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Assessing the longitudinal relationship between Peruvian children's TV exposure and unhealthy food consumption

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ABSTRACT

Studies have shown that heavy television exposure is a risk factor for childhood overweight and obesity. This relationship is most typically attributed to the influence of food advertising. Despite this growing array of studies, one limitation is that these studies have focused almost exclusively on high-income countries. It is unclear whether such findings hold true in low- or middle-income countries. To address this gap, this study investigated the relationship between television exposure and unhealthy snack consumption (a risk factor for childhood overweight/obesity) in a sample of Peruvian children aged 6–13 (n = 265). Results indicate that television exposure is indeed cross-sectionally and longitudinally related with unhealthy snack consumption. But for children from high socioeconomic status families, this relationship is even more pronounced. These findings justify efforts to help parents manage their children's television viewing as well as efforts to regulate food advertising in Peru.

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To date, the claim that heavy TV viewing increases the probability of obesity among young children (Hastings et al., 2003; Institute of Medicine, 2006) has most typically been supported with research conducted in high-income countries (The World Bank, 2014a) such as the United States (Lumeng, Rahnama, Appugliese, Kaciroti, & Bradley, 2006), Australia (Johnson, Kremer, Swinburn, & de Silva-Sanigorski, 2012), Norway (Kristiansen, Juliusson, Eide, Roelants, & Bjerknes, 2013), or Italy (Centis et al., 2012). While several hypotheses have been posited to explain the link between TV exposure and childhood obesity, the majority of researchers agree that the relationship is most likely a result of advertising exposure (Jordan & Robinson, 2008). Children who are heavy television consumers are exposed to increased levels of advertisements for unhealthy foods, and these advertisements subsequently lead to an increase in unhealthy food consumption (Jordan & Robinson, 2008). While the evidence to support this argumentation is generally robust, the external validity of such evidence depends on whether similar studies can find the same effects in different cultural contexts (Schutt, 2006). Surprisingly, there is little research about the effects of television exposure on obesity among young children in low- or middle-income countries in Latin America. The only exception is work by Novaes, Lamounier, Colosimo, Franceschini, and Priore (2012) and Wells et al. (2008)

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in which researchers reported positive cross-sectional associations between TV viewing and BMI among young Brazilian children and adolescents. Considering that food marketing is on the rise in Latin America (Moodie et al., 2013), there is a critical need for evidence-based knowledge about the influence of television exposure on childhood obesity in Latin America. Using longitudinal data from a sample of Peruvian children aged 6–13, this study is designed to help address this gap by investigating whether children's television exposure predicts subsequent unhealthy eating behaviors.

Background

After a recent period of economic expansion (The World Bank, 2014b), Peru has become an upper middle-income country (The World Bank, 2014c). This increased economic growth also brings with it an increased risk for the so-called poverty trap (Carter & Barrett, 2006), a situation in which individuals who have experienced an increase in their income may still be vulnerable to risk factors or "negative shocks" that can push them back to their former poverty level and, as a result, limit their ability to improve their status (Carter & Barrett, 2006). These negative shocks most typically result from sudden losses of income (Carter & Barrett, 2006), environmental events (Carter, Little, Mogues, & Negatu, 2007), or intense health conditions (Aldana, 2014). While all three represent potential shocks for Peruvians, researchers believe that health shocks, such as those associated with obesity (e.g., cardiovascular disease; Herouvi, Karanasios, Karayianni, & Karavanaki, 2013), are particularly concerning for Peruvians (Barrantes & Busse, 2014), because (1) this country is already beginning to battle obesity (8.2% of children under the age of 5 and 24.4% of children between 5 and 9 years old are overweight or obese; Alvarez-Dongo, Sanchez-Abanto, Gomez-Guizado, & Tarqui-Mamani, 2012), and (2) country-level economic growth is associated with increased obesity rates (Van Hook, Altman, & Balistreri, 2013).

Just as childhood obesity rates are concerning, unhealthy food advertising is also prevalent with almost 40% of the food advertisements during children's programming promoting foods high in sugar, salt, fat or saturated fat (CONCORTV, 2012). In response to this alarming advertising landscape and the current obesity rates, the Peruvian government has recently announced plans to implement regulations to control the marketing efforts of the food industry during children's programming (Diario El Peruano, Law Nº 30021, 2013; larepublica.pe, 2014). The underlying argument is that limiting food advertising should subsequently reduce children's unhealthy eating behaviors and, thus, decrease the likelihood of childhood obesity (Brescoll, Kersh, & Brownell, 2008), which would subsequently decrease the risk for high blood pressure, high cholesterol, type 2 diabetes, breathing and joint problems, and social and psychological problems both during childhood and adulthood (Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007; Hannon, Rao, & Arslanian, 2005; Puhl & Latner, 2007; Reeves, Postolache, & Snitker, 2008; Strauss, 2000; Sutherland, 2008; Taylor et al., 2006). From an empirical perspective, this combination of a heightened concern over potential health shocks associated with obesity as well as legislative interest in altering the advertising landscape in Peru makes this country a relevant context to investigate the relationship between children's television exposure (including food advertising) and predictors of childhood obesity (namely, unhealthy eating behaviors).

