Screen time and eating during screen time: associations with dietary intake in children and adolescents

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Abstract

Background: Increased TV viewing is associated with overweight and obesity in children and adolescents. Excess weight gain might be a result of increased dietary intake during television viewing, eating foods that are highly advertised at other times, or lack of physical activity. The objectives of this cross-sectional study were (1) to determine the extent of screen time and eating during screen time, and the correlation between these two different exposures, (2) to compare food and nutrient consumption of on- versus off-screen eating occasions, and (3) to determine whether screen time and eating during screen time is associated with overall dietary intake. Methods: Participants were part of the Food Environment Chilean Cohort (FEChiC, n=938, 4-6 y) and the Growth and Obesity Cohort Study (GOCS, n=752, 12-14 y), recruited in the southeast region of Santiago, Chile in 2016. Dietary data was collected via 24-h food recalls. For each eating occasion, participants or their primary caregiver reported activity performed during consumption. Analyses included Spearman correlations, multivariable linear regression models and logistic regression. For daily consumption analyses, post-hoc pairwise comparisons examined differences in our main outcomes by tertiles. Results: In our sample, 87.5% reported consuming at least one meal or snack per day while on a screen. The median kilocalories contributed by eating during screen time was 387 kcal/d in children and 848 kcal/day in adolescents, which represents 34.7% and 42.3% of daily energy intake, respectively. There were no consistent differences in the nutrient profile or food groups consumed for either age group when comparing eating occasions consumed on-screen versus off-screen. Daily consumption analyses revealed that higher weekly hours of TV viewing was associated with elements of a less healthy diet including more sweets and desserts in children, and more sugar sweetened beverages in adolescents. Conclusions: A large percentage of children and adolescents' daily energy intake is consumed while watching television or on their phone. In depth, longitudinal work is needed to understand how screen time eating affects diet quality and nutritional status.

Background

Screen time, including television (TV) viewing, has been associated with overweight and obesity in children and adolescents [1-4], as well as with poorer dietary quality [5-10]. More specifically, among children, eating during screen time has been related to lower consumption of fruits and vegetables and higher consumption of sugar-sweetened beverages and high-fat/high-sugar foods [11]. Likewise, among adolescents, watching TV during meals has been associated with poorer diet quality [12].

A recent meta-analysis revealed that eating while viewing TV was positively related with being overweight (OR = 1.28; 95% CI: 1.17, 1.39) for both boys and girls [13]. Several mechanisms have been proposed to explain the relationship between screen time, diet and obesity [14]. Screen time can affect weight gain by at least three ways: reduced physical activity attributable to increased time spent engaging in a sedentary behavior [15], the effect of unhealthy food marketing on eating behaviors [16], and overeating during screen time due to distraction [15] [17].

A key question that remains unanswered is whether children and adolescents who spend the most hours in front of a screen are also more likely to eat a greater proportion of their calories during screen time. A second question of interest is whether screen time and eating during screen time are associated with overall dietary intake. Progress in this area has been difficult because most studies of dietary intake lack information on actual food intake during screen time. Instead, many studies have assessed the association between overall screen time and dietary intake, regardless of whether the dietary intake actually occurred while watching screens [8, 15, 18, 19]. In addition, the few studies that do have a detailed measure of dietary intake during screen time [20-22] lack information regarding time spent during screen time. We seek to add to the body of literature regarding screen time behaviors and diet by combining dietary data from a 24-hour food recall questionnaire with data from a media exposure questionnaire in a sample of children and adolescents. The 24-hour food recall captures screen time eating behaviors, and the media exposure questionnaire allows for the assessment of overall screen time.

To address these gaps, this paper has three objectives utilizing two cohort studies. Firstly, we determine the extent of screen time and eating during screen time, in our samples, and in addition to the correlation between these two different, but likely related exposures. Then, we compare food and nutrient consumption of on- versus off-screen eating occasions. Finally, we determine whether screen time and eating duing screen time is associated with overall dietary intake.

Methods

1. Participants and setting

In this cross-sectional study, participants were preschool children and adolescents from two Chilean cohorts: the Food Environment Chilean Cohort (FECHIC) and the Growth and Obesity Cohort Study (GOCS). Both study cohorts were recruited from low- and middle-income neighborhoods in the southeastern area of Santiago, Chile. Recruitment strategies and inclusion and exclusion criteria of both cohorts have been described elsewhere [23-25]. Because of missing data on total weekly TV viewing time (n=34), dietary variables (n=46), and self-reported caloric intakes outside the plausible range (<400 kilocalories (kcal), n=2), the final analytic sample consisted of 1690 participants (preschool children, n=938; dolescents, n=752).

For both cohorts, we obtained written informed consent from parents or legal guardians of participants; in the case of adolescents, we also obtained an assent prior to data collection. The ethics committee of the Institute of Nutrition and Food Technology approved the study protocol.

