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Relationship between food insecurity and overweight in preschool-aged children in rural West Virginia

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RELATIONSHIP BETWEEN FOOD INSECURITY AND OVERWEIGHT IN PRESCHOOL-AGED CHILDREN IN RURAL WEST VIRGINIA

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ABSTRACT

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The prevalence of overweight among adults and children continues to increase. The purpose of this study was to evaluate demographic factors that may be associated with an increase in a child's weight status. Subjects were children aged 2 to 6 years old in two southern West Virginia counties, McDowell and Mercer. Children were weighed and measured, and BMI was calculated. Parents or other caregivers were asked to complete a questionnaire regarding child's age, household food security, and parents' age, height and weight, education level, and hours worked per week.

A positive association between food insecurity and overweight among children was present ($p=0.06$). The mother's BMI was positively associated with the child's BMI ($p<0.05$), however the father's BMI was positively associated with only the girl's BMI ($p=0.02$). The only significant association with the parents' education was that dad's educational attainment was associated with an increase in boys' BMI. This study revealed important information regarding relationships between household demographics and overweight in children.

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Introduction

Food security is defined as access by all people at all times to enough food for an active, healthy life. At a minimum, food security includes the availability of nutritionally adequate and safe foods, and an assured ability to acquire acceptable foods in socially acceptable ways. This includes not resorting to emergency food supplies, scavenging, stealing, or other coping strategies. When there is limited or uncertain availability of nutritionally adequate and safe foods or ability to acquire acceptable foods in socially acceptable ways, food insecurity exists. Furthermore, hunger may be a consequence of food insecurity. Hunger due to food insecurity exists when there is an uneasy or painful sensation caused by a lack of food and/or recurrent and involuntary lack of access to food (Anderson 1990).

Since 1995, as a survey supplement of the annual Current Population Survey (CPS), the United States Department of Agriculture (USDA) has collected food security information for the U.S population. A major goal of the data collection by the USDA is to monitor the prevalence of food insecurity in U.S. households. Each year USDA summarizes their findings in the *Measuring Food Security in the United States* series. Prevalence of household-level food insecurity and food insecurity with hunger is also available for each state (Nord et al, 2005).

Food insecurity prevalence rates are substantially higher in particular populations, including: households with incomes below the Federal poverty line, households headed by single women with children, Black households, and Hispanic households. Food insecurity is also more common in the South and the West areas of the United States, and in central cities and rural areas than suburbs. Food insecure households tend to spend

less for food than food secure households and are more likely to seek assistance from Federal food assistance programs such as the National School Lunch Program, the Food Stamp Program, and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) (Nord et al, 2005).

Existence of food insecurity in a household tends to lead to various dietary and health consequences; for women, a significant decrease in consumption of fruits, vegetables, and vitamin C is seen (Kendall et al, 1996). Inadequate nutrient intake of vitamin B-6, vitamin D, vitamin E, iron, calcium, magnesium, zinc, and pantothenic acid has also been identified in diets of low-income families (Emmons 1986). Household food insecurity and/or a low income status also affect the health status of children. Johnson-Down and associates found that children, nine to twelve years old, of low income households had significantly lower intake of vitamins A, C, iron and folate (1997). Fifth grade (9.58+/-0.58 years old) Hispanic children of food insecure households have been seen to consume a significantly less amount of meat products than children of food secure households (Matheson 2002).

Food insecurity and hunger are also associated with decreased health status in children. In a group of infants and toddlers <36 months old, children of food insecure households have greater odds, than children of food secure households, of being hospitalized since birth or having fair/poor health. The odds of being hospitalized since birth are almost three times greater for food insecure children (Cook et al, 2004). Children 6 to 16 years old of food insecure households are also significantly more likely to experience more frequent stomachaches and headaches. Along with preschoolers 1 to

5 years old, the same children are also more significantly likely to have more frequent colds (Alaimo et al, 2001).

Weinreb and associates found that for preschool-aged children (mean age = 4.2 years old) moderate hunger among children is a significant indicator of health conditions, but severe hunger is not. Severe hunger is a predictor of internalizing problems, decreased coping strategies, and dealing with anxiety (Weinreb et al, 2002).

For the last decade, questions concerning the association of food insecurity and obesity or overweight have arisen. The prevalence of obesity for adults and children has continued to rise over the last several years (Ogden 2006). Since obesity is associated with excess energy intake and food insecurity limits availability of foods, the relationship between the two may appear inaccurate. However, an association between obesity/overweight and food insecurity has been uncovered by various researchers. This paradox was first questioned in 1995 by William Dietz. In the last decade, several studies have assessed the relationship between food insecurity and weight status. The purpose of this study is to use collected information from parents of a group of preschool children in 2 counties in rural West Virginia to evaluate if the same association exists in a rural, low-income area. The information collected includes weight and height measurements of 2 to 6 year old children. The child's caregiver was asked to complete an 18 question survey which was used to evaluate the household's food security status.

Along with evaluating the association between food security status and weight status, other factors possibly associated with the weight status of preschool aged children were evaluated. The children's parents' BMI and age were evaluated along with the parents' education and hours worked per week.

Review of Literature

Prevalence of Food Insecurity

Even with various programs to aid in accessibility of food, food insecurity and hunger continue to be of concern across the nation. In 2005, results of the CPS supplement collecting food security information showed that 12.6 million households (11.0 percent) were food insecure. Approximately 13.9 million children (19 percent of all children under 18 years old) were part of a food insecure household. Since 1998, the prevalence of children in food insecure households has remained between 16.9 and 19.7 percent. Even more importantly 0.7 percent of children suffered from hunger due to food insecurity at least once during the year. The prevalence of food insecurity with hunger among children has remained between 0.5 and 0.7 percent since 1999, statistically unchanged (Nord et al, 2004).

Furthermore, 16.7 percent of households with children under 6 years old experienced food insecurity at least once in 2005. Of these households, 679,000 (3.9 percent of households with children under 6 years old) were food insecure with hunger. The prevalence of food insecurity is seen to be lowest in married-couple families, white non-Hispanic households, higher income households, and families in the Northeast (Nord et al, 2004).

The USDA also provided very useful data pertaining to the prevalence of foods insecurity with and without hunger by state. For state information, data for 2003-2004 were combined. In this two year time frame, 11.4 percent of all U.S. households were food insecure with or without hunger and 3.8 percent were food insecure with hunger. In West Virginia alone, percentages of households experiencing food insecurity with or

without hunger and food insecurity with hunger were 8.9 and 3.0, respectively (Nord et al, 2004). The prevalence of food insecurity with or without hunger in West Virginia households has decreased over the previous decade. The averages for 1996-1998 and 1999-2001 were 9.5 percent and 10.3 percent, respectively (Nord et al, 2004).