Television exposure and unhealthy eating

Although there have been several arguments put forth to explain the relationship between television exposure and childhood obesity, most researchers now agree that the influence of TV on obesity is rooted in persuasion effects (Jordan & Robinson, 2008). Typically explained through social cognitive theory (e.g., Gilmore & Jordan, 2012), the argument is that children who are heavy television viewers are exposed to significantly more unhealthy food ads, and in turn, children's intake of these types of foods increases (Robinson, 2001). This unhealthy eating subsequently increases the likelihood of childhood overweight and obesity (Robinson, 2001). Although there does not yet exist a "gold standard" randomized controlled trial investigating the relationship between TV viewing and unhealthy eating among youth (but see Robinson,1999) for the effects of TV on childhood obesity), cross-sectional, longitudinal, and experimental studies have contributed to a robust body of literature supporting the link between television exposure and children's unhealthy eating habits.

Aranceta, Perez-Rodrigo, Ribas, and Serra-Majem (2003), for example, studied a representative sample of Spanish youth between 2 and 24 years old ($n = 3534$). Among children between 2 and 13 years old ($n = 1375$), the researchers found that television exposure in excess of 2 h per day was associated with eating snacks including sweets, salty snacks, and sodas. Similarly, Parvanta et al. (2010) identified a cross-sectional association between paying attention to advertisements and food requests among 1552 Chinese children and adolescents between 6 and 18 years old. Cross-sectional associations have also been documented between TV watching and snacking among Australian youth (Brown, Nicholson, Broom, & Bittman, 2011) and American youth (Lipsky & Iannotti, 2012). Moreover, similar patterns have been reported longitudinally with heavy television exposure subsequently related to unhealthy food and beverage requests among American children (Andreyeva, Kelly, & Harris, 2011; Chamberlain, Wang, & Robinson, 2006; Wiecha et al., 2006). Comparable longitudinal effects have also been found for Canadian (Pagani, Fitzpatrick, Barnett, & Dubow, 2010) and Danish youth (Hare-Bruun et al., 2011), though the latter study provided evidence for the relationship between exposure and a lower preference for healthy foods for girls only. Finally, experimental studies point in the same direction. Chernin (2008) found that, among children aged 5–11exposure to a sugary drink advertisement increased preference for the advertised product, while Harris, Bargh, and Brownell (2009) observed that children aged 7–11 increased their consumption of snacks when watching a cartoon episode with ads that promoted unhealthy foods.

Taken together, the wide array of evidence offered by cross-sectional, longitudinal, and experimental designs provides strong evidence to support the assertion that exposure to television advertisements leads to an increase in unhealthy food consumption among youth.

In other words, it is clear that heavy television viewing is a risk factor for unhealthy eating, which is a determinant of obesity and cardiovascular diseases (Jordan, Piotrowski, Bleakley, & Giridhar, 2012). However, this evidence also highlights a critical gap in our knowledge. While it is reasonably clear that television viewing (by virtue of advertisement exposure) induces unhealthy eating among youth in higher income countries, we do not yet know if this is similarly true among low-to-middle-income countries. Considering that evidence suggests that Latin American youth spend a greater portion of their time with television (e.g., average of 5 h per day, Busse & Diaz, 2016; Fiates, Amboni, & Teixeira, 2008) than youth in higher income countries (e.g., average 2.4 h per day, Lipsky & Iannotti, 2012), it is reasonable

to ask if the association between exposure and unhealthy eating is more pronounced in cultural contexts in which children spend substantial amounts of time watching TV.

Peru is one such context. In Peru, the two most popular daily activities among children and adolescents are attending school and watching TV (CONCORTV, 2010). As such, it is not surprising that a recent study indicated that Peruvian children spend, on average, nearly 5 h watching TV during a typical weekday and 7 h during a typical weekend day (Busse & Diaz, 2016). While this amount of exposure may seem high in comparison to higher income countries, it is actually quite reasonable given the amount of time children spend at home after school. In Peru, children attend school in the morning only, which leaves them with a substantial amount of time during the day to engage in other activities. Since the influence of TV viewing on unhealthy eating seems to be much more pronounced among heavy TV viewers (Jordan & Robinson, 2008), this also means that the likely negative influence of television exposure on Peruvian children may be both statistically and practically meaningful.