2. Measures

Screen Time

Screen time included mother-reported (for preschoolers) and self-reported (adolescents) TV viewing. We assessed the number of TV viewing hours within a typical week with an adaptation of the Global Weekly Estimate of TV viewing [26]. The adapted instrument asked participants to estimate hours of TV viewing during six different periods: weekdays before school, after school until 10pm, and from 10pm until sleep time and weekends before noon, from noon until 10pm, and from 10pm until sleep. For each period, the response categories were “no hours” (=0), “less than an hour” (=0.5 to represent midpoint of range), “between one and two hours” (=1.5, to represent midpoint of range), and more than two hours (=3, as a conservative estimate, although participants might have viewed more than 3 hours, particularly during afternoons). Additionally, participants reported the number of days the TV was on in a typical week in the household. To create an estimate of weekly TV viewing hours, we combined the sum of the reported hours of TV viewing within each of the six periods, with the typical number of days per week of television use, an approach that has been previously used [27, 28] and that we describe in more detail in **Supplementary File 1**.

Eating during screen time

We derived this variable from the dietary intake data. We dichotomized activity performed concurrently during food and beverage consumption into “screen time”, which included consumption while watching TV or on phone, and “non-screen time”, which included all other activities mentioned. We then calculated the number of eating occasions and the percent of total energy intake (in kilocalories) consumed during screen time for each study participant.

Dietary intake

This study includes dietary data collected between April and July of 2016. Trained nutritionists conducted 24-hour dietary recalls, using a multiple-pass method assisted by a computer software (SER-24). In the GOCS cohort, adolescents reported their own intake. For the FECHIC cohort, the mother (primary caregiver) completed the recall, with input from child. A food atlas [29] was used to assess serving sizes of common Chilean food and beverages, with use of images such as bowls, plates, mugs and glasses. Participants’ responses were entered to SER-24; and the information was later reviewed by a second nutritionist to check for inconsistencies and ensure data quality in reporting.

Respondents identified name and time of eating occasions during the interviews. Participants reported items as either breakfast, *colación (*smaller meal or snack)*,* lunch, *once* (sit-down meal typically done in late afternoon)*,* dinner, and *picoteo (*snack or small appetizer). Additionally, for each eating occasion participants were asked what activity they engaged in during food consumption: watching television or on a phone, sitting, standing, studying, playing sports, walking or riding in a bus, car or other (transportation). Day of week of the dietary recall and place of consumption were also reported. Nutrient values were calculated with the use of the United States Department of Agriculture (USDA) Food and Nutrient Database [30-32] for non-packaged products. For packaged products, we obtained nutrient values from the nutrition facts panel of the product’s package, which was collected using a standardized protocol [33]. For cases in which participants did not mention product brand for the packaged product consumed, we

used the most similar product in our database in terms of name, flavor and description. We linked all eating occasions, foods, and their corresponding nutrients to activity performed during consumption.

For this analyses, grams and energy contribution (in kilocalories) of ready-to-eat (RTE) breakfast cereals, salty snacks, sweets and desserts, sugar sweetened beverages, milks and yogurt, and fruits were assessed for each participant, by eating occasion and at the daily level. Sugar sweetened beverages included industrial flavored waters, sports and energy drinks, sodas (non-diet), and fruit and vegetable juices or drinks (with added sugar). The first four groups are energy-dense products commonly marketed on television to children and adolescents globally [34], whereas the consumption yogurt, milk and fruits is an indicator of improved diet quality and thus promoted in dietary guidelines [35]. **Supplementary File 2** includes a list of common foods and beverages included in each one of these groups.

Socio demographics

In the children cohort, mothers reported sex and birthdate of child during interviews. For adolescents, the information was self-reported. This study did not collect data on household income. However, education is a commonly used proxy for socio-economic status [36, 37] and thus, maternal education level is our main socio-economic variable, which we categorized in three groups: less than high school, high school complete and above high school.

3. Data Analyses

All analyses were conducted using Stata Version 14 [38]. We used descriptive statistics to present sociodemographic characteristics, as well as the extent of screen time and eating during screen time among study participants. We then determined per capita and per consumer energy intake of key food/beverage groups consumed on-screen versus off-screen. *Per capita* refers to the mean consumption using our total sample as a denominator (stratified by age group), and *per consumer* refers to the mean consumption of a food/beverage group among those who reported consuming it.

Because many studies report only on-screen time rather than eating specifically during screen time, it is important to determine how well overall reported screen time might or might not capture eating during screen time. We examined the correlation of TV viewing and eating during screen time with the Spearman's Rank correlation coefficient [39] (continuous variables: hours/week and % kcal during screen time).

Eating occasion analyses

The eating occasion level of analyses allows us to differentiate screen vs non-screen time consumption, since each eating occasion could have been performed (and thus, reported) doing a different activity. Using multivariable linear regression models, we compared energy (kcal), percent energy from total sugars, percent energy from saturated fats, and sodium per 1000 kcal of eating occasion performed during on-screen time with those consumed off-screen time, while accounting for correlated errors due to repeated measures of eating occasions within individuals during a single day.

In our models, the primary outcome was the continuous variable for nutrients and the main independent predictor was a dichotomous variable for whether or not the eating occasion was done during screen time. Because the screen time – nutrient association might vary by type of eating occasion (meal versus snack), we additionally included an interaction term (screen*meal) in our models. These models additionally controlled for day of the food recall (week vs. weekend/holiday), location of consumption (school vs. not at school), sex, age and mother's education level. Pairwise comparisons were computed at an α level of 0.05 to examine differences in nutrient densities between screen- and off-screen eating occasions, within each type of eating occasion.

