Journal of Racial and Ethnic Health Disparities
https://doi.org/10.1007/s40615-017-0454-x

Associations Between Television Viewing and Adiposity Among South Asians

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Received: 23 August 2017 / Revised: 22 November 2017 / Accepted: 12 December 2017

Abstract

Objective Sedentary behaviors related to television (TV) viewing are associated with adiposity; however, few investigations have focused on South Asians, an ethnicity particularly vulnerable to metabolic perturbations. This study examined the relationships between TV viewing and adiposity in a cohort of middle-aged and older South Asians.

Method Data were obtained from Mediators of Atherosclerosis in South Asians Living in America (MASALA) study ($N = 906$; mean age [standard deviation] = 55 [9.4] years, 46% women). TV viewing hours per week was assessed through questionnaire and classified into tertiles for analysis. Multivariate linear regression models were used to examine the associations between TV viewing and measures of adiposity and body composition including body mass index (BMI), waist circumference, pericardial fat volume, and visceral, subcutaneous, and inter-muscular fat area after adjusting for covariates including intentional exercise.

Results Participants who were women, older, with lower education levels, and living longer in the United States watched TV for longer periods of times. Duration of TV viewing was positively associated with BMI ($p < 0.001$), waist circumference ($p < 0.001$), visceral fat area ($p = 0.001$), and pericardial fat volume ($p = 0.003$) independent of intentional exercise.

Conclusions While studies in South Asians with a longitudinal design need to confirm our findings, our cross-sectional results indicate that reduction in TV viewing may be beneficial in reducing adiposity and maintaining a healthy body composition.

Keywords Sedentary behavior · Television viewing · Adiposity · Body mass index (BMI) · Waist circumference · South Asians

Introduction

South Asians are individuals who originate from India, Pakistan, Bangladesh, Sri Lanka, and Nepal and are a rapidly growing ethnic group in the United States (US) [1]. Compared to other racial groups from US and Europe, South Asians are documented to have a higher prevalence of obesity-associated chronic diseases including type 2 diabetes and cardiovascular disease [2–4].

South Asians have been shown to have a higher percentage of body fat than Caucasians and other Asian ethnic groups [5] and are also at higher risk of abdominal obesity which is a significant risk factor for insulin resistance [3, 6]. Sedentary behaviors, especially television (TV) viewing, have been found to be associated with weight gain, obesity, and higher risk of chronic diseases [7], and one of the reasons could be the reduction in physical activity among those with higher level of TV viewing [8, 9]. For example, in a cohort of elderly Hispanics, the highest quartile of TV viewing time was associated with a significantly higher prevalence of metabolic syndrome, and in addition, the number of abnormalities for metabolic syndrome components and the risk of high waist-to-hip ratio in the 3rd and 4th quartile of TV viewing was two and four times higher than that in the lowest quartile [10]. However, there are no investigations that we are aware of that have examined such associations in South Asians living in the US.

The objective of our study was to examine the associations between TV viewing and measures of adiposity in a cohort of

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s40615-017-0454-x) contains supplementary material, which is available to authorized users.

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Published online: 22 January 2018

middle-aged and older South Asians. We hypothesized that longer periods of TV viewing would be directly associated with adiposity.

Method

We used data from the Mediators of Atherosclerosis in South Asians Living in America (MASALA) study, which were collected from clinical sites located in the San Francisco Bay Area and the greater Chicago area [11]. A total of 906 South Asians were recruited.

TV viewing was assessed using Typical Week's Physical Activity Questionnaire [12]. Participants were queried the hours and minutes per week they spent sitting or reclining and watching TV. Data-driven tertiles of TV viewing hours were then generated for analysis, with 0–5 h/week for the 1st tertile, 5.1–11 h/week for the 2nd tertile, and ≥ 12 h/week for the 3rd tertile.

Height, weight, and waist circumference were measured using standard methods, and body mass index (BMI) was then calculated by dividing weight (kg) by square of height (m). Visceral and subcutaneous abdominal fat area (cm^2) and inter-muscular fat area (cm^2) were measured with abdominal CT scan and calculated using Medical Image Processing, Analysis, and Visualization (MIPAV) software from the National Institute on Aging of the National Institutes of Health. Pericardial fat volume (cm^3) and hepatic fat attenuation (Hounsfield Unit) were assessed by non-contrast cardiac CT. The detailed methods for anthropometry and fat area measurements are provided elsewhere [6, 11].

Covariates including age, sex, education, length of residency in the US, smoking status, and alcohol intake were assessed using structured interview questions and study questionnaires [11]. Intentional exercise was assessed using Typical Week's Physical Activity Questionnaire, and total metabolic equivalent (MET) minutes per week were calculated [13]. The validated Study of Health Assessment and Risk in Ethnic Groups (SHARE) food frequency questionnaire (FFQ) was used to assess energy intake [14]. Covariates were selected based on univariate analysis and previous literature.

