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Television viewing and body fat distribution among Bengali school children of Kolkata, India

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Abstract

Background Childhood obesity is considered as a major concern since a couple of decades. The increasing prevalence of childhood obesity is clear and concerns about the future health impact of childhood obesity are currently well documented. Low level of physical activity, high quantity of fat rich junk food consumption and prolonged leisure time with television (TV) viewing were reported to be significantly associated with obesity.

Objective The present study aims to evaluate the association of body fat distribution with television watching among school going Bengali children of Kolkata, India.

Sample and Methods 200 girls (aged 10–15 years) from a very heterogeneous background were selected from one state school. Data on socio-demographic aspects, TV viewing, computer use, physical activity and dietary pattern were collected by pretested questionnaire after obtaining prior consent from competent persons. Anthropometric measurements were taken following standard techniques.

Results Most of the participants preferred fat rich junk food and a few practice regular exercises. One-way ANOVA showed significant differences of body mass index (BMI), waist circumference (WC) and mid upper arm circumference (MUAC) between groups depending on the duration of TV viewing. The adiposity related variables were standardized by standard deviation score before the inferential analyses. Adjusted multiple linear regression showed positive effects of the duration of TV viewing on BMI (R^2=0.233) and MUAC (R^2=0.277).

Conclusion: Irrespective of economic status, prolonged television watching leads to an adverse body fat distribution among teenage girls of Kolkata.

Take-home message for students Prolonged TV viewing and computer use leads to adverse body fat distribution and may affect the health of children. Regular physical exercise and consuming a balanced diet should be added to one's lifestyle, to lead a healthy and prosperous life in future.

Introduction

The increasing prevalence of childhood obesity is of concern because of its ill-effect on life quality as they grow older and as it is likely to increase future health care costs. Overweight and obesity in children as well as in adolescents have been considered as a public health problem in the global perspective. Some 340 million children and adolescents (5–19 years) were overweight in 2016 and the prevalence is increasing continuously (WHO, 2022). The White House Task Force on Childhood Obesity Report (WHTFCOR, 2011) to the President depicted that the childhood obesity epidemic in the USA is a national health crisis as one in three children (31.7%) aged 2–19 years is overweight or obese. The report also stated that childhood obesity is more common among certain ethnic groups; obesity rates are highest among non-Hispanic Black girls and Hispanic boys, obesity is particularly common among American Indian children (WHTFCOR, 2011). Since the late 1970s to the early 21st century, the prevalence of childhood obesity has been doubled in preschool children aged 2 to 5 years and in adolescents aged 12 to 19 years, and it is three times higher for the children aged 6 to 11 years (Desrochers and Holt, 2007). Children who ate fast food consumed more total energy, fat, added sugars, and sugar-sweetened beverages, and less milk, fruits and vegetables, than those who did not, and showed higher deposition of body fat (Bowman et al., 2004). Dietary patterns and physical activity levels that contribute to the development of obesity often track into adulthood, particularly among children who are obese during adolescence. The recent increase in childhood obesity has received a great deal of attention in the scientific and popular press and has been attributed partly to food that children eat away from home (mainly fast food) and partly to television (TV) viewing (You and Nayga, 2005). In the UK, increasing hours of television viewing have been shown to strongly depend on the social class. Children and adolescents from the lower social classes view more hours of television per week and show an increased prevalence of obesity (Jago et al., 2005). A number of studies suggested a positive correlation between television viewing and children's poor eating behavior (Giammattei et al., 2003; Halford et al., 2004). The Colorado State University conducted a study among the children pertaining to cartoon viewing and food intake which ended with an interesting conclusion: that the children are consuming fat-rich and high calorie food to become as healthy as their favorite cartoon character the children tended to eat more candy after watching cartoons with an overweight cartoon character (Campbell et al., 2016). Maccoby (Maccoby, 1951) reported that television viewing has increased and leads to a steady decline in regular physical activity and undesirable levels of sedentariness among US children. A study conducted among Korean school children showed higher prevalence of obesity among girls who watch more television than their peers (Toyran et al., 2002). The association of prolonged television watching with an adverse obesity profile was shown in many studies and is supposed to be interceded by less physical activity, increased consumption of unhealthy food while watching TV, and exposure to advertisements of unhealthy food (Hingle and Kunkel, 2012; Jordan, 2010; Lipsky and Iannotti, 2012).