To estimate the probability of consumption of our key food and beverage groups, we created dichotomous variables for each group. Logistic regression models were used to estimate the association between on- and off-screen time consumption of food and beverage groups at a particular eating occasion. Similar to our nutrient density analysis, the model included an interaction term (screen*meal) and controlled for key covariates.

Daily consumption analyses

Our second analysis focused on examining the association between (1) screen time (specifically, TV viewing) and (2) eating during screen time with daily total intake. Thus, the unit of analysis was each study participant. To assess these associations, we created tertiles based on (1) energy intake consumed during screen time and (2) weekly TV viewing hours, both stratified by age group. Tertiles were considered more appropriate given the distribution of the exposures of interest, as well as to ensure similar sample size within each comparison group. We conducted crude (simple regression with one predictor – either screen time or eating during screen time) and multivariable regression models (to examine the associations of interest using the aforementioned control variables and used post-hoc pairwise comparisons to examine differences in our main outcomes by tertiles, compared to our reference tertile (lowest category).

Results

The mean age was 4.8±0.5 y for preschool children and 13.7±0.4 y for adolescents. 51.2% of children and 49.9% of adolescents were female. Maternal education level was lower in the adolescent cohort, as reflected by the greater percent who had not completed high school (29.1% in adolescents vs 17.7% in children) (**Table 1**).

3.1 Screen time and eating during screen time

Children reported a median of 9 to 10.5 hours of weekly television use, whereas in adolescents it was 11.5 to 13.5 hours. Eating during screen time was common in both age groups, with over 85% of participants reporting at least one eating occasion a day during screen time, and about a third of participants (30.4% children and 31.6% adolescents) reporting 3-4 screen time eating occasions. The median kilocalories contributed by eating during screen time was 387 kcal/d in children and 848 kcal/day in adolescents, which represents 34.7% and 42.3 % of daily energy intake, respectively.

Among children, breakfast and *once* were the meals most frequently consumed while viewing a screen, while among adolescents, dinner and *once* were the meals most frequently consumed while viewing as screen. More than half of our sample (49.7% children and 57.0% adolescents) reported at least one snack per day while viewing a screen.

Associations between eating during screen time and screen time use variables are reported in **Table 2**. Overall, the Spearman correlations were weak for both children and adolescents, for the whole week as well as only on weekend and weekdays separately (range 0.07 to 0.16).

3.2 Foods consumed during screen time and off screen time

As shown in the **Figure 1**, most food groups contributed to a greater percent of energy off-screen when compared to on-screen, which can be explained because at the daily level, overall more calories were consumed off-screen. **Supplementary File 4** provides further details in the per capita and per consumer mean energy intakes of these key food groups.

3.3 Eating occasion analyses with and without concurrent screen time

Table 3 shows nutrient density and predicted probability of food group consumption during eating occasions with and without concurrent screen time. Among children, screen time meals were higher in total sugars (as a percent of energy intake) but lower in overall energy, than non-screen time meals. In contrast, screen time snacks were lower in total sugars compared to non-screen time snacks ($p<0.05$). During screen time meals, RTE breakfast cereals, sweets and desserts, and milk and yogurts were more likely to be consumed, whereas fruits were less likely to be consumed. For snacks, sugar-sweetened beverages were less likely to be consumed during screen time snacks, whereas milks and yogurts were more likely to be consumed during screen time ($p<.05$)

Among adolescents, there were no major differences when comparing the nutrient profile of screen time to non-screen time meals and snacks. Compared to non-screen time eating occasions, screen time meals were slightly lower in percent of total sugar ($p<0.05$)

and screen time snacks were slightly lower in saturated fats, compared to non-screen time snacks ($p<0.05$). During screen time meals, milks and yogurts were less likely to be consumed than during non-screen time, whereas for snacks, fruits were more likely to be consumed during screen compared to off-screen.

3.4 Daily consumption analyses by eating during screen time and television viewing

As displayed in **Table 4**, children who consumed a greater proportion of their energy while viewing a screen consumed more total daily sugars (% energy) and less fruits (g) than children who consumed the least energy while viewing a screen ($p<0.05$). Among adolescents, higher eating during screen time was associated with lower total daily intake of energy, saturated fat, sweets and desserts and fruit consumption.

Children reporting more weekly TV viewing consumed more sweets and desserts (in grams). Adolescents reporting more weekly TV viewing consumed on average more energy and sugar-sweetened beverages (SSBs) (in grams), and less milk and yogurt (in grams) (**Table 4**). While there was also a tendency in both children and adolescents, towards lesser consumption of fruits with higher reported TV viewing, the differences were not statistically significant.

Discussion

We found that among Chilean children and adolescents, eating during screen time was very common (more than 85% of sample reporting screen time consumption), and that children consumed a notable proportion of their daily calories while watching a screen (34.7% and 42.3 % of daily energy intake for children and adolescents, respectively). When comparing eating occasions consumed on-screen versus off-screen, there were no consistent differences in the nutrient profile or food groups consumed for either age group. However, our daily consumption analyses revealed that higher weekly hours of TV viewing was associated with elements of a less healthy diet including more sweets and desserts in children, and more sugar sweetened beverages in adolescents.

