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THE RELATIONSHIP BETWEEN FOOD RULES AND CHILDHOOD OBESITY IN
RURAL AND NON-RURAL FAMILIES

BY

ANNA VENJOHN

A thesis submitted in partial fulfillment of the requirements for the

Master of Science

Major in Nutrition and Exercise Sciences

Specialization in Nutritional Sciences

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2020

THESIS ACCEPTANCE PAGE

Anna Venjohn

This thesis is approved as a creditable and independent investigation by a candidate for the master's degree and is acceptable for meeting the thesis requirements for this degree.

Acceptance of this does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department.

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This paper is dedicated to my parents Dave & Kelli, for supporting and believing in me even when I didn't believe in myself.

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ABSTRACT

THE RELATIONSHIP BETWEEN FOOD RULES AND CHILDHOOD OBESITY IN
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ANNA VENJOHN

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Background: Childhood obesity is continuing to rise, leading to long-term health consequences. Research shows that rural populations have higher rates of childhood obesity. There is a lack of research on how the home environment may affect this health disparity. Parents often enforce food rules to control their child's eating habits, but the difference between the rural and non-rural populations in enforcing these rules is unknown.

Purpose: The purpose of the present study was to determine if there is a significant difference in food rules between rural and non-rural school-aged children, and if these differences correlate to BMI categories.

Methods: Secondary cross-sectional data analysis from N=127 3rd, 4th, and 5th grade children at a rural and non-rural school. The children provided anthropometric and survey data. They were measured for weight and height to gather BMI data and screened for dietary data, specifically food rule data, using the Block Kids Food Screener.

Results: There was a significant difference in mean BMI percentile between rural and non-rural populations, with 43.6% of the rural population falling in the overweight or obese BMI category compared to 20% of the non-rural population. There was no significant correlation between specific food rules and BMI percentile. The non-rural group had an average of 6.28 of the 14 food rules while the rural group had an average of 3.81, $p = .0005$. In rural populations, rules about not eating sweet snacks and fried foods are significantly less likely to be perceived by the children when compared to non-rural populations. "Rural" status was a significant predictor of BMI percentile for only one of the food rules, but it was significant for all of the food rules when Overweight/Obese weight status was the outcome of interest. There was a significant positive association between rules around limiting portion sizes at meals and BMI percentiles when controlling for the relationship between rural status and BMI. When overweight/obese was the outcome, there was a positive association between rules around only having fruit for dessert and not having sweet snacks, even when controlling for the relationship between rural status and weight category.

Conclusion: This study found correlations between specific food rules, the rural population, and weight categories. Rural families have less family food rules than non-rural families, and childhood obesity was more highly associated with the rural population. Specific rules were associated with higher child weight, but it is unknown when these rules were put into place in the home environment. Research in rural areas is just as important as research in non-rural areas if improving the health of children is the

ultimate goal. Going forward, research should focus on the home environment as a whole.

Chapter 1: Introduction

Childhood obesity and preventative chronic disease deaths are steadily increasing in the United States. Prior research has shown that childhood obesity numbers are higher in rural populations when compared to non-rural populations. Researchers have attributed behavioral differences – such as diet and physical activity – to this discrepancy, but previous research leads to conflicting results in this area due to inconsistent testing methods and different definitions of the term “rural”.

The home environment plays a large role in how children behave around food throughout their childhood and into their adulthood. Part of the food home environment includes family food rules that are enforced at home, which may vary by family and location. The purpose of the present study is to further determine the relationship between family food rules and the prevalence of childhood obesity between rural and non-rural populations. This knowledge could be put to use developing educational materials and resources for the under-researched rural population to decrease their disproportionately higher childhood obesity rates.

