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Patterns of sugar-sweetened beverage consumption amongst young people aged 13–15 years during the school day in Scotland

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ABSTRACT

Background: There is currently little research regarding sugar-sweetened beverage (SSB) consumption patterns of young people though adolescents are thought to be frequent consumers of these drinks. There is no research regarding the other foods and drinks consumed alongside SSBs by young people. The aim of this paper is to explore the patterns of SSB purchase and consumption amongst young people aged 13–15 years.

Methods: A purchasing recall questionnaire (PRQ) was administered online in seven case study schools with 535 young people aged 13–15 years. Nutrient composition (kilocalories, fat, saturated fat, sodium and sugar) was also calculated for food/drink purchases. Chi-Square and Wilcoxon-Mann Whitney tests were conducted to examine patterns of SSB consumption and sugar/kilocalories consumption for SSB consumers and non-consumers.

Results: SSB consumers were significantly more likely to consume a drink at mid-morning break. Fewer consumed food at mid-morning break, ate food before school or ate food at lunchtime, but this was not statistically significant. A higher percentage of SSB consumers consumed 'unhealthy' food and drinks in comparison to young people who did not consume a SSB. Both median lunchtime sugar consumption (40.7 g vs 10.2 g) and median sugar as a percentage of Kcals (39% vs 14%) were significantly higher for SSB purchasers in comparison to non-purchasers.

Conclusion: The analysis highlights that SSB purchasers consume significantly more sugar at lunchtime than non-purchasers. However, both purchasers and non-purchasers exceeded WHO (2015) recommendations that sugar consumption be halved to form no more than 5% of daily energy intake. This study provides new insights for public health stakeholders and schools. Multifaceted and inventive strategies relevant to young people will be required to achieve the new WHO recommendations.

1. Background

There is widespread global concern about the prevalence of obesity across many developed countries. Obesity and overweight in adulthood is associated with a range of health outcomes including increased risk of heart disease, liver disease, stroke and type 2 diabetes (Kopelman, 2007). There is particular concern about obesity prevalence amongst child and adolescent populations, as many children go on to develop the conditions associated with adult obesity. Across developed countries more than a fifth of children aged 2–19 years (23.8% of boys; 22% of girls) is obese (Ng et al., 2014). The prevalence of 2–15 year olds in England who are overweight or obese is 31.2% (Health and Social Care Information Centre (HSCIC), 2015); and in Scotland 28% of children aged 2–15 years are considered at risk of overweight or obesity (The Scottish Government, 2016). Of the 34 countries within the Organisation

Abbreviations: BMA, British Medical Association; BMI, body mass index; FSA, Food Standards Agency; FSM, free school meals; FSS, Food Standards Scotland; HBSC, Health Behaviour in School-aged Children; HSCIS, Health and Social Care Information Centre; Kcals, kilocalories; NDNS, National Diet and Nutrition Survey; NICE, National Institute of Clinical Excellence; NMES, non-milk extrinsic sugars; OECD, Organisation for Economic Cooperation and Development; PRQ, purchasing recall questionnaire; RSD, regular soft drink; SACN, Scientific Advisory Committee on Nutrition; SIMD, Scottish Index of Multiple Deprivation; SSB, sugar-sweetened beverage; WHO, World Health Organisation.

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for Economic Cooperation and Development (OECD), the UK has the 9th highest prevalence of overweight (including obesity) amongst children aged 2–19 years. Prevalence of overweight and obesity for boys in the UK rank 15th highest (26.1%) and 4th highest for girls (29.2%; Public Health England, 2016).

In childhood and adolescence, concurrent psychosocial morbidities associated with obesity include lower self-esteem and quality of life (Griffiths, Parsons, & Hill, 2010) as well as an increased risk of depression (Sjöberg, Nilsso, & Leppert, 2005). Furthermore, the prevalence of type-2 diabetes, a disease usually associated with adult mid-life, is increasing amongst the adolescent population in the UK (Hsia et al., 2009). In order to help address this issue, the UK government previously released guidance regarding child weight management programmes (HM Government, 2009) and more recently a new Childhood Obesity Strategy was launched in 2016 (HM Government, 2016). However it has been met with some criticism that the proposals are not robust and do not go far enough to impact on public health (BMA, 2016; Diabetes UK, 2016). The Scottish Government (2011) has published an Obesity Route Map Action Plan, along with guidance for stakeholders regarding the improvement of the food and drink available to children and young people both inside and outside of school (The Scottish Government, 2014).

More recently, there has been a significant focus on the excessive consumption of sugar, which can lead to increased weight gain (Public Health England, 2015), with charities such as 'Action on Sugar' calling for the amount of sugar in processed foods and drinks to be reduced (MacGregor & Hashem, 2014). The World Health Organisation (WHO, 2015) and the Scientific Advisory Committee on Nutrition (SACN, 2015) have both suggested that sugar consumption be halved to form no more than 5% of daily energy intake for both adults and children (aged from 2 years upwards). The recommendations have also been supported by Food Standards Scotland (FSS, 2015), who have advised the Scottish Government to accept the recommendations.

