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1 An experimental food label applied to food served at a secondary school in Greater London and its  
2 influence on adolescent food choices.

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6 Keywords: Adolescent obesity, Food label, School food provision, Food choice behaviour

7 Abstract

8 Adolescent obesity is more prevalent in the United Kingdom than in almost any other higher income  
9 nation. Providing nutritional information in the form of a food label (FL) is one strategy that has the  
10 potential to reduce obesity because it informs choices. School food can theoretically provide a third  
11 of an adolescent's daily calorie intake, yet schools in England have no policies to guide pupils to the  
12 healthiest food choices on offer.

13 This is a pragmatic study, designed and applied an experimental FL in the form of a nutritional `food  
14 score` to the food on offer in a secondary school in Greater London. Quantitative survey data was  
15 collected at three time points for a total of nine weeks to explore if the FL influenced adolescent to  
16 select healthier food options in real time data. In addition, data from a food choice questionnaire  
17 identified which factors adolescents ranked as having the greatest influence on their food choices in  
18 order to evaluate if these factors require greater integration at policy level to reduce adolescent  
19 obesity.

20 The results indicated that with the application of the FL there was no significant effect on a change in  
21 food choices. The factors that adolescents ranked the highest that most influenced their food choices  
22 were taste, hunger, price, health, appearance, smell, and food that keeps them awake. The factor that  
23 adolescents unanimously ranked that did not affect their food choices was the influence of friends.

24 1. Introduction

25 Adolescents (age 10-24 years) make up a fifth of the United Kingdom population and obesity is more  
26 prevalent in the United Kingdom in older adolescents (age 15-19 years) than in almost any other higher  
27 income nation (Shah et al., 2019). One in five adolescents in the UK (age 11-15) are obese, and yet  
28 these figures exclude those adolescents in the overweight bracket, which could indicate that there  
29 may be an underestimation of the problem in this population (GOV.UK, 2017; Buck, 2020). Obese  
30 adolescents tend to remain obese into adulthood and therefore, interventions to reduce obesity  
31 during this lifespan are important as they can lay foundations for a healthier life in adulthood which  
32 in turn brings better social, health and economic benefits to the UK (Shah et al., 2019).

1

Food label (FL)

Nutrient profiling (NP)

33 Providing nutritional information in the form of a food label (FL) is one strategy that has the potential  
34 to reduce obesity. A FL allows consumers to compare the nutritional information between similar food  
35 products which can theoretically inform consumers as to which are the healthier food choices  
36 (Arambepola et al., 2008; Chiuve et al., 2011; Arsenault et al., 2012; Storcksdieck Genannt Bonsmann  
37 and Wills, 2012; Food Standards Agency (FSA), 2020). Since December 2016 all prepacked food in the  
38 UK was required to display mandatory nutritional information on the back of a FL, presented per  
39 100g/ml or per portion of the product (National Health Service (NHS), 2018; FSA, 2021). Nutritional  
40 information on the front of prepacked FL is voluntary and is predominantly assessed through nutrient  
41 profiling (NP). NP is the science of ranking foods in accordance with their nutritional composition to  
42 prevent disease and promote health (World health Organization (WHO), 2011). NP can provide  
43 information that can be used for several purposes. NP can categorise foods such as `low in fat` (less  
44 than 3 grams of fat/100g) or `high in salt` (more than 1.5gram/100g) (NHS, 2018). NP can score the  
45 healthiness of individual foods and generate definitions such as `unhealthy` or `healthier` which  
46 describes the effect of consuming that food on an average person's health (Arambepola et al., 2008;  
47 Townsend, 2010; WHO, 2011; Rayner et al., 2013; Arora and Mathur, 2014). NP can also provide  
48 information for FLs which can be a nutrient specific or a summary system (Arambepola et al., 2008;  
49 WHO, 2011; Chiuve et al., 2011; Arsenault et al., 2012); and can be used to regulate foods that are  
50 marketed to children (Rayner et al., 2009; Rayner et al., 2013). Multiple NP models exist which differ  
51 according to their purpose of use (Tetens et al., 2007; Arora and Mathur, 2014). However, the NP  
52 models that provide information for FLs have resulted in a plethora of front of pack FL designs yet,  
53 there is no consensus as to which design has the greatest influence on food choice behaviour.

54 One third of an adolescent's daily calorie intake can theoretically be consumed at school. Main meals  
55 provided at school in England must comply with the Department for Education (DfE) School Food  
56 Standards (DfE, 2021). However, the Office for Standards in Education (Ofsted) are responsible for  
57 correlating all other guidance to support pupils on informed food choices and healthy eating (School  
58 Food Plan, 2015; Food for life.org, 2018). Despite Ofsted inspections and the School Food Standards,  
59 there is no guidance or education for pupils as to which food items on offer are the healthiest or less  
60 healthy choices.

