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# 1 **Breakfast on-the-go: Evaluating the nutritional content of supermarket products**

## 2 **Abstract**

3 **Objective:** Breakfast consumption on-the-go is becoming an established food habit; this has been  
4 accompanied by a growing number of related products. Given the limited research on these  
5 products, and the growing trend in breakfast consumption away from home and on-the-go, the aim  
6 of this cross-sectional study was to survey and scrutinise the nutritional composition of breakfast  
7 on-the-go products available in the UK.

8 **Research Methods & Procedures:** Field visits to supermarkets of the top seven grocery retailers  
9 (accounting for 88% of the UK market) were conducted in a large city in the UK. Breakfast on-the-  
10 go products (n=128) were identified, and data (including price, energy and nutrients) were  
11 collected. Products were categorised according to food format (breakfast biscuits, breakfast drinks,  
12 high protein breakfast drinks and porridge pots). Products were profiled according to front-of-pack  
13 (FoP) nutrition labelling (low, medium, high) for fat, saturated fat, total sugars and salt content.  
14 Nutrient content and profiles were examined across categories.

15 **Results:** Significant associations were revealed between product type and nutrient profiles for total  
16 fat, saturated fat, and salt. Total sugar content varied from 11.8g per portion observed in biscuits, to  
17 high protein breakfast drinks, which contained almost double this level (20.0g). Notably, six out of  
18 ten breakfast on-the-go items (60.2%) were profiled as high for total sugars (according to FoP  
19 criteria). Most items were medium in total fat (87.5%), and low in saturated fat (61.7%) and low in  
20 salt (56.3%).

21 **Conclusion:** Reformulation of breakfast on-the-go products, principally with respect to sugar  
22 content, is warranted. This is particularly relevant given the growing role of breakfast consumption  
23 on-the-go, and ongoing developments in the sector as new product ranges and formats are  
24 introduced.

25

26 **Highlights**

- 27       • Changing breakfast habits are driving a sector of breakfast on-the-go products.
- 28       • Most breakfast on-the-go products (60.2%) were profiled as high for total sugars.
- 29       • Sugar content varied, e.g. 11.8g (breakfast biscuits), 20.0g (high protein drinks).
- 30       • As the popularity and relevance of these items increases, there is need to reformulate to
- 31       improve their nutrient profile.

## 32 **Introduction**

33

34 Most of the UK population regularly consume breakfast<sup>1</sup>, and some 51% consume breakfast away  
35 from home sometimes<sup>2</sup>; this has been attributed to time constraints and the accelerating pace of  
36 everyday life<sup>2,3</sup>. Notably, almost a third of breakfast consumption away from home is on-the-go<sup>2</sup>,  
37 previously estimated at 205 million occasions<sup>4</sup>. Breakfast on-the-go is fast becoming an established  
38 food habit<sup>5</sup>, and similar trends have been reported in the US<sup>6</sup> and Australia<sup>7</sup>. This has been  
39 accompanied by a fast-moving market in associated breakfast on-the-go (OTG) items. These are  
40 packaged products (with a shelf life) specifically targeting breakfast as an eating occasion, and in a  
41 format convenient to be eaten on the move or away from home, e.g. in the workplace. These items  
42 have gained popularity in the UK, with breakfast biscuits first introduced in 2010<sup>8</sup>, quickly  
43 followed by breakfast drinks and porridge pots. In 2016, breakfast drinks and breakfast bars  
44 accounted for 7% and 22%, respectively, of new breakfast products launched<sup>9</sup>. Interestingly,  
45 breakfast drinks also had the largest increase in new product development (2% to 11%) between  
46 2012 to 2015<sup>9</sup>, with sales exceeding £14 million in 2016, a 74% growth from the previous year<sup>10</sup>,  
47 while the market leader of breakfast biscuits reported sales of more than £70 million<sup>10</sup>. Further, in  
48 2018, the total value of the UK breakfast occasion was estimated at £11.6 billion, with the top  
49 breakfast categories reported to include breakfast biscuits and cereal bars<sup>11</sup>. Interestingly, key  
50 consumers for these OTG products are young adults who are most likely to consume breakfast  
51 while at work<sup>12</sup>, the so-called ‘deskfast’.