Sugar-sweetened beverages (SSBs) are defined by the British Medical Association (BMA) in their most recent report as "all non-alcoholic water based beverages with added sugar, including sugar-sweetened soft drinks, energy drinks, fruit drinks, sports drinks and fruit juice concentrates (BMA, 2015)".[2] SSBs have gained particular notoriety with regards to contributing to overall sugar consumption. Specifically, SACN (2015) has provided a recommendation that consumption of SSBs be minimised. This is highly significant, given that SACN have never previously recommended that consumption of a specific food or drink be minimised in the general population. In addition, there have been appeals to introduce a 'sugary drinks tax' in the UK to further discourage consumers from purchasing these products (Faculty of Public Health, 2013). The government has recently announced that such a tax, or levy will come into effect in April 2018. It is expected that this will apply to drinks containing more than 5 g of sugar per 100 mL, with a higher rate of tax for drinks containing more than 8 g of sugar per 100 mL (HM Treasury, 2016).[3] The estimated impact that this levy will have on obesity rates in the UK is variable and it has been argued that this is a regressive policy (Cornelsen & Carreido, 2015). However, the revenue raised by the tax would be ring-fenced to improve the health and wellbeing of children (Faculty of Public Health, 2013) and is expected to be invested in sports, physical education and breakfast clubs in schools (HM Treasury, 2016).

Recent research has not only found a positive association between regular SSB consumption and weight gain, metabolic syndrome and obesity (Hu, 2013; Laverty, Magee, Monteiro, Saxena, & Millett, 2015; Malik et al., 2010), but it has also been suggested that SSBs are significantly associated with an increased risk of type-2 diabetes (Bhupathiraju et al., 2013; De Koning, Malik, Rimm, Willett, & Hu, 2011; Eshak et al., 2013; The InterAct Consortium, 2013; Wang, Yu, Fang, & Hu, 2015). In a recent meta-analysis and systematic review, Imamura et al. (2015) concluded that, independently of adiposity, SSBs may be contributing to the considerable number of new cases of type-2 diabetes. The latest National Diet and Nutrition Survey (NDNS; Public Health England, 2014) found that 78% of 11–18 year olds consumed 'soft drinks' such as SSBs over a four-day period. This age group also reported the highest mean consumption of soft drinks, which are considered to be "the largest single source of sugar for children aged 11–18 years" (Public Health England, 2015, p. 12).

Currently, there is little research regarding SSB consumption patterns of young people in the UK nations and there has been no specific or in-depth focus on what other food and drink young people who drink SSBs also consume throughout the school day. It is imperative that we illuminate the consumption patterns of young people in relation to SSBs, not only due to the potential for adverse health effects but also with the possibility that young people are overlooking key nutrients by replacing or forgoing food in favour of SSBs. Using data from a Food Standards Scotland commissioned study of food and drink purchasing and consumption (Wills et al., 2015), the aim of this paper is to explore the patterns of SSB consumption amongst young people aged 13–15 years, including other food and drink reportedly consumed alongside SSBs throughout the school day. In addition, sugar consumption will also be examined in relation to SSB consumption. Young people aged 13–15 years were the focus of this work as they are often allowed to leave the school premises at lunchtime whereas younger secondary school aged children (11–12 year olds) are not; having autonomy to purchase food and drink beyond the school gates was a key priority for this commissioned research.

2. Research design and methods

2.1. Recruitment of case study schools

A case study approach was adopted in order to fully describe and take account of the social complexities of food and drink purchasing by young people during the school day; this approach informed the use of a range of qualitative methods (not reported here), details of which can be found in the full report (Wills et al., 2015) and in subsequent publications (Wills, Danesi, & Kapetanaki, 2016). Local authority education departments were contacted in the North, South, East and West of Scotland[4] with the aim of including schools that varied in terms of deprivation (using the Scottish Index of Multiple Deprivation (SIMD)[5] rank and proportion of pupils registered for means-tested free school meals

[2] For the purpose of this paper, 100% fruit juices, dilutable juices and flavoured water will not be considered SSBs.

[3] This tax will not apply to milk-based products or fruit juice not from concentrate.

[4] This study was funded by Food Standards Scotland therefore the fieldwork took place in Scotland; the funder was not informed of the fieldwork sites selected.

[5] SIMD consists of geographical 'zones' across Scotland that are ranked from 1 (most deprived) to 6505 (least deprived) by identifying concentrations of relative deprivation, measured on the basis of 7 domains; income; employment; health; education, skills and training; housing; geographical access; and crime (The Scottish Government, 2012).

Table 1
Scottish Index of Multiple Deprivation (SIMD) category, total number of registered food outlets within 800 m of schools and Free School Meal entitlement (FSM).