Chapter 2: Literature Review Tables

Table 1. Rural and Non-Rural Childhood Obesity

First Author L Name	Article Title	Study Purpose	Study Design	Sample Size and Description	Measurement Tools	Study Outcomes and Pertinent Findings
Lutfiyya	Is rural residency a risk factor for overweight and obesity in U.S. children?	To nationally examine if living in a rural area is a risk factor for overweight/obese children	Cross-sectional	Data from 2003-2004 with 46,396 phone interviews	National Survey of Children's Health	Overweight/obese children >5 were more likely to live in a rural area
McMurray	Cardiovascular disease risk factors and obesity of rural and urban elementary school children	To determine how large the effect of urban/rural settings were related to cardiovascular disease and obesity in children	Observational cross-sectional	2,113 3rd and 4th graders, 962 urban and 1,151 rural	Anthropometric measurements, cholesterol, pVO2 max, physical activity/smoking questionnaire	Most comparisons were not different from urban to rural, but body mass index and skinfolds were greater for rural youth, rural children had a 54.7% increased risk of obesity
Davis	Obesity and related health behaviors among urban and rural children in the United States: Data from NHANES 2003-2004 and 2005-2006	To examine the difference in obesity rates in rural and urban children using NHANES data	Multivariate analysis using cross-sectional survey	2003-2004 and 2005-2006 NHANES data, a total of 7,882 2-18 year olds	National Health and Nutrition Survey Data	16% of children nationwide live in rural areas. More rural children were obese compared to urban children (21.8% vs. 16.9%)
Lui	Urban-rural differences in overweight status and physical inactivity among US children aged 10-17 years	To explore the differences in weight status and physical activity between rural and urban U.S. children	Multivariate analysis using cross-sectional survey	47,757 10-17 year olds from the NSCH	National Survey of Children's Health	Rural children are more likely to be overweight, and more urban children were physically inactive compared to rural children
Williamson	Increased obesity in children living in rural communities of Louisiana	To assess the obesity rates of rural Louisiana children, compared to national standards	Observational cross-sectional	2709 children, average age of 10.5 of varying ethnicities in rural Louisiana	Louisiana Health Project	Children in rural Louisiana were more likely to be overweight and obese compared to national estimates
Tovar	Healthy-lifestyle behaviors associated with overweight and obesity in US rural children	To explore the correlation between rural obesity in children and healthy behaviors	Observational cross-sectional	1,235 children 6-11 years old from schools across rural U.S	Demographic information, BMI, and a Family Survey Questionnaire	Obese children were not more likely to engage in unhealthy behaviors than their normal weight peers. Obese children were twice as likely to 2 or more servings of vegetables per day

Joens-Matre	Rural-urban differences in physical activity, physical fitness, and overweight prevalence of children	To examine the difference in physical activity between rural, non-rural, and urban school children	Observational cross-sectional	3,416 4th-6th grade students from urban areas, non-rural, and rural in Iowa	Self-report physical activity and BMI measures	Urban children were the least active overall, and children from small cities had the highest levels of physical activity
Davis	Pediatric obesity attitudes, services, and information among rural parents: a qualitative study	To learn about how parents respond to pediatric obesity, barriers they face, and resources available to them	Focus groups	8 focus groups with 21 parents of overweight rural 3th-5th grade students	10 questions in a focus group, coded and converted into themes	The majority of parents were concerned with their children's weight, believed their overweight children were lazy, had tried many weight loss tools, and believed nothing would help. Rurality introduced barriers to weight loss such as lack of exercise facilities
Davis	Health behaviors and weight status among urban and rural children	To assess the weight status and health behaviors in urban and rural children	Observational cross-sectional	138 children average age 10 from 4 schools, 2 rural and 2 urban	Home: demographic questionnaire, 3-day diet record, 7-day PA recall, sedentary activity, and METs. School: 24-hour diet recall, PA interview, BMI	Urban and rural children consume equivalent calories. While rural children were more likely to eat junk food, urban children were more likely to skip breakfast. Urban children had more sedentary time, and rural children were more likely to be overweight

Table 2. Rural Vs. Non-Rural

First Author L Name	Article Title	Study Purpose	Study Design	Sample Size and Description	Measurement Tools	Study Outcomes and Pertinent Findings
McCormack	Diet and Physical Activity in Rural vs Urban Children and Adolescents in the United States: A Narrative Review	To determine how previous research has measured diet and physical activity differences between rural and urban children	Systematic review	17 articles were included in the review	PubMed, 2005-2015 Rural vs. Urban	5 studies were found that reported the difference in diet between rural and urban children, and 16 were found that reported on physical activity differences. Most of the studies used different definitions for rural and urban

