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The Relationship between TV Viewing and Food Intake and BMI in Preschool Children

Naser Kalantari¹, Saeid Doaei^{2*}, Hanieh Malmir³, Atefeh Aminifard⁴
and Maryam Gholamalizadeh⁵

¹Department of Community Nutrition, National Nutrition and Food Technology Research Institute, Faculty of Nutrition Sciences and Food Technology, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

²Students' Research Committee, National Nutrition and Food Technology Research Institute, Faculty of Nutrition Sciences and Food Technology, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

³Faculty of Nutrition Sciences, Tehran University of Medical Sciences, Tehran, Iran.

⁴Food Sciences and Industry, Khouzestan Sciences and Research Branch, Islamic Azad University, Khouzestan, Iran.

⁵Research Center of Natural Product Safety and Medicinal Plants, North Khorasan University of Medical Sciences, Bojnurd, Iran.

Authors' contributions

This work was carried out in collaboration between all authors. Authors NK and SD designed the study and wrote the protocol. Authors AA and MG wrote the first draft of the manuscript. Author HM managed the literature searches and analyses of the study. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/BJMMR/2016/24970

Editor(s):

(1) Toru Watanabe, Department of Pediatrics, Niigata City General Hospital, Japan.

Reviewers:

(1) Anonymous, Canada.

(2) Danielle Cristina Guimarães da Silva, Universidade Federal de Viçosa, Viçosa, Brazil.

Complete Peer review History: <http://sciencedomain.org/review-history/13887>

Original Research Article

Received 10th February 2016

Accepted 14th March 2016

Published 28th March 2016

ABSTRACT

Background: Considerable attention is currently being paid to childhood nutrition. Mass media, particularly television (TV), is believed to largely contribute to eating habits and Body mass index (BMI). This study was carried out to identify the relation between tendency towards TV viewing and its influence on children with food intake and BMI in pre-school kids.

*Corresponding author: E-mail: sdoaei@sbmu.ac.ir;

Methodology: The survey was conducted using a cross-sectional design, in which 114 children aged 2-6 yrs from 11 selected nursery schools were included. Regarding data collection related to TV viewing rate and influence rate of TV viewing from parents' viewpoint, a valid and reliable questionnaire was used. To collect data about children's diets intake, a food frequency questionnaire (FFQ) was applied. Face-to-face meetings and interviews with the parents were held. Height and weights of children were measured using a measuring tape and a digital weight scale. Data were analyzed using Pearson correlation coefficient and analysis of variance (ANOVA) statistical tests by SPSS software.

Results: It turned out that consumption rate of some food groups including meats & alternatives ($p=0.008$), sugars ($p=0.013$) and snacks & desserts ($p=0.011$) were higher in children who spend more time watching TV. In addition, Intake of cereals and breads appeared to be higher in children with strong desire for TV food ads ($p=0.019$). It was also revealed that influence rate of TV viewing and fats intake were positively correlated ($p=0.017$). No significant relationship was revealed between TV viewing rate and BMI in children

Conclusion: It can be concluded that tendency of preschool children to TV is positively related with some food groups intake and consumption of low nutritional-value foods.

Keywords: Television viewing; body mass index; dietary intake; children.

1. INTRODUCTION

Childhood is considered to be the most important period of life in which the main character qualities of individuals are formed and from which lots of fixed habits and behaviors such as eating habits in adulthood are descended [1,2]. In fact, provided that children are educated proper eating habits, they will have healthier diets and less risk of weight-related chronic disorders such as obesity, diabetes, high blood pressure, metabolic syndrome, as well as cardio-vascular diseases in adulthood [3,4]. Additionally, increased body weight in childhood is regarded as a strong predictive factor for adulthood obesity [5]. Eating habits development begins at the age of 2-3 yrs and will be fixed at 12 [6]. Several environmental factors such as family, friends, nursery and primary schools, and mass media can be addressed as influential causes for eating habits and behaviors [7,8]. Television is the most popular mass media in Iran. Based on some previous studies, Iranian children aged 5-10 yrs, on average, watch 4 h/9 min of TV, which is considered to be much higher than screen-time exposure recommended by World Health Organization (WHO) [9]. The amount of TV viewing has increased over the last decades, paving the way for the prevalence of childhood obesity [10]. Moreover, it is believed that much TV viewing result in reduced physical activity, increased non-nutritious and energy-dense food consumption, increased sense of starvation, and low-quality diet intake [11-13]. A TV in the child's bedroom is an even stronger marker of increased risk of being overweight [14]. There are 20-30 commercials on TV per hour, so a child whose