	SIMD category	Number of food businesses within 800 m	% FSM entitlement
School 1	1 (most deprived)	51	30–40
School 2	1 (most deprived)	16	10–20
School 3	1 (most deprived)	31	20–30
School 4	3 (least deprived)	33	20–30
School 5	1 (most deprived)	249	20–30
School 6	3 (least deprived)	5	0–10
School 7	2 (moderately deprived)	104	30–40

(FSM)[6]) and food outlet density surrounding each school. Food outlet density was determined by the number of businesses selling food or drink registered with the Environmental Health Department of each local authority. Additional businesses observed during fieldwork were also included (Full details can be found in the report (Wills et al., 2015)). Table 1 presents the SIMD rank, FSM entitlement and number of food businesses for each case study school.

2.2. The development and administration of a purchasing recall questionnaire (PRQ)

An online purchasing recall questionnaire (PRQ) was developed and administered online by the research team in a designated classroom in each of the seven case study schools. The research team gave prior instruction regarding how to complete the PRQ and were available for further questions throughout.

The PRQ was developed to identify young people's food and drink purchasing and, to a lesser extent, consumption habits during the school lunchtime period as part of a mixed methods study (Wills et al., 2015). The main purpose of the overall research was to investigate what food and/or drink items were purchased outside of school at lunchtime on the day of the questionnaire was administered to young people aged 13–15 years. But this was set into context with additional questions about all food/drink purchased and consumed at lunchtime (as well as before school and during the mid-morning break period). The PRQ consisted of fourteen food categories and eleven drink categories[7] adapted from the Food and Drink Purchasing Module 'Food and Drink on School Days' questionnaire ((Macdiarmid et al., 2012) administered as part of the Survey of Diet among Children in Scotland (Masson et al., 2012)). Some of the food and drink categories from the 'Food and Drink on School Days' questionnaire were further divided into individual categories on the PRQ (e.g. 'pizza, chips, pies, sausage rolls or burgers' was split so that young people could indicate whether they purchased pizza, or chips, or pies etc. rather than responding that they ate something from the overall category) to enable young people to more easily report every individual item purchased and/or consumed on the day the questionnaire was administered. Other food frequency questionnaires were checked and additional categories identified were included in the PRQ (namely the category 'dessert and yoghurt'). Lastly, a pilot study was conducted to test the clarity of the questions and categories included in the PRQ; as a result, some categories were more clearly defined. For example, the 'non-diet drinks' category was separated into two categories; 'regular soft drinks' (RSDs) and 'energy drinks'.

For each category of food/drink, young people were provided with a text entry box whereby they entered a description of the food and drink items that they had consumed (not purchased) at lunchtime on the day they completed the PRQ. They were also asked where the item came from and were given multiple options to choose from; from home; the school canteen; purchased before school; purchased outside school at lunchtime; from a friend; and other. If the young person reported that the item was purchased outside of school at lunchtime the PRQ asked further detailed questions about the purchased item including; the amount consumed (all, most, half less than half, none – saved for later and none – I gave it to someone else), brand, size (grams/millilitres, if known), outlet type, outlet name, cost and whether any promotional offers were noticed by young people. The question concerning the 'outlet type' that the food and/or drink item was purchased from was adopted from the 'Food and Drink on School Days' questionnaire (Macdiarmid et al., 2012).

Demographic questions on the PRQ were completed by each young person, regardless of their purchasing or consumption responses. These questions included sex, school year group and free school meal entitlement. In addition, questions regarding how often in a week the young person usually purchased food or drink outside of school at lunchtime and how often they had a school lunch provided by the school canteen were also included (everyday, 3–4 days a week, 1–2 days a week, less than once a week, never). Although the main focus of the commissioned research was regarding the purchases made at lunchtime outside of school, questions regarding consumption before school and during mid-morning break were also included (what was consumed and where it was consumed) and completed by all young people, regardless of whether they had consumed/purchased at lunchtime or not. This was to provide context for lunchtime purchasing and consumption.

In instances where the young person had written a food and/or drink item in a category that did not seem accurate, these items were re-categorised. Re-categorisation was based on the description of the item and any additional information the young person provided in the PRQ. For example, sports drinks were predominantly entered by young people who consumed them into the 'energy drinks' category but they were re-categorised as 'Regular Soft Drinks' because they do not meet the official definition of an 'energy drink' (i.e. high caffeine beverages, containing more than 150 mg of caffeine per litre; FSA, 2015). This was the most common inaccuracy noted. Occasionally chocolate bars were entered by young people who consumed them into the 'sweets' category and

[6] FSM are available to children attending primary or secondary school in Scotland and are means tested on the basis of the parent's or guardian's income and/or any benefits that they already receive from the government (The Scottish Government, 2015). FSM entitlement was based on pupils registered by local authorities on the 2013 FSM dataset. The proportion of secondary school pupils registered for FSM across Scotland was 15.5%.

