

Influence of Television Food Advertisements Related Purchasing Behaviours on Dietary Intake and Obesity Among Children in China

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Abstract

Background: This study aims to examine the effects of Television (TV) food advertisements (ads) related purchasing behaviours on children's dietary intake, overweight and obesity in China.

Methods: Data from 1,417 children (aged 6–17.99 years) in the 2011 China Health and Nutrition Survey were analysed. TV food ads related purchasing behaviours were assessed through the frequency of children's requests to purchase advertised foods and the frequency of parents' purchases of these advertised foods, as well as the frequency of children's purchases of advertised foods. The height and weight of children were measured. Logistic regression models were used to identify the associations between TV food ads related purchasing behaviours and overweight/obesity of children.

Results: TV food ads related purchasing behaviours were positively associated with children's dietary intake of energy, protein, fat and carbohydrates. After adjusting for potential confounding factors, TV food ads related purchasing behaviours were positively associated with children's overweight/obesity: OR (95% CI) for overweight/obesity were: 1.46 (1.01–2.11) for children purchasing advertised foods, 1.59 (1.15–2.18) for parents purchasing advertised foods for their children and 1.39 (0.99–1.95) for children requesting advertised foods.

Conclusions: TV food ads related purchasing behaviours are associated with children's dietary intake. Moreover, TV food ads related purchasing behaviours can increase the risk of overweight and obesity of children. Regulations on TV food ads should be considered in China.

Background

Childhood obesity is likely to persist in adolescence and adulthood, leading to an increased risk of cardiovascular diseases, musculoskeletal disorders, cancers, insulin resistance and psychological effects.^[1] Globally, over 340 million children and adolescents aged 5–19 years were overweight or obese in 2016.^[1] According to the Chinese National Survey on Students' Constitution and Health, among students aged 7–18 years, the obesity prevalence increased from 0.1% in 1985 to 6.4% in 2014.^[2] The underlying cause of overweight and obesity is an energy imbalance between calorie intake and calorie expenditure.^[1]

Children are frequently exposed to Television (TV) food advertisements (ads). In a study of TV food ads targeting children in 11 countries, food ads comprised 11% to 29% of the total ads, and among the food ads, non-core foods (high in undesirable nutrients or energy, as defined by dietary standards) comprised 53% to 87%.^[3] An analysis of nutritional content of food and beverage products in TV ads indicated that most food and beverage products in TV ads seen by children did not meet the nutrition recommendations of Interagency Working Group for saturated fat, trans fat, sugar and sodium.^[4] This finding is similar to that of Rodd's research.^[5]

TV food ads could affect the food purchasing behaviours of children and parents, which contributes greatly to childhood obesity. Previous studies have found that TV food ads increased children's requests and purchases for advertised foods and parents' purchases of advertised foods.^[6-10] Gbadamosi et al. found that TV ads were relevant to children's consumption of goods and services, prompting children to request advertised products or brands, particularly advertised foods, from their parents in Africa.^[7] This finding indicated that TV ads can influence children's food preferences and purchase requests. In a study among children above 6 years old in Western countries, TV ads affected children's requests for less nutritious products and their active participation in the

decision-making process involved in purchases.^[10] This may influence children's overweight and obesity. Similarly, in China, a study of the relationship between TV watching and snacking behaviour among children and adolescents showed that watching TV, especially TV ads, was significantly related to the demand, purchase and consumption of snacks.^[9]

Studies from developed countries have consistently shown that TV food ads affected children's food purchase requests and obesity. However, little is known how TV food ads related purchasing behaviours affect children's dietary intake and overweight and obesity. Thus, this study used the data from the 2011 China Health and Nutrition Survey (CHNS) to 1) explore the effect of TV food ads related purchasing behaviours on children's dietary intake of energy, protein, fat and carbohydrates; 2) explore the effect of TV food ads related purchasing behaviours on overweight and obesity among children in China.

Methods

2.1 Study design

The CHNS is an ongoing open cohort, an international collaborative project between the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute for Nutrition and Health (NINH, former National Institute of Nutrition and Food Safety) at the Chinese Center for Disease Control and Prevention (CCDC). It was designed to examine the effects of the health, nutrition and family planning policies and programmes implemented by national and local governments and to see how the social and economic transformation of Chinese society affects the health and nutritional status of its population. The longitudinal CHNS has been conducted since 1989 in eight out of the 23 Chinese provinces (Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Liaoning, Shandong), Heilongjiang province was enrolled as a ninth province in 1997.^[11] In 2011, three megacities (Beijing, Shanghai, Chongqing) agreed to participate in the study, whose results vary substantially in terms of geography, economic development, public resources and health indicators.^[12] A multistage, random cluster process was used to draw the sample in each of these provinces. Counties and cities in each province were stratified by income (low, middle and high), and a weighted sampling scheme was used to randomly select four counties and two cities in each province. Villages and townships within the counties and urban and suburban neighbourhoods within the cities were selected randomly. In each community, 20 households were randomly selected and all household members were interviewed.^[11]