The moderating role of socioeconomic status

Interestingly, although socioeconomic status (SES) tends to be negatively associated with obesity in higher income countries, the burden of obesity tends to travel to higher SES levels in countries with lower income (Monteiro, Moura, Conde, & Popkin, 2004). Monteiro et al. (2004) explain that, in low-income countries, the poor are more likely to be protected from obesity because of the lack of food availability combined with higher levels of energy expenditure. In fact, recent data suggest that higher income individuals in Peru remain at a greater risk for obesity than lower SES individuals (Poterico, Stanojevic, Ruiz-Grosso, Bernabe-Ortiz, & Miranda, 2012). That said, research has also shown that, as countries acquire greater wealth, food availability in general improves but the poor experience greater difficulty in identifying and acquiring healthy foods (Monteiro et al., 2004). Thus, this suggests that SES may moderate the relationship between television exposure and unhealthy snacking for Peruvian children in one of two different ways. On the one hand, if higher SES remains a risk factor for obesity in Peru (as a result of greater food availability combined with lower energy expenditure), children from high-SES families may experience stronger effects associated with television exposure since they are experiencing two risk factors simultaneously (i.e., television exposure and high socioeconomic status; often referred to as a "double dose," e.g., Fikkers, Piotrowski, Weeda, Vossen, & Valkenburg, 2013). Alternatively, if the increasing economic growth of the country has shifted the SES risk from higher income families to lower income families (Monteiro et al., 2004), then children from lower SES families may experience stronger effects associated with television exposure. Since both directions are plausible given the shifting economy in Peru, and since both directions highlight particular "at risk" groups that may be deserved of targeted interventions, it is important and relevant to explore the role of SES in this context.

The current study

In order to identify whether and the extent to which television exposure predicts unhealthy food consumption among Peruvian youth, a longitudinal study was conducted with children aged 6–13 living in the capital city of Peru (Lima). Based on the large body of existing

evidence supporting a positive cross-sectional and longitudinal relationship between television exposure and unhealthy eating, we posited the following hypotheses:

Hypothesis 1: TV exposure will be cross-sectionally and positively associated with the consumption of unhealthy snacks among Peruvian children.

Hypothesis 2: TV exposure will be longitudinally and positively associated with the consumption of unhealthy snacks among Peruvian children.

Although the longitudinal design cannot guarantee causality, in combination, evidence for both cross-sectional and longitudinal relationships provides support for the causal relationship between these variables (Schutt, 2006). In addition to these hypotheses, we also investigated the role of SES in these relationships. As noted above, it is unclear how SES may moderate this relationship. As such, we posit the following research questions:

Research question 1: Is the cross-sectional association between exposure and consumption of snacks moderated by socioeconomic status?

Research question 2: Is the longitudinal association between exposure and consumption of snacks moderated by socioeconomic status?

Method

Research design

A longitudinal design was used to test the study hypotheses and research questions. All data were collected via parental report.

Participants and procedures

After receiving approval from the Institutional Review Board of Universidad Peruana Cayetano Heredia, parents were recruited for participation via three large public elementary schools in Lima. Participating schools were located in three districts of Lima. To recruit participants, school principals were provided with letters of invitation as well as copies of the parental consent forms and parental surveys. The letters and survey instruments were distributed to all students in primary school – grades 2–6 in two schools and grades 1–6 in one school – in November 2013. Approximately 7 months later, in June 2014, the process was repeated with caregivers who had participated at baseline.[1] As required by the IRB, all participants signed a consent form during baseline and the follow-up. In total, 265 caregivers completed the baseline data collection. Response rate was 21%. Of these, 145 caregivers completed the second wave of data collection (54.72% retention).

Measures

Survey items were developed via formative testing (Busse & Diaz, 2016) and prior research (e.g., Chernin, 2008; Hare-Bruun et al., 2011; Olivares et al., 2004; Olivares, Yáñez, & Díaz, 2003; Parvanta et al., 2010). When not available in Spanish, measures were developed following a process of translation into Spanish and then back-translation into English, with derived versions compared against the original versions (Rogler, 1989). An iterative process resulted in subsequent versions that were later pilot tested with a sample of parents of children in a small public elementary school of Lima. These pilot participants were not included in the final analytic sample.

The independent variables in this study were television exposure and SES. The dependent variable in this study was unhealthy snacking. In addition, several control variables were measured: child age, television during meals, snacking with television, child physical activity, caregiver age, caregiver weight, caregiver employment, parents in household, and other children in the household. These variables were measured because research has identified them as confounders in the relationship between TV exposure and eating behaviors, or because they have been correlated with eating behaviors among children (e.g., Brown et al., 2011; Hare-Bruun et al., 2011; Jeong, Hwang, & Fishbein, 2010; Lipsky & Iannotti, 2012).