Statistical Analysis

Socio-demographic characteristics were reported as mean (standard deviation [SD]), median (interquartile range), or percentage and examined by ANOVA, Kruskal-Wallis, or chi-square tests across TV viewing tertiles. Pearson correlations between TV viewing and measures of adiposity were also examined. Multivariate linear regression models were used to assess the associations between TV viewing tertiles and BMI, waist circumference, visceral and subcutaneous fat area, hepatic fat attenuation, inter-muscular fat area, and pericardial fat volume adjusting for age, sex, education, length of residency in the US, smoking status, energy and alcohol intake, and intentional exercise. Models for visceral and subcutaneous fat, hepatic fat attenuation, inter-muscular fat, and pericardial fat were additionally adjusted for BMI. Effect modification by all covariates was examined by adding interaction terms with TV viewing in the regression models; these interaction terms were not significant ($p > 0.05$) and therefore removed from final models. All analyses were performed using Stata 13.1 (StataCorp, 2013) and two-tailed p-values < 0.05 were considered to be statistically significant.

Results

Participants who were older ($p < 0.001$), women ($p < 0.001$), those with higher education ($p = 0.002$), and those living for longer lengths of time in the US ($p < 0.001$) were more likely to spend time watching TV (Table 1). Bivariate analysis showed that higher TV viewing time was directly correlated with most measures of adiposity ($p < 0.05$) except hepatic fat attenuation (Supplementary Table 1).

Associations between TV viewing and measures of adiposity are shown in Table 2**.** Participants in the 2nd and 3rd tertiles of TV viewing had a mean BMI that was 0.9 ($p = 0.03$) and 1.1 ($p = 0.001$) kg/m^2 higher than the mean BMI of participants in the lowest tertile. Similarly, the mean waist circumference was also 1.9 cm ($p = 0.03$) and 2.9 cm ($p = 0.001$) higher in the 2nd and 3rd tertiles, respectively, compared to the lowest tertile of TV viewing. For adjusted mean visceral fat area and pericardial fat volume, the highest tertile of TV viewing was associated with 13 cm^2 ($p < 0.001$) and 5.8 cm^3 ($p = 0.009$), respectively, higher than those in the lowest tertile. No significant associations in the adjusted models were observed for TV viewing and hepatic fat attenuation, subcutaneous and abdominal inter-muscular fat area, but hepatic fat attenuation and inter-muscular fat area showed unexpectedly relatively better results in the 2nd TV viewing tertile than the 1st tertile. Beta coefficients from the multivariate models are shown in Supplementary Table 2.

Discussion

Our study demonstrates that in a cohort of middle-aged and older South Asians living in the US, weekly TV viewing was directly associated with measures of adiposity including BMI, waist circumference, visceral fat, and pericardial fat. These associations were observed independently of intentional exercise, wherein participants who watched television for ≥ 12 h/week had significantly higher BMI, waist circumference, visceral fat area, and pericardial fat volume compared to those with ≤ 5 h/week.

Our results are consistent with previously published investigations in other populations. In a cohort of middle-aged African Americans and Hispanics, participants who were in the highest quartile of sedentary time had about two times

Table 1 Socio-demographic and health characteristics across tertiles of hours of weekly television viewing among South Asians belonging to MASALA study

	Overall	Weekly television viewing hours			*p* value[a]
		1st tertile 0–5 h	2nd tertile 5.1–11 h	3rd tertile 12+ h	
N	906	319	297	290	
Age, years	55.3 (9.4)	53.1 (8.9)	54.5 (9.4)	58.6 (9.1)	< 0.001
Women, %	46.4	44.5	39.1	55.9	< 0.001
Years of residency in US, *n* = 887	27.0 (10.9)	25.1 (10.3)	26.9 (10.7)	29.25 (11.2)	< 0.001
Education ≥ bachelor's degree, %	87.9	92.2	88.2	82.8	0.002
Current smoker, %	3.4	2.8	3.0	4.5	0.48
Energy intake, kcal/day, *n* = 892	1682 (504)	1658 (510)	1706 (514)	1685 (488)	0.49
Alcohol intake 1+ drinks/week, %	33.0	35.7	33.0	30.0	0.32
Intentional exercise, MET-min/week	945 (315–1853)	885 (420–1785)	1103 (368–2010)	788 (300–1733)	0.06
BMI, kg/m^2, *n* = 903	26.0 (4.1)	25.4 (3.9)	26.1 (4.1)	26.4 (4.2)	0.007
Waist circumference, cm, *n* = 905	92.8 (10.3)	91.3 (10.0)	93.5 (9.6)	93.7 (11.2)	0.006
Visceral fat area, cm^2, *n* = 879	134 (56)	124 (52)	134 (53)	146 (61)	< 0.001
Subcutaneous fat area, cm^2, *n* = 827	236 (94)	227 (95)	238 (87)	246 (99)	0.06
Hepatic fat attenuation, HU *n* = 892	55.1 (10.6)	55.6 (10.4)	54.6 (10.4)	55.1 (11.1)	0.50
Inter-muscular fat area, cm^2, *n* = 857	21.4 (8.7)	20.1 (8.5)	20.5 (8.0)	23.6 (9.1)	< 0.001
Pericardial fat volume, cm^3, *n* = 894	58.6 (29.6)	53.5 (27.8)	58.4 (28.0)	64.3 (32.2)	< 0.001