61 The UK government has announced that from April 2022 it will enforce all businesses with 250 or more  
62 employees in England including cafes, restaurants and take away food to display calorific information  
63 on non-prepacked food and soft drinks (GOV.UK, 2021) however, this does not include school food.  
64 Yet, systematic reviews on the effectiveness of proving calories on non-prepacked food is inconclusive.  
65 Krieger and Saelens (2013) found an overall reduction of between 10 - 20 calories per meal in  
66 simulated laboratory settings. Cantu-Jungles et al., (2017) evaluated the effect of providing nutrition

67 labelling for both calories and nutrients and found that menu labelling in a live setting did not show  
68 any notable change on calories, total fat, saturated fat, sodium, or carbohydrate ordered or consumed  
69 amongst American adults.

70 Displaying calories on a FL in a school setting has been a consistent choice in which to measure if there  
71 are changes in food choice behaviour. There are three known published studies (Conklin et al., 2005;  
72 Rainville et al., 2010; Hunsberger et al., 2015) and one study which was undertaken but not published  
73 (Fresques', 2013) that have offered nutritional information in the form of calories and fat in a live  
74 school setting in America. Conklin et al., (2005) applied a FL to main course dishes at the point of sale.  
75 Results indicated that when supplying nutritional information pupils selected food choices lower in fat  
76 and calories, but the differences were slight to moderate. Rainville et al., (2010) measured calories  
77 and fat per serving in main course dishes purchased pre - and post the application of the FL. Results  
78 indicated an increase of 6.6 calories per menu item in the intervention group and decreased calories  
79 selected in the control group. Hunsberger et al., (2015) found a decrease of an average of 47 gross  
80 calories purchased/day and a reduction of an average of 2.1 grams of fat/day and the authors  
81 suggested that the FL caused pupils to take smaller portions of food. Fresques (2013) results indicated  
82 that daily calories per student between pre-intervention baseline and intervention data decreased  
83 from 602 to 596 but this was not significant, and fat remained at 23g both pre and post the  
84 intervention. Collectively, these studies cannot verify that providing information for either calories or  
85 fat influences adolescent food-choice behaviour at school. Moreover, providing calorie information  
86 on food in a school setting may not be the most appropriate FL format. Many adolescents employ  
87 dietary restraint to strive to conform to 'thinness,' which may lead to nutritional vulnerability  
88 (Shepherd and Dennison, 1996). Due to this possible vulnerability, a more overarching holistic FL is  
89 needed to guide young people to healthier food choices in school.

90 In 2009, the UK Office of Communications (Ofcom) (a government-approved regulatory and  
91 competition authority for broadcasting), requested the assistance from the UK Food Standards  
92 Association (FSA) to produce a set of criteria to assess whether food items intended to be advertised  
93 to children on television were nutritionally balanced (Rayner et al., 2009). The FSA commissioned the  
94 British Heart Foundation (BHF) to design a nutrient profile model. This model produced a numerical  
95 score for any given food product per 100g. In this model, a food score of four points or more classified  
96 the food as 'less healthy'. Only foods that scored below four from the healthy category could be  
97 advertised on television during children's viewing times. Rayner et al., (2009) suggested that this  
98 profile can also be used as a quality criterion for products supplied to school meals, hospitals, and the  
99 armed forces and for health impact assessments of meal service policies. Rayner et al., (2009) stated  
100 that 'the model can be adjusted so that points for foods and drinks fall on a scale from one to 100

3

Food label (FL)

Nutrient profiling (NP)

101 where one is the least healthy and 100 is the most healthy product using a simple formula: NEW SCORE  
102 = (-2) \*OLD SCORE + 70` (Rayner et al., 2009 pg. 8). This score is based upon per 100g of any given  
103 dish. Healthier food choices are calculated from their percentage per 100g from vegetables, fruits,  
104 seeds, nuts, legumes and per 100g from protein and fibre. Foods that are less healthy are calculated  
105 as foods that contain saturated fat, sodium, total sugars per 100g and kilo joules (kJ) energy content  
106 per 100g. Overall, foods that scored 64 and below are `less healthy` and foods that scored 65 and  
107 above are `healthy`. Using the Ofcom NP model was the basis of the experimental FL in the form of a  
108 `food score` for this study.

