Exploring the Relationship between Diet and TV, Computer and Video Game Use in a Group of Canadian Children

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Abstract: Increased screen-time has been linked to unhealthy dietary practices but most studies have looked primarily at television viewing or an amalgam. Therefore the purpose of this study was to investigate the relationship between specific screen-time (TV, computer, video game) and a selection of healthy dietary intake measures (calories, carbohydrate, fat, sugar, fruit, vegetables, fibre and sugar-sweetened beverages (SSB)) in a group of Canadian children. We used single day sedentary and dietary recalls to assess sedentary behaviour and diet in 1423 children (9.90 (0.58) y; 737 girls, 686 boys) from the Action Schools! BC Dissemination study. Correlations and multiple regression analyses were used to explore sedentary behaviour-diet relationships. TV and video game use were correlated with higher calories, fat, sugar and SSB consumption ($r = 0.07$ to 0.09; $p < .01$) and lower fibre intake ($r = -0.05$ to -0.06; $p < .05$). TV use was also correlated with lower fruit and vegetable intake. Regression analyses showed that when controlling for other variables, only TV and video game use predicted sugar and SSB consumption ($\beta = .06$ to $.08$; $p < .05$). Computer use was correlated with calories but did not significantly predict any of the measures of dietary intake. Although screen time was significantly associated with less healthy eating profiles, it did not account for much variance in dietary behaviour of these children.

Keywords: Healthy diet, sedentary, screen, children, non-screen.

INTRODUCTION

Sedentary behaviours such as television viewing and computer use are on the rise and represent western societies less demanding physical landscape [1]. Research on sedentary behaviour has focused on television viewing: Television viewing has been associated with obesity [2-4] and linked to low levels of physical activity [2, 5] and unhealthy eating behaviours [2, 6-11] in children. Numerous studies have found an inverse relationship between television viewing time and children's fruit and/or vegetable consumption [6, 7, 9]. Other pediatric studies have demonstrated a positive association between time spent viewing television and consumption of energy rich drinks [6, 10]; total calories [8, 10, 11]; and consumption of unhealthy snacks or fast food [2, 10, 12]. All of these associations, however, tend to be small.

While there has been considerable research on TV viewing and diet in children, few studies have investigated the relationship between diet and other sedentary activities such as video game play, computer-use and non-screen sedentary activities specifically. A few studies have looked at the relationship between dietary behaviours and combined TV/ video viewing [12-15], combined computer/video game time [16], combined TV/video viewing/computer time [17-19] or "sedentary time" that includes combinations of television, video game, computer, sitting and homework time [17, 20-23]. There is, however a paucity of research on the relationships between dietary behaviours and screen time activities other than television. We do not yet understand the relationships between specific screen time activities such as computer and video games, and eating behaviours. The diet-screen relationship may differ with different sorts of screens since some screen activities have more food advertising that can impact brands and types of foods requested by children [24]. In addition, during TV viewing both hands are available for eating but computer use and video game play occupies the hands, potentially limiting eating and drinking opportunities. Thus, the purpose of our study was to investigate the relationship between screen (TV, video game and computer) and non-screen sedentary activities, and the diet of Canadian children. Our targeted dietary intake measures are ones that contribute to the healthfulness of overall diet and include the intake of calories, fat, carbohydrate, sugar, fibre, fruits, vegetables and sugar-sweetened beverages (SSBs). We hypothesized that, because of the effects of food advertising and the availability of both hands for eating or drinking during television

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viewing, video game and computer use would have weaker links to less healthy dietary intake and television viewing would have stronger links.

MATERIALS AND METHODS

Study Design

We conducted a cross-sectional descriptive study using baseline data from the Action Schools! BC Dissemination trial, a large cluster randomized comparison trial evaluating the effectiveness of a school-based healthy living intervention (n = 1494). Of the 2401 grade four and five students in the 30 schools that volunteered to take part in the research, 62.2% consented to participate. Baseline data were collected during fall, 2005. Specifically, we examined the relationship between screen (TV, Video Game, Computer time) and non-screen sedentary activities, and select dietary intake (calories, fat, carbohydrate, sugar, fibre, fruit, vegetables and SSBs) in 1423 grade four and five children (aged 9.90 (0.58) y; 737 girls and 686 boys) living in four regions of British Columbia. The study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects were approved by the Clinical Research Ethics Board at the University of British Columbia and the Human Research Ethics Board at the University of Victoria.