mean TV watching is 4 hours, may be exposed to 80-120, 900, and 45000 of them daily, weekly, and annually respectively of them [7]. At the time of TV programs for children and adolescents, these TV ads mainly focus on junk foods and snacks such as potato chips, sugar-contained beverage and juices, chocolate, fast food like sausages, hamburger and pizza, fat-rich food and pickles leading to adverse eating habits in them [15].

According to statistics released by WHO, 7.6% of children in the world suffer from obesity and overweight [16]. In addition, based on figures reported by Iranian ministry of health, 4-7% children in rural areas and 15-20% in urban areas gain excess weight in the country [17] and fatness is estimated to have doubled over the last decade [18]. With regard to the impact of obesity and overweight on children physical and mental health and wellbeing and relevant consequences such as anxiety, educational failure, depression, low self-confidence, some cardio-vascular diseases and cancers, it is required to administer some preventive strategies like eating habits modification. Surveys conducted in the country have focused largely on investigating a relation between TV viewing with diet pattern and body weight of children. However, no study has been carried out to investigate the association between TV program contents and influence rate of TV viewing with food groups intake and body mass index (BMI).

The present study is to investigate the association of influence rate of TV viewing from parents' viewpoint and TV viewing rate as well as

TV program contents on diet intake and BMI in children aged 2-6 yrs coming from some nursery school in Tehran.

2. MATERIALS AND METHODS

The survey was conducted using a cross-sectional design in the summer of 2014. Employing cluster random sampling technique, 114 children aged 2-6 yrs from 11 selected nursery schools in Tehran were selected by cluster randomized sampling. In a briefing meeting, the school principals were explained about the purpose and the advantages of survey before the study began. In six of the nursery schools, face-to-face meetings and interviews with the parents were held to fill in food frequency questionnaire (FFQ). In these meetings, some other questionnaires including general information and TV viewing were filled out by parents and they signed an informed consent. In five schools, face-to-face interview was not conducted, so the questionnaires were presented to the parents and returned through the school principals. Then, through phone interviews with parents, the FFQ were completed.

Height was measured using a measuring tape established on the wall, whose values recorded to the nearest 0.5 cm. Weight was measured with light wearing garments by a digital weight scale (BF66 Beurer-Germany) to the nearest 100 gr. To gather the data related to child birth weight, child's age, mother's age and height, mother's employment, parents' literacy, accommodation status as well as family's income, the general information questionnaire was employed. Regarding data collection referring TV viewing rate and influence rate of TV viewing from parents' viewpoint, a questionnaire which had been already approved in terms of validation and reliability was used. In order to estimate the validity, a content and structure assessment was applied and also a test-retest method and kappa correlation coefficient was used to assess the reliability [19]. The questionnaire consisted of 11 questions, focusing on the influence rate of TV viewing from parents' viewpoint and TV viewing rate. All subtests were measured with rating scale approach using Likert Scale, ranging from Very "Low" to Very "Much". The rate below score 3, score 3 and above score 3 are considered low, medium and high respectively, in terms of influence rate of TV viewing from parents' viewpoint and TV viewing rate. To collect data related to children's diets, a

food frequency questionnaire (FFQ) which had already been developed and validated in Iran was used [20].