109 Regardless of the influence of a FL the theory of food choice is complex and is comprised of multiple  
110 interacting factors that require consideration when determining adolescent eating behaviour. Food  
111 choices can be influenced by individual, social and cultural aspects which are further shaped by  
112 internal and environmental factors (Story et al., 2002; Ooi et al., 2015). By understanding the factors  
113 that govern adolescent food choices can allow for an effective modification of dietary patterns  
114 (Steptoe et al., 1995). Steptoe et al., (1995) developed a food choice questionnaire that methodically  
115 identified both health and non-health related factors that influence food choices decisions. The  
116 development of a multidimensional questionnaire allowed a direct comparison of the importance  
117 placed on each of the nine factors encompassing health, mood, convenience, sensory appeal, natural  
118 content, price, weight control, familiarity, and ethical concern which consisted of 36 items. Ooi et al.,  
119 (2015) modified Steptoe et al`s., (1995) version specifically to determine food choice motives for  
120 Malaysian adolescents. Ooi et al`s (2015) food choice questionnaire identified six factors (health and  
121 nutrition knowledge, price and convenience, media, mood and sensory appeal, peers, and parents)  
122 which consisted of 36 items (Table 1).

123 The objective of this pragmatic study is to explore whether an experimental FL in the design of a  
124 nutritional `food score` when applied to food on offer in a secondary school setting could guide  
125 adolescents to select healthier food choices. However, the factors influencing adolescent eating  
126 behaviour are not fully understood because eating behaviour is multi-faceted. Using a food choice  
127 questionnaire this study intended to measure the importance adolescents placed on the factors that  
128 influence food choice behaviour and to evaluate if these factors require greater attention and  
129 integration into public health strategies that aim to reduce adolescent obesity.

## 130 2. Methodology

131 The study used a quantitative experimental design in which an intervention was implemented to  
132 evaluate if a change in food choice behaviour occurred. The target population for this research was  
133 adolescents, as there is a lack of previous research on this population group's food choices at school.

134 The characteristics were adolescents in English state secondary schools in London. The term `state`  
135 schools include community schools, foundation schools, and grammar schools controlled by the local  
136 government or academies run by a governing body (GOV.UK, ND). The term secondary school  
137 educates students between the ages of 12 and 16, students can go onto sixth form from the ages of  
138 16 and 18 years old (Internations, 2020). The exclusion criteria consisted of special educational needs  
139 secondary schools because an individual's food choices may include a range of individual additional  
140 factors. The geographical area was identified as the boroughs in London ( $n=33$ ) as they are accessible  
141 to the researcher. The four poorest boroughs in London were initially selected (Ealing, Brent, Newham  
142 and Barking & Dagenham) (London's Poverty Profile, 2018). The link between poverty and childhood  
143 obesity is well documented (Webb et al., 2006; Gosis et al., 2016; Cohen, 2018) therefore, if the food  
144 score proved successful in changing adolescent food choice behaviour this would be an important  
145 finding for public health policies (Gosis et al., 2016). The study used non-probability typical case  
146 purposeful sampling (Fox et al., 2018) and the four boroughs' councils web sites were analysed to  
147 establish who operated the school catering provision.

148 The contract caterer that agreed to take part in the study nominated a school in Greater London that  
149 met the criteria. The criteria required the school to have a cashless payment system to record sales,  
150 to minimise additional operational work for the caterer, be a mixed gender school as the study sought  
151 to identify if there were gender differences in food choices, to obtain the client consent (the client is  
152 the contact between the school and the caterer), and to allow the study to be implemented in term  
153 one or term two. Term three (Easter to July) was not included in this research due to the number of  
154 pupils who would not be at school due to exam revision or were on work experience and therefore  
155 not using the school restaurant.

156 The caterer provided the school's three-week autumn menu cycle (Figure 1).

School - Autumn Week Three				
MENU				
MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Chicken Tikka Masala served with Rice & Mango Chutney	Cottage Pie Served With Fresh Broccoli	Baked Ham with Roast Potatoes & Seasonal Vegetables	Southern Fried Chicken served with Wedges & Spicy Slaw	Fish of the Day with Tartar Sauce, Lemon, Chips & Peas or Beans
Chana Dhal served with Rice & Mango Chutney	Cheese topped Bean Hot Pot	Spinach, Feta & Mushroom Tart	Roasted Pepper & Mature Cheddar Frittata with Side Salad	Fresh Vegetable & Barley Casserole
Jacket Potato with a choice of Fillings	Jacket Potato with a choice of Fillings	Jacket Potato with a choice of Fillings	Jacket Potato with a choice of Fillings	Jacket Potato with a choice of Fillings
Pasta, Noodle or Rice Pot with freshly made Sauces	Pasta, Noodle or Rice Pot with freshly made Sauces	Pasta, Noodle or Rice Pot with freshly made Sauces	Pasta, Noodle or Rice Pot with freshly made Sauces	Pasta, Noodle or Rice Pot with freshly made Sauces
Rhubarb Crumble with Custard Sauce	Apple sponge cake with Custard Sauce	Warm Lemon Drizzle Cake with Custard	Chocolate Sponge with Chocolate sauce	Selection of Hot & Cold Desserts