2.2 Participants

In 2011, data of 15,732 participants were merged. Data were collected from participants during face-to-face interviews with trained interviewers. Exclusion criteria include missing weight or height information (n=629); below 6 years of age and over 17.99 years of age (n=13,531); unknown values on the primary variables of TV food ads related purchasing behaviours, ethnicity and education (n=33); missing values on the primary variables of age, education, urbanisation index, per capita annual family income, ethnicity, TV food ads related purchasing behaviours, dietary intake of energy, fat, protein and carbohydrates (n=122). The final sample included in the analysis was 1,417 children aged 6–17.99 years.

2.3 Measures

2.3.1 Socio-demographic characteristics. Age, education, urbanisation index and per capita annual family income were encoded and converted into count data. Self-reported education was recoded into three categories

(illiterate/primary school, junior middle school, high middle school or higher).^[13] The urbanisation index and per capita annual family income were recoded into tertiles (low, medium, high).^[13]

2.3.2 TV food ads related purchasing behaviours. TV food ads related purchasing behaviours were assessed by the questions “do you ask your parents to purchase the foods seen on TV ads?”, “do your parents purchase advertised foods for you?” and “do you purchase the foods seen on TV ads by yourself?”. Respondents reported the frequency (“very seldom”, “seldom”, “sometimes”, “often”, “very often” and “unknown”) of these purchasing behaviours. The options of “very seldom”, “seldom”, “sometimes”, “often” and “very often” were defined as “<1 time/month”, “1–3 times/month”, “1–2 times/week”, “3–4 times/week”, “≥5 times/week”, respectively. For each of the above purchasing behaviours, responses of ‘very seldom’ and ‘seldom’ were combined as ‘no’; and responses of ‘sometimes’, ‘often’ and ‘very often’ were combined as ‘yes’ for the analysis.

2.3.3 Dietary intake. Individual dietary data for the same three consecutive days were recorded for all household members, regardless of age or relationship to the household head.^[12] This was achieved by asking each individual, except children aged younger than 12, on a daily basis to report all food consumed at home and away from home on a 24-hour recall basis.^[12] If the children were not present, their caregivers would be required to contact them to obtain the children’s food consumption information. For children younger than 12, the mother or a mother substitute who handled food preparation and feeding in the household was asked to recall the children’s food consumption.^[12]

2.3.4 Overweight and obesity. Height and weight were measured in the 2011 CHNS survey. Height and weight of children were measured by at least two trained health workers who followed standard protocol and techniques, with one worker taking the measurements while a second health worker recording the readings^[14]. Body weight was measured in light indoor clothing to the nearest tenth of a kilogram with a beam balance scale; height was measured without shoes to the nearest tenth of a centimeter, using a portable stadiometer^[14]. The International Obesity Task Force cut-off of body mass index was used for defining overweight/obesity among children.^[15]

2.4 Data analyses

Descriptive statistics were used for the sample characteristics. The categorical variables were described using frequency and percentile, and the metrological data description used mean and standard deviation. Student’s t-test was performed to examine the relationships between TV food ads related purchasing behaviours and dietary intake of energy, fat, protein and carbohydrates. To determine if the relationships between TV food ads related purchasing behaviours and overweight and obesity existed, odds ratio (OR) and 95% confidence intervals (CI) for the outcome variable were calculated by using binary logistic regression. All statistical tests were conducted using STATA software (Version 12, StataCorp, College Station, TX, USA). Statistical significance was considered when $P < 0.05$ (two-sided).

Results

3.1 Sample characteristics of participants

Table 1 presents the descriptive statistics for the demographic variables and overweight/obesity. The mean age of the sample was 10.9 (SD 3.3). Among participants, 63.1% lived in rural areas. The prevalence of overweight/obesity was 17.9%. Overall, 18.3% of the children reported they requested advertised foods from their parents, 16.9%

purchased advertised foods by themselves and 21.1% reported that their parents purchased advertised foods for them.

Table 1. Sample characteristics of participants (n = 1417).