Participants

Children were recruited in September 2005 *via* invitation/information letters sent home by the teachers. We obtained written consent from parents/guardians; children gave verbal and written assent. In all, 1494 students consented to participate in the study at baseline. Of those, 1423 students were measured (n = 52 students were absent, n = 1 moved prior to being measured and n = 18 failed to complete some questionnaires so we were unable to use their results).

Measurement Procedures and Protocols

Descriptive Characteristics

We measured height as stretched stature to the nearest 0.1 cm (Seca 214 Portable Stadiometer) and weight to the nearest 0.1 kg (Conair digital electronic scale). Height and weight were measured twice and the mean was used in our analyses.

Dietary Intake

We administered a single 24-hour dietary recall to assess dietary intake of each participant. We analyzed results using the EHSA Food Processor Nutrition and Fitness Software (v. 10.0, Salem, OR) to calculate calories, fat, carbohydrate, sugar and fibre. Consumption of fruit, vegetables and sugar-sweetened beverages (SSB includes flavoured milk, sweetened carbonated beverages, non-carbonated flavoured beverages, sweetened coffee and tea, and sports beverages) were determined from the dietary recall; we assessed serving size using the Canada Food Guide [25].

Sedentary Behaviour

We measured sedentary behaviours using a single day self-report sedentary behaviour recall questionnaire, modified from the Middle School Physical Activity and Nutrition Scan (M-SPAN) [26]. The questionnaire asked children to report the number of minutes spent in each of the following sedentary activities on the previous day: television, video games, computer, homework, talking with friends and ‘other’ sedentary activities. We calculated Total Screen Time from total time spent watching television, playing video games and using the computer. Total Sedentary Time was calculated as the sum of all time spent on sedentary activities. Non-screen Sedentary Time was [Total Sedentary Time - Total Screen Time].

Statistical Analyses

We used the Statistical Package for the Social Sciences (SPSS; v20.0, Chicago, IL) to analyze our results. We generated descriptive characteristics for the sample and used Pearson product-moment correlations to analyze associations among variables. Based in part on the relationship between variables in univariate analysis, we developed a series of multiple linear regression models to identify the relation between screen activities and dietary intake (calories, fat, carbohydrate, sugar, fibre, fruit, vegetables and SSBs). For sedentary behaviours, we used continuous measures in multiple regression models (but when describing the effect of sedentary behaviours on dietary intake we converted the minutes to an hour as we felt it was more meaningful). First, we examined the variance explained by Total Sedentary Time (independent variable) for each dietary (dependent) variable. Second, we evaluated the independent contribution of overall screen time and non-screen sedentary time to dietary variables. Third, we evaluated the variance explained by television, computer and video game time (independent variables) for each of the dietary (dependent) variables. We controlled for age and gender within each regression model (entered first) as both were significantly associated with screen time and non-screen sedentary time. When entered into the model, age was not a significant predictor of any of the variables while gender significantly predicted calories, fat, carbohydrate and sugar across all three models (regression coefficients ranged from 0.64 to.124; p <.05). We accepted a significant beta of ≥ 0.1 as small/weak and ≥ 0.3 as medium [27].

RESULTS

We present descriptive characteristics of our sample in Tables **1** (physical characteristics and dietary intake) and 2 (sedentary activities; means and standard deviation all). Boys were taller and heavier than girls, and a higher proportion of boys (9.9%) were overweight or obese. Boys consumed more calories, protein, carbohydrates, fat and sugar than girls but had similar proportions (percentage) of macronutrients. Consumption of fruit, vegetables, fruit and vegetable servings combined (FV), and SSBs were similar for boys and girls. Boys spent more time than girls watching TV, playing video games and using the computer but spent similar time in non-screen sedentary activities.

We present associations between diet and sedentary behaviours in Tables **3** and **4**. From the Pearson-product moment correlations (Table **3**) we see that television viewing times were negatively correlated with fibre (r = -0.06; p <.05), vegetable (r = -0.05; p <.05) and combined fruit and vegetable (FV) consumption (r = -0.05; p <.05) and positively correlated with calories, fat, sugar and SSB consumption (r = 0.07 to 0.08; p <.01). From linear regression models (Table **4**), higher television viewing predicted sugar (β=.06, p <.05, 95% CI =.008 to.139) and SSB (β =.06, p <.05, 95% CI =.037 to.605) consumption. Based on the unstandardized regression coefficients, for every additional hour of television