Television exposure

Following procedures described by Bleakley, Jordan, and Hennessy (2013), television exposure was measured by asking parents to report how much television their child views during a typical weekday, such as last Tuesday, and during a weekend day, such as last Saturday. Specifically, parents were asked to report how much time their child spends watching TV on a typical weekday from (1) the moment *your child w*oke up until noon, (2) from noon until 6 pm, and (3) from 6 pm until *your child* fell asleep. The question was repeated for weekend exposure. To generate an estimate of daily exposure, the weekday estimate was multiplied by 5, the weekend estimate was multiplied by 2, and then these values were summed and then divided by 7 to create an average daily exposure. Because some answers resulted in extreme values, we applied the winsorizing procedure (Erceg-Hurn & Mirosevich, 2008; Keselman, Algina, Lix, Wilcox, & Deering, 2008) at the item level to normalize the distribution of the variables, and replaced these values with the score of 3 standard deviations above the mean (i.e., one-sided winsorizing). The average television exposure at baseline was $M = 5.86$ h (SD = 2.82), which is consistent with other estimates of Peruvian children's television exposure (Busse & Diaz, 2016).

Socioeconomic status

Following Hare-Bruun et al. (2011), socioeconomic status was measured with the caregiver's education level using an item adapted from the Peruvian National Household Survey (Instituto Nacional de Estadística e Informática, 2012) in which the highest level of education of the responding caregiver was measured. Response categories were none, incomplete primary, complete primary, incomplete high school, complete high school, incomplete superior technical, complete superior technical, incomplete college, complete college, and postgraduate (master or doctorate). This variable was dichotomized by approximating a median-split with 43.40% reporting high school or less.

Unhealthy snacking

To measure unhealthy snack consumption, parents were asked two questions that were developed for this study. These items were adapted from Jordan et al. (2012) who measured consumption of sugary drinks using a similar item wording. First, parents were asked "To your knowledge, how many packaged sweet snacks – such as chocolate, candy, gum, or similar – does your child have on an average day?" Then, parents were asked "To your knowledge, how many packaged salty snacks – such as potato chips, chisitos, cheese tris,[2] or similar – does your child have on an average day?" For both questions, the maximum possible answer was 20 packaged snacks per day. Following the same procedure described by Jordan and her colleagues (2012), both items were averaged to create a single measure

for number of snacks (time 1: $M = 1.47$, SD = 1.63, $n = 265$; time 2: $M = 1.22$, SD = 1.19, $n = 145$). Both time 1 and time 2 measures were positively skewed.

Child age

Age of the child was measured in years by subtracting the child's date (year) of birth from the date (year) that the survey was completed ($M = 9.72$, SD = 1.56, *Min-Max* = 6–13).

TV during meals

Adapted from Hare-Bruun et al. (2011), parents were asked three questions to identify the frequency with which children watched television during mealtimes. Parents were asked "How often does your child watch TV while having breakfast [lunch, dinner]" with response categories being almost never or never, only weekends, once or twice a week, most days, and every day, on a 5-point scale ranging from 0 to 4 (Cronbach's $\alpha = .77$, $M = 2.06$, SD = 1.20).

Snacking with TV

Using an item employed by Lipsky and Iannotti (2012), snacking while watching TV was measured by asking parents "How often does your child eat a snack (e.g., fruit, a sandwich, cookies, etc.) while he/she watches TV (including videos and DVDs)?" Response categories were never, less than once a week, 1–2 days a week, 3–4 days a week, 5–6 days a week and everyday, on a 6-point scale ranging from 0 to 5 ($M = 1.83$, SD = 1.36).

Child physical activity

To measure the target child's typical physical activity, one item from Lipsky and Iannotti (2012) was used. Specifically, parents were asked "Outside school hours: how many hours a week does your child usually exercise in his/her free time so much that he/she gets out of breath or sweat?" Response categories for this item were none, about half an hour, about 1 h, about 2–3 h, about 4–6 h and 7 h or more, on a 6-point scale ranging from 0 to 5 ($M = 1.82$, SD = 1.33).

Caregiver age

The responding caregiver's age was measured in years by subtracting the caregiver's date (year) of birth from the date (year) that the survey was completed ($M = 37.51$, SD = 7.44).

Caregiver weight

Following procedures described by Hare-Bruun et al. (2011), the responding caregiver's weight was self-reported in kilograms ($M = 64.20$, SD = 12.25).