Table 3. Food Rules and Home Environment

First Author L Name	Article Title	Study Purpose	Study Design	Sample Size and Description	Measurement Tools	Study Outcomes and Pertinent Findings
Lopez	Parenting styles, food-related parenting practices, and children's healthy eating: A mediation analysis to examine relationships between parenting and child diet	Looked at how the 3 parenting styles were associated with mealtime structure, modeling healthy food, and household food rules	Longitudinal MATCH across 3 years	174 mother-child pairs (8-12 year old children) from Los Angeles	Mothers: Parenting Styles and Dimensions Questionnaire, Children: 24-hr diet recall, HEI-2010 score	HEI-2010 score is affected by parents' use of mealtime structure, no significance with the different parenting styles
Mihrshahi	Associations between childhood overweight, obesity, abdominal obesity and obesogenic behaviors and practices in Australian homes	To discover how home environment and parental practices influence obesity in older children and adolescents	Cross-sectional, representative population survey	Australian children ages 5-16	SPANS survey, anthropometry, WHtR, self-report home-based weight-related behavior questions	Children with parents that had no rules about screen-time and/or rewarded good behavior with sweets were significantly more likely to be overweight/obese
Loth	Food-related parenting practices and child and adolescent weight and weight-related behaviors	To determine what previous research concludes about the correlation between food-related parenting practices and weight status and behavior	Systematic review	93 articles were obtained from PubMed and Google Scholar		Parents should avoid restriction of food available in the home, pressuring children to eat, using food as a control, or relating restriction/pressure-to-eat to healthy behaviors
Loth	Food-related parenting practices and adolescent weight status: a population-based study	To examine the link between parenting practices and weight status, with possible demographic associations	Cross-sectional	2231 children with 3431 parents	Anthropometric measurements, school surveys, and home surveys	Food-related parenting controls were common. Restricted eating was higher in parents with overweight children, while pressure-to-eat was higher in parents with normal weight children. No demographic associations found
Shloim	Parenting styles, feeding styles, feeding practices, and weight status in 4-12 year old	To identify the relationship between BMI in children, parenting styles, feeding	Systematic review	31 studies from 2010-2015 with subjects aged 4-12	Medline, PsycINFO, Web of Science, Food Science and	Parenting style was most highly associated with children's BMI, with uninvolved, permissive, and authoritarian most highly correlating with higher BMIs. High BMIs

	children: a systematic review of the literature	styles, and feeding practices			Technology Abstracts	also linked with pressure to eat and restrictive eating practices
Puhl	If you are good you can have a cookie: how memories of childhood food rules link to adult eating behaviors	To determine if parental food rules growing up influence adult eating behaviors	Cross-sectional retrospective	122 subjects mean age of 44.6	Self-report surveys with demographics, food rules, restraint scale, binge eating behaviors, and weight history	Parents using food as a control is linked with binge eating and restrictive eating later in life. Parental food rules can have lifelong impact
Couch	Home food environment in relation to children's diet quality and weight status	To explore the relationship between the home food environment, child/parent characteristics, diet quality, and weight status	Cross-sectional	699 child-parent pairs in California	3-day diet recall, home environment variables, children's BMI	High BMI associated with parental food restriction, permissive feeding style, and perceptions of healthy food cost. BMI negatively associated with parental encouragement/modeling, and pressure to eat
Pearson	Family correlates of fruit and vegetable consumption in children and adolescents: a systematic review	To review the relationship between the home food environment and child fruit and vegetable consumption.	Systematic review	60 studies which included fruit and vegetable intake and at least one family behavior, children 6-11 or 12-18	Science Direct, PubMed, PsycINFO, Medline, and Web of Science as well as manual searches	Parental modeling, intake, and encouragement positively correlated with higher FV consumption in children. Family rules (demand/allow) positively associated with children's FV consumption
Pyper	The impact of different types of parental support behaviors on child physical activity, healthy eating, and screen time: a cross-sectional study	To determine if parental supports predict that the children will meet physical, behavioral and dietary guidelines	Cross-sectional	3,206 parents/guardians with one child under 18 in Canada	Computer assisted telephone interview survey	Parental support behaviors such as taking the children places they can be active and eating family meals away from the TV were associated with meeting activity and FV guidelines
Rosenkranz	Model of the home food environment pertaining to childhood obesity	To assess the interplay between home food environment and create a model for future intervention in the home	Systematic review	NA	NA	The home food environment is composed of an interplay of different environments, including micro, macro, built, natural, sociocultural, political, and economic. The home food environment affects childhood health indicators.