52

53 While breakfast consumption has been supported as a simple nutrition recommendation<sup>13</sup>,  
54 associated with diet quality<sup>1</sup>, wellbeing and a healthy lifestyle<sup>14</sup>, as well as reduced risks of type 2  
55 diabetes<sup>15</sup>, metabolic syndrome<sup>16</sup>, and obesity<sup>16,17</sup>, limited research exists on the nutritional quality  
56 of breakfast OTG products. An Australian study<sup>7</sup> reported that breakfast drinks had higher energy,  
57 sugar and sodium, while breakfast bars had more total and saturated fat, and sugar (both compared

58 to an alternative of cereal with whole milk). Another Australian study<sup>18</sup> found breakfast drinks to  
59 have high energy density and similar sugar content to energy drinks and sugar sweetened beverages.

60

61 Given the limited research on breakfast OTG products and the growing trend in breakfast  
62 consumption away from home and on-the-go, the aim of this cross-sectional study was to survey  
63 and scrutinise the nutritional composition of these products.

64

## 65 **Materials and methods**

66 The top seven grocery retailers in the UK were identified; these accounted for 88% of the UK  
67 market<sup>19</sup>. Supermarkets for these retailers (in one large city in England) were selected as the sites  
68 for data collection. Ethical approval for this study was granted through the faculty research ethics  
69 committee.

70

71 A comprehensive survey of breakfast OTG products was conducted in November 2016 in these  
72 supermarkets. In order to ensure that all relevant products available in the supermarkets were  
73 included in the study, two visits to each supermarket site were undertaken. For each set of visits, a  
74 total of 339 OTG products were identified across the seven data collection sites. In this study,  
75 breakfast OTG products were defined as packaged convenience foods identified as breakfast items  
76 and available at ambient temperature. These criteria were pre-defined prior to initial reconnaissance  
77 conducted at the supermarket retailers, and refined prior to data collection visits. Products not  
78 meeting this definition were excluded, as were 'specialist' items such as baby breakfast foods. Data  
79 recorded from products were: brand and product name, energy, nutrient content, ingredients, price  
80 and portion size. All data were checked and inspected for inconsistencies, unexpected or missing  
81 values, and any anomalies were rectified. Details for the products were cross-checked using retailer  
82 and manufacturer websites, wherever possible. In addition, 5% of data (corresponding to 17 cases)  
83 were randomly selected and verified to check that the data entry corresponded with the original

84 source. Many OTG products were available at more than one supermarket, i.e. the total of 339 OTG  
85 products across the seven supermarkets corresponded to 128 unique OTG products. Therefore, the  
86 final dataset was aggregated (with 211 duplicates removed), and the OTG products in the final  
87 dataset (n=128) were categorised according to food format and content. In accordance with the  
88 non-normal distribution of the data, data were described as medians and interquartile ranges (25th  
89 and 75th percentiles). Nutrient content across different categories was examined using Kruskal-  
90 Wallis tests, followed by pairwise comparisons to determine differences between categories. For all  
91 items in the final dataset (n=128), levels of fat, saturated fat, total sugars and salt were considered  
92 against criteria for the UK's front-of-pack (FoP) nutrition labelling system<sup>20</sup>, and assigned low,  
93 medium or high, corresponding to a colour code of green, amber or red, respectively. This system  
94 was used to assess the fat, saturated fat, total sugars and salt content of the products and was a  
95 means of categorising foods based on their nutritional quality<sup>21</sup>. The relationships between product  
96 types and FoP categories, were examined using Fisher exact tests. Data analysis was performed  
97 using SPSS Statistics Version 23.0 (IBM), and significance was set to  $p < 0.05$ .

98

99 **Results**

100

101 Across the seven retailers, 339 OTG products were identified; these corresponded to 128 unique  
 102 OTG products, with the majority, i.e. 80 of the 128 products, available in multiple retailers. The  
 103 items were categorised as: breakfast biscuits (including breakfast bakes and breakfast bars), (n=44);  
 104 porridge pots (oats typically combined with dried milk powder, sugar and flavouring), (n=68);  
 105 breakfast drinks (n=8); high protein breakfast drinks (n=8). Data for these were compiled, Table 1.

