RESEARCH
Review

Diet and Physical Activity in Rural vs Urban Children and Adolescents in the United States: A Narrative Review

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ABSTRACT

Current research suggests that the prevalence of obesity is higher among rural youth than urban youth. Due to the health implications that are associated with child and adolescent obesity, it is critical to understand systematic differences in diet and physical activity (PA) behaviors that may be contributing to this disparity in weight. However, varying definitions of rural and inconsistencies in study tools and methodologies may limit the generalizability of findings from research in this area. The objective of this narrative review was to synthesize and critically evaluate existing literature comparing diet and PA behaviors between rural and urban children and adolescents, providing recommendations for future research. Only five studies were found that reported on measures of diet in rural vs urban youth, whereas 16 were found that reported on measures of PA. Dietary assessment tools were generally standard and acceptable; however, differences existed in how dietary outcomes were defined. Few studies used assessment tools that objectively measured PA, and definitions for meeting PA recommendations varied among studies. Very few studies defined rural using the same criteria. Future research on the rural youth obesity disparity should focus on including a high-quality assessment of both diet and PA (as opposed to one or the other) and on using an appropriate and consistent definition of rural.
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CHILDHOOD OBESITY IS ASSOCIATED WITH INCREASED risk for many adverse health conditions, including cardiovascular disease, diabetes, sleep apnea, social and psychological issues, and bone and joint issues.[1-4] In addition, childhood weight tracks into adulthood and obese children are more likely to be obese adults,[5-7] further adding to disease risk in adulthood. Whereas 31.8% of youth in the United States aged 2 to 19 years are overweight or obese (and nearly 17% are obese),[8] a recent meta-analysis indicates that odds of obesity among rural youth are 26% higher than for urban youth.[9]

The rural–urban disparity in obesity is likely influenced by both diet and physical activity (PA). Research describing the disparities in these behaviors is challenging to synthesize because of important differences in the methodology and assessment tools used by existing studies. For example, dietary data have been collected with 24-hour dietary recalls, food frequency questionnaires, and food records, among other tools, each of which has its own strengths and limitations. Likewise, PA data have been collected with both objective and subjective measurement tools, such as accelerometers and physical activity recall (PAR) questionnaires, respectively. How certain variables are defined may also vary among studies. For example, study authors define meeting PA recommendations based on the data they have available, which does not always align with actual recommendations and limits comparability between studies. Moreover, more than 2 dozen federal definitions for *rural* exist, and depending on which is used, between 17% and 49% of the US population can be classified as rural.[10]

Briefly, the US Census Bureau Classification uses census track data to categorize areas as an Urban Area (population of 50,000 or more), Urban Cluster (places outside of Urban Areas), or Rural (areas that are not urban).[11] The Office of Management and Budget Metropolitan Area Standards categorize counties as Metropolitan Statistical Areas (MSAs), Micropolitan Statistical Areas, or non–Core Based Statistical Areas based on population density.[12] Definitions put out by the US Department of Agriculture include urban influence codes (UICs), rural–urban continuum codes (RUCCs), and rural–urban commuting areas (RUCAs). The UIC classification system has 12 categories, two of which are metropolitan and 10 of which are nonmetropolitan.[13,14] Classification is based on population size and proximity to MSAs, which are set by the Office of Management and Budget. The RUCC classification system has nine categories, three of which are metropolitan and 6 of which are nonmetropolitan.[14] Classification is based on population size, degree of urbanization, and proximity to metropolitan areas. The RUCA classification has 10 categories and combines US Census Bureau information with community information to distinguish among categories.[15]

Despite the challenges of synthesizing research on the diet and PA behaviors of rural vs urban youth, it is critical to understand what about these behaviors may be driving a disparity in obesity. Moreover, an assessment of the current literature on the topic is needed to inform future research efforts. Therefore, the purpose of this narrative review was to evaluate and synthesize the literature on diet and PA of rural vs urban youth to determine whether and how these behaviors vary between groups. Implications for future research are also discussed.

METHODS

A research team of one faculty member and one graduate student searched PubMed for peer-reviewed articles published from January 1, 2005, through August 31, 2015. Search terms included *rural*, *non-rural*, *urban*, *childhood*, *child*, *adolescent*, *youth*, *obesity*, *overweight*, *physical activity*, *inactivity*, *inactive*, *sedentary*, *nutrient*, *nutrition*, and *diet*, with a combination of any and/or all of the preceding terms. A snowball strategy allowed for examination of references in identified articles, and inclusion of additional articles as appropriate. The primary faculty member reviewed all potential articles for inclusion and a second faulty member served as a tiebreaker when consensus was needed about whether or not a study should be included. Literature on PA and the built environment has indicated that due to geographical heterogeneity, studies examining rural–urban differences be country-specific.[16] As such, articles were included in this review if the research was conducted in the United States, if diet and/or PA were quantitatively or qualitatively measured, and if a rural population (aged $\leq$19 years) was compared with an urban (ie, nonrural) population. Articles were included regardless of study design or how authors defined rural and urban.

