began it was determined that the lunch period was actually just over 20 minutes in length leading to the exclusion of this school for our project. Regardless, the fact

that differences in Body Fat were detected is noteworthy. Further investigation of our RC-MEEQ data is currently underway to determine the relationship between school lunch length and self-reported exercise and food behaviors and attitudes.

The question remains “Is the environment contributing to increases in obesity”? Certainly, we observed and recorded differences. But to what extent does the environment contribute to these differences? Further research is warranted to delve deeper into this research question.

Future Directions

Certain States (Arkansas and South Carolina to name 2) now require yearly BMI data be obtained from all children in k-12 school systems. Thus a data set exists in which the possible sample biases we may have experienced with our project would not be a factor. We are working on a proposal to contact various school districts within these 2 states to identify schools that have long and short lunches. We will subsequently compare the BMI data from our targeted schools to determine if such data support our hypothesis of increased BMI with decreased lunch times. Since the BMI data is available the analysis will consist of matching long and short lunch schools with their reported BMI data. Once identified, body fat percent will also be recorded from our schools of interest and the RC-MEEQ will be distributed. Additional environmental factors of interest will also be explored with upcoming research proposals. Assessments of school environments will discern specific areas/factors that may be contributing to eating behaviors and subsequent research on such factors will begin. Such factors may include lighting, music, socializing behaviors, organization of food (fruits and vegetables in the

front of lines versus the back), time spent eating in differing environments such as fast food/home, etc. Elucidating environmental factors that are contributing to negative eating habits will lead to strategies for reversing the effects of such factors and implementing environmental cues that actually promote healthier eating strategies.

Personal Note: I would like to formally thank the ACS Mellon Faculty Development Granting body for this opportunity. This project has provided invaluable experience for 3 faculty members and over a dozen students. Furthermore, the findings have already lead to additional funding, professional presentations and the development of new research projects. It is not an overstatement to say that the project we have just completed has permanently and positively altered my career. I am indebted.

Sincerely,

*Andrew Kurt Thaw, Ph.D.
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Table 1.

Means (Standard Deviations) for Anthropometric Measurements for Students Attending High Schools with Short Lunches (≤ 25 minutes) and Long Lunches (≥ 30 minutes) (N = 243)

Anthropometric Measurements	Lunch Type	
	Short Lunch (≤ 25 minutes)	Long Lunch (≥ 30 minutes)
Body Mass Index	22.23 (3.96)	21.91 (3.91)
Waist Circumference	29.55 (4.42)	30.61 (4.07)
Body Fat %	24.70 (9.77)	20.04 (8.02)
Skeletal Muscle %	34.18 (7.74)	34.95 (7.30)

Table 2.
Means (Standard Deviations) for Total Consumption Time (in seconds) for Students Attending Schools with Short Lunches (≤ 25 minutes) and Long Lunches (≥ 30 minutes) in Florida and Mississippi

State	Lunch Type	
	Short Lunch (≤ 25 minutes)	Long Lunch (≥ 30 minutes)
Florida	465.11 (198.75)	482.28 (230.77)
Mississippi	556.56 (170.18)	776 (246.83)

