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# Fruit and Vegetable Consumption, Body Mass Index, and Dieting Behaviors among Florida Middle and High School Youth

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## ABSTRACT

*The purpose of this study was to examine fruit and vegetable consumption reported by Florida middle school and high school students and to determine if consumption was associated with: (1) demographic characteristics; (2) body mass index (BMI); and/or (3) weight loss behaviors. Data from the 2009 Florida YRBS and the MSHBS were used. Both surveys used a two-stage cluster sample design, producing a representative sample of students. In addition to socio-demographic variables, independent variables included engaging in weight loss behaviors. Dependent variables were adequate fruit and adequate vegetable consumption. Descriptive, chi-square and logistic regression analyses were performed. Results indicated that less than 25% of youth reported consumption of adequate amounts of fruit and less than 10% reported consuming adequate amounts of vegetables. No significant relationships were found between BMI and either fruit or vegetable consumption. Exercising, both exercising and dieting, fasting, and using pills /powders to lose weight were significantly associated with adequate fruit and vegetable consumption. Dieting to lose weight was significantly associated with adequate vegetable but not adequate fruit consumption. Interventions promoting healthy weight for children and adolescents need to address positive and negative behaviors and encourage greater consumption of fruits and vegetables.*

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## BACKGROUND

Dietary surveys in the United States (U.S.) have consistently indicated lower than recommended fruit and vegetable consumption among children and adolescents (CDC, 2010; Granner et al., 2012; Lorson et al., 2009; Rasmussen et al., 2006; Neumark-Sztainer et al., 2002; Kimmons et al., 2009). Adolescents seem particularly to display a pattern of low consumption (Lorson et al., 2009; Kimmons et al., 2009). Simultaneously, there exists a well-recognized epidemic of overweight and obesity among U.S. children and youth (CDC, 2015a). Seven out of 10 obese adolescents develop into obese adults (Zhao et al., 2011) and obesity during childhood is associated with the development of type 2 diabetes and cardiovascular disease throughout the lifecycle (Allcock et al., 2009). Therefore, the childhood obesity epidemic potentiates the need for promoting healthy behaviors to mitigate the risk in the development of these obesity related cardio-metabolic diseases.

Increasing fruit and vegetable consumption has been suggested as a possible means to achieve a

healthy weight status (Lowry et al., 2008; Tohill et al., 2004; Rolls et al., 2004). Fruits and vegetables are cited as having a low caloric density due to their relatively high fiber and water content. A small number (n=2) of epidemiologic studies in children, as reviewed by Tohill et al. (2004), showed mixed results in terms of an association between fruit and vegetable consumption and body weight. Interventions which have included a component to increase fruit and vegetable consumption have shown some success in the promotion of a healthy weight, especially when combined with other strategies such as calorie control and increased energy through exercise (Lowry et al., 2008; Rolls et al., 2004).

Of interest is the extent to which children and adolescents outside of an intervention setting practice both positive and negative behaviors related to the desire to achieve weight loss. An older study of adolescents based on YRBS data reported an association between dieting and exercise with increased fruit and vegetable consumption (Pesa et al., 2001). Another report did not find fruit and

vegetable consumption linked to being overweight (Neumark-Sztainer et al., 2007).

The purpose of this study was to examine fruit and vegetable consumption behaviors of middle school and high school students in Florida and to see how these behaviors were associated with: (1) demographic characteristics; (2) weight status, as defined by Body Mass Index (BMI); and (3) other behaviors which might be associated with the desire to lose weight. This type of information can aid in developing school health strategies which can assist in increasing fruit and vegetable consumption, promoting a healthy weight, and discouraging negative behaviors such as fasting and inappropriate consumption of weight loss medication.

## METHODS

### Participants

We analyzed self-report data from the 2009 Florida YRBS and the MSHBS questionnaires. There were 11,941 respondents for the data analyzed with 6,277 being in middle school and 5,664 being in high school. Table 1 shows the distribution of students by each of the independent and dependent variables used for this analysis, overall and stratified by middle school and high school.