The questionnaire contained 168 food ingredients, and consumption of each was reported daily, weekly and monthly. These ingredients are classified into 17 food groups including whole cereal grains, processed cereal grains, pulses, meats, dairy products, vegetables, fruits, nuts & kernels, hydrogenated fats, oils, sugars, honey & jams, beverages, snacks & desserts, tea & coffee and pickles. In the study, food items were allocated to 9 food groups including cereals & breads, meats & alternatives, dairy products, fruits, vegetables, simple sugars, snacks & desserts, fats and beverages. Feeding guide published in a book entitled "Krause's Food and the Nutrition Care Process" was applied as the reference for appropriate consumption of each food group [21]. Data were analyzed using Pearson correlation coefficient and analysis of variance (ANOVA) statistical tests by SPSS (version 21) and the level of significance was set at $p \leq 0.05$.

3. RESULTS

The findings obtained from demographic data and social characteristics showed that children age was between 2.3 and 6.9 yrs. Most of the mothers were housewives, married and had academic education at the time of conducting survey and their BMI were higher than the normal. None of them smoked cigarette. Most of the families participating in the survey came from middle-class and affluent backgrounds. The general characteristics of children and their families are shown in Table 1. To determine the values related to influence rate of TV viewing from parents' viewpoint, mean scores of each sub-test was calculated. Table 2 suggests that TV viewing rate and influence rate of TV viewing from parents' viewpoint turned out high and medium respectively.

In addition, the average rate of TV viewing in children was estimated to be 2 h/47 m (+ 1 h/35 m) and the most popular programs were kids' series and cartoons (n=111), TV ads (n=62), films and TV series (n=55). Moreover, it appeared that intake of vegetable group was lower than recommended rate (3 units/d) in half of the children (Table 3). It also points out that fruits, meats and dairy products were consumed about 25% less than recommended rates.

(2 units/d for fruits and meats and 3 units/d for dairy products). However, fats and simple sugars, snacks & desserts and beverages intake turned out to be 50%, 50%, 25% and 25% higher than the permitted level. Relationship between children TV viewing rate and influence rate of TV viewing from parents' viewpoint with intake of

food groups and BMI was analyzed using Pearson correlation and analysis of variance (ANOVA) adjusted for all potential confounders (Parent's occupation, education levels, BMI, income, marriage and their consent to child TV viewing). The results are displayed in Tables 4 and 5.

Table 1. General characteristics and social factors related to children and their families

Variable	Count (percent)	Variable	Count (percent)	Variable	Mean $\pm$ standard deviation
Mother's educational status		Family's income		Child's age (year)	4.39 $\pm$ 1.01
Lower than diploma	6(5.3)	Less than 10 million Rials	2(17.5)	Birth weight (kg)	3.29 $\pm$ 0.39
Diploma	34(29.8)	Between 1 and 2 million Rials	67(58.8)	Child's BMI	1.77 $\pm$ 15.37
Higher than diploma	74(64.9)	Over 2 million Rials	27(23.7)	Mother's age	32.28 $\pm$ 5.96
Father's educational status		Child gender		Mother's weight	66.46 $\pm$ 10.37
Lower than diploma	9(7.9)	Girls	71(63.3)	Mother's height	161.97 $\pm$ 6.05
Diploma	30(29.8)	Boys	43(37/3)	Mother's BMI	25.48 $\pm$ 3.99
Higher than diploma	75(65.8)	Mother's marital status			
Mother's employment status		Married	114(100)		
Housewife	84(73.7)	Single parent	0(0)		
Employee	30(26.3)				

