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Effect of Television Viewing on Pediatric Obesity[1]

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Objective To test the effect of television viewing on pediatric obesity in urban China. **Methods** Stratified multistage cluster random sampling method was used for subjects selection. Nine thousand three hundred and fifty-six children, as well as their parents, were investigated. Questionnaire survey was used for data collection. Children's weights and heights were measured in the clinic of the investigated kindergartens or schools by trained investigators following the standardized procedure. **Results** The percentages of children and adolescents who watched television less than 1 h, 1-2 h, 2-3 h and more than 3 h daily were 32.5%, 46.0%, 15.4% and 6.1%, respectively, while the prevalence of obesity was 10.9%, 11.8%, 13.2% and 15.1%, respectively. Each hourly increment of television viewing was associated with 1%-2% increase in the prevalence of obesity. **Conclusions** Time spent watching television is directly related to an increase risk of obesity, television viewing time is an independent factor for pediatric obesity.

Key words: Children and adolescent; Television viewing; Obesity

INTRODUCTION

The prevalence of obesity among children and adolescents has substantially increased in both developed and developing countries. Of the 38 developing countries with available trend data, 16 showed a rising trend in the prevalence of overweight from the earlier to the latest data points, while 14 showed no obvious changes and 8 showed a falling trend[1]. The similar increasing trend is also found in China[2]. Recent research indicated that the prevalence of obesity among children in urban China has reached the level of developed countries[3].

Studies indicated that the onset of obesity is the result of comprehensive factors including genetic, environmental and social factors. Considering it is difficult to explain the obesity epidemic as our genes have not changed substantially during the past two decades, this rapid increase suggests the role of environmental rather than genetic factors[4], although an interaction between gene and environment could be occurring. The energy balance equation is the key to understanding childhood obesity, especially the modifiable behaviors, such as diet, physical activity and inactivity. Television viewing is a major source of inactivity.

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Television viewing has been cited as one of the causes for increasing prevalence of obesity based on both longitudinal and cross-sectional observational studies in developed countries[5-8]. However, there is substantially less published information from developing countries, even less from China, on the relationship between television viewing time and pediatric obesity.

In order to explore the relationship of television viewing and childhood obesity, to provide scientific information for developing preventive strategy, the data from "A cross-sectional study of the eating practice of children in urban China" conducted in 2000 in four cities of China were used in this paper.

SUBJECTS AND METHODS

The children and adolescents were selected from four eastern cities of China (Guangzhou, Shanghai, Jinan and Harbin) using stratified multistage cluster random sampling method. Each city was divided into urban and suburban areas.

Questionnaire survey was used for collecting information on the eating practice of children including television viewing time. Questionnaires were designed for obtaining information from preschool children, elementary students, junior students and their respective parents. The questionnaire was interview-administered for children aged 4-8 years, self-administered for students older than 8 years of age, and all the parents.

The weight and height of the children were measured in the clinics of the investigated kindergartens or schools by trained investigators following the standardized procedure.

Overweight and obesity were defined as a weight-for-height exceeded 110% and 120% respectively of China standard for children aged 7-16 years, of the WHO reference for children aged 4-6.9 years because no national-wide representative weight-for-height standard of 4-6.9 years old children in China by now.

The subjects were divided into four groups by mean hours of television viewed daily as less than 1 h/d, 1-2 h/d, 2-3 h/d and more than 3 h/d. The proportions of the children and adolescents who watched television different times were calculated and the prevalence of obesity at different levels of reported television viewing was compared by x^2 tests. Logistic regression models were developed using the program SAS 6.12 to identify television viewing time characterizing obesity after adjustment for possible confounding and interactive effects. Factors examined were sex, age groups, domicile regions, domicile situation, income, educational levels of parents, breakfast frequency, fast food consumption frequency, desired body size by children and their parents, as well as television viewing hours. We computed adjusted differences and 95% confidence intervals from the regressions. All P-values were two-sided. A level $P<0.05$ was accepted as statistically significance.

RESULTS

Nine thousand three hundred and fifty-six Chinese children and adolescents including 4 570 boys and 4 786 girls aged 4-16 years were investigated. Information was obtained from 2 329 (24.9%) preschool children, 4 474 (47.8%) elementary students and 2 553 (27.3%) junior students.

The cross-sectional prevalence estimates of the number of hours of television viewing for Chinese children and adolescents aged 4-16 years are shown in Table 1. Overall, there were 32.5%, 46.0%, 15.4% and 6.1% of the children and adolescents who watched television less than 1 h, 1-2 h, 2-3 h and more than 3 h daily. More boys than girls watched more than 2 h

of television daily. The proportions of boys and girls who watched more than 2 h of television per day were 23.1% and 20.0%, respectively.

TABLE 1

Prevalence (per 100) of Daily Television Viewing Time Among Chinese Children and Adolescents

TV Time (Hours per Day)	Boy		Girl		Total	
	Freq.	CF	Freq.	CF	Freq.	CF
<1	30.7	30.7	34.2	34.2	32.5	32.5
1-2	46.2	76.9	45.8	80.0	46.0	78.5
2-3	16.4	93.3	14.5	94.5	15.4	93.9
>3	6.7	100.0	5.5	100.0	6.1	100.0

Note. TV Time: Television Viewing Time; Freq: Frequency; CF: Cumulative Frequency.

