

Television access, dinnertime food consumption and obesity among young children in Oklahoma

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Abstract

Background: Excessive television viewing has been associated with obesity and greater food intake but research has rarely focused on young children. This study aimed to determine relationships between home television access, dinnertime food consumption and obesity among children aged 3–5 years.

Methods: Caregivers of children (n=72) reported: 1) children's bedroom television access; 2) number of televisions in the home; 3) frequency of child eating dinner in front of the television; 4) presence of television viewable from dining areas; and a three-day dietary recall of child's dinner food intake. Total kilocalories (kcal), fruit and vegetable servings, and body mass index percentiles (BMI%ile) were calculated.

Results: Children were 3.7±0.7 years old, 43% male, 47% white, 26% overweight or obese, and mean BMI%iles were 68.6±28.8. At dinner, children consumed 426±146 kcals, 0.12±0.25 fruit, 0.59±0.59 vegetable, and 0.69±0.58 combined fruit and vegetable. Children without bedroom television's consumed more vegetables (0.80±0.67 vs. 0.39±0.41; t=3.091, p=0.003) and combined fruit and vegetables (0.90±0.66 vs. 0.5±0.44; t=2.963, p=0.004). Children with ≥3 televisions in the home had higher BMI%iles than those with ≤2 televisions (68.8±27.3 vs. 54.3±29.3; F=4.629, p=0.035). Neither frequency of dining while watching television nor presence of television viewable from dining areas were associated with the BMI%ile.

Conclusions: Greater television access in the home, including bedroom televisions and the overall number of televisions, is associated with lower fruit and vegetable intake and higher BMI%ile among young children. This study supports recommendations that children should not have bedroom television access and could help inform future childhood obesity prevention and intervention strategies.

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Introduction

The prevalence of obesity among 2–5-year-old children in the United States (US) increased from 5% in 1976 to 14% in 2012 [1], with a slight decline to 8% in 2014 [2]. In obese children, the risk for development of chronic diseases such as morbidity, mortality [3, 4], central obesity, metabolic syndrome

[5], type 2 diabetes mellitus and/or cancer [6] are identifiable. Further, 2–5-year-olds enrolled in the Oklahoma Women, Infants and Children (WIC) supplemental program had a higher prevalence of obesity (14%) [7] than the national average (8%) [2], which increases lifetime disease burden. Although there is no single cause for the obesity epidemic, theories include exposure to obesogenic environments

(“the sum of the influences that the surroundings, opportunities or conditions of life have on promoting obesity in individuals and populations”) [8], particularly pertaining to television (TV) access [9, 10].

Research indicates that children between the ages of 6 and 17 years commonly exceed the American Academy of Pediatrics’ (AAP) TV viewing recommendations of <2 hours/day [11, 12], which is moderately associated with weight gain and obesity [9, 13]. For example, excessive TV viewing is associated with a higher body mass index (BMI) percentile [9, 14] and greater food intake [9] in children. Independent of TV viewing time [15], placement of TV in the child’s bedroom increases accessibility and subsequent viewing opportunities [16]. The presence of a TV in a child’s bedroom is associated with more time spent watching TV [16, 17] and higher levels of obesity [15], which confirms the need for further research.

Research has examined the associations between TV access in the home, obesity and food consumption, but has rarely focused on young children (3–5 years old), despite the important behavioral patterns that develop during the preschool ages [18]. Therefore, the purpose of this study was to determine the relationship between TV access in the home, dinner time food consumption, including total kilocalories (kcal) and fruit and vegetable servings, and obesity among 3–5-year-old children in the state of Oklahoma, US. This information will, undoubtedly, be useful in future research focused on childhood obesity prevention and intervention strategies, and will provide insight into understanding complexities that surround obesogenic environments.

Methods

Study Design

Young children (3–5 years old) and their primary caregivers ($n=72$) were recruited from licensed child care centers ($n=15$) across Oklahoma, US, for this cross-sectional study. Approximately 50 centers were contacted; of these, 16 enrolled, 24 were interested but were not scheduled due to study demands, and 10 were not interested or did not return recruitment phone calls. The locations of the recruited centers

included five in the Oklahoma City and Tulsa metropolitan areas (average center capacity of 133 children) and 11 rural areas (average center capacity of 79 children). Eligibility criteria for participants included: ages 3–5 years and all-day attendance at child care (reported by the caregiver). Data were collected between fall 2011 and spring 2013. Caregivers provided voluntary informed consent before participating in the study. The study was approved by the University of Oklahoma Health Sciences Center Institutional Review Board.