Overall TV viewing was lower than in other Latin American countries such as Brazil [40] and Mexico [41] and much lower than the US. In the US, for example, the average TV viewing time was close to 2.5 hours/day, but when other forms of media use were taken into account, the total amount of screen time was between 5 and 12 hours/day depending on age group [42]. Nevertheless, screen time in Chile (~ 2h and 2.5 h, for children and adolescents, just in TV viewing) surpasses recommendations to limit screen time use to 1 hour/day [43] in children 2-5 years and <2 hours/day [44] for children and teens 5 to 17 years.

Despite lower screen time, eating during screen time was more common and contributed to a higher proportion of total daily calories in Chile compared to the United States. Specifically, one study conducted in a small US sample found that kids consumed 20-25% of daily energy intake during TV viewing, compared to 36-43% in this study. These differences between both studies could be due to study setting (place and year) as well as in how screen time consumption was defined. Over 70% of our sample reported at least one main meal in front of a screen, which is similar to a recent UK study [22], but higher than in Brazil (~60%) [45] and Canada (~30%) [46]. The eating occasions most frequently consumed while viewing a screen in our sample were breakfast and *once*, in children, and dinner and *once* for adolescents. *Once*, a Chilean meal typically consisting of bread and an assortment of fixings (such as jam, butter, avocado and cheese) might in some cases replace dinner. Our results are similar to what was found in the US [20] and in Mexico [47] in which dinner and snacks were most frequently consumed while on a screen.

The high proportion of calories and eating occasions consumed while on a screen in our sample is of concern, given previous research linking poor diet quality to screen time consumption [11] [48]. However, in our study, we did not find a large, consistent association between eating during screen time and nutritional quality (as measured by % of calories from critical nutrients or by more- or less- healthy food groups) when we examined this relationship at the eating occasion level. For children, at the eating occasion level, on-screen meals were associated with a higher percent of energy from total sugar, but the opposite was found for snacks. At meals consumed during a screen, children were more likely to consume breakfast cereals, desserts/sweets, and milk and yogurt than off-screen, which could be a reflection of the fact that breakfast was the most commonly meal consumed on-screen. Surprisingly, sugary drinks were actually less likely to be consumed during snacks consumed while viewing a screen. Meanwhile, adolescents, there were only trivial differences in the nutritional profile for on vs. off screen snacks and meals, with similarly small differences found for food groups consumed.

These mixed results were further reflected when we analyzed the association between overall eating during screen time and total daily intake. Children who consumed the most calories on-screen consumed a higher percent of sugar and less fruit. However, adolescents who consumed the most calories on-screen consumed fewer total calories, a lower percentage of saturated fat, and less sweets and desserts, and fruit. Although somewhat surprising, previous studies have also reported mixed findings. For example, while one recent study found that children who watched TV during meals consumed on average 6% more energy from ultra-processed foods, compared to those who did not [22], another study [21] did not find significant associations between increased TV viewing at meals and overall diet quality.

When we examined the relationship between overall TV viewing and diet, we found more consistent associations between higher TV viewing and poorer dietary quality, although the differences remained relatively small. For example, we found that children watching more TV consumed more sweets and desserts, and adolescents with higher TV viewing consumed more SSBs, and milks and yogurts. While there was also a tendency towards lesser consumption of fruits with higher reported TV viewing, the differences were not statistically significant. One explanation for our observed associations is that there might be unmeasured characteristics that are related to screen time, such as parenting style, which also might drive or affect children's dietary behaviors. For example, parental self-efficacy to limit screen time has been associated with children's screen time [49], and it could also be related to self-efficacy of other family dietary behaviors.

A second, and likely more important aspect to consider is TV food and beverage advertising. Children and adolescents are exposed to unhealthy food marketing around the globe [50, 51]. Across different countries, the products that are advertised tend to be high in energy, saturated fats, sugars, and sodium, and be of little nutritional value [34, 52, 53]. Unhealthy food and beverage marketing affects children's food preferences, choice and consumption [54-57] of advertised products, and in Chile, products commonly advertised on TV during the same time period than when our data collection took place included sodas and sweet desserts (cookies, chocolate, candies, and bakery) [52]. Our results suggest that the increase in consumption of advertised products might not necessarily be during screen time itself, but at other times of the day (at least for adolescents), since we did not observe a consistent increased likelihood of consumption of typically advertised products during screen time. For example, in adolescents, sweets and desserts, and SSBs were as likely to be consumed at meals with or without screens. In addition, product placement, a form of marketing, might also be influencing dietary choices. For example, beverages are commonly portrayed in TV shows preferred by adolescents, which might affect norms regarding their desirability [58] and latter consumption.

If we believe that food marketing might be the major driver of some of the associations observed, then our results suggest that discouraging overall screen time as a behavior might be more important than discouraging consumption during screen time itself; indeed, the two were not well correlated and it was only overall screen time that was linked with poor diet. Also, our results highlight the importance of understanding how the implementation of the Chilean Law of Labelling and Marketing, which restricted child-targeted food and beverage marketing of products exceeding certain nutrient thresholds [59], might have shifted both children's exposure to TV advertising and their dietary intake.