[7] Food categories: hot or cold sandwich, filled roll or baguette; pizza, pie or burger; chips; sausage roll or similar pastry item; cereal bar, biscuit or cake (including muffins, Danish pastries, doughnuts and iced buns); crisps or a similar snack; chocolate; sweets; ice cream or ice lolly; fruit or fruit salad; dessert or yoghurt (not a yoghurt drink); salad; hot pot meal or soup; and something that has not been mentioned.Drink categories: pure fruit juice or smoothie; diet drink (e.g. Diet Coke, Ribena Light); energy drink (e.g. Red Bull); regular soft drink (e.g. Coke, Ribena); flavoured water; plain water (still or sparkling); plain or flavoured milk; coffee (including latte, cappuccino etc); tea; hot chocolate; and something that has not been mentioned.

vice versa.

In most cases, the PRQ was administered online immediately after the lunch break during afternoon lessons. However, where this was not possible (because of PCs or laptops being unavailable, for example) it was administered the following morning with instructions issued to complete the questionnaire based on the lunch period from the previous day.[8] Letters explaining the purpose and procedures of the study were sent to parents or guardians at the outset, providing parents with the opportunity to withdraw the participation of their child in the study (none did so). In addition, the young people were given the opportunity to withdraw from the study by the research team at the start of the lesson period (none did so) and they gave their informed assent to participate by completing the PRQ. Instructions were given to pupils by the research team at the start of the session about how to complete the questionnaire and they had opportunity to ask questions of the researchers if they were unclear. It was explained to teachers that students were not obliged to complete the PRQ should they not want to. Ethics approval was obtained from the University of Hertfordshire Health and Human Sciences Ethics Committee prior to fieldwork commencing.

2.3. Nutrient composition

The information provided by young people regarding what was purchased was used to identify what the item was and what nutrients it contained; this was calculated for each young person who purchased at least one food/drink item outside of school at lunchtime. Items that were consumed, but not purchased outside the school at lunchtime were not included in this analysis. In order to fully identify each item purchased, the young person had to provide a description of the item, the name of the outlet it was purchased from and the price and/or size of the product. The item was then purchased from the same outlet by the research team, using the details provided by the young people in the PRQ.[9] If a full description of a food/drink item and the name of the outlet was not provided by young people, then nutrient information was not calculated.

In the case of packaged items (such as chocolate bars or bottled drinks), the weight/volume, along with nutrient information (where available) was recorded from the label by the research team. In the case of unpackaged items, such as chips or sausage rolls, the items were purchased from the outlet and weighed using digital scales[10]. If items purchased did not have the nutrient information on its packaging, the software package Diet Plan was used to calculate nutrient composition including energy (kilocalories), fat (grams), saturated fat (grams), salt (grams), sodium (milligrams) and sugar[11] (grams). If the amount consumed was recorded by the young person, nutrient composition of the food/drink was calculated whereby it was multiplied by a proxy factor (relating to whether they said they had consumed, all, most, half, little or none of the item). Data were entered into and analysed using software package SPSS version 21. Descriptive statistics and Chi-Square tests regarding both consumption and purchases were calculated and Wilcoxon-Mann Whitney tests of nutrient data were conducted to examine patterns of SSB consumption. Results were considered significant if $p < 0.05$.

3. Results

The PRQ was completed by 535 young people (Table 2); 284 (53.1%) girls; 265 (49.5%) were from class S2 (i.e. younger pupils aged 13–14 years); and 92 (17.2%) reported that they were entitled to free school meals (FSM). One-hundred and fifty-two (28.4%) did not report consuming any food at lunchtime on the day of the PRQ and 117 (21.9%) did not report consuming any drinks at lunchtime on the day of the PRQ. Thirty-seven percent reported purchasing food and/or drink at least twice a week from the school canteen. Seventy-seven percent reported purchasing outside of school at lunchtime at least twice a week, meaning the majority of young people surveyed purchase food and/or drink outside of school at lunchtime on a regularly basis in comparison to purchasing at the school canteen.

3.1. Consumption of SSBs

Analysis of SSB consumption data (not purchases) are now described and tested using Chi-Square tests. SSBs were consumed at lunchtime on the day the PRQ was administered by 224 (41.9%) young people; Table 2 presents demographic information in relation to SSB consumption. Forty-five percent of boys and 39.1% of girls reported consuming a SSB at lunchtime and 45.7% of younger pupils (class S2) and 38.1% of older pupils (class S3) reported consuming a SSB at lunchtime, however these differences were not statistically significant ($p = 0.116$ and $p = 0.113$ respectively). There was also no significant difference with regards to SSB consumption and FSM entitlement ($p = 0.841$). Significantly fewer young people who purchased lunch in the school canteen regularly (i.e. at least twice a week) consumed a SSB at lunchtime (34.5%), compared with those who purchased lunch at school less often (46.2%; $p = 0.006$). Similarly, those who purchased food or drink outside of school regularly were significantly more likely to say they consumed a SSB at lunchtime (46.1%) than those who ventured outside school at lunchtime once a week or less (27.6%; $p < 0.001$). Lunchtime SSB consumers were significantly more likely to report that they had purchased food (55.8% vs. 36.2%; $p < 0.001$) and drink (65.9% vs. 15.5%; $p < 0.001$) outside of school at lunchtime on the day the PRQ was administered.