Measurement of Food Insecurity

The USDA tool that has been used since 1995 as part of the CPS to measure food insecurity is the U.S. Household Foods Security Survey Module. This is an 18 question survey asking questions pertaining to experiences and behaviors that indicate food insecurity. Ten of the questions pertain to the household level and the remaining 8 questions are specific to children in the household (Bickel et al 2000). This same survey was used to measure food security in this study. The USDA has developed codes, or scores, for each question in order to evaluate food security status. Further details on scoring the survey module can be accessed at http://www.fns.usda.gov/fsec/FILES/FSGuide.pdf. The CPS and most studies gaining food security information utilize this particular survey. In 1999, researcher Edward Frongillo concluded that the series of questions are dependable, precise, and accurate in evaluating food insecurity and hunger status.

Definition of overweight

The CDC has defined overweight and obesity differently for adults and children. To aid in defining overweight, the CDC uses Body Mass Index (BMI), which is a number calculated from the individual's weight and height. In metric measurement, BMI is equal to weight (kg) / [height (m)]^2. For children, BMI is age and sex specific and is normally referred to as BMI-for-age. After calculating a child's BMI, it is usually plotted on a

CDC growth chart to obtain a percentile ranking. The percentiles are then used to categorize weight status, as the following:

Table 1 Defining weight status of children with BMI percentiles (National Health and Statistics, 2000).

Weight Status Category	Percentile Range
Underweight	Less than the 5th percentile
Healthy weight	5th percentile to less than the 85th percentile
At risk of overweight	85th to less than the 95th percentile
Overweight	Equal to or greater than the 95th percentile

Prevalence of Overweight

The National Health and Nutrition Examination Survey (NHANES) is used to collect data pertaining to the overweight and obesity status of the U.S. civilian, noninstitutionalized population. This sample has been used to evaluate the prevalence of overweight in children and also review changes from previous years sampled. In 2003-2004, 26.2 percent of children aged 2 to 5 years old were at risk for overweight or overweight (BMI-for-age at 85th percentile or higher). More specifically, 13.9 percent of children aged 2 to 5 years old were overweight with BMI-for-age at 95th percentile or higher. After adjusting for age and race/ethnicity, tests showed a significant increase in the prevalence of overweight in children over 1999-2000, 2001-2002, and 2003-2004. In all children aged 2 to 19 years, there was no significant difference in prevalence of overweight between boys and girls (Ogden 2006).

More specifically, the 2004 Pediatric Nutrition Surveillance System (PedNSS) monitored the nutritional status of children taking part in Federally funded health programs. This survey system has the ability to provide information for individual states. All records are from children 5 years old or younger. In 2004, 12.6 percent of the West Virginia children were found to be overweight (BMI-for-age greater than 95th percentile).

This places West Virginia in the top one-fourth of the United States for overweight children. According to the PedNSS findings, the prevalence of overweight children has increased by 3.8% from 1995 and 2004 (Polhamus et al, 2006).

Characteristics of McDowell and Mercer counties

The most recent data for the prevalence of overweight or obesity in individual counties in West Virginia was collected in 1999. Data collected during this study was from McDowell and Mercer counties in southern West Virginia. In 1995-1999, the prevalence of adult obesity in McDowell and Mercer counties were 29 percent (ranked 4th out of 55 counties) and 17 percent (ranked 30th), respectively. Previous data from 1990-1994 showed an obesity prevalence of 17.3 percent in McDowell county and 16.2 percent in Mercer county (Chaudari et al, 2002).

McDowell and Mercer counties are on the southern border of West Virginia. Along with the prevalence of overweight and obesity, other characteristics of McDowell and Mercer counties contributed to the choice of using these two particular counties for this study (Vital Health Statistics of West Virginia, 2005).

Table 2 Demographics of McDowell and Mercer counties

	McDowell County	Mercer County	West Virginia
	Rank in State	Rank in State	
Population, 2005[a]	24,726	61,589	1,816,856
	30th of 55 counties	7th of 55 counties	
Per Capita Income Average, 2004[b]	17,622	24,820	25,792
	53rd of 55 counties	13th of 55 counties	
Average Household Size, 2004	2.42	2.33	2.4
Average age, 2000	40.2	40.5	40-49
1-4 year old children, 2000[c]	1,113	2,968	81,629

a Appendix 1
b Appendix 2
c Appendix 3

The per capita income of McDowell county is less than 96% of the other counties in West Virginia. Where as, Mercer County's per capita income is 24,820, which ranks 13th compared to that of other West Virginia counties. McDowell county is more rural than Mercer county. Mercer county has an interstate highway and two state colleges, whereas McDowell county has neither (Workforce, 2006).

Previous studies associating weight with food security status

The paradox of hunger causing obesity was first questioned in 1995 by William Dietz. In a case report, he described a case in which a 7-year-old client of a food insecure household was 220% of her ideal body weight. He proposed that this may be in part due to eating foods with a greater fat content to prevent hunger, during times when there was a lack of money to buy a variety of foods (Dietz 1995). In the last decade, a variety of studies have been conducted to investigate if this paradox is true in various populations.

Food insecure adults are more likely to be obese than the food secure adults. However in the same study, food security was not significantly associated with childhood (ages 2-12 years) overweight (Martin and Ferris, 2007). Parents often attempt to protect their children from harm and discomfort. It appears that this may also be true when families experience a lack of resources to have access to a variety of healthy foods for themselves and their dependents. Women reporting mild or moderate food insecurity, compared to severe food insecurity or totally food secure, are significantly more likely to be overweight (BMI>27.3) (Townsend et al, 2001). In California women, an increased risk of obesity was observed in all levels of food insecurity compared to food secure households (Adams 2003). Within the last several years, there has been an increase in

studies relating food security status in households with children and the weight status of children and adolescents.

In 2006, Patrick Casey and colleagues analyzed the NHANES data from 1999-2002. Their report was based on an analysis of food security and overweight status within the previously collected data. Seventeen percent of the children aged 3 to 17 years lived in a household that experienced food insecurity. Almost 30% of children had a BMI≥85th percentile for age. Children, aged 3 to 17 years, who lived in a food insecure household were significantly ($p<0.01$) more likely to be at risk for overweight (BMI≥85th percentile for age to 95th percentile for age) or overweight (BMI≥95th percentile for age), compared to those from food secure households. The data were also analyzed more specifically. Preschool-aged children 3 to 5 years old and boys who live in food insecure households were not significantly more likely to be at risk for overweight, compared to their counterparts who were in food-secure households. Similar results were found with overweight children. Girls and 12 to 17 year old children of food insecure households were significantly more likely to be overweight than those of food secure households. The association between overweight status and food security was not found in any other age group, but the trend in all age groups was for a higher prevalence of overweight children in food insecure households (Casey at al, 2006).