Trained researchers conducted scripted telephone interviews with the caregivers, lasting approximately 35 minutes, and utilizing a Healthy Home Survey [19] and Three Dinner Dietary Recall to collect information about the child’s TV access and dinnertime food consumption, respectively. Up to three attempts to contact each caregiver were made.

Measures

TV access in the home

The Healthy Home Survey is a structured questionnaire designed to be administered via telephone to measure elements of the obesogenic home environment of young children [19]. It has reported a mean kappa value of 0.81 for media environment reliability with perfect reliability 1.00 (1.00) and high validity 0.88 (0.75, 1.00) for assessing a child’s bedroom TV access [19]. This study included the survey items: 1) Does <child> have a working TV in their bedroom? (Yes/No). 2) How many working TVs do you have in your home? (The responses were collapsed to ≤ 2 or ≥ 3 TVs). 3) How often does <child> eat in front of the TV each week? (The responses were collapsed to 0 days/week or ≥ 1 day/week). 4) Do you have any working TVs viewable from dining areas? (Yes/No).

Dietary intake

Caregiver also provided a dietary recall of the food consumed at the child’s previous three dinner meals. Since the dietary recall was collected over the telephone, researchers used a “What’s in a Serving Size” data sheet to aid in verbal descriptions of serving sizes and associated food quantification. For

example, a piece of cornbread was referred to as “the size of a bar of soap,” and ½ cup cooked vegetable was described as “the size of a light bulb.” Further prompts were given regarding food preparation methods, brand names, condiments, and ingredients in mixed foods like casseroles to ensure the proper capture of the child’s dinner intake. The following scenario demonstrates the types of consistently detailed questions that were asked: If the caregiver reported that their child consumed “chicken and rice casserole,” the interviewer asked about 1) portion sizes, 2) if the chicken was baked, fried, grilled, etc., 3) if the rice was white, brown, long grain, etc., and 4) if any dressings, oils, marinades, seasonings, etc. were added. After all the preparation information was recorded, interviewers asked about condiment use during the dinner meal. The recipe was then entered into nutrient analysis software, FoodWorks® version 10, by trained researchers to obtain nutritional information.

Any fruit or vegetable that the child consumed, regardless of quantity, was counted as a serving. For example, if the child was reported to have consumed a taco with diced tomatoes and lettuce, it is unlikely that the tomatoes and lettuce were accurately measured at ¼ cup each. In addition, the caregiver may not have remembered the exact amount of tomato or lettuce atop the taco, but was certain the child had consumed them. Thus, for the purposes of this study, said consumed diced tomatoes and lettuce were considered as two vegetable servings. Further justification for choosing servings includes existing variation in serving sizes for different fruits and vegetables and the precise volume error associated with dietary recall.

Foods that were considered vegetables included fresh, frozen, or canned varieties, and V8 (vegetable juice brand) or tomato beverages. Fried vegetables, processed tomato products (i.e. ketchup), pickles, and deli salads were excluded as vegetables due to diminished overall nutrient quality but were included in the overall nutrient analyses. Foods that were considered fruits included fresh, frozen or canned varieties (i.e., fruit cocktail and applesauce), and homemade fruit salad. Fruited yogurt and fruit juice without V8 branding were excluded as fruit but included in the overall nutrient analyses. V8 brand foods were included because of the vitamin and

mineral content, as well as ingredients that have more nutritive properties than the majority of fruit juices. Fruited yogurt and fruit juice were excluded due to added sugars and diminished nutritional value (i.e. fiber content and wholesome vitamins and minerals).

Total kcals, fruits, vegetables and combined fruits and vegetables were averaged across the three dinners for those children with three dinners reported ($n=63$). If a child only had one dinner reported ($n=1$), the amount of food (kcals, fruits and vegetables) represented their average consumption for all three dinners; if a child had only two dinners reported ($n=8$), those two dinners were averaged and that average represented the third dinner. Comparisons of children with data from all three dinners showed no statistical difference between dinners one, two and three (data not reported), justifying the procedures to average across days.

Demographics and anthropometrics

Caregivers reported the child’s age, gender and race, along with socio-economic status; two caregivers did not provide income data. Height (centimeters) and weight (kilograms) were measured using a Seca scale and portable stadiometer (Chino, CA) at the child care centers by researchers. BMI percentiles were calculated in accordance with the Centers for Disease Control and Prevention (CDC) growth chart percentiles [20].