Of the young people who reported consuming a SSB at lunchtime, 165 (73.7%) reported that the SSB they consumed was a RSD, 41 (18.3%) reported consuming an energy drink and 19 (8.5%) reported consuming both a RSD and an energy drink. However, there was no significant difference by gender ($p = 0.264$), age group ($p = 0.806$), FSM ($p = 0.582$) or regularity of purchasing inside school ($p = 0.747$) or outside school ($p = 0.374$).

3.2. Food items consumed at lunchtime

A total of 383 respondents said they consumed at least one food item at lunchtime on the day the PRQ was administered; 160 of these young people (42.8%) said that they also consumed a SSB at lunchtime and 223 (58.2%) said that they did not consume a SSB at lunchtime. This was not statistically significant ($p = 0.878$).

Table 3 compares lunchtime food consumption by young people, according to whether they also consumed a SSB at lunchtime or not. When compared to young people who did not consume a SSB

[8] There were no obvious differences in the data collected at these different time points.

[9] Where participants did not provide full details (e.g. the price of the item), but the item was still easily identifiable, this information was recorded by the researchers.

[10] For foods that consisted of separate components (e.g. a sandwich or filled roll), each component was weighed separately. For components that could not be weighed (e.g. ketchup or butter) a weight was assumed based on the suggested portion size in Diet Plan.

[11] Sugar was recorded as non-milk extrinsic sugars or 'free sugars' as defined by SACN (2015, p. 4); 'all monosaccharides and disaccharides added to foods by the manufacturer, cook or consumer, plus sugars naturally present in honey, syrups and unsweetened fruit juices. Lactose when naturally present in milk and milk products is excluded'.

Table 2
Demographic variables and consumption of SSBs at lunchtime among young people.

	All (n = 535)		No SSB Consumed (n = 311)		SSB Consumed (n = 224)		p[a]
Sex							
Girl	284	(53.1%)	173	(60.9%)	111	(39.1%)	0.116
Boy	251	(46.9%)	138	(55.0%)	113	(45.0%)	
Class							
S2 (Age 13–14 years)	265	(49.5%)	144	(54.3%)	121	(45.7%)	0.113
S3 (Age 14–15 years)	270	(50.5%)	167	(61.9%)	103	(38.1%)	
Free School Meals							
No	443	(82.8%)	257	(58.0%)	186	(42.0%)	0.841
Yes	92	(17.2%)	54	(58.7%)	38	(41.3%)	
Purchasing from school canteen							
Once a week/Never	338	(63.2%)	182	(53.8%)	156	(46.2%)	**0.006**
Regularly (at least twice a week)	197	(36.8%)	129	(65.5%)	68	(34.5%)	
Purchasing outside of school							
Once a week/Never	123	(23.0%)	89	(72.4%)	34	(27.6%)	**<0.001**
Regularly (at least twice a week)	412	(77.0%)	222	(53.9%)	190	(46.1%)	

Significant values in **bold**.
[a] Chi-squared test between lunchtime SSB consumers and non-consumers.

at lunchtime, a significantly larger proportion of SSB consumers consumed 'chips' (12.6% vs. 26.9%; $p < 0.001$) and 'sweets' (17.0% vs. 27.5%; $p = 0.008$). Twenty-six percent of SSB consumers also consumed 'chocolate', however this was not statistically significant when compared to non SSB consumers (32.5%; $p = 0.118$). Nineteen percent of SSB consumers consumed 'fruit or fruit salad' at lunchtime when compared to young people who did not consume a SSB (24.8%); however this was not statistically significant ($p = 0.153$).

3.3. Consumption before school and at mid-morning break

Table 4 presents the proportions of SSB consumers and non-consumers who also consumed food and/or drink before school and at mid-morning break. Of the young people who reported eating before school, a similar proportion also consumed a SSB at lunchtime (63.8%) to those who did not consume a SSB at lunchtime (67.8%; $p = 0.394$). There was no significant difference in food consumption at mid-morning break ($p = 0.484$) between SSB lunchtime consumers (60.7%) and non-consumers (57.6%). On the basis of young people who consumed food at mid-morning break (n = 315), a significantly larger proportion of lunchtime SSB consumers consumed sausage rolls (9.5% vs. 3.4%; $p = 0.024$) at mid-morning break, when compared to young people who did not consume a SSB at lunchtime. There was no significant difference between the proportion of SSB consumers who consumed chocolate (20.4% vs. 14.6%; $p = 0.173$), pizza (12.4% vs. 6.7%; $p = 0.085$) or chips (24.8% vs. 30.3%; $p = 0.615$) at mid-morning break, when compared to non-SSB consumers.