Many children may be protected from food insecurity when other family members are experiencing the consequences. However some children are not protected. When focusing on households in which children do experience the effects of food insecurity (11.2% of children included), child food security status is significantly associated with the risk of overweight in children ages 3 to 17, both boys and girls, white and Mexican

American (not black), and children in families with income below the poverty level. As stated, the associations are between food insecurity and at risk for overweight, not overweight. Overweight status was significantly associated with food insecurity in children 12 to 17 years old, girls, and children in families below with income below the poverty level. However, there was no significant association with children aged 3 to 5 years or boys (Casey et al, 2006).

In 1999, a group of 13,500 kindergarten children was measured, weighed, and their BMI was calculated. Researchers used the USDA's Household Food Security Survey Module to question caregivers regarding food security. For 11,400 of the children from the previous data set, these steps were repeated three years later in 2002. Comparisons were made within the group for differences between 1999 and 2002. Food insecurity among the children in kindergarten was seen to have a significant effect on the changes of BMI and weight only among girls. The girls were more likely to have an increase in their BMI and weight between 1999 and 2002. Among the boys, there was an association between food insecurity and BMI and weight, but it was not statistically significant. Along with growth, food insecurity was associated with lower reading scores, mathematics scores, and lower social skills for girls and boys (Jyoti et al, 2005).

Some ethnic groups seem to be affected by food insecurity at different degrees than others. Mexican American children are sometimes more likely to display an association between food security and weight status. In a study of 239 Mexican-American families in the state of California, the 12-item Radimer/Cornell food security scale was used to estimate the levels of food insecurity during the last month. Portable scales were used by trained interviewers to weigh and measure the children. Overweight

was defined as BMI≥85th percentile for age and obesity was defined as BMI≥95th percentile for age. The majority of the families reported some level of food insecurity, with only 21% reporting food secure. Fourteen percent of the children were measured as being overweight and 23% were obese. Families who reported household food insecurity tended to have the highest average BMI for age and percentage of children who were overweight and obese; however, differences in BMI by food security level were not statistically significant (Kaiser et al, 2002).

The Continuing Survey of Food Intakes by Individuals (CSFII) was a nutrition survey conducted by the USDA in 1994 through 1996. The data from the survey were used to examine the characteristics of children, aged 0 months to 17 years, living in food-insufficient households, especially in households with low-income. For this study, food-insufficiency was defined as reports of "often don't have enough to eat" or "sometimes don't have enough to eat". Weight and height was self-reported by the children's caregiver(s). Low-income households were defined as a household with income at or below 130% of the federal poverty line. This guideline is used as income criteria for several federal assistance programs, such as the Food Stamp Program (Casey et al, 2001).

When compared to the children of food-sufficient, higher-income households, children who are from a food-insufficient, low-income household were significantly more likely to be overweight (BMI percentile greater than the 85th). However, among the low-income households food sufficiency did not have a significant relationship with the children's weight status (Casey et al, 2001).

Purpose of the Study

There have been few studies that have found a relationship between the weight of children and household food security status. Also, no known studies have been conducted in rural West Virginia. The objectives of this study are:

1) To determine the prevalence of household food insecurity in McDowell and Mercer counties.
2) To determine the prevalence of overweight in 2 to 6 year old children in McDowell and Mercer counties.
3) To quantify the relationship between food insecurity and BMI among preschool-aged children in McDowell and Mercer counties.
4) To quantify the relationship between BMI among preschool-aged children in McDowell and Mercer counties and their parents' BMI, age, education attainment, and hours worked per week.

Methods

Data collection for this study was conducted in cooperation with the West Virginia University (WVU) Extension Service Family Nutrition Program (FNP) in McDowell and Mercer counties in southern West Virginia. These counties were chosen due to their strong FNP leadership and McDowell county's high prevalence of obesity. Lisa Mitchell, the Family and Consumer Sciences Extension agent, the Nutrition Outreach Instructors in these counties, Dr. Cindy Fitch, recent WVU graduate student Jill Kloss RD, and Melissa Webber collected the data. All parties were trained in appropriate methods for weighing and measuring children.

Study participants were preschool age (2 to 6 years old) and their parents who are participating in the FNP Head Start Program. Investigators met with the parents to explain the study and received informed consent before enrolling the children in the study (Appendix 4). Approval was granted by the West Virginia University Institutional Review Board for the Protection of Human Subjects (IRB #15613).

Obtaining demographics

The sex and birth date of children were provided by the child's parent or caregiver. All children were measured in light clothing and without shoes. Height was measured using a portable stadiometer and weight was measured using an electronic scale. BMI percentiles were calculated using EpiInfo 2000. For the children, BMI percentiles were divided into 3 categories, including: normal weight as less than 85^{th} percentile, at risk for overweight as equal to or greater than 85^{th} percentile but less than the 95^{th} percentile, and overweight as equal to or greater than the 95^{th} percentile.

Age, height, and weight of the mother and father were self reported by caregivers. The weight and height was then used to calculate the parents' BMI. The parents' BMI was divided into similar categories as the children: normal weight as BMI < 25, overweight as $25 \leq BMI > 30$, and obese as $BMI \geq 30$. The children's parents' education level and their hours worked per week were obtained. Further questions obtained the number of adults in the home and who was primarily responsible for purchasing and preparing food (Appendix 5).

Food security analysis

Caregivers of the children were asked to respond to the Household Food Security Survey module (Appendix 6). In order to determine the food security of the families,

each response was coded and scored according to previously validated methods (Bickel et al, 2000). Each negative and affirmative response is coded as either 0 or 1, respectively. Each survey participants' total amount of affirmative responses is totaled. Using a chart established by the USDA, the affirmative responses are given either a scale value or a code pertaining to a food security status level. On a continuous scale, fully secure households have a scale value of zero, and the most severe food insecure have a scale value of ten. Categorical status level scores allow each household to be listed as one of four conditions: food secure, food insecure without hunger, food insecure with moderate hunger, or food insecure with severe hunger (Appendix 7). Categories are summarized in Table 3. For analysis, households were listed into two categories – food secure and food insecure (including those with and without hunger).