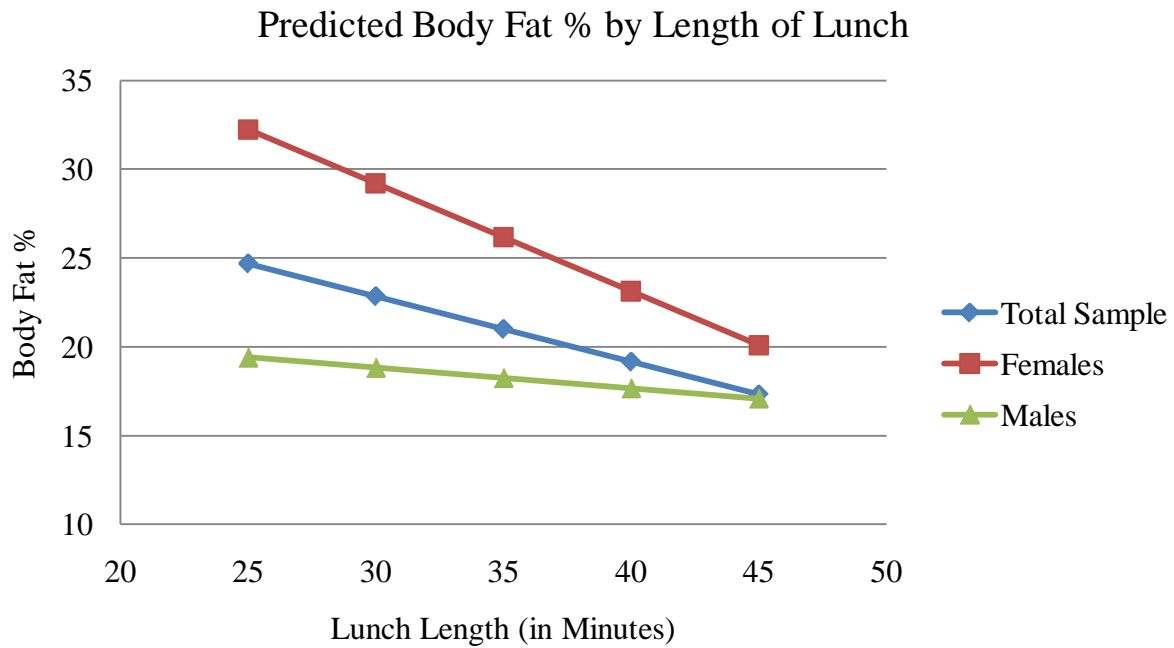


Figure 1. Predicted percentage of body fat for students attending schools with varying lunch length

*Students attending schools with relatively longer lunch periods had a lower body fat percentage even after controlling for sex, grade in school, whether or not the school was public or private, and whether or not the school was in Mississippi or Florida, $\beta = -.26$, $t(214) = -4.07$, $p < .001$. However, this effect was strongest for girls, $\beta = -.79$, $t(214) = -3.90$, $p < .001$.

Table 3

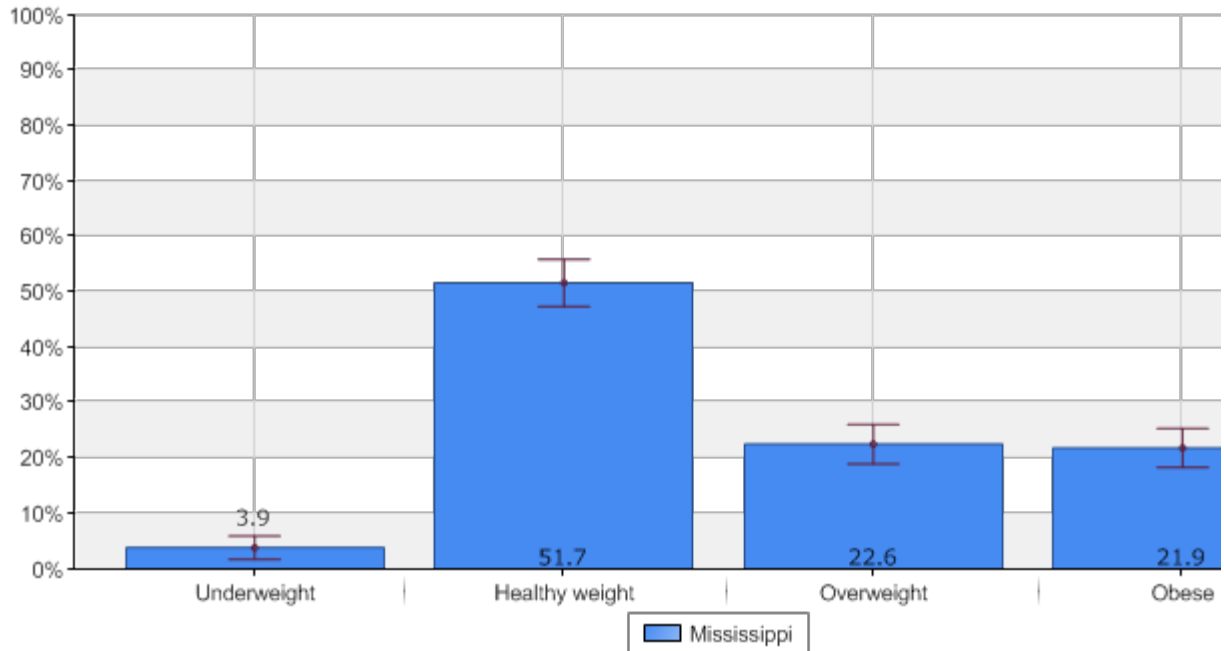
- Selected Criteria:**
- Child Health Measures
 - Mississippi
 - 2007
 - Physical and Dental Health
 - 1.4: Weight status - BMI-for-age, 4 categories, age 10-17 (details...)