Data analysis

Means, standard deviations and frequencies were calculated for descriptive characteristics and food consumption. Paired t-tests were used to determine if there was a difference in kcal intake between weekdays and weekend days. Independent t-tests were used to compare kcal, fruit, vegetable and combined fruit and vegetable intake with 1) children’s bedroom TV access (Yes/No), 2) number of working TVs in the home (≤ 2 or ≥ 3 TVs), 3) frequency of child eating dinner in front of the TV each week (0 days/week or ≥ 1 day/week), and 4) presence of working TVs viewable from dining areas (Yes/No). SPSS™ version 9 was used for analyses.

Results

Children ($n=72$) were 3.7 ± 0.7 years of age, 43% were male, and 26% were overweight or obese with a mean BMI percentile of 68.6 ± 28.8 . The majority of young children were white (48%); 29% were American Indian/Alaska Native, 11% Black/African American, 10% Hispanic and 3% were Asian. Over half (63%) of children had a household income between \$20,000 and \$50,000 and 57% lived in the Oklahoma City and Tulsa metropolitan areas, with 43% living in more rural areas. The majority (71%) of respondents were mothers, 21% were fathers, 4% were grandparents, and remaining respondents were stepparents or "other".

Overall, nearly half (49%) of the children had bedroom TV access. Sixty percent of households had ≥ 3 TVs in the home. Over half (51%) of the children did not watch TV during dinner. The majority (51%) of children did not have TVs viewable from dining areas. For the dietary recalls, weekdays represented 83% of day one, 69% of day two and 65% of day three. For day one (weekday=408 kcals, weekend=430 kcals) and day three (weekday=456 kcals, weekend=381 kcals), there was no difference based on day of the week; however, for day two, there was higher kcal intake on the weekday (weekday=456 kcals, weekend=381 kcals, $p=0.37$). Given the ranges expressed, and that for two of the three days there was no difference, the analyses were conducted on averaged dietary recalls. An average of 426 ± 146 kcals, 0.14 ± 0.27 fruit servings, 0.59 ± 0.59 vegetable servings and 0.71 ± 0.59 combined fruit and vegetable servings across the three dinners was reported.

Children without bedroom TVs consumed significantly more vegetable servings (0.80 ± 0.67 vs. 0.39 ± 0.41 ; $t=3.091$, $p=0.003$) and combined fruit and vegetable servings (0.90 ± 0.66 vs. 0.50 ± 0.44 ; $t=2.963$, $p=0.004$) than children with bedroom TVs. Bedroom TV access was not associated with dinnertime consumed kcals ($t=-1.130$, $p=0.262$), fruit servings ($t=-0.263$, $p=0.793$) or BMI percentile ($t=-1.823$, $p=0.073$).

Children with ≥ 3 TVs in the home had significantly higher BMI percentiles than those with ≤ 2 TVs in the home (68.8 ± 27.3 vs. 54.3 ± 29.3 ; $F=4.629$, $p=0.035$). There was no association between the number of TVs

in the home and kcals ($t=-0.510$, $p=0.612$), fruit servings ($t=-0.978$, $p=0.331$), vegetable servings ($t=1.968$, $p=0.053$) or combined fruit and vegetable servings ($t=1.412$, $p=0.162$) consumed at dinner.

The frequency of TV viewing during dinner was not associated with any outcome variable: kcals ($t=-0.978$, $p=0.331$), fruit servings ($t=0.358$, $p=0.721$), vegetable servings ($t=0.061$, $p=0.951$), or combined fruit and vegetable servings consumed ($t=0.159$, $p=0.874$), nor with BMI percentiles ($t=1.372$, $p=0.147$).

TV accessibility in dining areas was not associated with any outcome variables: kcals ($t=-0.404$, $p=0.688$), fruit servings ($t=0.986$, $p=0.327$), vegetable servings ($t=-0.534$, $p=0.595$), or combined fruit and vegetables servings consumed ($t=-0.176$, $p=0.861$), nor with BMI percentiles ($t=1.660$, $p=0.101$). Further data can be found in Table 1.

Discussion

This study reports that young children with greater TV access, as measured by bedroom TV access and number of TVs in the home, consumed fewer fruits and vegetables and had a higher BMI. Our current findings are consistent with studies regarding the effects of media on health and dietary consumption in older children with a mean age of 17 years [16]. Likewise, young children with ≥ 3 TVs in the home had a higher BMI percentile than those with ≤ 2 TVs. This result supports the previous finding that more TV viewing time was associated with higher levels of obesity in 2- to 9-year-old children [14]. However, there was no difference in dietary intake based on days/week and watching TV during dinner or TV access in dining areas.