Table 1: Descriptive Characteristics and Dietary Intake

	All			Girls (n = 737)		Boys (n = 686)		
	N	Mean	SD	Mean	SD	Mean	SD	P Value
Descriptives								
Age (years)	1423	9.9	0.6	9.9	0.6	9.9	0.6	p = 0.33
Height (cm)	1415	140.8	7.3	140.5	7.3	141.1	7.2	p < 0.17
Weight (kg)	1415	37.2	9.6	36.3	9.1	38.0	10.1	p < 0.01
% overweight/obese [a]	1415	29.3%		24.5%		34.4%		p < 0.001
Dietary intake								
Calories (Kcal/d)	1397	1918.0	739.9	1824.9	677.1	2018.1	790.3	p < 0.001
Protein (g/d)	1397	72.5	32.4	68.4	29.0	77.0	35.2	p < 0.001
Carbohydrate (g/d)	1397	268.0	104.4	257.4	96.7	279.3	111.1	p < 0.001
Fat (g/d)	1397	64.5	37.7	60.7	34.4	68.5	40.6	p < 0.001
Protein (%)	1397	15.1%		15.0%		15.3%		p = 0.28
Carbohydrate (%)	1397	56.1%		56.4%		55.6%		p = 0.15
Fat (%)	1397	28.8%		28.5%		29.1%		p = 0.28
Sugar (g/d)	1397	117.7	62.3	112.6	56.9	123.3	67.3	p < 0.01
Fruit (servings/d)	1395	2.6	2.7	2.6	2.5	2.6	2.9	p = 0.71
Vegetable (servings/d)	1395	2.0	2.0	2.0	2.0	2.0	2.1	p = 0.95
FV (servings/d)	1395	4.6	3.7	4.7	3.4	4.6	3.9	p = 0.81
Fibre (g/d)	1395	15.8	8.4	15.8	8.4	15.9	8.4	p = 0.88
SSB (mls/d)	1395	218.9	304.2	207.6	282.8	231.0	325.4	p = 0.15

[a] ≥ 85^{th} %ile Body Mass Index [28].
FV = fruit and vegetable, combined.
SSB = Sugar-sweetened beverages (includes flavoured milk, sweetened carbonated beverages, non-carbonated flavoured beverages, sweetened coffee and tea, and sports beverages).

Table 2: Time Spent Yesterday in Screen Activities and Non-screen Sedentary Activities

	All			Girls		Boys		P Value
	N	Mean	SD	Mean	SD	Mean	SD	
Computer use (min/d)	1421	17.3	33.9	15.4	30.8	19.3	36.9	p < 0.05
Video game use (min/d)	1421	12.9	32.0	4.0	13.1	22.3	42.0	p < 0.001
TV time (min/d)	1421	42.7	51.2	40.1	48.0	45.5	54.3	p < 0.05
Total screen time (min/d)	1421	72.8	77.9	59.5	61.5	87.2	90.2	p < 0.001
Non-screen sedentary time (min/d)	1421	75.9	67.7	79.2	69.3	72.2	65.9	p = 0.54
Total sedentary [a] (min/d))	1421	148.7	108.2	138.7	99.4	159.5	115.9	p < 0.001

[a]Total Sedentary includes TV, video game, computer, talking on phone, homework and other miscellaneous sedentary activities.

Table 3: Pearson Correlation Coefficients between Dietary Intake and Sedentary Activities

	TV (min/d)	Computer (min/d)	Video Game (min/d)	Non-Screen Sedentary (min/d)	Total Screen (min/d)	Total Sedentary (min/d)
Calories (Kcal/d)	0.07 [b]	0.06 [a]	0.08 [b]	0.10 [c]	0.10 [c]	0.14 [c]
Fat (g/d)	0.07 [b]	ns	0.07 [b]	0.06 [a]	0.10 [c]	0.11 [c]
Carbohydrate (g/d)	ns	ns	0.06 [a]	0.09 [b]	0.08 [b]	0.11 [c]
Sugar (g/d)	0.08 [b]	ns	0.09 [b]	ns	0.10 [c]	0.11 [c]
Fibre (g/d)	- 0.06 [a]	ns	- 0.05 [a]	0.13 [c]	- 0.06 [a]	ns
Fruit (servings/d)	ns	ns	ns	ns	ns	ns
Vegetable (servings/d)	- 0.05 [a]	ns	ns	0.12 [c]	ns	ns
FV (servings/d)	- 0.05 [a]	ns	ns	0.10 [c]	ns	ns
SSB (mls/d)	0.07 [b]	ns	0.08 [b]	ns	0.09 [b]	0.07 [b]