106

107 **Table 1** Portion size, price, energy and nutrient content (all per portion) across breakfast on-the-  
 108 go items (medians and interquartile ranges (IQR))  
 109

	Breakfast biscuits	Porridge pots	Breakfast drinks	High protein breakfast drinks
<i>n</i>	44	68	8	8
Portion size	50 (40-50) g	60 (55-70) g	250 (250-250) ml	330 (275-330) ml
<i>per portion</i>				
Price (£)*	0.39 (0.35-0.54) <sup>a</sup>	0.99 (0.85-1.20) <sup>b</sup>	1.37 (1.34-1.39) <sup>c</sup>	1.43 (1.38-1.57) <sup>c</sup>
Energy (kJ)	838.9 (692.5-929.9) <sup>a</sup>	918.4 (857.7-1049.1) <sup>b</sup>	798.1 (713.9-881.8) <sup>a</sup>	830.5 (786.6-881.8) <sup>ab</sup>
Protein (g)	3.3 (2.6-3.8) <sup>a</sup>	8.4 (7.1-10.9) <sup>b</sup>	9.2 (8.6-9.5) <sup>bc</sup>	20.0 (20.0-21.0) <sup>c</sup>
Fat (g)	6.5 (4.5-7.5) <sup>a</sup>	3.2 (2.7-3.9) <sup>b</sup>	4.4 (2.5-7.0) <sup>ab</sup>	0.6 (0.4-3.1) <sup>bc</sup>
Saturated fat (g)	1.1 (0.7-1.9) <sup>a</sup>	0.6 (0.5-0.8) <sup>b</sup>	2.3 (0.3-4.3) <sup>ab</sup>	0.3 (0.2-2.0) <sup>b</sup>
Carbohydrate (g)	31.6 (27.0-34.3) <sup>a</sup>	37.4 (34.2-41.7) <sup>b</sup>	25.0 (25.0-26.0) <sup>a</sup>	24.0 (22.0-24.0) <sup>a</sup>
Sugar (g)	11.8 (9.5-13.2) <sup>a</sup>	14.1 (10.8-16.5) <sup>b</sup>	19.3 (18.5-20.0) <sup>c</sup>	20.0 (12.0-20.0) <sup>bc</sup>
Salt (g)	0.2 (0.2-0.3) <sup>a</sup>	0.1 (0.1-0.2) <sup>b</sup>	0.4 (0.4-0.4) <sup>ac</sup>	0.5 (0.5-0.6) <sup>c</sup>
Fibre (g)	2.3 (1.6-2.8) <sup>a</sup>	4.0 (3.2-4.7) <sup>b</sup>	5.5 (5.3-5.8) <sup>c</sup>	3.2 (3.0-6.3) <sup>bc</sup>

110 \* an average price was calculated for each product to address any price variation between  
 111 supermarkets; categories with an unlike superscript letter within a row indicate a significant  
 112 difference for that variable.

113

114 Breakfast OTG items ranged in price from 11p to £1.58 per portion. Price per portion varied  
 115 significantly across product types  $\chi^2(3) = 87.32$ ,  $p < 0.001$ , with a mean rank of 26.25 for biscuits  
 116 the least expensive (median=39p), and 119.50 for high protein breakfast drinks the most expensive  
 117 (median=£1.43). Energy median values were relatively low, ranging from 798.1kJ (drinks) to  
 118 918.4kJ per portion (porridge pots). Notably, there was a large variation in protein content per