There was a statistically significant difference ($p = 0.042$) in the proportion of young people consuming a drink at mid-morning break when comparing lunchtime SSB consumers (71.0%) and non-consumers (62.1%). RSDs and energy drinks were among the

Table 3
Young people's consumption of food items at lunchtime in relation to SSB consumption at lunchtime (n = 383).

	No SSB consumed (n = 223)		SSB consumed (n = 160)		*p*[a]
Sex					
Girl	129	(57.8%)	78	(48.8%)	
Boy	94	(42.2%)	82	(51.2%)	
Class					
S2 (Age 13–14 years)	104	(46.6%)	90	(56.3%)	
S3 (Age 14–15 years)	119	(53.4%)	70	(43.8%)	
Free School Meals					
No	189	(84.8%)	136	(85.0%)	
Yes	34	(15.2%)	24	(15.0%)	
Total Number of Food items Consumed	516		413		
Food category consumed					
Hot or cold sandwich, filled roll or baguette	107	(48.0%)	70	(43.8%)	0.480
Pizza, pies or burgers	30	(13.5%)	24	(15.0%)	0.699
Chips	28	(12.6%)	43	(26.9%)	**<0.001**
Sausage roll or similar pastry item	22	(9.9%)	15	(9.4%)	0.846
Cereal bar, biscuit or cake	67	(30.2%)	42	(26.3%)	0.381
Crisps or similar snack	61	(27.5%)	50	(31.3%)	0.446
Chocolate	58	(26.1%)	52	(32.5%)	0.188
Sweets	38	(17.0%)	44	(27.5%)	**0.008**
Ice cream or ice lolly	6	(2.7%)	8	(5.0%)	0.243
Fruit or fruit salad	55	(24.8%)	30	(18.8%)	0.153
Dessert or yoghurt	7	(3.2%)	7	(4.4%)	0.539
Salad	8	(3.6%)	5	(3.1%)	0.790
Hot pot meal or soup	14	(6.3%)	16	(10.0%)	0.192
Other	17	(7.6%)	5	(3.1%)	0.059

Significant values in **bold**.
[a] Chi-squared test between lunchtime SSB consumers and non-consumers who also consumed food at lunchtime (n = 383).

Table 4
Food and drink consumption before school and at mid-morning break in relation to SSB consumption.

	All (n = 535)		No SSB Consumed (n = 311)		SSB Consumed (n = 224)		p^a
Food Consumed Before School	354	(66.2%)	211	(67.8%)	143	(63.8%)	0.394
Drink Consumed Before School	399	(74.6%)	233	(74.9%)	166	(74.1%)	0.333
Food Consumed at Mid-Morning Break	315	(58.9%)	179	(57.6%)	136	(60.7%)	0.484
Drink Consumed at Mid-Morning Break	352	(65.8%)	193	(62.1%)	159	(71.0%)	**0.042**

Significant values in **bold**.
[a] Chi-squared test between lunchtime SSB consumers and non-consumers.

most commonly reported items consumed at mid-morning break for those who subsequently consumed a SSB at lunchtime. On the basis of young people who consumed a drink at mid-morning break (n = 352), lunchtime SSB consumers were significantly more likely to report that they had consumed a RSD (26.3%; p = 0.001) or an energy drink (23.8%; p < 0.001) at mid-morning break when compared to those who did not consume a SSB at lunchtime (12.0% vs. 6.3% respectively), meaning they were drinking sugar-containing drinks at both mid-morning break as well as during the lunch period. At mid-morning break, plain water was significantly more likely to be consumed by those who did not consume a SSB at lunchtime (47.4% vs. 28.1%; p < 0.001), meaning they were drinking less sugar-containing drinks throughout the school day.

3.4. Lunchtime kilocalories (Kcals) and non-milk extrinsic sugar (NMES) consumption

Nutritional data were collected for 243 young people[12] based on the purchases they said they made at lunchtime outside of school on the day the PRQ was administered. One-hundred and thirty-one (54.9%) of these young people purchased a SSB at lunchtime. Median total Kcals consumed at lunchtime was 415 Kcal for SSB purchasers and 369 Kcal for non-SSB purchasers. Non-parametric[13] Wilcoxon-Mann Whitney statistical tests were carried out to test the difference in Kcals consumed between SSB purchasers (n = 131) and non-purchasers (n = 112). There was no significant difference in total Kcals consumed at lunchtime between SSB purchasers and non-purchasers (Z = −1.441, p = 0.150). Median total sugar consumption (grams) at lunchtime was 40.7 g for SSB purchasers and 10.2 g for non-purchasers. Total sugar consumption at lunchtime was significantly higher for SSB-purchasers than for non-purchasers (Z = −8.342, p < 0.001). Lastly, sugar consumption as a percentage of reported lunchtime Kcal intake was also calculated. The median for sugar as a percentage of lunchtime energy intake was 39% for SSB-purchases compared to 14% for non-purchasers. Sugar as a percentage of lunchtime Kcals intake was significantly higher for SSB purchasers than for non-purchasers (Z = −6.674, p < 0.001).