[a]p < 0.05.
[b]p < 0.01.
[c]p < 0.001.
ns = not significant; FV = fruit and vegetable; SSB = sugar-sweetened beverages (includes flavoured milk, sweetened carbonated beverages, non-carbonated flavoured beverages, sweetened coffee and tea, and sports beverages).

viewing you could expect an increased intake of 19 mL of SSBs and 4.4 g of sugar. Computer time was positively correlated with calories (r = 0.06; p <.05; Table **3**) but did not predict any of our dietary intake markers. Time spent playing video games was positively correlated with calories, fat, carbohydrate, sugar and SSB consumption (r = 0.07 to 0.09; p <.05 to .01) and negatively correlated with fibre (r = 0.05; p <.05), but was not associated with fruit and/or vegetable consumption (Table **3**). Video game time predicted sugar (β =.06, p <.05, 95% CI =.008 to. 220) and SSB consumption (β =.08, p <.05, 95% CI =.174 to 1.097; Table **4**). Based on the unstandardized regression coefficients, every additional hour of video game play would be associated with an estimated increased intake of 38 mL of SSBs and 6.8 g of sugar. Non-screen sedentary time was weakly correlated with calories, carbohydrate, FV and fibre intake (r = 0.10 to 0.13; p <.01). Non-screen sedentary time predicted caloric (β =.10; p <.001, 95% CI =.480 to 1.661), carbohydrate (β =.09; p <.001, 95% CI =.051 to. 219), FV (β =.09; p <.001, 95% CI =.002 to. 008) and fibre intake (β =.13; p <.001, 95% CI =.010 to. 024). Each additional hour of non-screen sedentary time could be associated with an increased daily intake of 64 kcal, 8.1 g of carbohydrate, 1.9 g of fat, 0.24 vegetable servings, 0.30 FV servings and 1.0 g of fibre. When we pooled screen activities to create total screen time and total sedentary time, correlations between sedentary behaviour and most dietary variables were slightly stronger, however, all significant correlations remained weak (Table **3**). Regression models suggest that total screen and total sedentary time predict caloric, fat, sugar and SSB intake (β =.07 to .12; p = <.05 to <.001) and that total screen time predicts fibre (β = -.08; p <.01, 95% CI = -.014 to -.002) intake.

Table 4: Standardized Beta Coefficients from Multiple Linear Regression Analyses for Predicting Dietary Intake from Sedentary Behaviour

	Model I			Model II		Model III
	TV (min/d)	Computer (min/d)	Video Game (min/d)	Non-Screen Sedentary (min/d)	Total Screen (min/d)	Total Sedentary (min/d)
Calories (Kcal/d)	ns	ns	ns	.10 [c]	.07 [a]	.12 [c]
Fat (g/d)	ns	ns	ns	.06 [a]	.07 [b]	.10 [c]
Carbohydrate (g/d)	ns	ns	ns	.09 [c]	ns	ns
Sugar (g/d)	.06 [a]	ns	.06 [a]	ns	.08 [b]	.09 [c]
Fibre (g/d)	ns	ns	ns	.13 [c]	-.08 [b]	ns
Fruit (servings/d)	ns	ns	ns	ns	ns	ns
Vegetable (servings/d)	ns	ns	ns	.12 [c]	ns	ns
FV (servings/d)	ns	ns	ns	.09 [c]	ns	ns
SSB (mls/d)	.06 [a]	ns	.08 [b]	ns	.09 [c]	.07 [a]

[a]$p < 0.05$.
[b]$p < 0.01$.
[c]$p < 0.001$.
ns = not significant; Veg = vegetable; FV = fruit and vegetable; SSB = sugar-sweetened beverages (includes flavoured milk, sweetened carbonated beverages, non-carbonated flavoured beverages, sweetened coffee and tea, and sports beverages).

DISCUSSION

We extend the literature by evaluating the relationship between different types of screen (TV, computer and video game) and non-screen sedentary activities, and food intake in a group of Canadian children. Unique to our study, we investigated the association between dietary intake and video game time specifically in pre-adolescent children. The study participants were typical of other similar aged Canadian children with almost one third overweight or obese [29] and caloric consumption of approximately 2000 kcal/day [30]. The proportion of macronutrients consumed was consistent with recommended daily values (between 10-30% energy from protein, 45-65% energy from carbohydrate and 25-35% energy from fat) [31]. Participants consumed 4.6 servings of FV per day, on average, which was similar to intakes reported for Canadian children elsewhere [32] and close to Canada Food Guide recommendations of five to six servings of fruits and vegetables per day [25]. However, less than half of our children met these guidelines. Of note, as we included potatoes as a vegetable this would inflate our daily totals compared with other studies that do not include potatoes as a vegetable.