### Instruments

The YRBS is the Centers for Disease Control and Prevention's (CDC) school-based survey conducted by state and local health and education agencies (Florida Department of Health [FDOH], n.d.; FDOH, n.d.). The MSHBS is a Florida-specific survey that contains many of the YRBS questions and uses the same sampling and administration methodologies (FDOH, n.d.; FDOH, n.d.). Both the MSHBS and the YRBS used a two-stage cluster sample design, producing a representative sample of students from public middle schools (grades 6-8) and high schools (grades 9-12) after the data are weighted. The MSHBS and YRBS questionnaires included questions regarding tobacco, alcohol and drug use; physical activity and nutrition; unintentional injury thoughts and behaviors, and violence and personal safety. In all, 6277 middle school students in 99 schools participated (overall response rate was 81%) and 5,664 students in 80 schools participated (overall response rate was 71%). Students were asked a number of questions requesting the number of servings of various foods over the past 7 days: fruit, 100% fruit juice, green salad, carrots, other vegetables (other than potatoes), and potatoes.

### Procedure

For the analysis, data from both surveys were combined and variables for identical questions and response options on both survey questionnaires were

identified and used as dependent and independent variables. The independent variables used for this analysis were grade (6-12); sex; race/ethnicity categorized as "white (non-Hispanic)," "black (non-Hispanic)," "Hispanic," and "Other;" weight status categorized as "desirable," "overweight," "obese," and "unknown," based on current CDC definitions for youth less than 20 years of age (CDC, 2015b); and engaging in the following weight loss behaviors: exercise, diet, combined diet/exercise, fast, and/or pills. "Unknown" for weight status was included as a separate category because a large proportion of students did not report height and/or weight. Dependent variables were "Adequate Fruit," which was defined as consuming at least two servings of fruit per day in the past 7 days (including eating any fruit and drinking 100% fruit juice) and "Adequate Vegetables," which was defined consuming at least three servings of vegetables per day in the past 7 days (including green salad, carrots, and other vegetables, but excluding potatoes).

### Data Analysis

Data were managed using SAS 9.2 (SAS Institute Cary, NC). Descriptive, chi-square, and logistic regression analyses were performed using SUDAAN 11.0 (RTI International Research Triangle Park, NC). The data were weighted to account for non-response.

## RESULTS

Table 1 shows the distribution of students by each of the independent and dependent variables used for this analysis, overall and stratified by middle and high school. Middle and high school students were similar regarding the race/ethnicity categories white (non-Hispanic), black (non-Hispanic), and Hispanic. Middle and high school students were also similar regarding fasting to lose weight and adequate fruit and vegetable consumption. A higher proportion of high school students were in all of the weight status categories (all  $p < .01$ ), except for the "Unknown" category. A significantly higher proportion of middle school students had "Unknown" weight status ( $p < .01$ ) compared to their high school counterparts. A higher proportion of middle school students engaged in the following weight lose behaviors: exercise, diet, and diet and exercise combined (all  $ps < .01$ ). A significantly higher proportion of high school students used pills/powders to lose weight ( $p < .01$ ).

Table 2 shows the results from the chi-square analyses using fruit and vegetable consumption as the dependent variables. The proportion of students who consumed adequate fruit was statistically significantly higher among girls ( $p < .01$ ), those who exercised to lose weight ( $p < .01$ ), those who combined exercise and diet to lose weight ( $p = .02$ ), those who fasted to lose weight ( $p < .01$ ), and those who used pills/powders to lose weight ( $p < .01$ ). The

proportion of students who consumed adequate fruit was significantly lower among those reporting white (non-Hispanic) race/ethnicity ( $p < .01$ ).

The proportion of students who consumed adequate vegetables was significantly lower among those reporting white (non-Hispanic) race/ethnicity ( $p < .01$ ). The consumption of adequate vegetables was statistically significantly higher among those who engaged in any of the weight-loss behaviors examined (all  $ps < .01$ ).