Caregiver employment

Similar to Brown et al. (2011), the number of hours that the responding caregiver spends in employment each week was assessed by asking respondents "In a typical day, approximately, how many hours are you employed outside home?" with response categories being 0, 1–2, 3–4, 5–6, 7–8, and more than 8 h. This variable was dichotomized to differentiate between caregivers who are and are not employed outside the home. In total, 27.55% of the responding caregivers reported no employment outside of the home.

Parents in household

To identify whether both parents were living in the household, one item was adapted from Jeong et al. (2010). Respondents were asked "which of the following options represent the

family members living in the household with your child?" with response categories being *both parents, only mother or father,* and *neither father nor mother*. This item was dichotomized to differentiate those families with both parents present in the household from those with none or only one of them. In total, 69.06% of respondents indicated that both parents resided in the household.

Children in household

To identify whether any other children under 12 years old were residing in the household, one item was adapted from van Zutphen, Bell, Kremer, and Swinburn (2007). Respondents were asked "how many children under twelve years old live in your household (not including your child)?" This variable was dichotomized to represent whether or not any other children under 12 were present in the household. In total, 32.45% of caregivers reported no other children under 12 other than the target child living in the household.

Analytic approach

A series of analytic steps was taken to test the hypotheses and answer the research questions. First, to determine appropriate model covariates, spearman correlations were used to examine the bivariate correlations between television exposure, unhealthy snacking, and all potential control variables. Following recommended guidelines for the parsimonious selection of control variables (Darlington, 1996), all control variables which were significantly associated with unhealthy snacking either cross-sectionally or longitudinally were considered appropriate for model inclusion. In practice, this meant that five variables were included in all models: television during meals, snacking with television, caregiver employment, parents in household, and other children in household.

Because the initial multivariate models violated the assumptions of linearity and homoscedasticity, the dependent variables were dichotomized (Allison, 1999) by approximating a median-split using 1 snack as the cut-point (0 = 1 snack or less; 1 = more than 1 snack: 46.42% = ate more than one snack at time 1; 34.48% = ate more than one snack at time 2). Then, following covariate selection, two multivariate logistic regression models were conducted to test the study cross-sectional and longitudinal hypotheses. To investigate whether socioeconomic status moderated the relationship between television exposure and unhealthy snacking, similar multivariate logistic regression models were run again, this time including an interaction term between socioeconomic status and exposure. Models that investigated cross-sectional relationships had a sample size of 265, whereas models that investigated longitudinal relationships had a sample size of 145. In order to control for intraclass correlation, or the dependence of responses among children in the same classroom, we controlled for clusters at the classroom level in multivariate analyses. There were 44 clusters in all the three schools. STATA 13.0 was used to conduct statistical analyses.

Results

Descriptive statistics

Of the 265 caregivers at baseline, 86% were mothers, nearly all (97%) reported having a TV at home, with 90% reporting having between 1 and 3 televisions at home, and 83% reported access to cable TV. From this pool, nearly 55% (n = 145) were retained in wave 2. Caregivers

not included in wave 2 provided incomplete information at time 2 ($n = 1$) or dropped out from the study ($n = 119$). Those who dropped out were not different from those who remained in the study in regard to SES. In order to assess the associations among study variables, spearman correlations among all variables were computed (see Table 1). At the bivariate level, unhealthy snacking at time 1 was associated with television exposure ($\rho = .29$, $p < .001$), television during meals ($\rho = .14$, $p < .05$), snacking with television ($\rho = .15$, $p < .05$), caregiver employment ($\rho = .14$, $p < .05$), parents in household ($\rho = -.16$, $p < .01$) and other children in household ($\rho = .14$, $p < .05$). The majority of these relationships were no longer significant at time 2. Only unhealthy snacking at time 2 was associated with television exposure ($\rho = .34$, $p < .001$) and unhealthy snacking at time 1 ($\rho = .46$, $p < .001$).

Hypothesis 1: Cross-sectional results

To address hypothesis 1, which posited a cross-sectional relationship between television exposure and unhealthy snacking, an adjusted logistic regression model was used. When controlling for model covariates, results indicated that TV exposure was associated with an increase in the odds of the target child eating more than one snack on a typical day by 20% (OR = 1.20, CI = 1.09–1.32). In other words, each hour of television viewing was associated with 20% greater odds of eating more than 1 snack in a typical day. Hypothesis 1 was supported. See Table 2 for a full accounting of the statistical model.

Hypothesis 2: Longitudinal results

To address hypothesis 2, which posited a longitudinal relationship between television exposure and unhealthy snacking, an adjusted logistic regression model was used. When controlling for model covariates as well as unhealthy snacking at baseline, results indicated that TV exposure was associated with an increase in the odds of the target child eating more than one snack on a typical day by 15% (OR = 1.15, CI = 1.02–1.29). In other words, each additional hour of television viewing at baseline was associated with 15% greater odds of eating more than 1 snack in a typical day at follow-up. Hypothesis 2 was supported. See Table 2 for a full accounting of the statistical model.