**Available Daily**  
Mixed Salad, Jacket Potatoes, Selection of Filled Sandwiches, Baguettes, Paninis, Wraps, Salad Boxes, Shaker Pots, Fresh Fruit Pots, Dessert Pots, Yoghurt Pots and Drinks including Homemade Smoothies

157

158 Figure 1 Autumn week menu 3 of the selected school

159 Due to the limited space in the schools' restaurants not all food items could display a food score. The  
 160 selected food items that displayed the food score had to meet the following criteria: the food item  
 161 was in the top 20 highest sales from the previous menu cycle to reflect current eating behaviour and  
 162 the food item had to be pre-coded into the till. The caterer's dietician provided a standardised recipe  
 163 for each of the selected dishes on the menu. The nutritional information from the standard recipes  
 164 was entered into the Diet plan 7 nutrition software package that created a breakdown of nutrients  
 165 per 100g (foresoft.com, 2021) for each dish.

166 This study used the Ofcom NP model which was modified to score food from one to 100 with a score  
 167 of one being the least healthy and a score of 100 the healthiest. When the breakdown of nutrients per  
 168 100g from Diet plan 7 were input into the Ofcom model this generated a food score for each selected  
 169 dish on the menu cycle. The food score was the basis of the numerical nutritional FL which compared  
 170 the average means of the food score from pre-intervention baseline, which took place in weeks one,  
 171 two and three and at post-intervention phase one which were recorded in weeks four, five and six and

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Food label (FL)

Nutrient profiling (NP)

172 post-intervention phase two recorded in weeks seven, eight and nine. If the mean food score  
173 increased in the post-intervention phase one or post-intervention phase two the food score was  
174 successful in changing adolescent food choices to healthier options. If the mean score decreased or  
175 remained unchanged in the post-intervention phases, the food score was not deemed successful in  
176 changing adolescent food choices.

177 The caterer recorded daily sales for each dish on the menu cycle for the nine-week intervention.  
178 Weeks 1, 2 and 3 were recorded as pre-intervention baseline sales. No scores were visible to the pupils  
179 at this stage. The week (0) before the intervention began tutors received an `awareness pack` which  
180 contained a standardised tutor sheet to read to their tutor group on how the food score worked and  
181 each pupil had a `know your score` postcard. The message on the post card was `the higher the score  
182 the healthier the food choices`. When the intervention commenced the food scores were placed in  
183 holders on the sneeze screen above or beside each dish (Figure 1) and A3 posters, identical to the  
184 pupils' postcards, were displayed in the school restaurant (Figure 2). Pre-intervention baseline sales  
185 were compared to a repeat of the three-week menu cycle at post-intervention phase one (weeks 4, 5  
186 and 6) and post-intervention phase two (weeks 7, 8 and 9). Sales were analysed to establish if the  
187 intervention influenced food choice behaviour and to evaluate if any effect would be sustained. It was  
188 hypothesised that the mean scores of the foods selected will increase after the application of the food  
189 score, that will indicate that pupils selected healthier food choices.



190



191

192 Figure 1. Food scores placed on the sneeze screen and next to the food items, to indicate the  
 193 nutritional value, cards were relatively large to easily recognisable



194

8  
 Food label (FL)  
 Nutrient profiling (NP)

195 Figure 2 indicates the A3 posters used on display to remind students about the nutritional value of the  
196 products and increase awareness

197 After the nine-week intervention pupils were requested to complete a four-part paper-based food  
198 choice questionnaire which were distributed through the form tutors and all educational years. Each  
199 pack contained a tutor guide for tutors to read out in tutor time and packs of questionnaires. Pupils  
200 were asked to complete the questionnaires during tutor time. After completion, each tutor collected  
201 and returned the questionnaires to a designated area that the client had organised at the school. As  
202 this was a paper-based questionnaire the researcher manually input the completed replies ( $n=744$ )  
203 into Bristol Online (now called Jisc). Part one requested sociodemographic data, part two asked lunch  
204 preferences, part three asked pupils to rank on the five-point scale, with five being the highest and  
205 one being the lowest whether they noticed the food score, and if they considered the food score  
206 influenced their food choices. Part four of the questionnaire asked participants to rank on the five-  
207 point scale which factors from the combined FCQ from Steptoe et al., (1995) and Ooi et al., (2015)  
208 (Table 1) had the greatest influence on adolescent food choice at school. Two additional questions  
209 were included. The literature identified that adolescents reveal that they are interested in nutrition,  
210 and that they understand that they should consume five portions of fruit and vegetables. This  
211 questionnaire wanted to ask the importance of food containing *lots of fruits and vegetables*. Hunger  
212 was also identified as a factor from the literature, therefore, how important was *keeps me full* was  
213 included. Each of the 21 questions started with *it is important to me that the food I eat on a typical*  
214 *day at school (tick one answer from the five-point scale from one being not important to five being*  
215 *very important from each line).* This quantitative data enabled the identification of any statistically  
216 significant differences in the importance adolescents place on factors affecting their food choice.