Participants spent more than two hours per day, on average, engaged in sedentary activities. Boys spent more time engaged in screen activities than girls and this aligns with other reports [33]. In contrast, screen time was considerably less than reported by Leatherdale and Ahmed [34] who assessed a large, representative sample of Canadian children. While 27% of participants in our study reported more than two hours of screen time, over half of their respondents reported more than two hours. Importantly, their participants were older (age 11-18). Methodological differences in measurement tools may partially explain this discrepancy as well. Specifically, the questionnaire we used asked about sedentary activities on the previous day (which may or may not represent a weekend day) while the Leatherdale and Ahmed analysis asked about the ‘typical’ number of hours per day spent in sedentary pursuits. Finally, participants in our study reported sedentary times in minutes while sedentary time was reported as a categorical variable (e.g. less than one hour, one to two hours, etc.) in the Leatherdale and Ahmed report.

The Association between Television Viewing and Diet

Television viewing was negatively correlated with the consumption of fruit and/or vegetables and fibre, and positively correlated with caloric, fat, sugar and SSB intake. Others also reported that more time spent TV viewing was associated with higher caloric, fat and soft drink or energy-dense drink consumption and lower consumption of fruits and vegetables [5, 23, 35]. Linear regression analysis suggested that TV viewing was associated with increased consumption of sugar and SSB. Based on the regression analysis, it is estimated that every 60 minutes of television viewing would be associated with a 19 mL/day (approximately 0.07 servings) in SSB intake. While weak, this is similar to results suggested by others (0.05 to 0.11 servings/day) [6, 10, 16, 35] and in spite of different reporting methods (odds ratios and prevalence ratios) represents the same trend in numerous other studies [5, 7, 17, 36]. A few studies, however, reported no association between television viewing and SSB consumption [37, 38] and others have detected this association in boys but not in girls [39]. It is important to understand the relationship between television viewing and SSB intake since high SSB consumption is associated with an increased risk of obesity [40].

The Association between Computer Use and Diet

Few published papers have examined the specific relationships between computer or video game screen time and dietary behaviour. The boundaries between these activities can be blurred as many children who play digital games may not differentiate between computer time generally and time on the computer dedicated to playing video games. We noted a weak correlation between computer use and caloric intake but these results did not persist when computer use was entered into our regression model. Importantly, few studies have looked explicitly at the diet-computer use relationship. Some studies have assessed the relationship between diet and computer use combined with other screen activities [16-19, 22] but few [5, 41] have looked explicitly at the diet-computer use relationship and none have explored the diet-computer use relationship specifically in pre-adolescent children. Chaput and Tremblay [41] found that computer-related activities promoted overconsumption of food in young adults when compared to a resting condition, and Utter and colleagues [5] found a positive association between computer time and energy intake in their adolescent participants (mean age 14.9 years). Unlike our findings, Utter *et al*. [5] reported that the high computer use group also had higher consumption of soft drink and FV. Our questionnaire did not differentiate between using the computer for recreational and homework purposes, whereas recreational computer use (which excluded time spent on the computer doing homework) was used in their study. Furthermore, our participants were pre-teen and theirs were adolescents.

The Association between Video Games and Diet

To our knowledge no other studies specifically investigated the association between video game use and dietary intake specifically in pre-adolescent children. We observed significant correlations between video game play and caloric, fat, sugar and SSB intake and a negative association with intake of fibre – markers of an unhealthy diet. With all other variables in the regression model, video game use remained a significant predictor of sugar and SSB consumption. Every additional hour of video game play was associated with an increased intake of 38 mL of SSBs and 6.8 g of sugar. Using a broader age range (9-15 year olds), Falbe *et al*. [42] examined longitudinal changes in electronic game use and diet. They found that baseline use of electronic games (including both video and computer games) and the change in use of electronic games over two years were both associated with changes in consumption of foods with low nutritional quality. In exploring the association between dietary intake and video game play, Chaput and colleagues [43] found that following a one hour session of either playing video games or relaxing in a comfortable chair, adolescent males had higher net caloric intake (59 kcal) at a subsequent ad libitum meal. What they considered overconsumption was not associated with sensations of hunger or appetite. The authors suggested it was related to increased mental stress, measured by increased sympathetic tone associated with the video game session.