Table 3 Scoring of food security responses

Affirmative Responses	**Scale Value**	**Status Level**	
		Code	**Category**
0-2	0.0-2.2	0	Food Secure
3-7	2.4-4.4	1	Food Insecure without hunger
8-12	4.7-6.4	2	Food Insecure with moderate hunger
13-18	6.6-9.3	3	Food Insecure with severe hunger

Statistical analysis

To evaluate the relationship between household food security status and weight status among the children, a Poisson regression analysis was used. The FREQ Procedure was used to evaluate the relationship between weight status in the children with the parents' BMI, age, and education. Lastly, the GLM Procedure was used to evaluate the association with children's weight status and the hours worked each week by parents. For all analysis, a p-value ≤ 0.05 indicated significance.

Results

A total of 201 subjects were included in the analysis. Whites made up 89% of the subjects, and the remaining 11% were black. There were 94 males (46.8%) and 107 females (53.2%). The average age was 52 months (4 years and 4 months old), with a range of 25.7 to 71.8 months old (2 to 6 years old). The characteristics of the children's mothers and fathers are described in Table 4.

Table 4 Characteristics of children's parents

	Mothers	**Fathers**
Age (years)	n=190	n=174
Less than 20	2 (1.0%)	0
20-29	90 (42.1%)	62 (35.6%)
30-39	80 (42.1%)	87 (50%)
40-49	16 (8.4%)	20 (11.5%)
Greater than 50	2 (1%)	5 (2.9%)
Highest level of Education	n=192	n=186
Less than 12 years	41 (21.4%)	44 (23.7%)
High school diploma or equivalent	77 (40.1%)	90 (48.3%)
Some college courses	47 (24.5%)	34 (18.3%)
College degree	20 (10.4%)	12 (6.5%)
Graduate degree	7 (3.6%)	6 (3.2%)
Hours worked per week	n=98	n=113
	34.95 hours	46.79 hours

Mean BMI of the preschool subjects was 16.8, with a range from 12.2 to 29. A normal BMI was seen in 67% of the children, while 15.5% and 17.5% of the children were at-risk-for overweight and overweight, respectively. The mean BMI of mothers (n=179) was 28.2, with 30% being overweight (BMI between greater than 25 but less than 30) and 30% being obese (BMI $\geq$ 30). The mean BMI of fathers (n=171) was 28.4, with 39% being overweight and 29% being obese. Accordingly, 32% of fathers' and 40% of mothers' BMI were within normal limits.

Seventy-four percent of the children live in households with two adults, and 17% of the children live in households with only one adult. In 85% of the households mothers are primarily responsible for purchasing the food, and 85% of mothers were also responsible for preparing the foods.

Of the 194 participants responding to the food security survey, 144 households (74.2%) were found to be food secure during the previous year. Of the remaining 50 households (25.8%) who reported food insecurity, twelve (6.2%) experienced moderate hunger and one household (0.5%) experienced severe hunger due to food insecurity.

The association between household food security status and children's BMI ≥ 85% percentile for age was statistically significant ($p<0.1$) (Table 5). The child's gender, age, and ethnicity had no statistically significant association with the level of household food security.

Table 5 Children's BMI categories in households experiencing various levels of food security

	Normal weight	**At-risk-for overweight**	**Overweight**	**Total**
Food secure	101	22	21	144
Food insecure without hunger	22	5	10	37
Food insecure with moderate hunger	6	3	3	12
Food insecure with severe hunger	1	0	0	1
Total	130	30	34	194

The parents' age was not statistically associated with the children's BMI. A significant positive association was present between the BMI of mothers and both boys and girls ($p=0.02$). Father's BMI was only significantly associated with girls' BMI ($p=0.03$). Father's highest education attainment had a significant association with the

boys' BMI (p=0.02). Mom's education attainment only had a tendency to be associated with the child's BMI (p=0.1). The number of hours worked by either parent and the number of adults in the household had no significant relationship with child's BMI.

Discussion

The aim of this study was to determine various factors that may be associated with child's BMI. Household demographics were also evaluated in the two studied counties in West Virginia. Compared to the 2004 PedNSS results for 1 to 5 year old children in West Virginia, this study found a greater prevalence of overweight in preschool children (aged 2 to 6 years) in McDowell and Mercer counties (Polhamus et al, 2006). Among the adults, the prevalence of obesity in the studied sample was similar to the 1999 prevalence of 29% in McDowell county and higher than the 17% prevalence in Mercer county (Chaudari et al, 2002).

The results show that children who are overweight are more likely to be in a household experiencing food insecurity, than children who are of a normal weight. Few studies have seen a similar relationship. The results are somewhat in agreement with Casey and associates (2006). In their study comparing children aged 3 to 17 years, an association existed between food insecurity and risk of being overweight or greater (BMI percentile $\geq 85^{th}$) and being overweight (BMI $\geq 95^{th}$ percentile). However, when they evaluated just the children aged 3 to 5 years, there was no significant association with weight and household food security status. There was only a correlation among children being at risk of overweight or greater among children who have specifically experienced food the effects of food insecurity. These children are not protected from the effects of food insecurity, unlike what some researchers have hypothesized.

The study of Mexican-American preschool age children in California showed an similar increase in percent of overweight among children of food insecure households, however their results were not significant. Trained interviewers obtained weight and height measurements from the children. The 12-item Radimer/Cornell food security scale was used instead of the 18-item USDA Food Security Module. This was used in order for the researchers to compare to studies in other similar populations and to reduce burden on participants. Due to the use of different survey models, the two studies may not be equally comparable.

The significant correlation with weight and food security status Jyoti and colleagues used longitudinal data from 1998 and 2001 to test how food security status relates to changes in the BMI of children. The children were in kindergarten in 1998 and in 3rd grade in 2001. In 1998 and 2001, the parents were interviewed to obtain the child's weight and height, and the USDA food security module was used to collect food security data. Their results found that girls, in a household experiencing food insecurity in the past year, had a significant change in BMI over the three years. Interviewers did not measure the children. Instead, parents were asked to respond to questions concerning the weight and height of their children (Jyoti et al, 2005). Whereas, in our study trained interviewers weighed and measured each child.

The significant findings that mothers' BMI was positively related to child BMI suggests that other family or household factors may have a strong association with the child's weight. There was also a significant positive relationship between fathers' BMI and girl's BMI, however not the boys' BMI. This relationship seems to suggest a genetic relationship between the BMI of parents and their child(ren). Further research

controlling for other environmental factors would be helpful in describing this relationship and describing if it is in fact due to genetics.

The only significant finding associating the education attainment of parents and child BMI was that the father's education was positively related to the boys' BMI. The mother's education attainment only had a non-significant tendency to be related to the child's BMI. The relationship between the child's BMI and the parents' education level is perplexing. No other known research exists which evaluated this relationship. Due to our significant finding, the topic should be studied further to attempt to find a reason for the association.