Few studies from India have shown the positive relationship between television watching and an adverse obesity profile among children and adolescents. Television viewing alters the child's intake of food in ways that are not adequately reflected by total energy intake or percent of calories from fat (Kapil and Bhado-

ria, 2014). Television viewing can affect a child's body fat change as it relates to physical activity levels and dietary habits. More leisure time devoted to television viewing compromises the time normally available for other activities. Average daily TV/video watching time reflects the child's life style since TV time replaces the child's active exercise time. Prolonged television viewing was associated with increased body fat among the children and adolescents of Bangalore city (Kuriyan et al., 2007).
The above brief literature review is indicative of the fact that low energy expenditure, high calorie fast food intake and prolonged periods of television watching are major causes for body fat accumulation in children and adolescents throughout the world. India is not an exception. Yet, the association between leisure time, television viewing, computer use and body fat distribution and obesity among the children and adolescents has rarely been evaluated in the Indian population. The present study conducted among Bengali Hindu School girls of Kolkata tried to reveal the association between the economic status of the family and the body fat distribution.

Sample and Methods

Study area and participants

Data were collected during the winter season (December, 2017 to January, 2018) from students of the Buniadi Bidyapith Girls School in Kolkata, West Bengal, India. The school was chosen as it is run by the Government of West Bengal, with students from a very heterogeneous economic background. Moreover, the collector of the data was an alumnus of this school which helped her to make the initial rapport and to facilitate logistic support. Initially, all 213 girls (aged 10 – 15 years), from grade 5 to grade 9, were approached to participate in the study. The participation of 13 girls had to be cancelled as they either reported menstrual disorders or withdraw participation due to some unavoidable circumstances.

Ethical issues

The data were collected after taking verbal consent from the study participants. The Head Mistress of the said school was approached with a formal letter and with her kind permission the data were collected from the school premises without hampering the regular class. The parents of the students were informed about the study and permission from them was obtained.

Data type

A pre-tested questionnaire schedule was used to collect data on the socio-demographic status, television viewing and computer use, duration of private tuition class, physical activities, and dietary practices. The data on age at menarche was also collected, as menarcheal status might be associated with body fat distribution. The educational status of the parents of the study participants was categorized as "up to primary" (up to 4th class and "above primary" (above 4th class). The occupational status of the parents was categorized as: own account small business, service, housewife and others (taxi driver, tailor, carpenter, mason, governess and domestic help). Information on monthly income and expenses was obtained by questionnaire. Physical activity was categorized in two divisions: practicing at least one form of sport (e.g. jogging and running, swimming, dancing, gymnastics and karate) or no sports. Information on the consumption of different homemade and out of

home food items was obtained by a food frequency checklist. The duration of television watching, computer use and tuition classes along with favorite TV programs was recorded on an hourly basis. Anthropometric measurements were taken following Lohman et al. (1988). Height and weight were measured to the nearest 1cm and 100g, respectively, with the help of Martin's anthropometer and weighing scale. Circumferences were taken at mid upper arm (MUAC), waist (WC) and hip (HC) with the help of a non-elastic tape. Skinfold thickness measurements at biceps (BSF), triceps (TSF) and subscapular (SSSF) were taken with a Holtain skinfold caliper. While taking the measurements, the study participants wore light clothes and remained bare footed. BMI was calculated by dividing the weight (in kg) of an individual by her height squared (m^2), Waist-to-Hip Ratio (WHR) was derived by dividing minimum WC (cm) by HC (cm), centripetal fat ratio (CPFR) was calculated by dividing TSF (mm) by the sum of TSF and SSSF (mm) and sub-scapular tricep skinfold ratio (STSR) was derived by dividing SSSF by TSF.

Statistical Analyses

Descriptive statistics (mean+SD) were calculated for continuous and percentages for discrete variables. One-way ANOVA was performed to test differences of the mean values between the categories of television viewing for significance. Before the inferential analyses, we standardized the obesity related variables by using standard deviation scores. Correlation coefficients were derived to find the relationship between adiposity related variables with hours spent for television viewing and computer use, and family income. Adjusted linear multiple regression analysis was performed to detect significant confounding variable(s) for each adiposity related variable. All statistical analyses were performed using SPSS 16.0 software. The level of significance was set at $p<0.05$ level.

Results

Table 1 characterizes the study participants and their socio-demographic profile. The mean income and expenditure were Rs 6958.75 (US$ 84.31) and Rs 4325.00, respectively. Age at menarche and standard deviation of age at menarche were 11.32±2.11 years, respectively.

Table 2 shows the frequency of consumption of different food items, both in home and out of home, on a daily, weekly and monthly basis. The overwhelming majority of the girls consumed rice or bread (ruti in local term) as the principal staple food. While daily consumption of vegetables was found among 80% of the study participants, consumption of butter/ghee was only found among 36% of the girls. The majority of the girls drank milk on a daily basis. 36% of the study participants reported on out of home pastries or cakes on a daily basis, followed by deep fried oily food and soft drinks.