Table 3 shows the adjusted odds ratios for the two dependent variables examined. The results shown are the final models after independent variables that did not contribute significantly to the model were removed. Both final models account for significant interactions. Overall, girls had a 23% higher adjusted odds ratio for consuming adequate fruit compared to males (95% CI 1.11-1.36); however, there was a significant interaction showing that girls who fasted had a 27% lower odds ratio for adequate fruit consumption compared to their counterparts (95% CI 0.55-0.97). Compared to the referent categories, other significant covariates showing higher adjusted odds ratios for consuming adequate fruit include Hispanic (OR=1.47, 95% CI 1.31-1.65), black (non-Hispanic) (OR=1.66, 95% CI 1.46-1.90) and Other race/ethnicity groups (OR=1.49, 95% CI 1.25-1.78), exercising to lose weight (OR=1.28, 95% CI 1.16-1.41), fasting to lose weight (OR=1.51, 95% CI 1.23-1.86), and using pills/powders to lose weight (OR=1.32, 95% CI 1.03-1.68).

The adjusted odds ratio for consuming adequate vegetables was higher among girls compared to males until the significant interaction between gender and using pills/powders was included in the model. The interaction indicates that girls who used pills/powders to lose weight had an adjusted odds ratio 87% higher for adequate vegetable consumption compared to their counterparts (95% CI 1.15-3.04). The adjusted odds for adequate vegetable consumption was higher among those reporting black (non-Hispanic) (OR=1.24, 95% CI 1.02-1.51) and Other race/ethnicity (OR=1.82, 95% CI 1.43-2.32) compared to white (non-Hispanic) students

## DISCUSSION

This research supports previous findings of low fruit and vegetable consumption among children and adolescents (CDC, 2010; Granner et al., 2012; Lorson et al., 2009; Rasmussen et al., 2006; Neumark-Stainer et al., 2002; Kimmons et al., 2009; Upton et al., 2012). In both the middle school and high school populations more individuals reported consuming the recommended amounts of fruits as opposed to vegetables, however over 75% of youth reported less than recommended consumption amounts. Vegetable consumption was even more

problematic with approximately 90% indicating that recommended amounts were not consumed. One national study of high school students reported consumption of fruits and vegetables both as being only 1.2 median times per day and encouraged more programs to help facilitate adherence to the recommendations (CDC, 2010).

Changing gender differences in self-reported consumption, which changed with age/grade level, are worth exploring further. In this sample, boys were more likely to report that they were not meeting the fruit and vegetable consumption recommendations as they advanced from middle school to high school. This could be due to the school's policy to eat in the cafeteria or if the school has an open campus policy. The school food environment that a child is exposed to has been found to influence a child's nutrient intake including their consumption of fruits and vegetables (Brefel et al., 2009).

Another demographic trend which appeared in this study was the greater likelihood that white, non-Hispanics (both in middle and high school) were more likely to report being significantly less likely to follow the daily recommendations related to consumption of fruits and vegetables. This contrasts with findings of the 2010 National Youth Physical Activity and Nutrition Study (NYPANS), which found no significant racial/ethnic differences in fruit consumption among high school students and found that non-Hispanic black, and Hispanic students were less likely to report consuming vegetables (CDC, 2010). More studies are needed to determine if geographical location influences racial/ethnic differences in fruit and vegetable consumption.

This study indicated that middle school students who report one potential weight loss behavior – recommended daily consumption of fruits and vegetables – also were more likely to report another positive weight loss strategy – exercising to lose weight. Both middle school and high school students who reported eating the recommended amounts of fruits and vegetables were also more likely to report using negative strategies to lose weight such as – fasting to lose weight or – used pills/powders to lose weight. Such clustering of behaviors would suggest that programs designed to increase fruit and vegetable consumption and promote exercise as strategies to support achieving or maintaining a healthy weight also should explicitly address dangers associated with the negative strategies of fasting and the taking of the pills and powders for weight loss. Evidence has linked a higher fruit and vegetable consumption with adolescents who practice negative behaviors to control their weight. A focus on positive body image may be beneficial to reduce negative body image (Quick et al., 2013).