Variables	Total populations	Overweight/Obesity		P-value
		No (n=1,164)	Yes (n=253)	
	n (%) or Mean±SD	n (%) or Mean±SD	n (%) or Mean±SD	
Age(year)	10.9±3.3	11.0±3.3	10.2±3.1	<0.001
Gender				
Boy	725 (51.2%)	570 (49.0%)	155 (61.3%)	<0.001
Girl	692 (48.8%)	594 (51.0%)	98 (38.7%)	
Ethnicity				
Han	1,229 (86.7%)	995 (85.5%)	234 (92.5%)	0.003
Minority	188 (13.3%)	169 (14.5%)	19 (7.5%)	
Education				
Illiterate/primary school	895 (63.2%)	711 (61.1%)	184 (72.7%)	0.002
Junior middle school	368 (26.0%)	316 (27.1%)	52 (20.6%)	
High middle school or higher	154 (10.9%)	137 (11.8%)	17 (6.7%)	
Urbanisation index				
Low	473 (33.4%)	410 (35.2%)	63 (24.9%)	0.002
Medium	474 (33.5%)	388 (33.3%)	86 (34.0%)	
High	470 (33.2%)	366 (31.4%)	104 (41.1%)	
Urban or rural				
Urban	523 (36.9%)	414 (35.6%)	109 (43.1%)	0.025
Rural	894 (63.1%)	750 (64.4%)	144 (56.9%)	
Per capita annual family income				
Low	473 (33.4%)	402 (34.5%)	71 (28.1%)	<0.001
Medium	472 (33.3%)	400 (34.4%)	72 (28.5%)	
High	472 (33.3%)	362 (31.1%)	110 (43.5%)	
Children requested advertised foods from parents				
No	1,157 (81.7%)	968 (83.2%)	189 (74.7%)	0.002
Yes	260 (18.3%)	196 (16.8%)	64 (25.3%)	
Parents purchased advertised foods for their children				
No	1,118 (78.9%)	940 (80.8%)	178 (70.4%)	<0.001

Yes	299 (21.1%)	224 (19.2%)	75 (29.6%)	
Children purchased advertised foods				
No	1,177 (83.1%)	975 (83.8%)	202 (79.8%)	0.132
Yes	240 (16.9%)	189 (16.2%)	51 (20.2%)	
Energy intake (kcal/d)	1,554.2±569.1	1,534.3±567.2	1,645.6±570.2	0.005
Fat intake (g/d)	58.3±31.3	57.1±31.2	63.7±31.0	0.002
Protein intake (g/d)	53.9±21.9	52.9±21.7	58.5±22.6	<0.001
Carbohydrates intake (g/d)	203.2±85.9	201.9±85.2	209.3±88.9	0.209

3.2 Association of TV food ads related purchasing behaviours and dietary intake

Table 2 indicates that children whose parents purchased advertised foods for them had higher dietary intake of energy, protein, fat and carbohydrates than children whose parents did not purchase advertised foods for them. Children who purchased advertised foods had higher dietary intake of energy, protein, fat and carbohydrates than children who did not purchase advertised foods. In addition, children who requested for advertised foods from their parents were positively associated with their dietary intake of energy, protein and fat.

Table 2. Association of TV food ads related purchasing behaviours and dietary intake (n = 1417).

Dietary intake	TV food ads related purchasing behaviours								
	Children requested advertised foods from their parents			Parents purchased advertised foods for their children			Children purchased advertised foods		
	No n=1,157	Yes n=260	P- value	No n=1,118	Yes n=299	P- value	No n=1,177	Yes n=240	P- value
Energy intake (kcal/d), mean (SD)	1,550.1 (571.9)	1,572.5 (557.4)	0.565	1,534.8 (562.1)	1,626.7 (590.1)	0.013	1,528.1 (557.1)	1,682.4 (610.0)	<0.001
Fat intake (g/d), mean (SD)	58.0 (31.5)	59.7 (30.4)	0.429	57.5 (31.3)	61.3 (30.9)	0.061	57.2 (31.1)	63.7 (31.5)	0.004
Protein intake (g/d), mean (SD)	53.4 (22.0)	56.1 (21.4)	0.066	52.6 (21.6)	58.6 (22.7)	<0.001	52.8 (21.4)	59.3 (23.6)	<0.001
Carbohydrates intake (g/d), mean (SD)	203.4 (86.8)	202.4 (82.3)	0.864	201.4 (85.8)	209.7 (86.1)	0.138	200.3 (84.6)	217.5 (91.2)	0.005

3.3 Logistic regression analyses of the association between TV food ads related purchasing behaviours and overweight and obesity