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226 Table 1 Identifies the constructs and factors selected in each food choice motives questionnaire.

<i>Steptoe et al., (1995)</i>	<i>Ooi et al., (2015)</i>	<i>School Questionnaire</i>
Contains a lot of vitamins and minerals	Contains vitamins and minerals	Contains vitamins and minerals
Keeps me healthy	Keeps me healthy	Keeps me healthy
Is nutritious	Is nutritious	Is nutritious
Is high in fibre	Is high in fibre	Is high in fibre
Is high in protein	Is high in protein	Is high in protein
Is good for my skin/teeth/hair/nails		NA
Contains no artificial ingredients	Contains no artificial ingredients	NA
Is low in calories	Is low in calories	Is low in calories
Is low in fat	Is low in fat	Is low in fat
Helps me to control my weight	Helps me to control my weight	Helps me to control my weight
Contains natural ingredients	Contains natural ingredients	NA
Contains no additives		NA
Is cheap	Is cheap	Is cheap
Is not expensive	Is not expensive	NA
Is easily available in shops/supermarkets	Is easily available in shops/supermarkets	NA
Takes no time to prepare	Takes no time to prepare	NA
Can be cooked very simply	Can be cooked very simply	NA
Can be bought in shops near to where I live/study	Can be bought in shops near to where I live/study	NA
Is easy to prepare	Is easy to prepare	NA
Is good value for money	Is good value for money	NA
	Is the focus showed in the advertisement	NA
	Is as promoted in advertisement in the media	NA
	Is advertised in the media (television, radio internet etc.)	NA
	Is suitable for the image as advertised in the media	NA
Helps me cope with stress		Helps me cope with stress
Makes me feel good	Makes me feel good	Makes me feel good
Cheers me up	Cheers me up	NA
Helps me relax	Helps me relax	NA
Smells nice	Smells nice	Smells nice
Looks nice	Looks nice	Looks nice
Helps me cope with life	Helps me cope with life	NA
		Keeps me full
Tastes good	Tastes good	Tastes good
Keeps me awake/alert		Keeps me awake
Has a pleasant texture		Has a pleasant texture
		Includes lots of fruit and vegetables
Is what I usually eat		Is what I usually eat
Is familiar		Is familiar
Is like to food I ate as a child		NA
Comes from countries I approve of politically		NA
Has the country of origin clearly marked		NA
Is packaged in an environmentally friendly way		NA
	Is recommended by my friends	NA
	Is preferred by my friends	NA
	Similar to those consumed by my friends	Similar to those chosen by my friends
	Is encouraged by my friends	NA
	Is preferred by my father/mother	NA
	Is recommended by my father/mother	NA
	Is prepared by my father/mother	NA

227

228 3. Results and discussion

229 Each of the selected 14 dishes on the menu cycle had a calculated food score. Each time a pupil  
 230 selected a dish the food scores were recorded to provide a daily score for each dish. The daily scores  
 231 were added together to provide a mean food score for each dish each week. If after the application of

232 the FL healthier food options (higher scores) were selected more frequently the mean food scores  
 233 would increase. The differences in the mean food score before and after the application of the FL  
 234 would indicate its effectiveness.

235 3.1. FL and effect on sale of items – real-time purchasing effect

236 As indicated in Table 2 from the nine weeks experiment the mean food score from pre-intervention  
 237 baseline (weeks 1, 2 and 3) (43587.21) to post-intervention phase one (week 4, 5 and 6) (47473.93)  
 238 increased by 3886.72 then decreased from post-intervention phase one (47473.93) to post-  
 239 intervention phase two (weeks 7, 8 and 9) (46454.64) by 1019.29. The total increase in the food score  
 240 from pre-intervention baseline to post-intervention phase two was 2867.43. Mauchly’s test indicated  
 241 significance at 0.002, so the Greenhouse Geiser adjustment was used, and an ANOVA indicated that,  
 242 although the mean suggests an upward trend, no significant difference was present ( $F(2, 26) = 2.19$ ,  
 243  $p > .05$ ). There is no literature that has evaluated the application of a food score to food on offer at a  
 244 secondary school to compare to these findings.