Research question 1 & 2

To address research question 1 and 2, which asked whether socioeconomic status moderated the cross-sectional or longitudinal relationship between television exposure and unhealthy snacking, adjusted logistic regression models with an interaction term between television exposure and socioeconomic status were conducted. When controlling for model covariates, results indicated that the cross-sectional relationship between television exposure and unhealthy snacking was moderated by SES (OR = 1.26, CI = 1.03–1.55). Specifically, television exposure increased the odds of eating more than 1 unhealthy snack on an average day by 26% for those children whose caregivers reported an education level greater than high school. Furthermore, when investigating this pattern longitudinally, results similarly indicated that the influence of television exposure on unhealthy eating was moderated by SES. When correcting for model covariates and unhealthy snacking at baseline, baseline television exposure increased the odds of eating more than 1 snack on an average day by 44% for

Table 1. Bivariate spearman correlations for study variables.

	Unhealthy snacking Time 2	1	2	3	4	5	6	7	8	9	10	11	12
1. Unhealthy snacking (Time 1)	.46***	1.00											
2. TV exposure	.34***	.29***	1.00										
3. Child age	.03	.05	.10	1.00									
4. TV during meals	.11	.14*	.30***	.15*	1.00								
5. Snacking & TV	.16	.15*	.10	.05	.18**	1.00							
6. Child activity	−.13	−.08	−.06	−.07	−.10	.04	1.00						
7. Caregiver age	−.08	−.04	.01	.22***	−.02	−.07	−.04	1.00					
8. Caregiver weight	.08	.03	.02	−.05	.05	.03	−.06	.11	1.00				
9. SES	−.07	−.08	−.28***	.06	−.15*	−.10	.09	.12*	.02	1.00			
10. Caregiver Emp	−.04	.14*	.02	.04	.01	−.04	.14*	−.01	−.03	.12*	1.00		
11. Parents in HH	−.10	−.16**	−.12	.05	.06	−.08	.04	.14*	.15*	.04	−.10	1.00	
12. Children in HH	.05	.14*	.01	−.09	−.09	.01	−.00	−.23***	.03	.01	−.10	−.06	1.00

Notes: $N = 265$ for all correlations, except with snacks at time 2 where $N = 145$; 1. Socioeconomic status (SES), caregiver employment (Emp), parents in household (HH), and children in household (HH) are dichotomous.
*$p < .05$; **$p < .01$; ***$p < .001$.

Table 2. Cross-sectional and longitudinal multiple logistic regression models predicting unhealthy snacking.

	Unhealthy snacking time 1		Unhealthy snacking time 2	
	Odds ratio	Robust standard error	Odds ratio	Robust standard error
Unhealthy snacking at time 1	Omitted		1.97**	.50
TV exposure	1.20***	.06	1.15*	.07
TV during meals	1.38**	.15	.95	.15
Snacking with TV	1.12	.10	1.07	.15
Caregiver employment	1.70	.52	.47**	.16
Parents in household	.55*	.13	.46	.20
Children in household	1.95**	.48	1.22	.57
Sample size	265		145	
Pseudo R^2	.12		.17	

Notes: Dependent variable: Eating snacks: one or fewer unhealthy snacks = 0, more than one unhealthy snacks = 1. For unhealthy snacking at time 2, unhealthy snacking at time 1 is continuous. Caregiver employment, parents in household, and children in household are dichotomous.
*$p < .05$; **$p < .01$; ***$p < .001$.

Table 3. Cross-sectional and longitudinal multiple logistic regression models predicting unhealthy snacking, with moderation by SES[a].

	Unhealthy snacking time 1		Unhealthy snacking time 2	
	Odds ratio	Robust standard error	Odds ratio	Robust standard error
Unhealthy snacking at time 1	Omitted		1.98**	.48
TV exposure	1.08	.08	1.01	.08
TV during meals	1.37**	.15	.94	.16
Snacking with TV	1.11	.10	1.05	.14
Caregiver employment	1.71	.55	.47*	.17
Parents in household	.55*	.14	.42*	.18
Children in household	1.95**	.47	1.34	.67
Socioeconomic status (SES)	1.04	.32	1.21	.48
TV Exposure x SES	1.26*	.13	1.44*	.23
Sample Size	265		145	
Pseudo R^2	.13		.19	

Notes: Dependent variable: Eating snacks: one or fewer unhealthy snacks = 0, more than one unhealthy snacks = 1. For unhealthy snacking at time 2, unhealthy snacking at time 1 is continuous. Caregiver employment, parents in household, and children in household are dichotomous. TV exposure was centered before creating the interaction term with SES.
*$p < .05$; **$p < .01$; ***$p < .001$.
[a]We conducted the same moderation analyses using the ordinal measure of SES (for both the cross-sectional and longitudinal analyses) and results were similar; the only difference was that the estimate of the interaction term in the cross-sectional analyses was marginally significant ($p < .08$).

those children whose caregivers reported an education level greater than high school (OR = 1.44, CI = 1.05–1.96). See Table 3 for a full accounting of the statistical model.