Logistic regression analyses (Table 3) show the relationship between TV food ads related purchasing behaviours and overweight and obesity. When adjusting for age, gender and intake of energy, children who requested advertised foods (OR = 1.54; 95% CI 1.11–2.13) or purchased advertised foods (OR = 1.50; 95% CI 1.05–2.16) were more likely to become overweight and obese than children who did not request or purchase advertised foods; and children whose parents purchased advertised foods for them had a higher risk of overweight and obesity (OR = 1.70; 95% CI 1.25–2.32) than children whose parents did not purchase advertised foods for them. After further adjusting for ethnicity, education, income, urbanisation index and residence, the correlation remained significant between children ([OR = 1.46; 95% CI 1.01–2.11]) or parents ([OR = 1.59; 95% CI 1.15–2.18]) purchasing advertised foods and the risk of children’s overweight and obesity. However, in this model, children’s requests for advertised foods from their parents were not significantly related to the risk of childhood overweight and obesity ($P > 0.05$).

Table 3. Association between TV food ads related purchasing behaviours and overweight and obesity (n = 1417).

	Model 1 ^a	Model 2 ^b
Independent variables	OR (95% CI)	OR (95% CI)
Children requested advertised foods from their parents		
No	Reference	Reference
Yes	1.54 (1.11–2.13)*	1.39 (0.99–1.95)
Parents purchased advertised foods for their children		
No	Reference	Reference
Yes	1.70 (1.25–2.32)**	1.59 (1.15–2.18)**
Children purchased advertised foods		
No	Reference	Reference
Yes	1.50 (1.05–2.16)*	1.46 (1.01–2.11)*

^a Model 1: adjusted for age, gender, intake of energy.

^b Model 2: additional adjustment for ethnicity, education, income, urbanisation index, residence (urban/rural).

* $P < 0.05$, ** $P < 0.01$.

Discussion

Approximately 20% of the children requested advertised foods from their parents, purchased advertised foods, and reported that their parents purchased advertised foods for them. The reason may be that the marketing strategies of repetition and enticement in TV food ads have the potential to influence purchase intentions of children and parents.^[16] Marketing strategies in TV food ads, such as using celebrity endorsers or cartoon characters to promote

products, designing snack packages with cartoon images or adding small toys in snacks, may have a promotion effect on the food purchasing behaviours of children and their parents.^[17] In the present study, 21.1% of the children reported that their parents purchased advertised foods for them. Some studies have shown that parents usually have negative attitudes towards ads; they believe that unhealthy foods in ads may have harmful influences on children's dietary habits.^[18-20] However, other studies found that parents' behaviour of purchasing snacks for their children was greatly influenced by media ads and lacked rationality, which may be due to parents' lack of knowledge of the nutritional information in children's snacks.^[20,21] In addition, a previous study demonstrated that parents' positive discussions with their children about ads can increase children's understanding of ads and offset the negative effects of ads to a certain degree.^[22] Hence, strengthening the education on TV food ads for parents and children, restricting children's purchasing behaviours of unhealthy advertised foods and training children to distinguish between healthy and unhealthy food ads would help children develop correct cognition of advertised foods. In addition, parents correctly interpret the content of TV food ads for their children may also be an effective measure. In fact, many developed countries have restricted TV food ads targeted to children.^[23] However, it is not the case in China. The 'Advertising Law of the People's Republic of China' stipulates that the content of ads for children under the age of 14 should not 'persuade children to ask their parents to buy advertising goods or services'.^[24] The Chinese government should formulate relevant policies to restrict unhealthy food ads to be broadcast on various media platforms, specifically on children's programmes. Some public service ads or tips related to healthy dietary habits (i.e. consuming less high-sodium, high-sugar or high-fat foods) should be inserted in children's programmes.

This study demonstrated that TV food ads related purchasing behaviours were positively associated with children's dietary intake of energy, protein, fat and carbohydrates. Advertising foods of poor nutritional quality can influence children's food preferences and make children tend to choose food rich in fat, refined sugar and sodium.^[25] This inclination may result in higher dietary energy and fat intake in children who request or purchase advertised foods than children who do not. Moreover, the amount of time children spend watching TV was associated with the number of their requests for advertised foods, and the likelihood that parents would purchase these foods.^[6,8] This finding may be a reason for a previous conclusion that longer TV viewing time was associated with a higher intake of energy and fat among children.^[6] Simultaneously, the current study found that children who purchased advertised foods had higher protein intake, which may be due to the ads of milk and dairy products targeted to children. Milk is rich in a variety of nutrients, especially protein, calcium and vitamins, and its protein digestibility rate is high (92%–98%), which can increase children's protein intake and contribute to the development and growth of children.^[26] A previous study found that the popularity of dairy product ads in various media had a positive impact on people's understanding of the benefits of consuming dairy products and facilitated milk purchase decisions.^[27] This finding implies that the government should implement policies to promote healthy food ads on various media platforms, thereby increasing the recognition and consumption of healthy foods among children. However, a recent study found that individual food purchasing was an inaccurate basis for characterising dietary intake of energy and nutrients, which may be influenced by food wastage, non-consumption of purchased foods and consuming foods that were purchased by others.^[28] Even if an individual consumes only self-purchased foods, it is difficult to fully calculate the nutritional content of the individual consumes by using individual food purchases, because each dietary recall represents only a "sample" from all purchased foods, not the nutritional content of the entire purchased set.^[28] Therefore, TV food ads related purchasing behaviours could only reflect the dietary intake of children on a limited level.