245 Table 2 Indicates the Mean and Standard Deviation (SD) of the Food scores at baseline, three weeks,  
 246 and six weeks for this school

<i>Results for the School</i>	<i>TIME 1 Pre-intervention Food Score (weeks one, two and three) 3 weeks</i>	<i>Baseline</i>	<i>TIME 2 Post-intervention phase one Food Score (weeks four, five and six) 3 weeks</i>	<i>TIME 3 Post-intervention phase two Food Score (weeks seven, eight and nine) 3 weeks</i>
The Mean	43587.21		47473.93	46454.64
The Standard Deviation	(11961.31)		(8332.01)	(9126.66)

247 This research sought to detect if females reported noticing the food score more than males (Table 3)  
 248 and if females self-reported that the food score affected their food choices more than males (Table  
 249 4). In the questionnaire pupils were asked to select (from a five-point scale) how much they noticed  
 250 the food score from one, they did not notice to five, they did notice. Using the same scale, pupils were  
 251 asked how much the food score affected their food choices from one, it did not affect my food choice  
 252 to five, it did affect my food choices. From the 744 pupils’ response to ‘Did you noticed the food score’  
 253 then removing the incomplete data for gender declaration, 674 responses remained. Most pupils  
 254 responded at either end of the scale and those answering 2-4, indicating uncertainty, were not  
 255 included in the following analyses. From the 346 female responses, 198 (57.2%) selected score 1  
 256 meaning they did not notice the food score and 54 (15.6%) selected score 5 meaning that they did  
 257 notice the food score. From the 328 male responses, 186 (56.7%) selected score 1 and 61 (18.6%)  
 258 selected score 5. There was a non-significant association between pupils’ gender and noticing the food  
 259 score  $\chi^2(4) = 1.46, p > .05$  (Table 3).

260

261 Table 3 Indicates the gender and frequency of responses to each category of notice the food score

<i>School</i>	<i>Gender</i>	<i>% that selected Score 1</i>	<i>Number of responses</i>	<i>% that selected Score 5</i>	<i>Number of responses</i>	<i>Chi Square Value</i>	<i>* Indicates Significant results</i>
	Females	57.2	198	15.6	54	1.46	
	Males	56.7	186	18.6	61		

262

263 3.2.FL and food choices

264 From the self-reported questionnaire fewer pupils responded to the question of whether the food  
 265 score affected their food choices (Table 4). From the 661 pupils' response to 'Did the food score affect  
 266 your food choices' From the 339 female responses, 216 (63.7%) selected score 1 meaning it did not  
 267 affect their food choices and 25 (7.4%) selected score 5 meaning that it did affect their food choices.  
 268 From the 322 male responses, 216 (67.1%) selected score 1 and 19 (5.9%) selected score 5. There was  
 269 a non-significant association between pupils' gender and pupils reporting that the food score had a  
 270 perceived effect on their food choices  $\chi^2 (4) = 1.36, p > .05$ .

271 Table 4 Indicates the gender and frequency of responses to each category of 'self-reporting if the food  
 272 score 'affected their food choices

<i>School</i>	<i>Gender</i>	<i>% that selected Score 1</i>	<i>Number of responses</i>	<i>% that selected Score 5</i>	<i>Number of responses</i>
	Females	63.7	216	7.4	25
	Males	67.1	216	5.9	19
	Mean		(216)		(16)

273

274 As the study by Hunsberger et al., (2015) identified not noticing a FL could be attributed to either  
 275 adolescents' automatic non-cognitive behaviour or their lack of awareness could be due to the impact  
 276 of the time pressured environment in a school restaurant. As a pupil in Hunsberger et al., (2015) stated  
 277 'nobody would really have time to stop right there and look at it because you have to keep on going'  
 278 (Hunsberger et al., 2015, p. 5). In addition, one pupil stated 'when we see it big, we want to know what  
 279 that is because you notice it more' (Hunsberger et al., 2015 p. 5).

280 The results from this study indicated that adolescents did not notice the FL and that the FL did not  
 281 influence their food choices, yet other studies do identify adolescents do engage with a FL. Some  
 282 studies identified that adolescents are high FL users (Haidar et al., 2017), others report that  
 283 adolescents were frequent FL readers, with females being significantly higher than males, 'use' was  
 284 attributed to seeking price, expiry date and brand name (Saha et al., 2013; Talagala and Arambepola,  
 285 2016).