Table 2. Rate and tendency of children towards different TV programs

Variable	Count (percent)	Variable	Count (percent)	Variable	Standard deviation $\pm$ mean
TV viewing rate		Children's popular programs (third choice)		TV viewing rate from parents' viewpoint	3.29 $\pm$ 0.66
Less than 2 hours	42(36.8)	Films and TV series	32(28.1)	Influence rate of TV viewing (parents' viewpoint)	2.64 $\pm$ 0.49
More than 2 hours	72(63.2)	TV ads	10(8.8)		
Children's popular programs (First choice)		Science programs	6(5.3)		
Kids' series and cartoons	109(95.6)	Cd and DVD cartoon	4(3.5)		
TV ads	5(4.4)	kids' series and cartoons	1(0.9)		
Children's popular programs (second choice)		Unanswered	58(50.9)		
TV ads	50(43.9)				
Films and TV series	23(20.2)				
Science programs	8(7)				
Cd and DVD cartoon	1(0.9)				
Unanswered	32(28.1)				

Table 3. Children's intake of different food groups

Intake of different food groups	N (%)	Intake of different food groups	N (%)
Fats		Bread and cereals	
Less than 3 unit/d	64(56.1)	Less than required rate(3unit/d)	40(35.1)
More or equal to 3 unit/d	50(43.9)	More or equal to 3 unit/d	74(64.9)
Sugars		Dairy products	
Less than 2 unit/d	46(40.4)	Less than required rate(3unit/d)	21(18.4)
More or equal 2 unit/d	68(59.6)	More or equal to 3 unit/d	93(81.6)
Snacks & Desserts		Meats	
Less than 2 unit/d	75(65.8)	Less than 2unit/d	28(24.6)
More or equal to 2 unit/d	39(34.2)	More or equal to 2 unit/d	86(75.4)
Beverages		Vegetables	
Less than 1 unit/w	76(65.8)	Less than 3unit/d	49(43)
More or equal to 1 unit/w	38(33.3)	More or equal to 3 unit/d	65(57)
		Fruits	
		Less 2unit/d	22(19.3)
		More or equal to 2 unit/d	92(80.7)

Table 4. Association of children food intake and BMI with tendency towards different TV programs using analysis of variance (ANOVA)

	Cereals	Meats	Dairy products	Fruits	Vegetables	Sugars	Snacks & Desserts	Fats	Beverages	BMI
Interested in cartoon	0.607	0.074	1.315	0.548	0.275	0.279	1.570	0.242	0.247	0.972
Interested in films and TV series	0.129	0.527	1.659	0.076	0.095	1.039	0.445	2.025	1.165	1.074
Interested in TV ads	5.630*	0.370	0.397	0.627	0.120	0.070	1.599	0.017	0.589	0/002*
Interested in to sport programs	2.076	0.488	0.358	0.355	1.347	0.256	0.152	0.089	0.005	0.02
Interested in Science programs	0.738	1.312	0.266	0.787	0.003	0.013	0.141	0.360	0.334	1.386

**P<0.05; *p<0.01

Table 5. Relationship between food intake and BMI with TV viewing rate and influence rate of TV viewing (parents' viewpoint) using Pearson correlation coefficient

	Cereals	Meats	Dairy products	Fruits	Vegetables	Sugars	Snacks & desserts	Fats	Beverages	BMI
TV viewing rate	0.127	0.246 **	-0.036	0.159	0.084	0.233*	0.221 *	0.153	0.118	0.012
Influence rate of TV viewing (parents' viewpoint)	-0.04	0.036	0.102	0.14	0.111	0.035	0.101	0.225*	0.007	0.009

P<0.05*; **p<0.01

The results showed that TV viewing rate in boys was higher than girls (2.9 ± 1.58 Vs 2.71 ± 0.59), but girls were influenced by TV viewing more than boys (2.71 ± 0.49 Vs 2.54 ± 0.49) from parents' viewpoint. Higher TV viewing rate in children resulted in higher consumption of meats ($p=0.008$), sugars ($p=0.013$) and snacks & desserts ($p=0.011$). In addition, Intake of cereals and breads appeared to be higher in children with strong desire for TV food ads ($p=0.019$). Regarding influence rate of TV viewing from parents' viewpoint, children who were more likely to be affected, showed higher intake of fats ($p=0.017$). However, no significant relationship was revealed between TV viewing rate and BMI in children ($p=0.09$). Finally, desire for TV advertising appeared to be positively correlated with BMI ($p=0.021$). Gender was not found to be a factor of significant impact on findings using ANOVA.