TV food ads related purchasing behaviours were positively associated with children's overweight and obesity, which may be a reason for the positive association between screen time and obesity.^[6,29,30] This finding may have several possible explanations. Firstly, previous studies have shown that children were exposed to a considerable number of TV food ads, predominantly of foods high in fat, sodium and sugar.^[4,31] Purchasing and consuming these foods may be a reason for the increased risk of obesity in children.^[32] These findings are consistent with the result of this study that overweight or obese children had a higher proportion of purchasing advertised foods than children who are not overweight or obese. Secondly, the present study showed that the above TV food ads related purchasing behaviours resulted in higher dietary intake of energy, protein and fat. According to previous studies, excessive dietary energy intake is a major factor in the development of obesity in children,^[33] and high fat intake appears to be causally related to overeating and obesity, at least in susceptible individuals.^[34] Thirdly, in developing countries such as China, older primary caregivers, such as grandparents, appear to be susceptible and receptive to children's food purchasing requests.^[35] Thus, these primary caregivers are likely to give in to children's purchasing requests for unhealthy advertised foods, which may influence children's eating habits and increase the risk of childhood obesity.

Several limitations of this study need to be mentioned. Firstly, the cross-sectional data analysed in the study restricts conclusions about a causal relationship between TV food ads related purchasing behaviours and dietary intake and overweight and obesity among children. Secondly, we cannot analyse what kinds of the advertised foods were responsible for the results. This key question is worth exploring further. Thirdly, the TV food ads related purchasing behaviours were self-reported by children. Hence, responses could be influenced by acquiescence bias, extreme response bias or dishonesty. Therefore, the result of the study should be approached with caution.

Implications For Research And Practice

This analysis indicated that TV food ads related purchasing behaviours have a positive effect on children's dietary intake of energy, protein and fat. Moreover, TV food ads related purchasing behaviours are positively associated with children's overweight and obesity. The findings stress the importance of targeting school-aged children and their parents to promote rational dietary intake and reduce the risk of obesity in children via reducing purchasing unhealthy foods seen on TV food ads. Future research would benefit from longitudinal studies with more precise assessments of purchasing and consuming what kinds of foods seen on TV food ads to further understand the influences that contribute to the development of children's dietary intake and childhood obesity. Finally, future obesity prevention or dietary intake interventions may consider focusing on healthy TV food ads as an innovative way to promote and target healthy eating and food purchasing behaviors. The result of the study would reflect that Chinese government should formulate regulations on TV food ads; health educators could conduct TV food ads related education or interventions to promote healthy food purchasing behaviours and dietary intake and reduce the risk of childhood obesity.

Conclusion

This analysis constitutes the first large-scale study of the relationship between TV food ads related purchasing behaviour and dietary intake and overweight and obesity among children in China. The results indicated that TV food ads related purchasing behaviours have a positive effect on dietary intake of energy, protein, fat and carbohydrates of children. Moreover, TV food ads related purchasing behaviours are positively associated with

children's overweight and obesity. Hence, conducting studies in China that can track more nutritional behaviours related to TV food ads is necessary.

Declarations

Ethics approval and consent to participate

The survey was approved by the institutional review committees of the University of North Carolina and the National Institute of Nutrition and Food Safety. All subjects gave their informed consent for inclusion before they participated in the study, and written informed consent was obtained from a parent or guardian for participants under 16 years old.

Consent for publication

Not applicable.

Availability of data and materials

The datasets analysed during the current study are available in the CHNS official website, [<https://www.cpc.unc.edu/projects/china>].

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

J.X. was involved in the design, data analysis, interpretation, and preparation of manuscript. Y.Z. and Z.S. were involved in the concept, design and critical revision. M.Z., Z.C., C.X., Y.X. and M.S. were involved in the concept, planning, and critical revision. All authors read and approved the final manuscript.

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