The association of obesity and television viewing time for Chinese children and adolescents is shown in Fig. 1. The prevalence of obesity increased as hours of television viewing increased. The prevalence of obesity among children and adolescents who watched television less than 1 h, 1-2 h, 2-3 h and more than 3 h daily was 10.9%, 11.8%, 13.2% and 15.1%, respectively. Obesity prevalence was highest among children and adolescents who reported watching television more than 3 h per day. Each additional hour of television watching per day increased about 1%-2% of obesity prevalence.

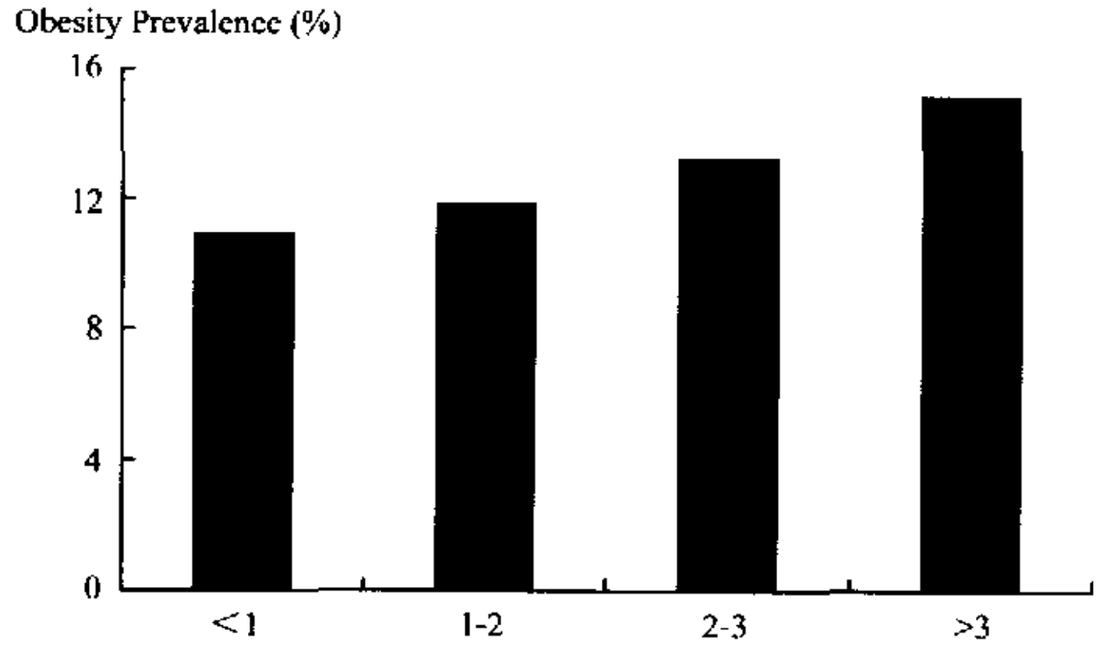

FIG. 1. Hours of Television Viewing per Day.

Table 2 shows the prevalence of obesity among boys and girls by hours of television viewing. There was an increasing trend of obesity as hours of television watching increased among both boys and girls, but the difference of obesity between different television viewing levels was significant only among girls, but not among boys. The prevalence of obesity among girls who watched television less than 1 h, 1-2 h, 2-3 h and more than 3 h per day was 7.8%, 8.9%, 11.4% and 15.1%, respectively.

A wide variety of control variables were introduced into the Logistic regression analysis to control their potential bias on the obesity. These variables included sex (male, female), age groups (preschool, elementary and junior students), domicile regions (urban, suburban), domicile situation (Northeast, East, Mid-South), income (domiciliary monthly *per capita* income in RMB distributed in three categories: low: less than RMB 293.20, middle: RMB

293.20-722.90, high: over RMB 722.90), education levels of parents, breakfast frequency (0-1 times/week, 2-4 times/week and 5-7 times/week), fast food consumption frequency (never, 3 times or less and more than 3 times monthly) and desired body size by children and their parents. The dependent variable was obesity (0=obesity, 1=not obesity). On the basis of Logistic analysis, there was a significant relationship between obesity and sex, age group, domicile regions, domicile situation, income, breakfast frequency and fast food consumption frequency, as well as television viewing time.

TABLE 2

Pediatric Overweight and Obesity Prevalence (%) by Hours of Television Viewing

TV Time	Boy			Girl			Total		
(Hours per Day)	OW	OB	OW+OB	OW	OB	OW+OB	OW	OB	OW+OB
<1	12.2	14.4	26.6	10.1	7.8	17.9	11.1	10.9	22.0
1-2	13.3	14.8	28.1	11.5	8.9	20.4	12.4	11.8	24.2
2-3	14.7	14.8	29.5	11.7	11.4	23.1	13.2	13.2	26.4
>3	13.4	15.1	28.5	11.2	15.1	26.3	12.4	15.1	27.5
χ^2		0.146	2.152		18.445	14.878		10.633	15.473
P		0.986	0.542		0.001	0.002		0.014	0.001

*Note.*OW: overweight; OB: Obesity; OW+OB: overweight and obesity.