**Table 1**  
**Distribution of Students by Demographics, Weight Status, Weight Loss Behaviors, and Self-reported Consumption of Fruits and Vegetables**

	All Respondents		Middle School		High School		Middle/High School Comparison
Characteristics	N	Percentage	n	Percentage	n	Percentage	p-value
<b>Total</b>	11789	100	6277	100	5664	100	--
<b>Grade</b>							
6	2201	14.7	2201	33.5	--	--	--
7	2079	14.5	2079	33.2	--	--	--
8	1967	14.6	1967	33.3	--	--	--
9	1610	15.7	--	--	1610	28.0	--
10	1503	14.6	--	--	1503	26.1	--
11	1276	13.7	--	--	1276	24.4	--
12	1153	12.1	--	--	1153	21.5	--
<b>Sex</b>							
Male	5936	50.2	3088	51.4	2848	49.3	.04
Female	5889	49.8	3166	48.6	2723	50.8	.04
<b>Race/ethnicity</b>							
White (non-Hispanic)	4622	47.1	2404	45.9	2218	48.1	.54
Black (non-Hispanic)	2376	22.8	1325	22.8	1051	22.9	.97
Hispanic or Latino	3763	24.2	2005	24.9	1758	23.6	.64
Other	936	5.9	482	6.5	454	5.4	.04
<b>Weight Status</b>							
Desirable	6551	56.5	2963	48.1	3588	62.9	<.01
Overweight	1296	11.2	608	9.8	688	12.3	<.01
Obese	915	7.8	425	6.8	490	8.6	<.01
Unknown	3179	24.5	2281	35.4	898	16.2	<.01
<b>Exercised to lose weight</b>	7730	65	4492	73.8	3238	58.3	<.01
<b>Dieted to lose weight</b>	4565	38.8	2473	40.6	2092	37.5	<.01
<b>Combined diet and exercise to lose weight</b>	4086	34.5	2284	37.6	1802	32.2	<.01
<b>Fasted to lose weight</b>	1149	10.0	608	10.2	541	9.9	.59
<b>Used pills/powders to lose weight</b>	519	4.5	225	3.7	294	5.1	<.01
<b>Adequate fruit</b>	2694	23.6	1412	24.5	1282	22.9	.07
<b>Adequate vegetables</b>	1121	9.4	585	9.2	536	9.4	.71

\*Subgroup totals listed. Do not include those with missing data points.

**Table 2**  
**Chi-square Analysis of Demographic Characteristics, BMI Status, and Selected Weight Loss Behaviors in Relationship to Adequate Fruit and Vegetable Consumption**

	Adequate Fruit		Adequate Vegetables	
Characteristics	Percentage	p-value	Percentage	p-value
<b>Grade</b>				
6	24.7	.4731	10.2	.53
7	24.4		9.0	
8	24.4		8.7	
9	23.9		10.2	
10	23.4		8.9	
11	22.9		8.6	
12	21.1		9.7	
<b>Sex</b>				
Male	22.3	.0041	8.9	.06
Female	24.8		9.9	
<b>Race/ethnicity</b>				
White (non-Hispanic)	19.5	<.0001	8.2	<.01
Black (non-Hispanic)	28.4		9.8	
Hispanic or Latino	26.2		9.8	
Other	26.8		13.7	
<b>Overweight/ Obese</b>				
Desirable	23.4	.9039	8.8	.09
Overweight	24.4		9.1	
Obese	23.7		11.1	
Unknown	23.6		10.2	
<b>Exercised to lose weight</b>				
Yes	25.1	<.0001	10.0	<.01
No	20.7		8.3	
<b>Dieted to lose weight</b>				
Yes	24.6	.0881	11.4	<.01
No	22.9		8.2	

<b>Combined diet and exercise to lose weight</b>				
Yes	25.2	.0185	11.4	<.01
No	22.7		8.4	
<b>Fasted to lose weight</b>				
Yes	28.9	.0001	16.5	<.01
No	22.8		8.7	
<b>Used pills/powders to lose weight</b>				
Yes	30.6	.0010	19.1	<.01
No	23.2		9.0	

**Table 3**  
**Logistic Regression Final Models Related to Demographics, Weight Loss Behaviors, and Adequate Fruit and Vegetable Consumption**