These two results are counter to hypotheses supported by previous studies demonstrating that TV viewing influences dietary intake among young children [9].

Children in this study had levels of obesity than the national average (26% vs. 21%) [25], although prevalence was not as high as it is among the Oklahoma WIC population (31%) [7]. Children consumed an average of 426 kcals at the dinner meal.

Table 1. Television access, dinnertime food consumption and obesity among young children in Oklahoma (mean \pm SD)

Bedroom TV Access	Yes (n=35)	No (n=37)	p value
Kcals	446 \pm 166	407 \pm 125	0.262
Fruit	0.12 \pm 0.27	0.11 \pm 0.24	0.793
Vegetable	0.39 \pm 0.41	0.80 \pm 0.67	0.003*
Fruit & Vegetable combined	0.51 \pm 0.44	0.90 \pm 0.66	0.004*
BMI Percentile	69.2 \pm 25.9	57.0 \pm 30.5	0.073

Working TVs in Home	Few TVs (≤ 2) (n=29)	More TVs (≥ 3) (n=43)	p value
Kcals	416 \pm 153	434 \pm 143	0.612
Fruit	0.08 \pm 0.17	0.13 \pm 0.27	0.331
Vegetable	0.76 \pm 0.66	0.49 \pm 0.52	0.053
Fruit & Vegetable combined	0.81 \pm 0.65	0.61 \pm 0.52	0.162
BMI Percentile	54.3 \pm 29.3	68.8 \pm 27.3	0.035*

Dinner TV Viewing Frequency	0 days/week (n=37)	≥ 1 days/week (n=35)	p value
Kcals	410 \pm 146	444 \pm 147	0.331
Fruit	0.13 \pm 0.28	0.11 \pm 0.23	0.721
Vegetable	0.60 \pm 0.66	0.60 \pm 0.52	0.951
Fruit & Vegetable combined	0.70 \pm 0.65	0.68 \pm 0.51	0.874
BMI Percentile	67.5 \pm 26.7	58.2 \pm 30.6	0.174

Dinner TV Access	Yes (n=35)	No (n=37)	p value
Kcals	433 \pm 153	420 \pm 142	0.688
Fruit	0.09 \pm 0.17	0.14 \pm 0.31	0.327
Vegetable	0.63 \pm 0.60	0.56 \pm 0.60	0.595
Fruit & Vegetable combined	0.70 \pm 0.57	0.68 \pm 0.61	0.861
BMI Percentile	57.2 \pm 31.9	68.4 \pm 24.7	0.101

BMI: Body Mass Index; SD: Standard Deviation

* Denotes there was a significant difference from independent samples t-test at the $p \leq 0.05$ level.

The Dietary Reference Intakes (DRI) [15], MyPlate [26], and Estimated Energy Requirements (EER) [27], largely base kcal needs on a child's level of physical activity [26, 28], and range from 1200–1600 kcals [26, 28]. While physical activity can affect energy requirements, these recommendations may not be entirely appropriate for cohorts of children who are primarily physically inactive or sedentary.

To our knowledge, this is the first study to explore the relationship between bedroom TV access and consumption of fruits and vegetables, and to examine these behaviors of a young population at home. The previous literature has examined food intake of preschool-age children at child care centers [29] and via individual dietary recalls [30]. The CDC found children aged 2–5 years meet fruit intake targets, although this declines after age five [30]. Therefore, this study provides a gap in the existing literature in that it reports dietary intake patterns for young children in their home environment.

A novel aspect of this study is that the influence of bedroom TV as the only form of media on a child's fruit and vegetable consumption was assessed, whereas other studies researched the effects of bedroom TVs in conjunction with other electronic media devices, such as video games [17]. A European study found that elevated TV viewing was associated with higher BMI among 2- to 9-year-old children; each additional hour of daily TV viewing was associated with a 1.2% increase in BMI [14]. Another novelty is that the relationship between the number of TVs in the home and adiposity has not previously been explored until this study such that current results indicate that more TVs in the home are associated with higher levels of adiposity in young children.

While the current findings expand on known relationships between TV access and health, the precise relationship between bedroom TV access and dietary consumption is unclear. Potential drivers for this association could be children's food choices due to TV advertisement exposure [31, 32], parenting styles [33–35], or family structure [36]. Forty-nine percent of child-specific TV food advertisements during the week are for sweets/candy or salty/fast food products, which has led to 40% of children who are exposed to these advertisements asking their parents to purchase the advertised products [31, 32].