Addition of all these control variables did little to alter the significance of the television-obesity relationship. Table 3 shows the Logistic regression coefficients and Odds Ratios of television viewing time for predicting obesity in children and adolescents. The estimated odds ratios relating obesity to television viewing in this regression changed little from the unadjusted estimates (Table 2). The adjusted odds of being obese were 1.253 (95% CI=1.031-1.523) times greater for children and adolescents watching 2-3 h of television per day and 1.398 (95% CI=1.075-1.819) times greater for those watching more than 3 h of television per day compared with those watching for 0-1 h. These odds ratios also showed a substantial dose-response relationship of television viewing hours. However, there was no significant difference of obesity between the children and adolescents whose reported television viewing time was less than 1 h and 1-2 h per day.

TABLE 3

Logistic Regression Coefficients and Odds Ratios of TV for Predicting Pediatric Obesity

Variable	*N*	Obesity[a] (%)	Parameter Estimate	*P*> Chi-square	OR（CI）Crude	OR（CI）Adjusted
TV Time						
<1	3012	10.9			1.000	1.000
1-2	4255	11.8	0.0971	0.2026	1.089(0.941-1.260)	1.102(0.949-1.279)
2-3	1427	13.2	0.2255	0.0237	1.233(1.019-1.490)	1.253(1.031-1.523)
>3	563	15.1	0.3353	0.0125	1.444(1.119-1.865)	1.398(1.075-1.819)

Note. TV Time: Television Viewing Time; OW: Overweight; OB: Obesity; [a]Obesity defined as a weight-for-height exceed 120% of the WHO reference for children aged 4–6.9 years old and exceed 120% of China standard for children aged 7–17 years old.

DISCUSSION

Next to sleeping, television watching occupies the greatest amount of leisure time during childhood[9]. The proportion of overtime television viewing was not same in different countries. Almost half of US children watched more than 2 h of television a day (48% of boys and 38% of girls)[10], while 31% of Turkey children spent at least 4 h a day watching television during weekday and 71.7% during weekend[11]. 20% of school age children watched more than 3 h daily in Chile[12] and 37% of Hong Kong children spent more than 4 h watching television on the survey day[13].

The proportion of reported watching 2 h or more of television per day was relatively lower among children and adolescents in urban China, which was 23.1% among boys and 20.0% among girls. But there is an increasing trend of the household year-end possession of televisions that increased annually and rapidly from 17.2 in 1985 to 111.6 in 1999 per 100 urban households[14]. At the same time, the prevalence of obesity has increased rapidly in the last 10 years with 9.1% yearly average increase rate of Chinese children[2], and the prevalence of obesity of Chinese students also increased two to three times between 1985 and 1995[15].

We found that the amount of television viewing was related to obesity of Chinese children and adolescents in this cross-sectional study, this result was coincided with other studies. Dietz and Gortmaker[5] reported that the amount of television viewing has also been related to obesity in both cross-sectional and longitudinal investigations and this result was repeated in 1996[7]. Andersen also reported that boys and girls watch 4 or more hours of television each day had greater body fat and a greater body mass index than those who watched less than 2 h per day recently[16].

Little is known about the way in which television viewing affects the obesity prevalence. Firstly, television viewing may reduce energy expenditure from displacement of physical activity. Energy expenditure may be reduced because watching television requires no energy in excess of resting metabolic rate, and it may reduce the time spent in more energy-expensive activities[17]. Secondly, overtime television viewing may increase dietary energy intake, either during viewing or as a result of food advertisement. Television viewing is associated with between-meal snacking of children, the consumption of food advertised on television[18,19] and the children's attempts to influence their mothers' food purchases[20-22]. But the food most heavily advertised on children's television, and more likely to be consumed by children watching increased amounts of television, are calorically dense foods and the proportion of advertised foods higher in sugar, fat and salt has barely changed since 1978[23].

Simillar as our finding, Crespo[10] indicated that a higher prevalence of obesity was significantly associated with higher television watching among girls after adjusting several correlates (e.g., age, race/ethnicity, family income, energy intake, physical activity). By same data (NHANES III), Crespo[10] found that energy intake has a tendency to increase with increased television watching, with girls consuming on average an extra 732.2kj (175 kcal) a day when comparing those watching 1 h or less of television with those 5 or more hours a day.

A limitation of our study is only cross-sectional data available, which step our conclusion of a cause association between television viewing and child obesity because excess adiposity in a child may be attributable to the effects of poor dietary and activity patterns cumulating over years before data collection. However, this cause association had

been proved by the data and studies in US[5,7].

As the adverse outcomes including obesity of exposing to television, the American Academy of Pediatrics[24] recommends that parents should "limit and focus time spent viewing television of children to less than 1-2 h per day", "participate in the selection of programs to be viewed by children" and "avoid using the television as an "electric babysitter"".

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