Table 3 shows different activities of the study participants pertaining to academics and physical exercise. The majority of the participants did not physically exercise. Only about 25% of the girls practiced at least one form of sports, like swimming, dancing, gymnastics, and so on, on a regular basis. Television watching was very common irrespective of the day of the week. The majority of the participants was using computers and attended private tuition classes for one to two hours on a regular basis.

Table 4 shows the frequency of watching different channels/programs of television. Regional Bengali programs were watched by most of all participants (81.0%). Some cartoon channels were also overwhelmingly viewed.

Table 5 depicts the descriptive statistics of adiposity related variables. The mean value

Table 1 The socio-demographic profile of the study participants (n=200)

Variable	Mean		Standard Deviation	
Age of the participants	12.57		±1.33	
Age at menarche	11.32		±2.11	
Family income	6958.75		±6060.90	
Family expenditure	4325.00		±3371.74	
Educational and occupational status of the parents				
Variable	Father		Mother	
	n	%	N	%
Up to primary	57	28.50	146	73.00
Above primary	143	71.50	54	27.00
Business	51	25.50	2	1.00
Service	83	41.50	6	3.00
Others	66	33.00	5	2.50
Housewife	-	-	187	93.50

Table 2 Prevalence (%) of consumption of food items (n=200)

Out of home				Homemade			
Food item	Daily	Weekly	Monthly	Food item	Daily	Weekly	Monthly
Cake-pastry	27.71	48.19	19.87	Rice/bread	95.89	25.12	25.12
Egg roll	6.62	63.85	27.71	Vegetables/fruits	79.89	16.84	3.26
Momo	9.15	45.07	37.32	Fish	53.80	42.93	3.26
Oily food	21.47	65.10	11.40	Egg	39.24	58.06	2.68
Soft drinks	14.51	42.74	42.74	Chicken	6.87	80.42	12.69
Noodles	11.76	69.41	18.82	Butter/Ghee	36.02	50.00	13.97
				Mutton	-	55.14	38.97
				Milk	85.50	12.23	-

Table 3 Time spent in different activities on weekdays and holidays (n=200)

Time spent (in hours)	Computer		TV viewing		Private tuition		Physical exercise	
	W#	H$	W	H	W	H	W	H
0	17.0	92.5	1.0	3.5	47.0	50.8	75.5	75.5
< 1	71.0	4.0	40.0	13.5	19.0	17.3	13.4	10.3
1-2	9.5	2.0	51.0	59.0	19.0	26.9	6.6	8.5
3-5	2.5	1.0	4.0	10.0	14.5	3.6	3.0	2.2
> 5	-	0.5	4.0	14.0	0.5	1.5	1.5	3.5

Weekdays; $ Holidays

of BMI was 18.61 kg/m2, while that of WHR was 0.86. The mean value of MUAC was just below 23cm.

Table 6 shows the result of one-way ANOVA of different adiposity related variables. The mean values of all the variables were highest among individuals who spent more than 5 hours viewing television. Significant differences were found for MUAC, WC and BMI.

Table 7 shows the correlation matrix of different adiposity related variables and confounding variables. BMI, MUAC, CPFR and STSR showed a significant correlation with TV viewing. None of the adiposity related variables showed any significant correlation with time spent for computer use. BMI was significantly correlated ($p<0.05$) with family income.

Multiple linear regression analysis was separately performed using BMI, MUAC, WHR, CPFR and STSR as dependent variables. For each analysis, family income, age at menarche, and different activity related variables were used as independent variables.

Table 4 Preference of television programs (n=200)

Name of the programme	%
Nick	65.0
Pogo	77.5
Disney	63.5
Sonic	27.5
Cartoon network	76.0
Discovery	70.0
Animal planet	71.5
Animax	17.5
Animated programmes	25.0
Reality shows	42.5
National geography	38.5
Hindi programmes	79.0
Bengali programmes	81.0

Table 5 Descriptive statistics of anthropometric and adiposity related variables (n=200)

Variable	Mean	Standard Deviation (±)
Height (cm)	146.15	7.63
Weight (kg)	40.06	9.30
MUAC (cm)	22.95	2.97
WC (cm)	61.23	9.45
HC (cm)	71.40	8.69
Biceps skinfold (mm)	11.28	3.32
Triceps skinfold (mm)	14.06	4.30
Sub-scapular skinfold (mm)	14.30	4.80
WHR	0.86	0.08
BMI (Kg/m^2)	18.61	3.41
Centripetal fat ratio	0.49	0.04
Subscapular triceps skinfold ratio	1.02	0.16

Table 8 depicts the result of the multiple regression analysis using z-score values of BMI and MUAC, separately as dependent and other confounding variables as independent. Only television viewing was found to significantly predict BMI (β=0.403; $p<0.01$) and MUAC (β=0.289; $p<0.05$). The other regression analyses failed to reach significance and are not shown.