Discussion

Given the large body of evidence showing that television exposure is associated with unhealthy eating behaviors, and subsequently overweight and obesity among children (Hastings et al., 2003; Institute of Medicine, 2006) as well as evidence that Peruvian children are high consumers of television (Busse & Diaz, 2016; CONCORTV, 2010), it was hypothesized that television exposure would be positively associated with eating sweet and salty snacks cross-sectionally and longitudinally. Results supported these hypotheses. Each additional hour of television that Peruvian children viewed increased the long-term odds of a child consuming more than one unhealthy snack by 15%. This effect was particularly pronounced

for children residing in higher SES homes where the longitudinal odds of unhealthy snack consumption rose to 44%.

At present, structural conditions in Peru favor both increased television viewing as well as increased snacking. The short school day means that children can begin viewing television early afternoon and continuing this viewing until bedtime (Busse & Diaz, 2016). Moreover, unhealthy snacks are easily accessible at school kiosks and food carts located right outside the school, and Peruvian children have significant autonomy when it comes to purchasing inexpensive sweet and salty snacks for themselves (Busse & Diaz, 2016). It seems likely that this combination of increased exposure to television advertising alongside accessible unhealthy snacking is leading to increased consumption of unhealthy foods and is putting these youth at increased risk for childhood overweight. This concern is particularly true for youth from higher SES households, who may have greater discretionary income to put toward unhealthy snacking. That said, the concern associated with SES may change over time in Peru. As the Peruvian economy continues to grow, food availability is expected to increase and, along with this, individuals with lower education and lower health knowledge (common among the poor) are likely to experience difficulty in identifying and acquiring healthy food (Monteiro et al., 2004). Therefore, in future stages of the country's development, it may be that the link between television viewing and unhealthy eating behaviors will become more pronounced among children from lower SES levels. Future work which follows up on this changing country can provide important information on how SES risk can depend upon the economic health of the larger country.

Academic and public policy implications

Results from this study are consistent with other studies that have examined the relationship between time spent with media and the unhealthy eating behaviors of children in high-income countries (e.g., Lipsky & Iannotti, 2012; Wiecha et al., 2006). This consistency is notable as it boosts the external validity of the claim that television exposure (via advertising) increases unhealthy food consumption and subsequently puts children at risk for childhood overweight and obesity by highlighting these findings in a Latin American context. Equally important, these results are highly relevant for public health programs that target childhood obesity in Latin American countries and middle-income countries such as Peru.

For nearly two decades, researchers have suggested that TV viewing is a modifiable risk factor that can be addressed as a means to decrease childhood obesity (Robinson, 1999, 2001). Findings from this study lend support to the recommendation that public health campaigns work to identify and promote ways to help children achieve healthier viewing amounts. The question, of course, is how a public health campaign can appeal to parents and children to achieve these healthier viewing amounts. For many children, particularly Peruvian children, television viewing is part of the daily life – and as such, changing these viewing patterns is likely going to require a renegotiation of the roles, rules, and general patterns of the entire family (Evans, Jordan, & Horner, 2011). Recently, in an attempt to identify how to communicate television reduction messages to parents, Bleakley, Piotrowski, Hennessy, and Jordan (2013) compared the attitudinal, normative, and self-efficacious beliefs of parents who intended to limit their children's viewing to 2 h or less per day (an often-cited "recommended" limit of daily television viewing) with parents who did not share this intention. Results indicated significant differences in both attitudinal and normative beliefs and suggested that health communication

campaigns which (1) highlight the positive outcomes associated with television reduction (e.g., reducing television will help children do better in school) as well as (2) show that other parents limit their children's television viewing can help create a social norm about the importance of limiting viewing and subsequently increase the likelihood that parents will reduce their children's television viewing. Future research which builds on the work by Bleakley and her colleagues (Bleakley, Piotrowski et al., 2013) by testing the differential effectiveness of messages which target these attitudinal or normative beliefs can provide crucial information on best practices in regard to the design of such preventive messages.