4. Discussion

This study used data from a Food Standards Scotland funded study (Wills et al., 2015) to explore the patterns of SSB consumption amongst young people aged 13–15 years, including other food and drink consumed alongside SSBs throughout the school day. This is particularly important given the plans for implementation of a 'sugary drinks tax' in the UK in April 2018 (HM Treasury, 2016), the UK government's launch of a new childhood obesity strategy, and the recent recommendations from Public Health England (2015), WHO (2015) and SACN (2015) regarding sugar and SSB consumption. There is a growing global concern regarding overweight/obesity and excessive consumption of sugar and SSBs amongst the general population. For instance, both France and Mexico have seen a reduction in SSB sales with the introduction of a 'soda tax', with the hope that it will reduce obesity and improve health in the future (WHO, 2016b). Although there is previous evidence regarding sugar and SSB consumption of young people, there is no evidence to our knowledge regarding what other food or drink is consumed alongside SSBs throughout the school day in the UK and the findings from this study provides new insights.

Five hundred and thirty-five young people completed the PRQ, of which, 224 (41.9%) consumed at least one SSB at lunchtime on the day of the PRQ. Although this study was a snapshot at one point of time during the school day, it is important to reiterate the latest National Diet and Nutrition Survey (Public Health England, 2014) findings that over a four-day period 78% of young people across the UK aged 11–18 years consumed a soft drink. The latest findings from the international Health Behaviours in School-aged Children survey (HBSC; WHO, 2016a) also show that 20% of girls and 29% of boys aged 13 years and 24% of girls and 32% of boys aged 15 years from Scotland reported daily consumption of 'soft drinks'. These gender differences were statistically significant. Furthermore, significant gender differences were found in more than half of the countries included in the HBSC report, including Germany, Spain and France. In contrast to the findings from HBSC and Wouters, Larsen, Kremers, Dagnelie, and Geenen (2010) there was no statistically significant difference between gender and SSB consumption in this study. Further contradicting the findings from HBSC international data (WHO, 2016a) that 'soft drink' consumption increases with age, this study found that while a higher percentage of younger pupils did consume a SSB at lunchtime compared with older pupils, this was not significantly different.

Lunchtime SSB consumers were significantly more likely to purchase food and drink items outside of school at lunchtime and consume a drink at mid-morning break on the day the PRQ was administered. Not all young people will have a choice about the foods and drinks that are available to them either at home or through making purchases with money given to them by parents., However it is possible that some young people, for a variety of reasons are electing to drink SSBs in preference to alternative beverages that are more nutritious, such as milk, fruit juice or water, which is concerning given that SSBs have little or no nutritional value. In addition to forgoing more nutritious beverages, it would also appear that some young people are consuming SSBs and not eating food at lunchtime or breakfast before school. This suggests that SSB consumers could be omitting key nutrients that are not present in SSBs because they are either deciding not to consume alternatives or simply do not have the availability of other more nutritious options, supporting previous conclusions (Frary, Johnson, & Wang, 2004) that SSBs have a negative impact on the

[12] 286 respondents reported that they had purchased a food or drink item at lunchtime on the day of the PRQ, however nutritional data was collected for 243 (85%) respondents due to the limited information provided and missing data (see nutrient composition in the methods sections).
[13] Data is not normally distributed, nor is it representative of the population.

quality of young people's diets.

What is particularly noteworthy is the differences in the types of food/drink consumed at lunchtime by SSB consumers when compared to non-consumers. A significantly larger proportion of SSB consumers consumed food that could be considered as 'unhealthy' (such as chips and sweets). In comparison a larger proportion of those who did not consume a SSB at lunchtime consumed food that could be considered as 'healthy' (such as fruit), although this was not statistically significant. Worryingly, from a public health and nutrition perspective, energy drinks and RSDs were the most common drinks consumed at mid-morning break by young people who subsequently drank a SSB at lunchtime. This indicates that respondents who drank SSBs in addition to the SSB they consumed at lunchtime are likely to have a considerably higher sugar intake than is reported here. Contrastingly, a significantly higher proportion of those who did not consume a SSB at lunchtime consumed plain water at mid-morning break.