Some factors did exist that may have skewed the results of this study. Other than the child's height and weight, data were self-reported by parents (or other caregivers). Limitations always exist with self-reported data. The parents may be ashamed or reluctant to honestly answer questions regarding food purchasing or eating habits for them or their children. When asked to report their weight and height, they may also be reluctant. Some respondents may also not have known the actual weight and height of the child's other parent, if they were not present. Also when asked how many hours each parent worked per week, several respondents did not give a complete answer.

Conclusion

The prevalence of overweight and obesity among children and adults continue to increase. Some changes need to be made to lower this increasing prevalence. This study of children aged 2 to 6 years old in rural, southern West Virginia showed there are factors among the household or parents that are significantly related to the child's likelihood of being at risk-for-overweight or overweight. Using these findings, future researchers

should use other controls to evaluate if there are any confounding factors leading to these associations.

The relationship between food insecurity and the increased prevalence of overweight is a perplexing issue. Many suggestions for this bizarre association exist. In 1995, William Dietz was first to question this relationship. As he suggested, those with limited funds to purchase foods at certain times of the month may use foods of high fat or high calorie content to subside feelings of hunger. These high fat and high calorie foods are often not high in other nutrients, vitamins, and minerals. Along with unnecessary weight gain, their increased intake and limited intake of nutrient-dense foods can later lead to other negative health consequences, such as cardiovascular disease and diabetes.

Federally programs such as the Food Stamp Program (FSP) and Women, Infants, and Children (WIC) provide food supplements to many of these low-income families. The funds or supplemental food packages are typically distributed or available to use at a particular time of the month. Once these food supplies are depleted, the family members may have to rely on other methods to fulfill their hunger cues. This includes the previously mentioned high-fat and high-calorie foods.

Families living in rural, low-income areas, such as McDowell and Mercer counties, are also often limited in their choices of supermarkets and grocery stores. The stores that are available may also have a limited variety or amount of healthful foods such as fresh fruits and vegetables. Along with limited available, the more expensive pricing of fresh fruits and vegetables, low-fat meat products, and whole grain foods limit some families' ability to purchase healthful foods. Therefore, there is a great need for the

continuation of the federal, state, and local programs that allow families to purchase and consume healthy food options.

The significant relationship between increased parents' BMI and increased child's weight status surfaces some concerns which should be further researched. This research should evaluate if this association is due to genetics or environmental factors. Education for the parent and child can potentially have an effect on decreasing this association. With an increase in technology for entertainment and an increase in parents' concern with the safety of their community, many children do not have adequate time or space to play outside.

Body weight plays an important role in everyone's life. Those who are overweight are more likely to have other on-going medical concerns and consequences. It is very important to continue to research the causes of obesity and unwanted weight gain. Along with this research, programs to continue to aid in weight loss and nutrition education can aid in increasing everyone's health.

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Appendix 1

West Virginia Population, 2004 and 2005
Table 1

County	2004*	2005*	County	2004*	2005*
Barbour	15,476	15,689	Monongalia	83,918	84,386
Berkeley	89,362	93,394	Monroe	13,568	13,507
Boone	25,721	25,703	Morgan	15,810	16,022
Braxton	14,950	14,851	Nicholas	26,276	26,464
Brooke	24,785	24,515	Ohio	45,410	45,112
Cabell	94,801	94,031	Pendleton	7,897	7,844
Calhoun	7,415	7,387	Pleasants	7,441	7,376
Clay	10,424	10,356	Pocahontas	8,995	8,851
Doddridge	7,418	7,476	Preston	29,856	30,115
Fayette	47,049	46,823	Putnam	53,836	54,443
Gilmer	6,982	6,950	Raleigh	79,175	79,167
Grant	11,537	11,673	Randolph	28,495	28,571
Greenbrier	34,886	35,027	Ritchie	10,486	10,540
Hampshire	21,542	22,025	Roane	15,359	15,407
Hancock	31,507	31,350	Summers	13,809	13,740
Hardy	13,209	13,287	Taylor	16,202	16,291
Harrison	68,303	68,369	Tucker	7,046	6,943
Jackson	28,477	28,403	Tyler	9,365	9,340
Jefferson	47,663	49,206	Upshur	23,996	23,712
Kanawha	195,218	193,559	Wayne	42,515	42,091
Lewis	17,132	17,199	Webster	9,849	9,804
Lincoln	22,564	22,374	Wetzel	17,048	17,117
Logan	36,502	36,237	Wirt	5,835	5,896
McDowell	24,726	24,273	Wood	87,100	87,047
Marion	56,453	56,509	Wyoming	24,698	24,479
Marshall	34,722	34,337			
Mason	25,941	25,761			
Mercer	62,070	61,589	Total	1,815,354	1,816,856
Mineral	27,145	27,028			
Mingo	27,389	27,210			

* Population estimates from U.S. Bureau of the Census

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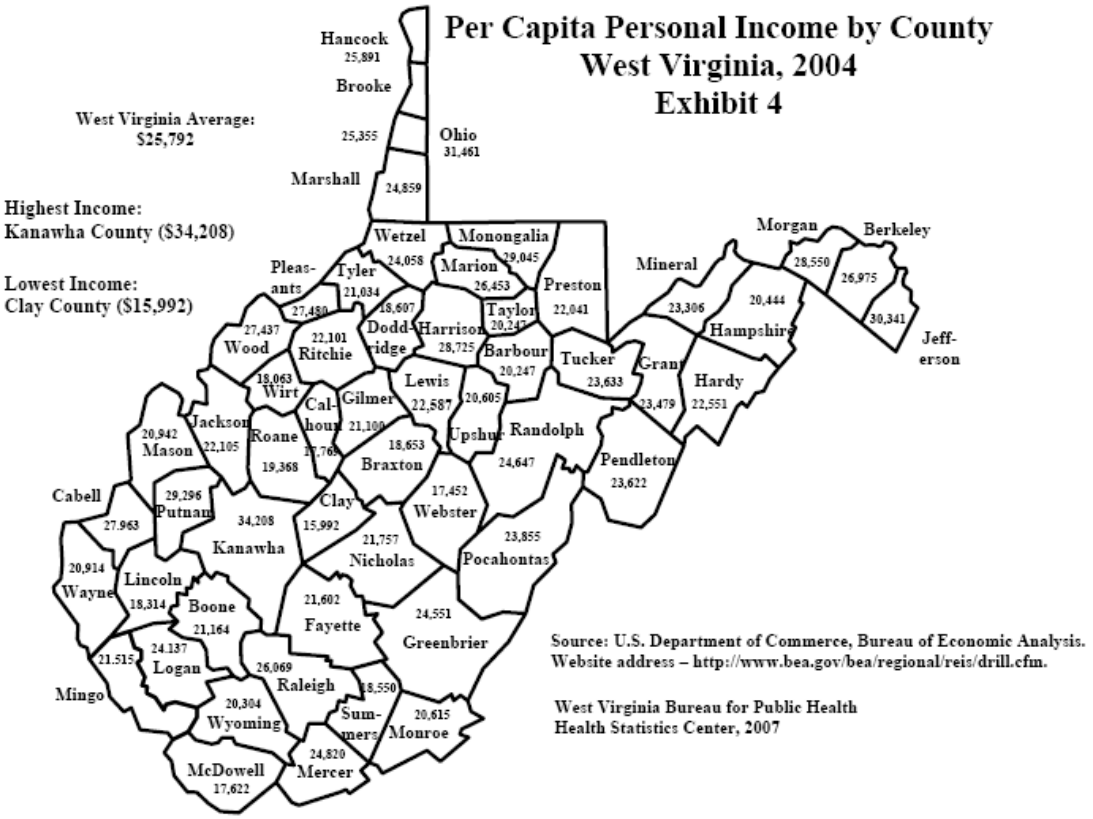
Appendix 2