Casual parental restriction toward children's viewing of TV advertisements for foods high in fat, salt or sugar content was unpredictably associated with more exposure to said advertised foods; therefore stronger restriction may be needed [33]. Permissive parenting and lack of any food restrictions may also have influenced the consumption of low nutrient dense foods [34], and the contrary shows that children subject to authoritative or authoritarian parenting styles had lower levels of screen time among 5-year-olds [37]. Parents with fewer restrictions may also be more likely to allow their children to have a bedroom TV [38]. Furthermore, children in homes with a step-parent and single-parent homes were more likely to have bedroom TVs and, hence, higher TV viewing time [36]. Thus, bedroom TV access may not have a direct relationship on dietary consumption, but rather it may be related to less healthy food choices due to secondary factors such as advertisements, parenting styles, the family environment, and lax government broadcast regulations.

The strengths of this study include the statewide sample of young children in Oklahoma, US which provides a baseline for BMI data. Existing statistics are solely from families enrolled in WIC, potentially revealing biased trends related to socio-economic and weight status. The measurement and quantification of diet is complex, and examining this in terms of kcal intake as well as healthful foods (i.e. fruits and vegetables) aids in understanding dietary patterns. Furthermore, the assumption was made that the analysis of three dinnertime meals provided an adequate representation of what children regularly consume at home, such that both weekdays and weekend days are included. The collection of multiple dinners is also a strength in that it increases the likelihood that the meals and foods consumed and analyzed were typical of the child's overall diet. In addition, the exploration of TV variables in the home among 3- to 5-year-old children contributes significant and novel findings related to food consumption patterns at the dinner meal.

Limitations of the study include the error associated with telephone interviews. Potential error associated with misinterpretation of information related to quantity of food consumed, food preparation methods, and the ability to accurately recall information, may have affected the data and skewed

subsequent nutrient analyses. However, resources for face-to-face interviews were not available given the geographic dispersion of participants. The researchers made attempts to relate portion sizes to common household items to allow for more reliable reporting, and asked detailed questions about food preparation methods, brands, ingredients, and condiments. The inclusion of V8 brand products assumes that it was a vegetable or fruit juice rather than a smoothie or other flavored juice drink. Very few children consumed any V8 products so the magnitude of this potential for over estimation of fruit and vegetables is minimal. This study utilized servings of fruits and vegetables as opposed to portion sizes to eliminate quantity error that commonly occurs in dietary recall. Another potential limitation was the exclusion of other popular media devices and their influence on our examined variables. While the Healthy Home Survey did include electronic devices such as disc players, videogames, and computers, our intent and purpose was to provide novel, stand alone, insight into the role of TV access on the food consumption of young children [19]. Also, food consumption patterns and obesity among the sampled children were associated with the cumulative effects of the home environment that were otherwise not examined in the present study.

The AAP currently recommends against TV placement in children's bedrooms, due to the negative health consequences of TV viewing [11] and their known contribution to the facilitation of an obesogenic environment. The current findings further support this recommendation, as the food choices of the young children with bedroom TV access included a lower consumption of fruits and vegetables, which is less favorable. Future studies should measure and address additional environmental variables (i.e. location of home or food availability) and media (i.e. iPads) contributions to understand how these factors influence outcomes such as kcals, BMI, and fruit and vegetable consumption. The study outcomes should also be expanded to include physical activity levels or populations of young children outside of the child care center setting. These findings, and future research, may help identify factors for interventions and also facilitate the development of intervention strategies in the home to promote healthier lifestyles in children.

Conclusions

This study was the first to report that TV access in the home, particularly bedroom TV access and total number of TVs, is related to fruit and vegetable consumption and obesity among 3–5-year-old children. Young children without bedroom TV access consumed more vegetables and more fruits and vegetables combined than those with bedroom TV access. The number of working TVs in the home was significantly related to the BMI percentile, such that having three or more TVs in the home was associated with a higher BMI percentile compared to having two or fewer TVs. Early childhood provides a window of opportunity to implement healthful and nutritious lifestyle habits, which in turn help keep an obesogenic environment at bay throughout childhood development. Identifying potential mechanisms by which TV access impacts diet and adiposity among young children is vital. This will help to create interventions focused on modifiable behaviors related to TV, which could contribute to obesity prevention and the reduction of long-term health risks.

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