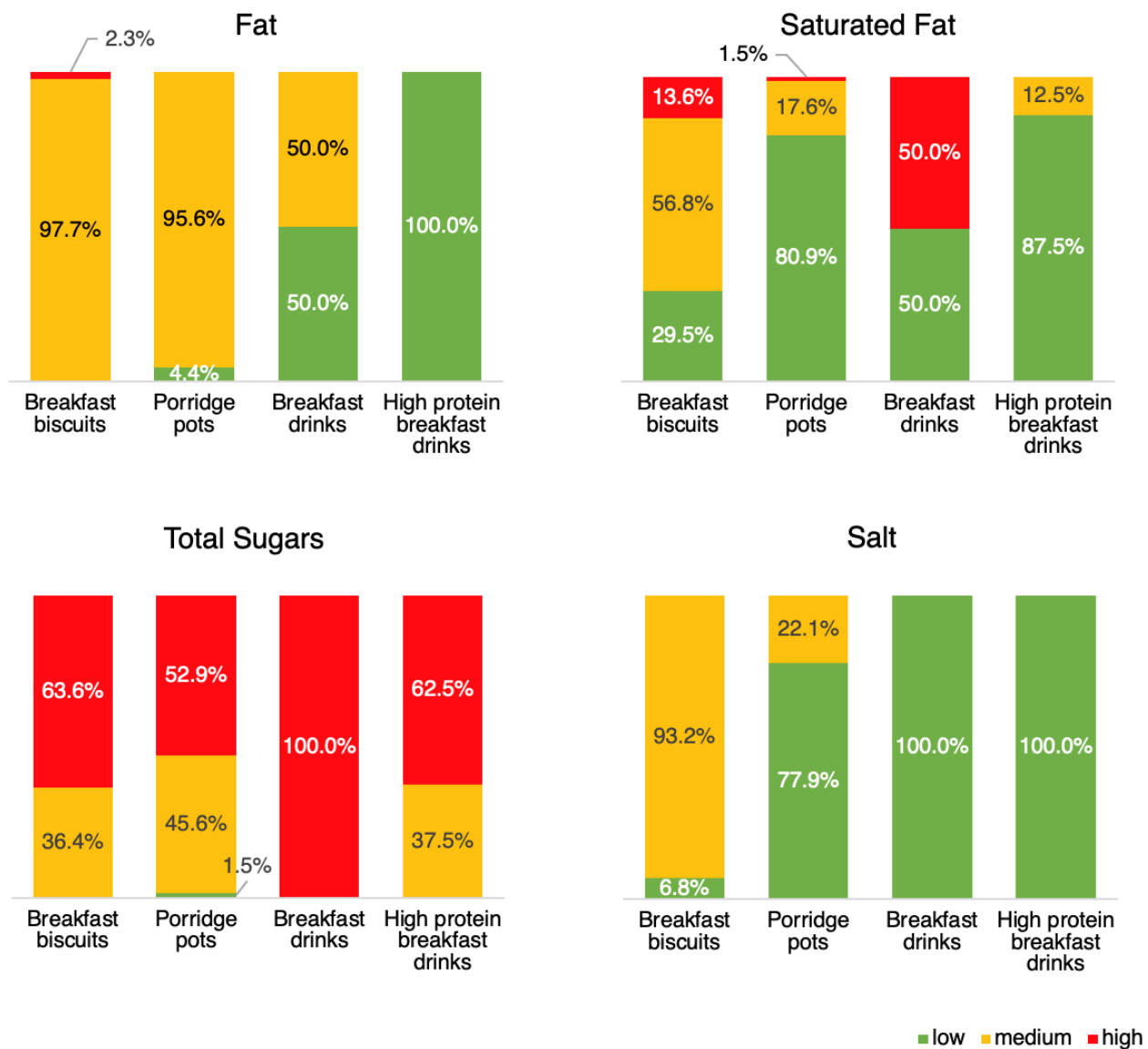
119 portion, exemplified by median levels of 3.3g and 20.0g, for biscuits and high protein breakfast  
120 drinks, respectively. Protein content varied significantly across product type  $\chi^2(3)=89.26, p<0.001$ ,  
121 as did energy content  $\chi^2(3)=23.49, p<0.001$ . Median fibre content of products was in the range of  
122 2.3g (breakfast biscuits) to 5.5g per portion (breakfast drinks). High protein breakfast drinks had the  
123 lowest fat content per portion (median=0.6g). The highest fat content was seen in breakfast biscuits  
124 (median=6.5g per portion), while breakfast drinks contained most saturated fat (median=2.3g per  
125 portion). Both fat and saturated fat content varied significantly across product type,  
126  $\chi^2(3)=47.33, p<0.001$ ;  $\chi^2(3)=15.41, p<0.001$ , respectively. The lowest carbohydrate content was  
127 found in breakfast drinks and high protein breakfast drinks (median=25.0g per portion,  
128 median=24.0g per portion, respectively), with porridge pots having the highest levels  
129 (median=37.4g). Sugar content varied from 11.8g per portion observed in biscuits, to high protein  
130 breakfast drinks, which contained almost double this level (20.0g per portion); total sugar content  
131 varied significantly across product types  $\chi^2(3)=31.21, p<0.001$ . Likewise, salt content varied  
132 significantly  $\chi^2(3)=61.09, p<0.001$ , with a mean rank of 42.71 for porridge pots containing the least  
133 salt per portion (median=0.1g), and 121.94 for high protein breakfast drinks (median=0.5g). Fibre  
134 content varied significantly across product type  $\chi^2(3)=51.73, p < 0.001$ ; lowest in biscuits with a  
135 mean rank of 34.31 (median=2.3g per portion) and highest in breakfast drinks with a mean rank of  
136 113.88 (median=5.5g per portion), reflecting the addition of fibre (e.g. soluble wheat fibre, inulin)  
137 to drinks. Significant differences were found between some pairs of product types for certain  
138 nutrients, and these are highlighted in Table 1. Notably, breakfast biscuits were significantly  
139 different to porridge pots.