Discussion

The process of modernization has brought many positive changes in lifestyle lead-

Table 6 Results of one-way ANOVA of adiposity related variables as dependent and hours of watching television as group variable

Variable	Watching television (in hours)				F
	<2	2-3	4-5	>5	
MUAC	22.074	22.687	23.677	24.875	2.76*
WC	59.559	62.520	60.256	70.150	2.86*
WHR	0.8583	0.8592	0.8362	0.9372	1.00
BMI	17.9697	19.0483	18.7421	21.0375	2.87*
CPFR	0.5021	0.4937	0.5049	0.4886	0.93
STSR	1.00	1.01	0.99	1.03	0.91

* Significant at $p<0.05$ level

Table 7 Pearson correlation matrix of different adiposity related variables and other confounding variables

Variable	Computer use	TV viewing	Family income
MUAC	-0.006	0.151*	0.101
WC	0.029	0.120	0.054
WHR	0.060	-0.006	-0.032
BMI	0.018	0.142*	0.143*
CPFR	0.118	0.162*	-0.047
STSR	0.095	0.173*	0.053

* Significant at $p<0.05$ level

Table 8 Result of linear regression analysis using BMI and MUAC separately as dependent and other confounding variables as independent variables

Independent variable	BMI			MUAC		
	B		p-value	B		p-value
(Constant)	13.654		.000	18.134		.000
Family income	2.750E-5	0.112	0.224	8.118E-6	0.089	0.412
Time spent in television viewing	1.858	0.403	0.002	1.254	0.289	0.021
Time spent in computer use	0.748	0.195	0.079	0.816	0.196	0.146
Total hours in physical exercise	0.011	0.012	0.912	0.009	0.005	0.892
Age at menarche	0.022	0.028	0.581	0.029	0.056	0.698
R2		0.233			0.277	

ing to considerable improvements in the standard of living. Contrarily, modernization is also associated with undesirable effects on lifestyle such as decreased physical activity and increased sedentary work. Children are increasingly exposed to integrated marketing communication activities that include television and print advertisements, product placements, sales promotions, packaging designs, public relations, in-school marketing and advergames (Desrochers and Holt, 2007). All of the aforesaid issues predominantly affect the health of the children.

Concerns regarding children's responses to television have traditionally and almost exclusively been focused on television content. In the developing countries, like India, the prevalence of child obesity and an adverse body fat profile are steadily increasing. However, to examine the relationship between sedentary lifestyle, in relation to television viewing and an adverse body fat profile has rarely been attempted. Hence, the necessity of the present study has been felt.

Although cases of obesity were almost absent, the present small scale cross-sectional study showed a considerable association between television viewing, computer use and body fat distribution among the school going children and adolescents of Kolkata. The participants lived in a metropolitan area and went to a local state school. They spent most of the day in school. An overwhelming majority of them used computers in the school. Very few of the girls regularly practiced exercise like dancing, jogging, and swimming. The girls spent most hours watching television during the holidays and preferred cartoon channels. Those who had computer access spent a fairly good amount of time playing games with their computers. Only some 25% of the girls practiced physical exercise. Junk fat-rich food, based on different advertisements and favorite characters in cartoon programs were preferred by the study participants. The present study revealed the association of television viewing with adiposity related variables, which corroborates with other studies among the USA (You and Nayga, 2005) and UK (Jago et al., 2005) schoolchildren.

The double effects of sedentary lifestyle with frequent consumption of soft drinks and junk food increase have also been reported in Indian school children of Velachery, Chennai (Anand et al., 2014). It is worth mentioning that the subcutaneous fat distribution in terms of CPFR and STSR were significantly correlated with the duration of TV viewing among the school girls of Kolkata. To the best of our knowledge, this relationship has not been reported in school girls of any other community in West Bengal. Women in Latvia were shown to increase in CPFR and STSR with increasing age (Kažoka and Vētra, 2012).

Increased television viewing can significantly predict BMI and MUAC (Halford et al., 2004). Among many adiposity related variables associated with high family income, TV viewing was found to be the most important variable, irrespective of family income status. Television was present in almost every household. Personal computers were only found in a few households where the family income was comparatively higher. In the present study, computer use was not associated with physical activities, confirming a study among 7 to 10 year old children of rural and urban areas of Brazil (Neto et al., 2014).

The study has certain limitations pertaining to the fact that data on actual calorie consumption and energy expenditure, vaccination and other medication were lacking. Future large-scale studies would be of immense importance, considering boys and girls in a comparative manner and taking rural study participants as well, to examine the effect of television viewing

and other sedentary activities on body fat distribution.

In conclusion, the study revealed a positive association of adiposity related variables with television viewing and income status of the family of teenage school girls of Kolkata.

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