Further research will also be needed to understand the relationship between non-TV screen time, eating behaviors, and dietary intake. Most of the research conducted to date has focused on TV viewing as the main form of screen time. However, child-directed TV supply, as well as the consumption of TV media has dropped in Chile over the past 3 years [60], with 2018 representing an all-time low in the average time on TV among children and adolescents. Furthermore, adolescents are the age group that most frequently reports use of TV via internet or streaming. Because research has shown that unhealthy food ads predominate in content on digital platforms such as YouTube [61, 62] Facebook [62] and Instagram [63], an area for future research is understanding how other forms of screen time (not only TV viewing) are related to diet, given the potential effects of unhealthy food marketing on these platforms.

TV viewing and other forms of screen time have been defined as sedentary behaviors [6], and screen time can lead to weight gain by affecting the energy balance equation towards less calorie expenditure, among other pathways. However, physical activity, sedentary behaviors and diet cluster together in complex ways, with healthy and unhealthy behaviors co-occurring [64], and it is possible for a child to be physically active, but at the same time have high levels of screen time. For our study, we lacked data on physical activity, but it would have been interesting to assess how this behavior was associated with levels of screen time, an important pathway in the screen time-obesity relationship.

Our study has several limitations. Because of questionnaire design and data available for the study, we were unable to distinguish between the eating that might have occurred with use of different devices (tablets, smartphones, computers, TVs, for example) and with different types of activities (video gaming, video watching, social media). It is possible that the relationship between screen time and dietary intake also depends on the type of device and activity. Second, our study sample was recruited from Southeastern Santiago, potentially limiting generalizability. However, 92% of Chilean children and adolescents (1st-8th grade) attend public funded schools [65], as does our sample, and we therefore believe that our sample is to an extent characteristic of this age group in Chile. Thirdly, as with any dietary study, our results are subject to the possibility of misreporting. In particular, the parents/caregivers of our younger participants might not have been aware of all foods consumed by the child, in particular during the school day, and even though we attempted to complement our information with the use of school lunch menus, it is always possible that the information is incomplete. Finally, the dietary intake was from a one-day period, which might not be representative of children and adolescents' usual food consumption, nor of their typical screen time eating behaviors.

Despite these limitations, several strengths are important to mention. First, our data enabled us to assess not only the behavior of eating during screen time, but also, how overall TV viewing relates to dietary intake. This allowed us to gain insights on the relative associations of each behavior, and whether behavioral interventions and recommendations should focus on discouraging one behavior versus the other. Second, our eating occasions analysis included a substantial sample, allowing us to compare on- versus off-screen time consumption with more level of detail than other studies have done. Furthermore, unlike other studies that also focused on the eating occasion level [21, 22], we did not restrict our analyses to main meals, but also captured snacks, providing a more complete picture of the associations of interest.

Conclusions

A large percentage of children and adolescents' daily energy intake is consumed during screen time. Overall TV viewing, as well as eating during screen time were associated with some aspects of an unhealthy diet. The low correlation between eating during screen time and overall TV viewing highlights their unique importance in understanding the pathways linking screen time to diet quality and overweight. Further research is needed to fully understand the role of screen time and eating during screen time in diet quality, and whether obesity prevention interventions and policies should prioritize discouragement of these behaviors.

List Of Abbreviations

FECHIC: Food Environment Chilean Cohort

GOCS: Growth and Obesity Cohort Study

Kcal: kilocalories

RTE: ready to eat

SSBs: sugar-sweetened beverages

TV: television

USDA: United States Department of Agriculture

Declarations

Ethics approval and consent to participate

For both cohorts, written informed consent was obtained from parents or legal guardians of participants; in the case of adolescents, an assent prior to data collection was also obtained. The ethics committee of the Institute of Nutrition and Food Technology (INTA) approved the study protocol.

Consent for publication

Not applicable (individual data of participants not presented).

Availability of data and material

The datasets generated and/or analyzed during the current study are not publicly available, but are available under request to the corresponding author.

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

MLJ, FDC, CC, and LST designed the study; FDC, CC and LST acquired the data; MLJ analysed the data and drafted the manuscript with contributions from LST; all co-authors assisted in the interpretation of results, provided critical feedback to help revise, and approved the final manuscript.

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Tables

Table 1. Socio demographic characteristics, screen time and eating during screen time in study sample stratified by sex