	<b>Adequate Fruit</b>		<b>Adequate Vegetables</b>	
<b>Independent Variables [Referent]</b>	<b>Adjusted Odds Ratio</b>	<b>95% Confidence Limit</b>	<b>Adjusted Odds Ratio</b>	<b>95% Confidence Limit</b>
<b>Girls [Boys]</b>				
Female	1.23	1.11-1.36	1.12	0.98-1.29
<b>Race/ethnicity [White (non-Hispanic)]</b>				
Black (non-Hispanic)	1.66	1.46-1.90	1.24	1.02-1.51
Hispanic or Latino	1.47	1.31-1.65	1.20	1.00-1.44
Other	1.49	1.25-1.78	1.82	1.43-2.32
<b>Exercised to lose weight [Did Not]</b>	1.28	1.16-1.41	*	
<b>Fasted to lose weight [Did Not]</b>	1.51	1.23-1.86	1.87	1.53-2.28
<b>Used pills/powders to lose weight [Did Not]</b>	1.32	1.03-1.68	1.29	0.89-1.88
<b>Interactions</b>	Girls – Fasted		Girls – Used Pills/Powders	
	0.73	0.55-0.97	1.87	1.15-3.04

\*Did not significantly improve the model and was not included in the final model for this dependent variable

## Limitations

This study has limitations, noted by others, such as only including individuals who attend school and not all individuals in the relevant age range (CDC, 2010). Information gathered was self-reported data and some students failed to complete all of the information. The survey did not define serving size (CDC, 2010). This study was also limited to Florida, which is a major grower of fruits and vegetables (Cantliffe et al., 2013), a factor which may affect consumption due to more local availability of fresh fruits and vegetables. The impact of the socio-economic environment is worth examining to determine if there is adequate availability of fruits and vegetables available to the students in the study. Some children's primary food consumption is at school and how many meals that are consumed at school may influence their fruit and vegetable intake considering schools must serve meals within certain guidelines. Inclusion of the middle school age group was a strength of this study; many studies of this type have focused exclusively on the high school population. Inclusion of additional grades helps better delineate changes in consumption which are characteristic of age advancement.

## Conclusions

Our results concur with those of other studies that have shown lower than recommended consumption of fruits and vegetables is an issue in child and adolescent health (CDC, 2010; Granner et al., 2012; Lorson et al., 2009; Rasmussen et al., 2006; Neumark-Stainer et al., 2002; Kimmons et al., 2009; Upton et al., 2012). In this study, less than 25% of all youth reported consumption of adequate amounts of fruit and less than 10% reported consuming adequate amounts of vegetables. No statistically significant relationships were found between BMI and either fruit or vegetable consumption but clustering of weight related modification behaviors (both positive and negative) were linked with fruit and vegetable consumption. For example, self-reports of exercising to lose weight, both exercising and dieting to lose weight, fasting, and using pills/powders to lose weight were significantly associated with adequate fruit and vegetable consumption. Dieting to lose weight was significantly associated with adequate vegetable but not adequate fruit consumption. This study of Florida middle and high school students support that interventions promoting healthy weight for children and adolescents need to address positive and negative behaviors and encourage greater consumption of fruits and vegetables (Neumark-Sztainer et al., 2007).

## IMPLICATIONS FOR SCHOOL HEALTH

It is well recognized that overweight and obesity are major public health problems affecting children

and adolescents in the U.S. (CDC, 2015a) and increased fruit and vegetable consumption may be one strategy to help maintain and achieve a healthy weight (Lowry et al., 2008; Tohill et al., 2004; Rolls et al., 2004; Pesa et al., 2001; Neumark-Sztainer et al., 2007). In this study analyzing data from the 2009 FYRBS and the MSHBS, white-non-Hispanic middle and high school students were significantly less likely to consume recommended amounts of fruits and vegetables when compared with other ethnic groups. Most middle and high school students in this study did not meet the recommended two or more servings per day of fruit (76.4%) or the three or more recommended servings per day of vegetables (90.6%). No significant relationship was found between self-reported overweight and obesity, despite the current scientific thought that increased consumption of more fruits and vegetables might be beneficial for healthy weight maintenance. Relationships between consuming recommended amounts of fruits were associated with selected weight loss behaviors for both middle and high school students. Because some of students' self-reported weight loss practices were negative, this research would support that school nutrition education and school lunch programs aimed at encouraging fruit and vegetable consumption among youth should also address health issues associated with positive and negative weight loss behaviors. Further research on clustering of dietary behaviors and weight loss behaviors is needed to target school nutrition education efforts as our research and that of Neumark-Sztainer et al. (2007) would suggest.

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