Vollmer	Parenting styles, feeding styles, and their influence on child obesogenic behaviors and body weight	To examine the influence of parenting/feeding styles on childhood weight and behavior	Systematic review	40 studies on parenting style and 11 on parental feeding style	PubMed, PsycINFO, and ERIC databases	Authoritative parenting is protective against negative health behaviors, while permissive/indulgent parenting is associated with negative health outcomes. Parenting style studies have a lot of variability in methodology and are hard to summarize, while feeding studies are much easier compare
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Table 4. Study Methodology

First Author L Name	Article Title	Study Purpose	Study Design	Sample Size and Description	Measurement Tools	Study Outcomes and Pertinent Findings
Pinard	The validity and reliability of the Comprehensive Home Environment Survey (CHES)	To assess the CHES in validity and reliability	Cross-sectional, contrasted CHES results with other measures	150 low-income parents with children 5-17 years old	Experts were consulted to create a screener similar to what the CHES is supposed to measure	The CHES and screener were highly correlated, therefore the CHES was shown as a reliable and valid tool
Gattshall	Validation of a survey instrument to assess home environments for physical activity and healthy eating in overweight children	To develop and measure the reliability and validity of a home environment survey	Cross-sectional	219 parents of overweight children and their children	Parents took the HES survey while their children took the Block Kids survey. Another set of parents took HES to test reliability, while another person in the household also took it to assess inter-rater reliability	All components were tested and found to be acceptable. F/V intake had 2 items removed for inconsistency. Inter-rater reliability varied. Parental policies were related to child and parent eating habits
Larson	Identifying correlates of young adult's weight behavior: survey development	To describe the development of a home environment survey	Cross-sectional	2,287 young adults in 4 groups	Project EAT-III survey guided by focus groups	Emphasized the importance of including the home, social, and physical environments in a comprehensive survey
van Assema	Differences between parents' and adolescents' perceptions of family food rules and availability	To observe the predicted difference between parent and child home environment reporting	Cross-sectional	502 students aged 12-14, and each student's parent/s	Self-administered questionnaires	High disparity was found between parent and child reporting. Highlights the importance of surveying both to get an accurate home environment representation
Pinard	Measures of the home environment related to childhood obesity: a systematic review	To assess the validity of the tools used to measure the home environment	Systematic review	40 papers between 1998 and 2010 having to do with home environment related to child eating, PA, or childhood obesity	MEDLINE, PYSCLIT, CINAHL, ERIC, and PsycINFO	Many studies focus on only one or two components of the home environment. Many designed their own measures, and do not necessarily have high external validity

Hunsberger	Relative validation of Block Kids Food Screener for dietary assessment in children and adolescents	To assess the validity of the Block Kids Food Screener	Cross-sectional	99 children in Oregon	Block Kids Food Screener and 24-h dietary recalls	The Block Kids Food Screener is a valid instrument for dietary assessment in children 10-17
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Chapter 3: Manuscript

Introduction

Childhood obesity is an increasing concern in the United States¹ and can lead to major health problems such as diabetes, cardiovascular disease, and obesity in adulthood, among many other health complications.² Prior studies have shown that childhood obesity is higher among rural populations,²⁻⁷ though the underlying mechanism behind this outcome remains unclear. Behavioral differences such as diet and physical activity have historically been attributed to this discrepancy, but research is somewhat conflicting and ambiguous in this area.^{2,3} Based on the CDC 2000 growth charts, rural populations are 9.8% less likely to be at a normal weight and 7.5% more likely to be overweight than populations from small cities (non-rural).⁴

Researchers have found physical activity and diet differences between the two populations, but associations remain inconclusive. For example, research shows that on average rural children are more active, and that non-rural children have higher amounts of time spent sedentary.^{4,6} Davis et al. found that rural and non-rural children eat an equivalent amount of calories from fat and overall calories.³ Rural children are less likely to participate in healthy behaviors,³ but one study found that obese children in general are more likely to participate in these healthy behaviors such as meeting daily vegetable requirements.⁸ Children in rural environments also tend to have less healthcare than their non-rural counterparts.⁷ In 2016 a narrative review found five studies comparing diet in rural and urban children. Two of these studies showed no difference in diet, while three found differences in calories, dairy intake, and vegetable intake.⁹ The review also found that of the 16 studies comparing physical activity in rural and urban populations, five

resulted in no difference and nine indicated that rural youth were more active than urban youth. Most of the studies included in the review used different types of tools to reach these findings, making conclusions in the area even harder to reach. This research further indicates that the obesity discrepancy may not be caused by diet or physical activity levels as they stand alone, but by environmental factors that contribute to a family's diet and activity levels.