Characteristics	Children				Adolescents			
	Girls (n=480)		Boys (n=458)		Girls (n=375)		Boys (n=377)	
Socio demographics								
Age (y; mean, sd)	4.8	4.8±0.5	4.8	4.8±0.5	13.7	13.7±0.4	13.6	13.6±0.4
Mother's education level[1] (%)								
Less than high school	94	19.6	72	15.7	96	26.1	119	32.2
High school complete	194	40.4	195	42.6	188	51.1	162	43.8
More than high school	192	40.0	191	41.7	84	22.8	89	24.1
Screen Time[2]								
Television Use								
Number of TVs in home (mean, sd)		3.1±1.1		3.1±1.2		3.3±1.2		3.3±1.1
Weekly hours reported (median, range)		9 h, 0-45		10.5 h, 0-49.5		13.5 h, 0-50.5		11.5 h, 0-44.5
Total weekly use (%)								
None	45	9.4	53	11.6	20	5.3	31	8.2
Less than 14 hours	284	59.2	241	52.6	176	46.9	189	50.1
14 hours or more	151	31.5	164	35.8	179	47.7	157	41.6
Eating during Screen Time[3]								
Per capita energy intake (kcal; median, iqr)		375, 425		407, 487		580, 727		748, 971
Per capita energy intake (% of total)		34.8, 36.7		34.4, 38.9		38.7, 46.7		43.8, 47.6
Percentage consuming	424	86.2	405	87.3	324	84.6	326	84.9
Per consumer[4] intake (kcal; median, iqr)		422, 382		461, 457		680, 648		893, 842
Per consumer intake (%; median, iqr)		38.7, 34.9		39.1, 34.6		44.5, 37.1		48.2, 42.7
Eating occasion frequency during screen time (%)[5]								
Breakfast		49.3		51.6		33.6		37.5
Lunch		36.6		32.7		34.3		37.6
Once		49.7		54.5		59.7		64.4
Dinner		46.4		40.2		68.8		67.2
Any meal		80.2		79.5		74.3		75.7
Any snack (*picoteo* or *colación*)		48.3		51.1		56.3		57.6
.. Number of eating occasions during screen time (%)								
. None	58	12.1	53	11.6	51	13.6	52	13.8
.. One to two	258	53.8	241	52.6	197	52.5	179	47.5
.. Three to four	136	28.3	149	32.5	114	30.4	124	32.9
.. Five or more	28	5.8	15	3.3	13	3.5	22	5.8

[1] Missing data for 14 adolescents. [2] Calculated with data from media exposure questionnaire. [3] Calculated from 24-hour recalls. [4] Those consuming at least one eating occasion during screen time. [5]Percent calculated with number of participants consuming each type of eating occasion as the denominator.

Table 2. Spearman correlations of participant's weekly television viewing (hours/week) with eating during screen time (% total kcal)

	Eating during screen time[1]								
	Weekdays			Weekend days			Overall		
	Rho	95%CI	p-value	Rho	95%CI	p-value	Rho	95%CI	p-value
Children	0.14 (n[2]=802)	[0.07, 0.21]	<.05	0.07 (n=136)	[-0.10, 0.23]	0.43	0.13 (n=938)	[0.06, 0.20]	<.05
Adolescents	0.16 (n=612)	[0.08, 0.24]	<.05	0.16 (n=140)	[-0.01, 0.33]	0.06	0.16 (n=752)	[0.09, 0.23]	<.05

[1]Variable operationalized from 24-hour recalls. [2] Sample size refers to number of participants (each participant contributed one food recall in the analysis)

Table 3. Comparison of nutrient densities and food group consumption during eating occasions with and without concurrent screen time[1]

Children	Meal Screen (n=1,383)		Non-screen (n=1,826)					Snacks Screen (n=613)		Non screen (n=1,545)				
Nutrients	mean	se	mean	se	Dif		p-value	mean	se	mean	se	Dif		p-value
Energy (kcal)	249	4	265	4	-17	5	**0.00**	150	5	152	4	-1	6	0.80
Total sugars (% kcal)	28	1	25	0	3	1	**0.00**	46	1	50	1	-4	1	**0.01**
Total saturated fats (% kcal)	10	0	10	0	0	0	0.37	9	0	8	0	0	0	0.35
Total sodium (mg/100 kcal)	131	3	138	3	-7	4	0.08	80	5	85	6	-5	9	0.55
Food Groups	%	se	%	se	Dif			%	Se	%	se	Dif		
RTE Breakfast cereals	6.1	0.7	3.0	0.4	3.1	0.8	**0.00**	7.3	1.1	6.2	0.6	1.1	1.3	0.38
Salty snacks	0.5	0.2	0.4	0.2	0.1	0.3	0.78	5.8	1.1	4.3	0.5	1.5	1.3	0.23
Sweets and desserts	11.9	1.0	9.0	0.7	2.8	1.2	**0.02**	29.8	1.9	31.7	1.3	-1.9	2.4	0.42
SSBs	18.5	1.1	18.2	0.9	0.3	1.5	0.86	12.7	1.5	19.8	1.0	-7.1	1.9	**0.00**
Milk and yogurts	45.4	1.4	39.8	1.0	5.6	1.9	**0.00**	34.5	2.0	28.8	1.2	5.7	2.5	**0.02**
Fruits	10.2	0.9	12.8	0.8	-2.6	1.1	**0.02**	19.7	1.7	19.5	1.1	0.2	2.1	0.92