Source: U.S. Department of Commerce, Bureau of Economic Analysis.
Website address – http://www.bea.gov/bea/regional/reis/drill.cfm.

West Virginia Bureau for Public Health
Health Statistics Center, 2007

Appendix 3

Age Group Distribution by County
West Virginia Population, 2000
Both Genders
Table 3

County of Residence	Less Than 1 Year	1-4 Years	5-9 Years	10-14 Years	15-19 Years	20-29 Years	30-39 Years	40-49 Years	50-59 Years	60-64 Years	65+ Years	Total
Barbour	156	669	1,004	1,069	1,179	1,911	2,085	2,299	1,976	789	2,420	15,557
Berkeley	987	4,037	5,519	5,650	5,181	9,658	12,183	11,984	9,193	3,047	8,466	75,905
Boone	335	1,273	1,609	1,627	1,673	3,429	3,246	4,406	3,315	1,158	3,464	25,535
Braxton	167	612	913	1,031	922	1,737	2,049	2,322	1,893	726	2,330	14,702
Brooke	240	1,038	1,466	1,489	1,734	3,023	3,221	4,038	3,239	1,297	4,662	25,447
Cabell	1,103	4,158	5,404	5,365	7,163	16,094	12,236	13,893	11,420	4,449	15,499	96,784
Calhoun	66	320	411	512	592	746	1,006	1,228	1,045	392	1,264	7,582
Clay	139	489	726	795	791	1,273	1,409	1,584	1,235	475	1,414	10,330
Doddridge	88	351	466	522	657	766	992	1,167	916	380	1,098	7,403
Fayette	531	2,154	2,820	2,892	3,302	6,224	6,166	7,605	5,892	2,179	7,814	47,579
Gilmer	71	277	351	435	712	1,175	863	965	863	350	1,098	7,160
Grant	132	582	703	723	658	1,349	1,612	1,639	1,578	595	1,728	11,299
Greenbrier	364	1,540	2,052	2,143	2,215	3,653	4,417	5,399	4,708	1,861	6,101	34,453
Hampshire	258	983	1,397	1,554	1,352	2,133	2,888	3,041	2,657	1,000	2,940	20,203
Hancock	351	1,376	1,904	1,960	1,905	3,605	4,317	5,384	4,074	1,774	6,017	32,667
Hardy	147	608	867	881	755	1,397	1,930	1,890	1,669	641	1,884	12,669
Harrison	779	3,145	4,433	4,554	4,782	8,117	9,368	10,320	8,639	3,137	11,378	68,652
Jackson	331	1,367	1,843	2,014	1,863	3,240	3,826	4,309	3,356	1,558	4,293	28,000
Jefferson	557	2,085	2,748	2,913	3,174	5,255	6,695	6,788	5,490	1,761	4,724	42,190
Kanawha	2,339	9,098	11,757	12,007	12,207	24,919	26,998	32,965	25,331	9,416	33,036	200,073
Lewis	170	723	1,111	1,094	1,043	1,899	2,402	2,606	2,217	883	2,771	16,919
Lincoln	242	1,080	1,428	1,481	1,626	2,920	3,167	3,431	2,730	1,099	2,904	22,108
Logan	436	1,726	2,279	2,272	2,621	5,030	4,839	6,544	4,775	1,738	5,450	37,710
McDowell	293	1,113	1,692	1,981	1,954	3,029	3,387	4,625	3,557	1,296	4,402	27,329
Marion	569	2,330	3,230	3,372	3,971	7,704	7,169	8,344	7,191	2,645	10,073	56,598
Marshall	391	1,509	2,321	2,417	2,270	3,853	4,747	5,789	4,709	1,718	5,795	35,519
Mason	295	1,228	1,653	1,650	1,751	3,045	3,460	4,166	3,351	1,425	3,933	25,957
Mercer	670	2,968	3,644	3,606	4,206	8,327	7,930	9,495	8,071	3,094	10,969	62,980
Mineral	299	1,200	1,791	1,932	1,975	3,076	3,665	4,048	3,629	1,381	4,082	27,078
Mingo	337	1,315	1,870	1,975	2,164	3,583	4,077	4,713	3,499	1,204	3,516	28,253

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Age Group Distribution by County
West Virginia Population, 2000
Both Genders
Table 3 (continued)