286

287 3.3. What adolescents think that matters in their food choice decision making  
 288 The research aimed to ascertain which of the 21 factors on the FCQ adolescents score as the most  
 289 important (score five) and the least important (score one) with regard to influencing their food choices  
 290 at school. Results indicated that the highest percentage of pupils scored the following factors at score  
 291 five, 64.9% `tastes good`, 32.9% `keeps me full`, 29.9% `is cheap`, 29.2% `keeps me healthy`, 28.9%  
 292 `looks nice`, 26% `smells nice`, and 25.2% `keeps me awake`. The factor that was identified as the least  
 293 influential (score one) was 66.5% `is similar to foods chosen by my friends` and 31.3% `helps me cope  
 294 with stress` (Table 5)

295 Table 5 indicates the factors that were identified as having the greatest influence of adolescent food  
 296 choices at school

*Factors influencing food choices at school*

<i>Likert scale 1-5</i>	1	2	3	4	5
<i>Contains vitamins and minerals</i>	18.5	13.3	30.8	19.7	17.6
<i>Is nutritious</i>	14.8	12.5	29.3	23.1	20.3
<i>Is high in fibre</i>	21.6	18.5	32.5	15.3	12.1
<i>Is high in protein</i>	17.7	16.2	30.5	21	14.6
<i>Is low in calorie's</i>	19.6	18	32	16.8	13.6
<i>Is low in fat</i>	19	17.1	31.1	18.7	14
<i>Helps me control my weight</i>	24	16.9	28.8	14.7	15.4
<i>Keeps me healthy</i>	12.9	9.6	23.5	24.8	29.2
<i>Includes lots of fruit and vegetables</i>	21.9	22.2	31.6	12.6	11.7
<i>Is what I usually eat</i>	17.9	15.1	29.9	20.8	16.3
<i>Is cheap</i>	15.4	12.7	22.8	19.2	29.9
<i>Makes me feel good</i>	15	12	28.9	21.1	23
<i>Smells nice</i>	15.3	12.1	21.2	25.4	26
<i>Looks nice</i>	10.8	9.5	22.6	28.3	28.9
<i>Keeps me full</i>	9	9	22.9	26.2	32.9
<i>Keeps me awake</i>	19.5	14.6	23.4	17.3	25.2
<i>Has a pleasant texture</i>	12.9	14	29.1	21.8	22.2
<i>Helps me cope with stress</i>	31.3	17.6	25.3	11.6	14.2
<i>Tastes good</i>	4.8	2.3	11.5	16.5	64.9
<i>Is familiar</i>	19	14.8	33.7	17.1	15.4
<i>Is similar to foods chosen by my friends</i>	66.5	15.1	13	3.2	3.2

297  
 298 In this study, the highest percentage of pupils (64.9%) scored taste at score five (Table 5) but the  
 299 reasons for these results cannot substantiate the meaning of taste from this quantitative data. The  
 300 literature agrees that taste is a predominant factor that influence adolescent food choices (Neumark-  
 301 Sztainer et al., 1999; Shannon et al., 2002; Story et al., 2002; Fitzgerald et al., 2010; Ensaff et al., 2015;

302 Ronto et al., 2020; Bawajeeh et al., 2020; Gilmour et al., 2020). Shannon et al., (2002) stated that from  
303 the 294 returned surveys 93.7% of the participants select food due to the taste but the study did not  
304 identify what taste meant to them. Neumark-Sztainer et al., (1999) and Ensaff et al., (2015) identified  
305 taste was associated with familiarity, participants knew it tasted good because they had eaten it  
306 before, but familiarity was not a factor that was identified as important in this study. Ensaff et al.,  
307 (2015) stated that taste and appearance were the principal factors in adolescent decision of food  
308 choices, yet the words used to express taste were vague such as `tastes good`, and food needs to have  
309 a `nice taste.` In a study by Gilmour et al., (2020), adolescents identified `taste preference` as the most  
310 significant intrapersonal factor that influenced their food choices and they identified two of the five  
311 flavours of `taste`; they liked carrots, broccoli, and cucumber due their `sweetness`, and they disliked  
312 peas, sprouts and cauliflower due to being slimy or `bitter`.

313 This study identified that 32.9% of adolescent rated `keeps me full` at score 5 (Table 5). The literature  
314 reports that healthy food is not synonymous with satiation with males (McKinley et al., 2005; Ronto  
315 et al., 2020; Gilmour et al., 2020; Voi et al., 2020; Azizan et al., 2021). However, no gender differences  
316 were investigated in this study. It is interesting to note that both Steptoe et al., (1995) and Ooi et al.,  
317 (2015) food choice questionnaire did not include hunger as a relevant factor to consider in food  
318 choices.

319 This study identified that 29.9% of adolescent rated `is cheap` at score 5 (Table 5). However, the school  
320 had 5.4% who were eligible for free school meals, thus indicating that this school was middle class,  
321 therefore the importance of this factor could differ with a more diverse range of socioeconomic status  
322 schools.