Increased intake of unhealthy food during or following TV viewing has been linked to the influence of advertising less healthy food choices to children [44]. This is an important distinction as video game play and computer use, although sedentary, do not always expose children and youth to food advertising. Marsh, Mhurchu and Maddison [45] reviewed the effects of screen-based activities on eating behaviour, independent of advertising. Even in the absence of food advertising, screen use was associated with increased dietary intake. Potential mechanisms include mindless eating while distracted by the screen and increased caloric consumption as a result of snacking during screen use [46]. Computer use and video game play have more limited exposure to food advertising than television viewing and ones' hands are somewhat occupied during video game and computer use. Therefore we anticipated that the influence of any non-television screen time on dietary intake might yield similar results. However, we found that watching TV and playing video games were both correlated with total caloric intake and the intake of fat, sugar and SSBs. Both activities were also significant predictors of sugar and SSBs intake. Conversely, computer use was correlated with increased caloric consumption but did not significantly predict any of our select measures of dietary intake. Half of our participants (49.8%) used two or more different screens on the evaluated day, which might partially explain the differences we observed.

The Association between Screen/ Non-Screen Activities and Diet

Other studies reported a relationship between increased time spent across multiple screen modes and unhealthy food patterns, including lower FV consumption [16-18], higher energy-dense beverage consumption [16, 17, 22, 42] and more unhealthy snacks [18, 22, 42]. This aligns with our findings. Interestingly, non-screen sedentary time was associated with higher caloric and fat intake, and also with more healthy dietary patterns of higher FV and fibre intake. This perhaps speaks to the consumption of more food generally while partaking of sedentary activities. In other studies adolescents that spent more time reading and/or doing homework consumed a healthier diet compared with those who spent less time engaged in these sedentary activities [5, 47]. This may be at least partially attributed to the absence of food advertising [44], but may also be associated with other environmental factors in the home.

Our results support ‘drilling down’ to determine relationships across specific sedentary behaviours and the exact types of food that contribute to food intake – as different stories emerge. For example, in our data total sedentary time and total screen time were weakly associated with higher intake of total calories, fat, sugar, and SSBs but unrelated to fruit and vegetable consumption. Further, although total screen time was associated with a decrease in fibre intake, non-screen sedentary time was associated with an increase, effectively cancelling out the effect in total sedentary time.

Strengths and Limitations

Our findings should be interpreted in light of the strengths and limitations of the study. Strengths include the relatively large sample size, the use of interval level data (collecting screen-time in minutes *vs.* categories) to describe screen use and reporting eating and sedentary activities on the same day. Limitations include the reliance on self-report to assess dietary behaviours and sedentary activities and the use of single day recalls. Although 24- hour dietary recalls are commonly used and have been validated in this age group [48], it is well known that children struggle to accurately recall and report their dietary intake [49]. Further, single day recalls may have misrepresented usual patterns of food consumption or sedentary activities on weekends *vs.* weekdays, depending on the recall day captured [50]. However, since both sedentary and dietary patterns were recalled for the same day, diet-sedentary comparisons are comparable. As well, with a consent rate of 62% there may have been a selection bias. Be aware that this study was undertaken at the onset of the shift towards active video games, thus we did not differentiate between active and non-active video game activities; this may have led us to overestimate the total amount of sedentary time in the few children who used active games.

The inherent bias in cross-sectional studies is well known and we are unable to discern any causal relationships. Prospective and intervention trials are needed to more convincingly establish an eating behaviour - screen-time relationship. In addition, studies that evaluate specific types of food eaten during screen-time periods would contribute valuable new evidence to the literature.

CONCLUSION

The results of our study lend support to a growing body of evidence that links screen-time to unhealthy dietary habits. Screens in this large sample, however, do not account for very much variance in dietary behaviour. Despite the small effect size, screens may be associated with unhealthy eating patterns. Specifically we found that despite occupying the hands and providing less exposure to the marketing of unhealthy food items, video games were associated with less healthy eating patterns. Given the sizeable proportion of the day that children and youth devote to screens, understanding the mechanisms that drive these unhealthy behaviours is a priority so that targeted interventions can mitigate these negative consequences.

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