Research shows that most families have food rules, some of which are beneficial while others are harmful to long term health. Previous studies on this subject have shown that food rules such as forcing second helpings or using food for reward or punishment have long lasting effects, whether positive or negative, on children¹⁰. Families that have rules focusing on the consumption of unhealthy foods raise children that are less likely to consume those foods later in life, while children whose parents used food to control their behavior are more likely to experience disordered eating as adults.^{10,11} Parenting style (authoritarian, authoritative, permissive, and uninvolved) also plays a role in family food and physical activity rules, and each style has been linked with different rules.¹² Authoritarian parenting is known for strict rules and punishment. Authoritative parenting is known for communication and constructive discipline. Permissive parents are considered lenient and often have fewer enforced rules and structure. Uninvolved parents are not involved with their child's life in either discipline or guidance. Authoritative is generally considered to be the best parenting style, and that assumption still holds true when discussing the home food environment. Permissive parenting styles have been associated with higher children BMI. In contrast authoritative styles are associated with lower BMI.^{13,14}

Previous research on this subject is hard to compare and summarize because current studies use different definitions of rural, non-rural, and urban.⁹ Interventions may need to look different for these populations, so research specifically looking at the causes of this health disparity will be important moving forward. This study used the USDA's 2013 Rural-Urban Continuum Codes to define rural and non-rural.¹⁵

This study delves into proposed behavioral and environmental differences between rural and non-rural populations that could explain the obesity disparity. It will specifically focus on food rules and guidelines in the home. The purpose of the present study is to determine if family rules and guidelines are associated with childhood obesity and activity rates, and if there are differences in the outcome between rural and non-rural children. The assumption is that children in rural environments will have fewer family food and activity rules/guidelines, and families with higher numbers of enforced rules/guidelines at home will have lower average childhood obesity levels.

Methods

The present study is a secondary data analysis of cross-sectional data that were collected from 3rd, 4th and 5th grade children (N=127) at two schools (n=62 rural, n=65 non-rural). Primary caregivers provided written consent for child study participation, and children provided verbal and written assent. The schools, children, and parents provided information in the form of surveys, anthropometrics, and body composition measurements. The original study assessed the home environment through the CHES (Comprehensive Home Environment Survey) and the school environment was assessed through a school administration questionnaire and observation data. All protocols and

procedures were approved by the South Dakota State University Institutional Review Board.

Children and Measurements

The children were measured for weight and height to gather BMI measurements. DXA (dual-energy x-ray absorptiometry) was also used to gather body composition data. Children were screened for dietary information using Block Kids Food Screener for Ages 2-17 2007.¹⁶ A questionnaire was developed to cover questions such as children's eating habits/behaviors, physical activity habits/behaviors, perceived neighborhood safety, body satisfaction, family relationships/dynamics, and sleeping habits. The children answered yes or no to questions about perceived home food rules (see Figure 1) and were given a score based on their answers: yes = 1 and no = 0. A higher score is indicative of a more ideal home environment in terms of food rules. The materials this study uses assume that all food rules and guidelines surveyed have a positive effect. Accelerometer data were also collected from the participating children to assess physical activity.

Statistical Analyses

All analyses were conducted using Stata 14. Demographic characteristics were compared between rural and non-rural children using t-tests and chi-square analyses. Pairwise correlations were used to examine the relationship between perceived food rules and child BMI percentile as well as the relationship with rural status and perceived food rules. Linear and logistic regression were used to examine the relationship between

perceived food rules, rural status and either BMI percentile or overweight/obese weight category as outcomes. Significance was determined using a p-value $\leq .05$.

Results

There was a significant difference in mean BMI percentile between rural and non-rural populations, with 43.6% of the rural population falling in the overweight or obese BMI category compared to 20% of the non-rural population as seen in Table 1. There was no significant difference between rural/non-rural groups in age or sex. There was no significant correlation between specific food rules and BMI percentile (Table 2). The non-rural group had an average of 6.28 (± 4.2) of the 14 food rules while the rural group had an average of 3.81 (± 3.5), $p = .0005$. When looking at differing food rules between the two populations in Table 3, data show that in rural populations, rules about not eating sweet snacks ($p = .007$) and fried foods ($p = .002$) are significantly less likely to be perceived by the children when compared to non-rural populations.