Question: Indicator 1.4: What is the weight status of children based on Body Mass Index for age (BMI-for-age)? (details...)

	Children age 10-17 years only				
	Underweight (less than 5th percentile)	Healthy weight (5th to 84th percentile)	Overweight (85th to 94th percentile)	Obese (95th percentile or above)	Total %
%	3.9	51.7	22.6	21.9	100.0
C.I.	(1.8 - 6.0)	(47.4 - 55.9)	(19.0 - 26.1)	(18.4 - 25.4)	
n	30	494	197	192	
Weighted Est.	13,047	173,011	75,543	73,308	

DATA ALERT: The category labeling for childhood obesity has recently changed, due to updates from the CDC.

Weight status of children based on Body Mass Index for age (BMI-for-age)
 Children age 10-17 years only
 Mississippi



With funding and direction from the [Maternal and Child Health Bureau](#), the National Survey of Children's Health was conducted by the Centers for Disease Control and Prevention's [National Center for Health Statistics](#). CAHMI is responsible for the analyses, interpretations, presentations and conclusions included on this site.

Suggested citation format: National Survey of Children's Health. NSCH 2007. Child and Adolescent Health Measurement Initiative, Data Resource Center for Child and Adolescent Health website. Retrieved [04/01/11] from www.nschdata.org.

Table 4

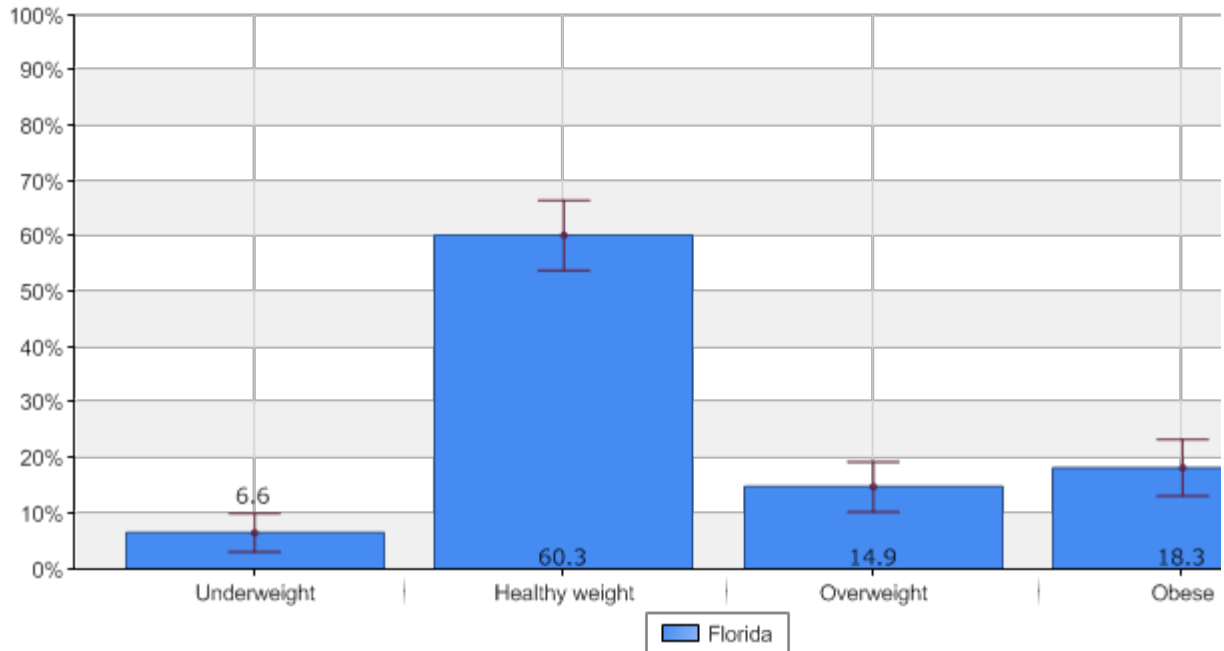
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	Children age 10-17 years only				
	Underweight (less than 5th percentile)	Healthy weight (5th to 84th percentile)	Overweight (85th to 94th percentile)	Obese (95th percentile or above)	Total %
%	6.6	60.3	14.9	18.3	100.0
C.I.	(3.1 - 10.1)	(53.9 - 66.6)	(10.3 - 19.4)	(13.2 - 23.4)	
n	38	524	137	127	
Weighted Est.	114,544	1,048,363	258,652	317,751	

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Weight status of children based on Body Mass Index for age (BMI-for-age)
 Children age 10-17 years only
 Florida



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