Our analyses also confirm that those who purchased a SSB outside of school at lunchtime not only consumed significantly more sugar at lunchtime, but also consumed significantly more sugar as a percentage of lunchtime energy intake (Kcals) than non SSB purchasers. This is a key finding, given the new recommendations from WHO (2015) stipulating that sugar form no more than 5% of total energy intake for both adults and children. Both SSB purchasers and non-purchasers exceeded the new recommendation, which suggests considerable effort will be required to reduce young people's sugar consumption. There was also no significant difference in total Kcals consumed at lunchtime between SSB consumers and non-consumers, suggesting that the difference in sugar consumption cannot be explained by a difference in the consumption of Kcals. In other words, SSB purchasers consumed more sugar, regardless of Kcals intake. This is a public health concern given the associations between sugar consumption and type-2 diabetes (Bhupathiraju et al., 2013; De Koning et al., 2011; Eshak et al., 2013; Malik et al., 2010; The InterAct Consortium, 2013; Wang et al., 2015), weight gain and increased BMI (Hu, 2013; Laverty et al., 2015; WHO, 2015). In addition, the amount of sugar and the frequency of SSB consumption is associated with dental caries in children (NICE, 2014; SACN, 2015) and is the main reason for admitting young children to hospital in England (Faculty of Dental Surgery, 2015). However it is important to note that nutritional analysis only concerned food and drink purchased outside school at lunchtime on the day of the PRQ, omitting food and drink bought in the school canteen or brought from home. Schools in the UK are obliged to follow nutritional guidelines and therefore the food and drink sold in the cafeteria is likely to be more nutritious; SSBs are not permitted to be sold to students in the school cafeteria.

Whilst we need a strategy to reduce SSB consumption by young people, simply removing access to SSBs within schools is not enough. In the case of our study, young people were able to leave the school premises during their lunch period and had access to these retailers whilst travelling to and from school (Wills et al., 2016). However, removing food and drink retailers within the proximity of schools is not likely to provide the answer (Ellaway et al., 2012). Adolescence is an important period, whereby young people start to experience more choice and autonomy and have greater access to their own money (Wills, 2005; Wills, Backett-Milburn, Gregory, & Lawton, 2005). Leaving the school premises is not only a way to enact these new freedoms and independence but can also be related to social issues, such as wanting to socialise with friends more freely in an unrestricted environment (Fletcher, Jamal, Fitzgerald-Yau, & Bonell, 2014; Macdiarmid et al., 2015; Wills et al., 2015; Young, Gilligan, & Bainbridge, 2014). School meals may be more nutritious than food or drink available outside the school at lunchtime but they are not always enticing or enjoyable. Providing students with a choice of affordable nutritious foods and a cafeteria that allows them to socialise with their friends in a less restrictive way may encourage young people to stay within the school premises (Fletcher et al., 2014; Wills et al., 2016) where SSBs are prohibited.

Although this study provides new insights regarding young people's consumption patterns of SSBs there were limitations. The data collected were not representative of the population and it was only a snapshot of one school day as it did not include consumption in the evening or on the way home from school. In addition, the nutrition analysis was only calculated for purchases made outside of the school at lunchtime and excluded food and drink items that were either bought from the school canteen or brought from home. Extending this study to include consumption for a whole day and at the weekend would provide a better understanding of young people's SSB consumption patterns, including nutritional analysis of food and drink other than that only purchased outside the school at lunchtime. No doubt consumption during the weekend will differ significantly to that of an average school day. It would also more accurately represent the frequency and amount of SSB consumption in a typical week as well as the amount of sugar and Kcals consumed.

5. Conclusion

Although previous studies have explored SSB consumption patterns of young people, this study provides fresh insights into the food and drink consumed alongside SSBs by young people throughout the school day. However this study also illuminates new challenges for both public health officials and schools. If we are to reduce young people's sugar consumption in-line with the new recommendations (SACN, 2015; WHO, 2015) then multifaceted and inventive strategies will need to be implemented to meet this challenge (Moorhouse, Kapetanaki, & Wills, 2015), given the high levels of sugar consumption of young people who both purchased and did not purchase SSBs in this study. Providing education about 'healthy eating' that is relevant and interesting to young people is one suggestion. Banning products or reducing the number of retailers in proximity to the school is unlikely to be successful given the ample opportunities for young people to access SSBs, from home, on the way to school, on the way home from school or from underground 'black markets' (Fletcher et al., 2014). Schools should not only provide healthier yet competing and affordable options in the school canteen alongside a more desirable social environment, but they should also include young people in these decisions (Wills et al., 2016). Lastly, considering the 'unhealthy' food and drink consumed alongside SSBs by the young people in this study, it's imperative we not only find new ways to encourage them to make better choices with their increasing autonomy and independence, but also ensure that the 'healthier' options are available in order for them to make those choices.

Declarations

Ethics and consent

This study was carried out in accordance with the Declaration of Helsinki. Ethics approval for the pilot and main studies was received from the University of Hertfordshire Health and Human Sciences Ethics Committee with Designated Authority in February

2014 (Approval Number HSK/SF/UH/00045).

Consent for publication

Not applicable.

Availability of data and materials

Due to property rights data cannot be made available as a public use file at this point.

Competing interests

The authors declare that they have no financial or non-financial competing interests.

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Author's contributions

LH helped collect data, cleaned and analysed the dataset and wrote the first draft of the manuscript. WW designed the study, contributed to data collection and contributed to the development of the manuscript. Both authors read and approved the final manuscript.

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