County of Residence	Less Than 1 Year	1-4 Years	5-9 Years	10-14 Years	15-19 Years	20-29 Years	30-39 Years	40-49 Years	50-59 Years	60-64 Years	65+ Years	Total
Monongalia	806	3,238	4,156	4,157	8,274	19,846	10,686	11,077	8,165	2,696	8,765	81,866
Monroe	143	580	800	894	842	1,848	2,266	2,246	2,007	715	2,242	14,583
Morgan	186	719	962	934	827	1,574	2,096	2,345	1,998	827	2,475	14,943
Nicholas	276	1,163	1,654	1,908	1,857	3,046	3,628	4,285	3,411	1,360	3,974	26,562
Ohio	476	1,973	2,769	3,009	3,519	5,780	5,752	7,466	5,602	2,181	8,900	47,427
Pendleton	80	360	503	545	470	923	1,089	1,274	1,034	458	1,460	8,196
Pleasants	90	351	514	494	507	867	1,070	1,211	950	338	1,122	7,514
Pocahontas	82	370	526	591	495	981	1,257	1,429	1,295	528	1,577	9,131
Preston	309	1,325	1,815	2,049	2,199	3,287	4,069	4,697	3,777	1,421	4,386	29,334
Putnam	638	2,726	3,582	3,769	3,414	5,859	7,886	8,818	6,709	2,227	5,961	51,589
Raleigh	899	3,458	4,681	4,889	5,060	10,706	10,514	13,065	10,130	3,618	12,200	79,220
Randolph	310	1,168	1,803	1,859	1,883	3,511	4,135	4,252	3,700	1,376	4,265	28,262
Ritchie	92	472	663	684	723	1,126	1,425	1,631	1,379	572	1,576	10,343
Roane	185	698	918	1,071	1,157	1,821	2,000	2,461	2,020	833	2,282	15,446
Summers	102	502	757	761	856	1,365	1,549	2,043	1,743	728	2,593	12,999
Taylor	180	684	1,002	1,132	1,082	1,851	2,342	2,565	1,965	747	2,539	16,089
Tucker	70	283	447	428	485	702	1,024	1,078	1,032	458	1,314	7,321
Tyler	110	393	607	699	619	975	1,268	1,523	1,291	528	1,579	9,592
Upshur	226	1,022	1,493	1,529	2,071	3,228	2,945	3,446	2,876	1,119	3,449	23,404
Wayne	516	1,955	2,813	2,904	2,993	5,386	5,882	6,292	5,527	2,224	6,411	42,903
Webster	91	409	635	670	665	1,105	1,222	1,579	1,347	514	1,482	9,719
Wetzel	184	823	1,146	1,249	1,219	1,761	2,348	2,699	2,392	1,011	2,861	17,693
Wirt	53	276	417	445	447	630	894	903	717	328	763	5,873
Wood	943	4,146	5,597	5,942	5,724	10,179	12,383	13,642	11,458	4,364	13,608	87,986
Wyoming	286	1,181	1,478	1,654	1,792	3,159	3,253	4,648	3,410	1,261	3,586	25,708
Total	20,176	81,629	111,150	116,182	125,578	233,686	245,333	283,662	228,153	85,900	276,895	1,808,344

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Appendix 4

Parental or Guardian Consent and Information Form

Factors Affecting Intake, Growth, and Body Mass Index of Preschool Children

Introduction
I, _____, have been asked to allow my child _____ to participate in a research study that examines the factors that affect intake and growth among children aged three to five years. Cindy Fitch, Ph.D., RD who is conducting this research at West Virginia University has explained the study to me. I understand that the money to pay for this study is being provided by the United States Department of Agriculture.

Purposes of the Study
I understand that the purpose of this study is to learn more about factors that influence intake, growth, and weight gain of children aged three to five years.

Description of Procedures
This study will be performed at a church, day care, or Head Start center that my child attends or at the county WVU Extension office. My child will be weighed and measured and I will be asked to report everything he/she eats or drinks for two 24-hour periods. I will also be asked to fill out a series of questionnaires. I understand that it will take about 1 hour of my time for the diet history and questionnaires. I have been given an opportunity to examine the questionnaires. Approximately 300 children will be enrolled in this study.

Benefits
I understand that this study is not expected to be of direct benefit to my child but the knowledge gained may be of benefit to others.

Risks and Discomforts
There are no known or expected risks from participating in this study.

Financial Considerations
I understand that there is no cost to me for participation in this study and I will receive a grocery store gift certificate for $20.00 as a token of appreciation for my time.

Initials _____ Date

Factors Affecting Intake, Growth, and Body Mass Index of Preschool Children

Alternatives
I understand that not participating in this study is an alternative that is open to me.

Contact Persons
For more information about this research I can contact Dr. Cindy Fitch at 304-293-3402, extension 1768. For information regarding my child's rights as a research subject, I may contact the Executive Secretary of the Institutional Review Board at 304-293-7073.

Confidentiality
I understand that any information obtained as a result of my child's participation in this research will be kept as confidential as legally possible. I understand that these research records, just like hospital records, may be subpoenaed by court order or may be inspected by federal regulatory authorities. My name or that of my child or any information from which we might be identified may not be published without my consent.

Voluntary Participation
Participation in this study is voluntary. If my child participates, I may withdraw my child from this study at any time. Refusal to participate or withdrawal will involve no penalty or loss of benefits for my child or me. I have been given the opportunity to ask questions about the research, and I have received answers concerning areas I did not understand. Upon signing this form, I will receive a copy.

I willingly consent to my child's participation in this research.

_____	_____	_____
Signature of Parent of Guardian	Date	Time
_____	_____	_____
Signature of Investigator or Investigator's Representative	Date	Time

Appendix 5

Parent Information Form

ID Number_____

Mother's Age
Less than 20 years
20 to 29 years
30 to 39 years
40 to 49 years
50 years or greater

Father's Age
Less than 20 years
20 to 29 years
30 to 39 years
40 to 49 years
50 years or greater

Mother's height_____ **Father's height** _____

Mother's weight_____ **Father's weight** _____

Number of adults in home _____

Who is primarily responsible for food purchases?_____

Food preparation?_____

Mother's education level
Less than 12 years
High school diploma or equivalent
Some college courses
College degree
Graduate degree

Father's education level
Less than 12 years
High school diploma or equivalent
Some college courses
College degree
Graduate degree

Mother's Occupation_____ **Father's Occupation** _____

Number of hours worked per week _____ Hours worked per week _____

How many hours per day does your child spend watching television or

videos?_____ Playing video or computer games?_____

Does he/she have a television in his/her room?_____

Appendix 6

Household Food Security Survey

These questions are about the food eaten in your household in the last 12 months, since _____ of last year, and whether you were able to afford the food you need.

1. Which of these statements best describes the food eaten in your household in the last 12 months?

    a. Enough of the kinds of food we want to eat

    b. Enough but not always the kinds of food we want

    c. Sometimes not enough to eat

    d. Often not enough

    e. No answer

(1a) Here are some reasons why people don't always have enough to eat. For each one, please indicate if that is a reason why YOU don't always have enough to eat. Circle all that apply and leave it blank if it does not apply to your household

a. Not enough money for food

b. Not enough time for shopping or cooking

c. Too hard to get to the store

d. I am on a diet

e. No working stove available

f. Not able to cook or eat because of health problems

This question does not apply to my family

(1b) Here are some reasons why people don't always have the quality or variety of food they want. For each one, please indicate if that is a reason why YOU don't always have the kinds of food you want to eat. Circle all that apply.

a. Not enough money for food

b. Kinds of food we want not available

c. Not enough time for shopping or cooking

d. Too hard to get to the store

e. I am on a special diet

This question does not apply to my family

The following statements are some that people have made about their food situation. For each statement, please indicate whether the statement was <u>often</u> true, <u>sometimes</u> true, or <u>never</u> true for your household in the last 12 months, that is, since last year at this time. Please circle your answer.