In addition to providing general support for health communication campaigns which encourage television reduction, the findings from this study are also directly relevant to Peruvian policy-makers. Peru has recently passed a law that will regulate the marketing of food products to children and adolescents under the age of 16 (Diario El Peruano, Law Nº 30021, 2013; larepublica.pe, 2014). According to the law, food advertising targeted at children and adolescents should not be misleading and must avoid persuasive appeals that easily induce children to select or buy unhealthy food products (Diario El Peruano, Law Nº 30021, 2013). While this law is yet to be implemented – due to a delay in the implementation process (larepublica.pe, 2014) – it does not ban food advertising in times when many Peruvian children are watching television (i.e., 6–9 pm, Busse & Diaz, 2016). As such, although the law is an important step in decreasing the amount of food advertising that children are exposed to, it will not remove it. Considering the findings of this study, as well as the existing evidence of the effects of TV advertising on children's eating behaviors (Hastings et al., 2003) and the significant health risks associated with childhood overweight and obesity, it is reasonable to call for a more stringent law that prohibits any advertising of food products when children are likely watching. Strict policies have already been implemented in Canada, Sweden, Norway, and the United Kingdom (Harris, Pomeranz, Lobstein, & Brownell, 2009); thus, there is precedence for such regulation. While research is still accumulating as to the effectiveness of these regulatory effects, at least in Canada, follow-up evaluations have shown that limiting fast-food ads which target children are associated with a decrease in fast-food consumption in those areas affected by the ban (Dhar & Baylis, 2011).

Limitations

There are several important limitations to consider in the context of these findings. First, this sample is a non-representative sample of children aged 6–13 attending public schools in an urban area of Peru. Replication with a more generalizable Latin American sample is warranted. Second, this study focused solely on snacking behaviors associated with television viewing, although there is reason to believe that sugary beverage consumption is also a critical context to investigate (Chernin, 2008; Jordan et al., 2012). Efforts to also investigate the interplay between advertising, sugary beverage consumption, and childhood overweight/obesity are warranted.

Methodologically, there are three important points to note. This study relied on parental report as opposed to child report. While the validity of parental reports to globally assess children's actual time with TV may be limited (Vandewater & Lee, 2009), the use of parental report is common practice when working with samples that involve young children. Moving forward, it would be worthwhile to investigate these findings with other complementary measurement approaches (e.g., experience sampling, observation, child report). It would

be similarly worthwhile to extend the measurement to include body mass index in order to evaluate whether unhealthy eating mediates the relationship between TV exposure and obesity. Second, related to parent report, the dependent variables in this study required parents to estimate the number of *packages* of sweet and salty foods their child has on a typical day. It is possible that parents had different perceptions about the size of packaged snacks. While this likely had little consequence in our study as the dependent variable was dichotomized, future studies should provide a clear description of the size of the *portion* of snacks so parents can better estimate the number of sweet and salty snacks that their children consume on a daily basis. Further, although our snacking measurement included food items that have been traditionally linked with an obesogenic environment, efforts to ascertain the validity of this measure – for example, its predictive validity via associations with children's body mass index – would be a welcome next step. Third, in this study, as noted in our analytic approach, the data did not meet the necessary statistical assumptions for parametric ordinary least squares regression. To address this challenge, we followed recommended statistical techniques and dichotomized our dependent variable. While this technique ultimately improved the accuracy of our analyses, it leaves us with theoretical challenges. In particular, this cuto-ff is a statistical one – not a theoretical one. In practice, this makes it challenging to determine how problematic it is for a child to be in the higher consumption group. While future work should certainly consider a more nuanced measure of snacking, we would argue that these findings provide an important first indication, in the Peruvian context, on the relationship between television and snacking behaviors.

Lastly, perhaps the most important limitation is that, although this study speculates that the mechanism of effect is advertising since many studies have found support for this (e.g., Andreyeva et al., 2011; Chernin, 2008; Parvanta et al., 2010), this study measured television exposure generally as opposed to advertising exposure specifically. Future work which is able to parse out television exposure versus advertising exposure to confirm this distinction is a reasonable and important next step.

Conclusion

A wide array of cross-sectional, longitudinal, and experimental studies supports the claim that advertising exposure induces unhealthy eating practices and subsequently places youth at increased risk for childhood obesity and overweight. However, this claim has largely been made with data from high-income countries, thus limiting its external validity. Using a Peruvian sample of youth, this study provides both cross-sectional and longitudinal evidence to support the external validity of this claim. Data reveal that increased exposure to television content increases the likelihood of unhealthy snacking, which is a crucial risk factor for overweight and obesity. Importantly, the study shows that children from the higher SES households are most at risk for these negative consequences. These results highlight a strong need for public health efforts to help caregivers regulate their children's television viewing as well as public policy efforts which work to regulate television food advertising in Peru.

Notes

1. 82.76% of the caregivers at follow-up were the same mothers that participated at baseline.
2. Chisitos and chese-tris are the names of salty snacks available in Peru.

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