Table 4 summarizes the determination of whether weight outcomes are associated with rural status and/or perceived food rules. "Rural" status was a significant predictor of BMI percentile for only one of the food rules, but significant for all of the food rules when Overweight/Obese weight status was the outcome of interest. There was a significant positive association between rules around limiting portion sizes at meals and BMI percentiles ($p = .048$) when controlling for the relationship between rural status and BMI. When overweight/obese was the outcome, there was a positive association between rules around only having fruit for dessert ($p = .024$) and not having sweet snacks ($p =$

.049), even when controlling for the relationship between rural status and weight category.

Discussion

Understanding the home environment could be the key to explaining and decreasing childhood obesity in the United States. Family food rules are a large part of the food environment at home, and exploring the differences between these rules could lead to better insight into the rural population, an understudied demographic. Home environment and family food rules seem to be associated with childhood obesity in rural locations, and may be part of the explanation for the disparity between populations. Many previous studies looking into home food and activity environments use surveys and measures that are too brief and not comprehensive enough to form adequate conclusions.¹⁷ Previous studies researching rurality differences, food rules, and childhood obesity all in correlation have not produced consistent results, whether from disorganized classification of the term rural, or various and inconsistent measuring tools. This study used a variety of validated measurement tools and used the child's food rule report as opposed to the parents' because they have been shown to have considerable discrepancies and the researchers wanted to study what was being perceived in the home by the children.¹⁸ This study also used both BMI percentile range and the specific BMI category of Overweight/Obese as outcomes, which was very unique and produced more interesting data than if it had only used one. There was a significant correlation between rurality and overweight/obesity, giving further credit to the theory that positive rurality status is a risk factor for childhood obesity. There was no correlation between specific home food rules

and BMI percentage overall, but significance did start to appear when looking specifically at the rural population. The rural population is associated with the overweight/obese category for all of the rules, but rules for limiting portion size, having fruit for dessert, and limiting sweet snacks all had relationships with higher weight while controlling for the rural population. This poses an interesting dilemma, as past research has shown that families with a structured home food environment have statistically less childhood obesity. The fact that these rules are associated with higher weight categories within or without the rural population could either indicate that these specific rules may contribute to childhood obesity, or that these rules were put in place retroactively. This study did not measure when or how long these rules were existent in the home environment, and the discrepancies in prior research, where some studies showed that overweight children have more home food rules, could be attributed to this. The data is based on the child's perception of rules, so another explanation of the significance of these three rules could be that perhaps children perceive these rules more easily, since rules about times or amounts can be enforced in the home environment without their awareness. These three rules may also be the easiest for parents to add or enforce retroactively, putting the authoritative parenting style into practice by controlling the home food environment instead of using food to control the child.

There was a significant difference in the types of rules between the rural and non-rural populations, and non-rural populations tended to have more food rules overall when compared to rural families, as was predicted by past research. The rural households were much less likely to have any rules about eating sweet or fried snacks.

The primary study collected physical activity data in the form of accelerometers and a physical activity questionnaire. The answer to the childhood obesity rurality disparity could lay more in the built environment differences of rural vs. non-rural and its effect on physical activity rules more than home food rules.

While the data surrounding these food rules showed many similarities between the rural and non-rural population, there were also multiple marked differences. Researching how and why these differences came to be a part of each specific community will give better insight into how to educate parents on raising healthy and happy children. Because these specific rules have been identified, we can work to educate each of these populations in supporting their children with the best home environment possible and hopefully work to reduce this health disparity.

Limitations

Like many studies before it, the researchers in this study had to define “rural” and “non-rural” using criteria which may differ from previous or following research, possibly making it difficult to compare. Secondly, only one school in a specific region was used for each variable, potentially disallowing the results to be accurately extrapolated to other regions.

Conclusion

The home environment plays a large role in a child’s life, and teaches them habits that will stick with them all throughout their adulthood. With childhood obesity and death from chronic disease on the rise in the United States, understanding the mechanisms

behind these problems is more important than it has ever been. This study found correlations between specific food rules, the rural population, and weight categories. Rural families have less family food rules than non-rural families, and childhood obesity was more highly associated with the rural population.