Adolescents	Meals Screen (n=985)		Non-screen (n=1,265)					Snacks Screen (n=562)		Non-screen (n=1,192)				
Nutrients	mean	se	mean	se	Dif		p-value	mean	se	mean	se	Dif		p-value
Energy (kcal)	445	9	428	8	17	13	0.19	223	10	244	8	-21	14	0.14
Total sugars (% kcal)	19.2	1	21.0	1	-2	1	**0.04**	42	1	39	1	3	2	0.12
Total saturated fats (% kcal)	9.2	0	9.1	0	0	0	0.74	9	0	10	0	-1	0	**0.03**
Total sodium (mg/100 kcal)	149.0	5	139.0	3	10	6	0.10	88	21	108	13	-20	26	0.45
Food Groups	%	se	%	se	Dif			%	se	%	se	Dif		
RTE Breakfast cereals	3.2	0.6	2.7	0.5	0.6	0.7	0.43	5.2	1.0	3.5	0.6	1.8	1.2	0.13
Salty snacks	0.6	0.3	0.8	0.3	-0.2	0.4	0.54	10.6	1.6	7.9	1.0	2.7	2.1	0.20
Sweets and desserts	11.4	1.2	12.1	0.9	-0.7	1.5	0.67	37.8	2.3	39.6	1.6	-1.8	3.0	0.55
SSBs	27.1	1.6	24.5	1.2	2.6	2.1	0.21	20.4	1.8	18.4	1.2	2.0	2.3	0.37
Milk and yogurts	17.2	1.3	25.0	1.2	-7.8	1.8	**0.00**	14.6	1.5	12.5	1.1	2.0	1.9	0.29
Fruits	11.4	1.2	11.3	0.9	0.1	1.5	0.95	17.3	1.8	10.7	1.1	6.6	2.2	**0.00**

[1] Model adjusted for sex, age in months, maternal education level, day of interview (weekday vs weekday/holiday), and location of consumption (school vs. not at school). [2] Standard errors adjusted for 938 clusters (in children) and 738 clusters (in adolescents).

Table 4a. Predicted daily nutrient intake by consumption during screen time (% kcal) and tertiles of TV viewing (weekly hours), among children.

	Eating during screen time							
	Tertile 1 (n=313) Range: 0-21.7% kcal		Tertile 2 (n=313) Range: 21.8-46.9%		Tertile 3 (n=312) Range: 47.0-100%		p-value	
	mean	se	mean	se	mean	se	2 vs 1	3 vs 1
Nutrients								
Energy (kcal)	1,260	22	1,243	22	1,210	22	0.59	0.10
Total sugars (% energy)	27.7	0.5	29.1	0.5	29.2	0.5	**0.03**	**0.02**
Saturated fat (% energy)	9.7	0.2	9.9	0.2	9.9	0.2	0.30	0.36
Sodium (mg/1000 kcal)	1208	25	1217	25	1220	25	0.80	0.74
Food Groups								
RTE Breakfast cereals (g)	6.9	0.8	6.9	0.8	7.0	0.8	0.97	0.90
Salty snacks (g)	3.8	0.9	5.5	0.9	4.2	0.9	0.19	0.77
Sweets and desserts (g)	54.4	3.5	51.2	3.5	45.9	3.5	0.51	0.09
SSBs (g)	155.4	10.8	163.9	10.8	155.2	10.8	0.58	0.99
Milks and yogurts (g)	282.4	12.5	260.4	12.5	294.6	12.5	0.21	0.49
Fruits (g)	80.6	5.2	66.5	5.2	61.1	5.2	0.06	**0.01**
	Weekly hours of television viewing							
	Tertile 1 (n=324) Range: 0 - 5.5 h		Tertile 2 (n=304) Range: 5.6 - 14 h		Tertile 3 (n=310) Range: 14.5 - 49.5 h		p-value	
	mean	se	mean	se	mean	se	2 vs 1	3 vs 1
Nutrients								
Energy (kcal)	1,222	21	1,243	22	1,249	22	0.50	0.38
Total sugars (% energy)	28.7	0.5	28.8	0.5	28.5	0.5	0.91	0.83
Saturated fat (% energy)	9.6	0.2	9.9	0.2	10.0	0.2	0.29	0.19
Sodium (mg/1000 kcal)	1186	24	1210	25	1251	25	0.49	0.06
Food Groups								
RTE Breakfast cereals (g)	7.7	0.8	6.9	0.8	6.1	0.8	0.46	0.14
Salty snacks (g)	4.4	0.9	3.8	0.9	5.1	0.9	0.65	0.57
Sweets and desserts (g)	42.9	3.5	54.8	3.6	54.2	3.5	**0.02**	**0.02**
SSBs (g)	163.9	10.6	142.2	10.9	167.8	10.8	0.16	0.80
Milks and yogurts (g)	280.6	12.3	280.4	12.7	276.3	12.6	0.99	0.81
Fruits (g)	73.2	5.1	69.0	5.3	65.8	5.3	0.57	0.32

[1] Model adjusted for sex, age in months, mother's education level, and day of interview (weekday versus non-weekday).

Table 4b. Predicted daily nutrient intake by consumption during screen time (% kcal) and tertiles of TV viewing (weekly hours), among children.