2. "We worried whether our food would run out before we got money to buy more".

    a. Often true

    b. Sometimes true

    c. Never true

    d. Don't know

3. "The food that we bought just didn't last, and we didn't have money to get more".

    a. Often true

    b. Sometimes true

    c. Never true

    d. Don't know

4. "We couldn't afford to eat balanced meals".

    a. Often true

    b. Sometimes true

    c. Never true

    d. Don't know

5. "We relied on only a few kinds of low-cost food to feed the children because we were running out of money to buy food".

    a. Often true

    b. Sometimes true

    c. Never true

    d. Don't know

6. "We couldn't feed the children a balanced meal because we couldn't afford that".

    a. Often true

    b. Sometimes true

    c. Never true

    d. Don't know

7. "My child was not eating enough because we just couldn't afford enough food".

    a. Often true

    b. Sometimes true

    c. Never true

    d. Don't know

8. In the last 12 months, since this time last year, did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food?

    Yes No Don't know

If yes, how often did this happen?

a. Almost every month

b. Some months but not every month

c. Only 1 or 2 months

d. Don't know

9. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money to buy food?

   Yes No Don't know

10. In the last 12 months, were you ever hungry but didn't eat because you couldn't afford enough food

    Yes No Don't know

11. In the last 12 months, did you lose weight because you didn't have enough money for food?

    Yes No Don't know

12. In the last 12 months, did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food?

    Yes No Don't know

    If yes, how often did this happen?

    a. Almost every month

    b. Some months but not every month

    c. Only 1 or 2 months

    d. Don't know

The next questions are about children living in the household who are under 18 years of age.

13. In the last 12 months, since this time last year, did you ever cut the size of any of the children's meals because there wasn't enough money for food?

    Yes No Don't know

14. In the last 12 months, did any of the children ever skip meals because there wasn't enough money for food?

    Yes No Don't know

    If yes, how often did this happen?

    a. Almost every month

    b. Some months but not every month

    c. Only 1 or 2 months

    d. Don't know

15. In the last 12 months were the children ever hungry but you just couldn't afford more food?

    Yes No Don't know

16. In the last 12 months, did any of the children ever not eat for a whole day because there wasn't enough money for food?

    Yes No Don't know

Thank you for participating in this study.

Appendix 7

Exhibit 3-3

**HOUSEHOLDS WITH COMPLETE RESPONSES:
FOOD SECURITY SCALE VALUES AND STATUS LEVELS
CORRESPONDING TO NUMBER OF AFFIRMATIVE RESPONSES**

Number of Affirmative Responses:		1998 Food Security Scale Values [a]	Food Security Status Level	
(Out of 18) Households With Children	(Out of 10) Households Without Children		Code	Category
0	0	0.0		
1		1.0	0	Food Secure
	1	1.2		
2		1.8		
	2	2.2		
3		2.4		
4		3.0		
	3	3.0	1	Food Insecure Without Hunger
5		3.4		
	4	3.7		
6		3.9		
7		4.3		
	5	4.4		
8		4.7		
	6	5.0		
9		5.1	2	Food Insecure With Hunger, Moderate
10		5.5		
	7	5.7		
11		5.9		
12		6.3		
	8	6.4		
13		6.6		
14		7.0		
	9	7.2	3	Food Insecure With Hunger, Severe
15		7.4		
	10	7.9		
16		8.0		
17		8.7		
18		9.3		

Vita

Melissa Webber

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Morgantown, West Virginia 26505

Phone: (304) 322-0133

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Education:

WEST VIRGINIA UNIVERSITY, Morgantown, West Virginia 26506. Pursuing a *Masters of Science* in Animal and Nutritional Sciences with a Major in *Human Nutrition and Foods*. Internship work specializing in: clinical and community dietetics and food service. Course work including biochemistry, physiology, maternal and child nutrition, and sports nutrition. To be graduated August 2007.

WEST VIRGINIA UNIVERSITY, Morgantown, West Virginia 26506. Obtained a Bachelor of Science in Family and Consumer Sciences with a major in Human Nutrition and Foods. Course work specializing in: nutrition, food science, and food service management, communications, and leadership. Graduated May 2003.

Professional Experience:

Nutritionist, **Monongalia County Health Department,** Morgantown, West Virginia 26505.
Responsibilities included: Gather nutrition related information from parents/caregivers of low-income and provide relevant counseling; conduct nutrition education lessons in group and individual settings; evaluate group home menus and make recommendations for change.

Nutrition Graduate Assistant, **Center For Excellence in Disabilities, West Virginia University,** Morgantown, West Virginia 26506.
Responsibilities included: Assist in obtaining pre-clinic information, clinical assessments, and follow-up information of consumers participating in the Feeding and Swallowing Clinic.

Nutrition Services Volunteer, **Mountainview Healthsouth Rehabilitation Hospital**, Morgantown, West Virginia 26505.
Responsibilities included: Assist in gathering, reviewing, and correcting patients' menu choices; observe the dietitian during clinical rounds.

Work Experience:

Customer Service Representative, **TeleTech**, Morgantown, West Virginia.
Responsibilities included: Provide quality customer service in assisting customers nationwide with financial matters; routinely operate Microsoft Windows and DOS based programs.

Child Care Provider, **Pleasant Day Schools**, Morgantown, West Virginia.
Responsibilities included: Provide supervision of children during play and instructional activities; develop and implement daily lesson plans.

Attraction Operator and *Receptionist*, **Valley World's of Fun**, Fairmont, West Virginia.
Responsibilities included: Operate and maintain amusement attractions; assure customer safety; provide quality customer assistance.

Work Experience (Cont.):

Office Assistant and *Traffic Control*, **West Virginia Department of Highways**, Ellenboro, West Virginia 26346.
Responsibilities included: Maintain employee, equipment and parts records; operate standard office equipment; assist with traffic control at work sites.

Cook, **Roberto's**, Pennsboro, West Virginia 26415.
Responsibilities included: Provide quality food in a timely manner; open and close restaurant; clean and sanitize.

Honors and Activities:

West Virginia University, Morgantown, WV.
Invited Honorary:

- Phi Upsilon Omicron

Organizations:

- American Dietetic Association
- Student Dietetic Association
- West Virginia University Marching Band
- Mountaineers For Christ student organization