323 In this school adolescents in this study (29.2%) identified the factor `keeps me healthy` was the fourth  
324 factor to score the highest at score five. Yet, all other factors as indicated in Table 5 that would be  
325 associated with health were not ranked as important. This study sought to identify if there was an  
326 association between gender in food choice and the importance placed on health because the  
327 literature advocated females are more influenced by health than males. Using the food choice  
328 questionnaire with the five-point scale `health and nutrition` encompassed nine factors; contains  
329 vitamins and minerals, is nutritious, is high in fibre, is high in protein, is low in calories, is low in fat,  
330 helps me control my weight, keeps me healthy, and includes lots of fruit and vegetables. Results  
331 indicated that there was a significant association between gender and specific health and nutrition  
332 factors. As can be seen in Table 6 from 689 pupils (361 female and 328 male) females' rate `keeps me  
333 healthy` significantly more highly than males  $\chi^2(4) = 21.38, p < .05$ , `contains vitamins and minerals`  
334 significantly more highly than males  $\chi^2(4) = 10.4, p < .05$  and `is nutritious` significantly more highly

335 than males  $\chi^2(4) = 11.17, p < .05$ . In addition, females rate factors associated with health and weight  
 336 and rate the factor 'is low in calories' significantly more highly than males  $\chi^2(4) = 9.62, p < .05$ , 'and  
 337 is low in fat' significantly more highly than males  $\chi^2(4) = 11.09, p < .05$ . It could be suggested that the  
 338 word 'health' is used to promote or identify the healthier food choices which may appeal to females.

339 Table 6 Indicates the significant association between gender and reporting on the importance placed  
 340 on health when making food choices

*School*

<i>Gender</i>	Factors					
<i>Females</i>	Contains	is	is	low	is	Keeps
	vitamins	nutritious	in	low	low	me
	and		calories	in		healthy
	minerals			fat		

341

342 The results from this study identified that 66.5% of pupils identified that selecting food that 'is similar  
 343 to their friends' was not considered to be a factor that influenced their food choices and ranked this  
 344 factor at a score of one (Table 5). Gilmour et al., (2020) focus group participants agreed with this  
 345 finding and were adamant that they were individuals who made their own choices. However, as Story  
 346 et al., (2002) identified that friends have an influence on behaviour by creating acceptable norms.  
 347 Eating is deemed as socialisation and recreation. Simultaneously adolescents desire peer approval yet  
 348 seek autonomy and individuality and believe that there is no influence from their friends. Other  
 349 studies identified that friends did influence adolescent food choice behaviour. Individuals who  
 350 selected healthier food choices were made to feel embarrassed or females were teased and were  
 351 called weird (Verstraeten et al., 2014; Calvert et al., 2020). Consuming unhealthy foods expressed a  
 352 belonging to the group which could be a protective factor thus highlighting the influence of friends on  
 353 food choices (Salvy et al., 2012; Verstraeten et al., 2014; Watts et al., 2015; Chung et al., 2017).  
 354 Gilmour et al., (2020) found an unusual relationship between peers and food choices at school.  
 355 Participants articulated that they selected the same option of food. They explained that if they  
 356 selected a big meal that is healthy and their friends selected fast food their friends would finish eating  
 357 before they did, and that they would be left in the canteen eating on their own. It can be suggested  
 358 that despite adolescents' belief that friends do not influence food choice behaviour evidence from the  
 359 literature suggests otherwise.

#### 360 4. Conclusion

361 A food score applied to food served in a secondary school in Greater London was not effective in  
 362 influencing food choice behaviour. Only 15.6% females and 18.6% males noticed the food score and  
 363 7.4% females and 5.9% males stated that it influenced their food choices. There were no differences  
 364 in gender as to noticing or self-reporting any effect of the food score on their food choices.

365 Adolescents rated sensory aspects of taste, appearance, and smell alongside hunger, keeping awake  
366 and price at score of five. Food choice and the importance placed on health was significantly  
367 associated more with females than males. The influence of friends was not reported to be a significant  
368 factor in adolescent food choice behaviour in this study.

#### 369 Implications for gastronomy

370 School food has gone through a turbulent time regarding the portrayal of unhealthy food on offer.  
371 However, more recent school food standards have resulted in this contract caterer offering high  
372 quality main meals with high nutritional scores. The implication for gastronomy is to appreciate how  
373 to market school food as tasty and filling at an affordable price. It is well documented that school food  
374 is more often more nutritious than a packed lunch. Satiated children and adolescents' will be more  
375 receptive to learning, therefore caterers and the school need to work together to encourage a greater  
376 uptake of school meals which will be of benefit to both.

#### 377 Declaration of interest

378 I can declare that for this paper titled `An experimental food label applied to food served at a  
379 secondary school in Greater London and its influence on adolescent food choices` have no conflict of  
380 interest.

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