	Eating during screen time							
	Tertile 1 (n=251) Range: 0-26.7%		Tertile 2 (n=251) Range: 26.8-56.8		Tertile 3 (n=250) Range: 56.9-100%		p-value	
	mean	se	mean	se	mean	se	2 vs 1	3 vs 1
Nutrients								
Energy (kcal)	1,953	41	1,782	41	1,840	41	**0.00**	**0.05**
Total sugars (% energy)	21.6	0.6	21.9	0.6	21.5	0.6	0.64	0.98
Saturated fat (% energy)	10.2	0.2	9.6	0.2	9.5	0.2	**0.02**	**0.01**
Sodium (mg/1000 kcal)	1294	29	1316	29	1346	29	0.60	0.21
Food Groups								
RTE Breakfast cereals (g)	4.7	1.1	6.2	1.0	7.0	1.1	0.33	0.13
Salty snacks (g)	14.6	2.4	16.2	1.0	9.3	2.4	0.65	0.12
Sweets and desserts (g)	105.5	6.7	69.5	2.4	76.6	6.7	**0.00**	**0.00**
SSBs (g)	321.1	24.2	332.5	6.7	341.1	24.2	0.74	0.56
Milks and yogurts (g)	193.4	12.4	170.0	24.1	154.9	12.3	0.18	0.03
Fruits (g)	69.8	6.5	73.6	12.3	53.8	6.5	0.68	**0.08**

	Weekly hours of television viewing							
	Tertile 1 (n=269) Range: 0 - 8.5 h		Tertile 2 (n=235) Range: 8.6 - 18.5 h		Tertile 3 (n=248) Range: 19 - 50.5 h		p-value	
	mean	se	mean	se	mean	se	2 vs 1	3 vs 1
Nutrients								
Energy (kcal)	1,791	39	1,827	42	1,958	41	0.52	**0.00**
Total sugars (% energy)	21.2	0.5	21.8	0.6	22.0	0.6	0.48	0.31
Saturated fat (% energy)	10.0	0.2	9.8	0.2	9.5	0.2	0.59	0.09
Sodium (mg/1000 kcal)	1356	28	1282	30	1314	29	0.08	0.31
Food Groups								
RTE Breakfast cereals (g)	6.8	1.0	6.2	1.1	4.9	1.0	0.66	0.19
Salty snacks (g)	12.7	2.3	10.7	2.5	16.5	2.4	0.56	0.26
Sweets and desserts (g)	84.6	6.6	81.9	7.0	84.6	6.8	0.79	0.99
SSBs (g)	286.6	23.3	318.6	24.8	391.7	24.0	0.35	**0.00**
Milks and yogurts (g)	196.7	11.9	160.8	12.7	158.2	12.3	**0.04**	**0.03**
Fruits (g)	67.2	6.3	64.7	6.7	65.1	6.5	0.79	0.82

[1] Model adjusted for sex, age in months, mother's education level, and day of interview (weekday versus non-weekday).

Supplementary File Legends

Supplementary File 1. Approach used for calculating weekly television viewing hours

Supplementary File 2. Sample products included in each food group of analyses

Supplementary File 3. Television behavior and use by cohort age group

Supplementary File 4. Per capita and per consumer intake of key food groups during screen time versus off screen time.

Supplementary File 5. STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

Figures

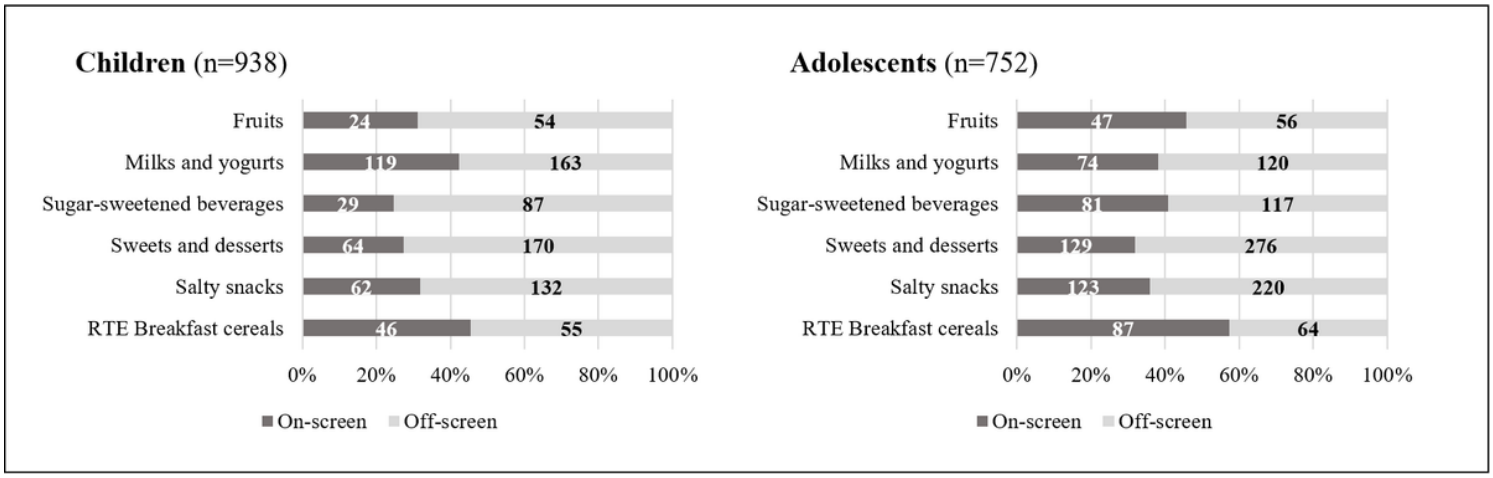

Figure 1

Proportion of energy intake from key food groups consumed on- versus off-screen, in children and adolescents (numbers in figure are in kilocalories).

Supplementary Files

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