RESULTS

Overall, 17 articles met inclusion criteria.[17-33] Five articles reported on measures of diet,[17-19,23,31] including consumption of different food groups[17-19,23,31] and nutrient intake.[18] Sixteen articles reported on measures of PA,[17,18,20-33] including meeting PA recommendations,[17,22-24,31-33] sedentary time,[17,18,23-25,27,29,31] and sports team participation.[18,24,27,28]

Dietary Outcomes

The five studies that reported on dietary outcomes are summarized in Table 1. All studies were cross-sectional and assessed the dietary patterns of youth representing a range of ages (2 to 19 years) with various assessment tools.

Davis and colleagues[18] collected data on 138 5th-grade students and their parents from two rural and two urban schools in Kansas (rural defined according to US Census Bureau 2000 criteria). Caregivers completed a 3-day food record for their child, which was averaged with a 24-hour dietary recall from the child. There were no significant differences in overweight/obesity between the two groups—44% of urban children were overweight/obese, whereas 42.8% of rural were. Differences in intakes of calories and percent of calories from fat were examined, along with servings of fruits, vegetables, dairy products, sugary beverages, and junk food (*t* tests were conducted without controlling for other variables). There were no differences in intake between rural and urban children for any of the dietary variables.

Using data from the 2003-2004 and 2005-2006 cycles of the National Health and Nutrition Examination Survey (NHANES), Davis and colleagues[17] analyzed a nationally representative sample of 7,882 youth aged 2 to 18 years (rural defined according to UIC). Although combined overweight and obesity prevalence did not vary between rural and urban youth (39.0% vs 32.0%), significantly more rural youth were obese than were urban youth (21.8% vs 16.9%, respectively). Youth aged 16 years and older and parents/guardians of those younger than age 16 years reported foods eaten, which were grouped into the following categories: fruits/vegetables, sugar-sweetened beverages, milk products, fried foods, meat, added fats, and desserts/sweets. There were no differences in dietary intake between rural and urban youth in any of the food categories (while controlling for race, sex, age, and other variables with significance in the full model).

Using data from the 1999-2006 cycles of NHANES, Liu and colleagues[23] analyzed a nationally representative sample of 16,537 youth (14,332 for dietary analyses) aged 2 to 19 years (rural defined according to RUCA categories). A 24-hour dietary recall was used to obtain dietary data (parent/guardian proxy report for those younger than age 6 years, assisted report for those aged 6 to 11 years, and self-report for those aged 12 to 19 years). Combined overweight and obesity prevalence was significantly higher among rural compared with urban youth (35.4% vs 29.3%), as was obesity (18.6% vs 15.1%). This significantly higher overweight/obesity prevalence in rural vs urban youth was observed in adolescents aged 12 to 19 years, but not in younger children. To determine rural–urban differences, χ^2 tests of independence were used. Rural children aged 6 to 11 years had a higher mean energy intake (1,934.8 vs 1,844.1 kcal) than urban children, and significantly more consumed 2 to 3 cups dairy per day (29.7% vs 22.8%). Among those aged 12 to 19 years, fewer rural than urban reported consuming $\geq$2 cups fruit per day (12.2% vs 16.5%). No other dietary differences were seen in children or adolescents.

Ettienne-Gittens and colleagues[19] examined fruit and vegetable consumption among 673 Texas Special Supplemental Nutrition Program for Women, Infants, and Children participants who self-reported as black, and their 351 children, using a survey distributed between November 2008 and January 2009 (rural defined according to RUCA categories and self-reported ZIP code).[19] Fruit and vegetable consumption was assessed using a 7-point Likert scale (ranging from consumption "never" to "4 or more times per day") and variety was assessed using a checklist where the respondent chose all applicable foods usually eaten by the child. About 42% of urban mothers and 43% of rural mothers indicated their children consumed fruit 2 or more times per day, whereas urban children had a significantly greater variety of fruit consumption. About 14.6% of urban mothers and 9.3% of rural mothers indicated their children consumed "vegetables, such as salad, carrots or sweet potatoes, not including potatoes, french fries, or potato chips" 3 or more times per day, whereas urban children had a significantly greater variety of vegetable consumption (as determined by *t* test).

Using data from the 2005-2006 US Health Behavior in School-Aged Children survey, Kenney and colleagues[31]