Results were reported as mean (standard deviation), median (interquartile range) or percentage

MASALA: Mediators of Atherosclerosis in South Asians Living in America; *BMI*: body mass index; *WC*: waist circumference; *MET-min*: metabolic equivalence minutes per week; *HU*: Hounsfield Unit

[a] ANOVA and chi-square tests were used to determine *p* values for continuous and categorical variables, respectively; Kruskal-Wallis test was used for intentional exercise

higher odds for higher BMI and higher waist circumference compared to the lowest quartile of sedentary time [15]. Similarly, in the Multi-Ethnic Study of Atherosclerosis (MESA) cohort, baseline prevalence of obesity was 18% higher for men and women who watched TV for > 6 h/day than those with ≤ 2 h TV watching per day [16]. Using longitudinal data after a follow-up of 6 years, leisure time TV viewing was associated with a risk of being overweight or obese in the middle-aged and older non-Hispanic whites and African Americans sub-groups in the cohort [17].

While several investigations have examined associations between sedentary behaviors such as TV viewing and adiposity,

Table 2 Adjusted means (standard error) for measures of adiposity across tertiles of weekly television viewing among South Asians of MASALA study

Measure of adiposity	Weekly television viewing hours			*p* value for trend
	1st tertile 0–5 h	2nd tertile 5.1–11 h	3rd tertile 12+ h	
BMI, kg/m^2	25.3 (0.23)	26.2 (0.24) [a]	26.4 (0.26) [a]	<.001
Waist circumference, cm	91.2 (0.57)	93.1 (0.56) [a]	94.1 (0.64) [a]	<.001
Visceral fat area, cm^2	130 (2.6)	133 (2.9)	143 (3.2) [a]	0.001
Subcutaneous fat area, cm^2	235 (5.1)	241 (4.5)	232 (5.0)	0.73
Hepatic fat attenuation, HU	55.5 (0.6)	55.3 (0.6)	54.8 (0.6)	0.23
Inter-muscular fat area, cm^2	21.3 (0.5)	20.9 (0.5)	22.1 (0.5)	0.07
Pericardial fat volume, cm^3	56.9 (1.5)	57.6 (1.5)	62.7 (1.7) [a]	0.003

Multivariate linear regression model adjusting for sex, age, education (≥ bachelor's degree), length of residency in US in years, current smoker, energy intake, alcohol (1+ drinks/week), intentional exercise (metabolic equivalence minutes/week); BMI was additional adjusted for visceral and subcutaneous fat area, hepatic fat attenuation, inter-muscular fat area, and pericardial fat volume; because of missing on covariates and adiposity measures, n=872 for BMI and waistcircumference, and n=779 for all other measures of adiposity

MASALA: Mediators of Atherosclerosis in South Asians Living in America; *BMI*: body mass index

[a] *p* value < 0.05, adjusted for multiple comparison using Dunnett's method. The 1st tertile of television viewing hours was the reference group

this is one of the first in a cohort of South Asians, an ethnic group particularly at high risk to cardiometabolic risk. However, the cross-sectional nature of this investigation is a significant limitation, and no causal relationships can be determined. Physical activity and sedentary behaviors were assessed using a validated questionnaire, but being self-reported in nature, misclassification cannot be ruled out. Also, the mean TV viewing time in this cohort was lower compared to those reported by other US populations. For example, in the MESA cohort including non-Hispanic whites, African-American, Hispanic-American, and Chinese American, the mean TV viewing was 2.1 h/day [16], while this cohort reported mean TV viewing of 1.3 h/day, and nationally representative data from the 2003–2006 National Health and Nutrition Examination Surveys indicate that 34% of US adults spent no more than an hour of TV viewing per day compared to 60% of the MASALA study participants [18]. However, overall screen time, including computer usage, may be more comprehensive for assessing sedentary time but was not examined, explaining the relatively better outcomes of hepatic and inter-muscular fat in the 2nd tertile of TV viewing time than the 1st tertile. The MASALA cohort is a representative sample of South Asians in the US, but it is important to note that cohort participants were highly educated and were middle-aged and older; therefore, findings may not be generalizable to less educated or younger South Asians.

In conclusion, TV viewing was associated with higher measures of adiposity among South Asians in the US. Studies among South Asians with a longitudinal design are needed to confirm our findings and to examine the effect of sedentary behaviors on metabolic risk.

Funding The MASALA study was supported by the National Institutes of Health (grant number R01-HL-093009) and body composition measurements were supported by grant K24HL112827. Data collection at UCSF was also supported by NIH/NCRR UCSF-CTSI (grant number UL1 RR024131).

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethnical Approval The study protocol and procedures were approved by the institutional review boards of UCSF and Northwestern University, and the informed consent was signed by all study participants.

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