4. DISCUSSION

The findings of this study suggest that there is an association between TV viewing and influence rate of TV viewing with food intake and in children. Examination of the children diets indicated that consumption of vegetables (43%), fruits (19.3%), meats (24.6%), dairy products (18.4%) and cereals (35.1%) were less than the relevant recommended levels and Intake of cereals and breads appeared to be higher in children with strong desire for TV food ads. In other studies, there were less reports about lower intake of vegetables, fruits and cereals and more reports about lower intake of dairy products and meats than recommended values. Further, intake of fats, sugars, snacks & desserts and beverages were 43.2%, 59.6%, 34.2% and 33.3% respectively, exceeding the relevant permitted levels [22,23]. According to the study conducted by Millar et al. [23]. It was revealed that children, on average, receive higher amount of these foods than permitted levels. It also suggests that as children get older, they receive more fat-rich food and less sweetened food. It is in correspondence with the study by Towers et al. [24]. Also, introducing kids and cartoons, advertising as well as films and TV series as the most popular TV programs for children, was similar to findings of a study about how children and adolescents use media by Sepasgar [25].

Further, time increase in TV viewing contributed to higher intake of meats (mostly in form of the alternatives like sausages, hamburger, pizza), sugars and snacks & desserts groups, which was

confirmed by some studies [26,27]. A positive relation between the variables was reported by wake et al. [28] and several other studies [29-31]. The difference between the results can be due to the difference in the age range of children studied, because in the other studies, children over 6 years old were taken into consideration. It appeared that enthusiasm for different TV programs can affect food intake in children. As mentioned before, there is a relation between interest in watching TV advertising and increase in cereals intake. In addition, meats intake in children interested in TV advertising was higher than uninterested ones (2.31 ± 3.61 Vs 2.02 ± 3.36), but it was not statistically significant ($p=0.544$) and as sausages, hamburgers and pizza are classified in meat group, this relation is significant. Ka et al reported that watching TV advertising can lead to 6% increase in meats consumption [32]. Mean fruits intake in children interested in TV scientific programs appeared to be higher compared with uninterested ones (4.48 ± 4.06 Vs 1.62 ± 3.51), but not statistically significant ($p=0.377$). However, an inverse relationship between fruits intake with TV viewing was reported by Matheson et al. [33]. The difference can be caused by the contents of scientific programs. Moreover, the results suggest that snacks & desserts intake was positively affected by desire for films and TV series viewing (1.39 ± 2.01 Vs 2.07 ± 1.79), but the relation was not significant ($p=0.506$), which is similar to the results of other studies. It is also achieved from the findings that influence rate of TV viewing and fats intake were positively correlated ($p=0.017$), which is confirmed by previous studies [34].

Further, in current study, desire for TV advertising and BMI in children were related together ($p=0.021$), which is consistent with other studies (12-14). No relationship was found between TV viewing time and BMI and this corresponds to the result reported by Shannon et al. [35].

5. LIMITATIONS

The findings of this study are based on cross-sectional data, and a important avenue for future research will be to replicate these studies with causal structures using longitudinal data.

6. CONCLUSION

It can be concluded that tendency of preschool children to TV is positively related with some

food groups intake and consumption of low nutritional-value foods. Also, curbing screen-time exposure, particularly advertising, can be taken into consideration as an approach to improve eating habits and to alleviate the prevalence of overweight and obesity in children.

CONSENT

All authors declare that written informed consent was obtained from the subjects for publication of this paper.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

ACKNOWLEDGEMENTS

This work was supported by the Student's Research Committee of Shahid Beheshti University of Medical Sciences, Iran (grant number 5588).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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