While objectively harder to do, research in rural areas is just as important as research in non-rural areas if improving the health of children is the ultimate goal. Going forward, research should focus on the home environment as a whole and especially include physical activity. It will be important to know when and why rules are enforced, and also to know why certain populations have particular rules. With this in mind, a question regarding the origin of home environment rules arises. Have these rules been passed on through family tradition and teaching or have they simply developed as a by-product of the environment around them? Understanding how the home environment was formed is the first step in changing it for the better.

Figure 1. Questions about perceived home food rules asked of child study participants

40. Are there rules at home about ...

	Yes	No
How many fruit servings you should eat?	<input type="checkbox"/>	<input type="checkbox"/>
When you should eat fruit?	<input type="checkbox"/>	<input type="checkbox"/>
How many vegetable servings you should eat?	<input type="checkbox"/>	<input type="checkbox"/>
When you should eat vegetables?	<input type="checkbox"/>	<input type="checkbox"/>
How often you should eat breakfast?	<input type="checkbox"/>	<input type="checkbox"/>
What you should eat at breakfast?	<input type="checkbox"/>	<input type="checkbox"/>
How many snacks you are allowed to eat?	<input type="checkbox"/>	<input type="checkbox"/>
When you are allowed to eat snacks?	<input type="checkbox"/>	<input type="checkbox"/>
Which snacks you are allowed to eat?	<input type="checkbox"/>	<input type="checkbox"/>
Taking second helpings at meals?	<input type="checkbox"/>	<input type="checkbox"/>
Limiting portion sizes at meals?	<input type="checkbox"/>	<input type="checkbox"/>
Only having fruit for dessert?	<input type="checkbox"/>	<input type="checkbox"/>
Not having sweet snacks?	<input type="checkbox"/>	<input type="checkbox"/>
Not having fried snacks (such as potato chips)?	<input type="checkbox"/>	<input type="checkbox"/>

Table 1 – Study demographics

Demographics	Total	Rural	Non-Rural	P-Value
Average Age	10.14	10.16	10.12	.8074
Sex (M/F)	63/64	33/29	30/35	.426
Food Rules (0-14)	5.07 ± .36	3.81 ± .45	6.28 ± .52	.0005
% of population with overweight/obese BMI	31.5%	43.6%	20%	.004

Table 2 – Correlation between food rules and BMI percentiles

Food Rule	P-Value
How many fruit servings should you eat?	.268
When you should eat fruit?	.374
How many vegetable servings you should eat?	.915
When you should eat vegetables?	.962
How often you should eat breakfast?	.363
What you should eat at breakfast?	.247
How many snacks you are allowed to eat?	.262
When you are allowed to eat snacks?	.805
Which snacks you are allowed to eat?	.090
Taking second helpings at meals?	.262
Limiting portion sizes at meals?	.105
Only having fruit for dessert?	.321
Not having sweet snacks?	.361
Not having fried snacks (such as potato chips)?	.782
Total Food Rules Score	.494

Table 3 – Difference between rural and non-rural perceptions of food rules

Food Rule	P-Value
How many fruit servings should you eat?	.931
When you should eat fruit?	.163
How many vegetable servings you should eat?	.212
When you should eat vegetables?	.104
How often you should eat breakfast?	.269
What you should eat at breakfast?	.061
How many snacks you are allowed to eat?	.215
When you are allowed to eat snacks?	.245
Which snacks you are allowed to eat?	.803
Taking second helpings at meals?	.676
Limiting portion sizes at meals?	.075
Only having fruit for dessert?	.335
Not having sweet snacks?	.007
Not having fried snacks (such as potato chips)?	.002
Total Food Rules	.0005

Table 4 – Relationship among weight categories, rurality, and food rules

Food Rule	P-Value BMI Percentiles	P-Value Overweight/Obesity
How many fruit servings should you eat?	.259	.110*
When you should eat fruit?	.502	.727*
How many vegetable servings you should eat?	.916	.486*
When you should eat vegetables?	.826	.466*
How often you should eat breakfast?	.265	.521*
What you should eat at breakfast?	.132	.209*
How many snacks you are allowed to eat?	.181	.217*
When you are allowed to eat snacks?	.954	.446*
Which snacks you are allowed to eat?	.079	.058*
Taking second helpings at meals?	.223	.058*
Limiting portion sizes at meals?	.048*	.078*
Only having fruit for dessert?	.230	.024*
Not having sweet snacks?	.172	.049*
Not having fried snacks (such as potato chips)?	.454	.232*
Total Food Rules	.175*	.067*

* Indicates that 'rural' was significant at $p < .05$

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