140

141 The percentage of items assigned to FoP categories (high, medium and low) with respect to fat,  
142 saturated fat, total sugars and salt is shown in Figure 1. Notably, most items (60.2%) and  
143 specifically all breakfast drinks and more than half of biscuits, high protein breakfast drinks and  
144 porridge pots, were profiled as high for total sugars. No association between product type and FoP



145 categories for total sugars ( $p=0.118$ ) was found. When considering fat, most were medium in total  
146 fat and low in saturated fat (87.5% and 61.7%, respectively). Significant associations were revealed  
147 between product type and FoP categories for fat ( $p<0.001$ ), with biscuits having the highest  
148 proportion of items medium or high, whereas all high protein breakfast drinks were low in total fat.  
149 Likewise a significant association between product type and saturated fat was found ( $p<0.001$ ).  
150 Breakfast drinks and biscuits displayed the most adverse saturated fat profile with 50.0% and  
151 13.6%, respectively exceeding the thresholds for high saturated fat. Conversely, the majority of  
152 high protein breakfast drinks (87.5%) and porridge pots (80.9%) were low in saturated fat. All items  
153 were low or medium in salt. There was a significant association between product type and FoP  
154 categories for salt ( $p<0.001$ ), and although all drinks were 'low' in salt, most biscuits (93.2%)  
155 exceeded the cut-off for low salt labelling.  
156



157  
158  
159  
160  
161

**Figure 1** Percentage of breakfast OTG products classified as low, medium and high (according to front-of-pack nutrition labelling<sup>20</sup>) for levels of fat, saturated fat, total sugars and salt (colour figure)

162

163 **Discussion**

164 This overview has revealed breakfast OTG products to be high in total sugar, medium in total fat,  
165 low in saturated fat, and low in salt content. Differences across product type (breakfast biscuits;  
166 porridge pots; drinks; and high protein breakfast drinks) were found. Notably, differences in sugar  
167 content, exemplified by 20g per portion in high protein breakfast drinks, almost twice as much as  
168 breakfast biscuits (11.8g per portion) were revealed. This variation in sugar across product types  
169 corresponds with previous research from Australia<sup>7</sup>.

170

171 Most OTG products were assigned 'high' in total sugars, according to FoP nutrition labelling. This  
172 included almost two thirds of breakfast biscuits and more than half of porridge pots, all breakfast  
173 drinks and most high protein breakfast drinks. In contrast, salt levels were low in most products,  
174 including all drinks and most porridge pots, potentially reflecting the UK's salt reduction strategy  
175 which began in 2004<sup>22</sup>, and is credited with reducing the population's mean salt intake.<sup>23,24</sup>

176

177 The energy content of breakfast OTG items ranged from 798.1kJ for breakfast drinks to 918.4kJ per  
178 portion for porridge pots; this was relatively low compared to conventional recommendations for  
179 breakfast, i.e. 1.7 MJ, based on a woman's average energy requirements<sup>25</sup>. This is relevant since it  
180 is unclear whether these items are generally consumed as part of a breakfast meal (which should  
181 account for approximately 20% of daily dietary intake<sup>26</sup>) or are the sole component. Further work  
182 examining the contribution of breakfast OTG to the nation's diet, and how these items are  
183 consumed including their consumption outside the breakfast setting, would be valuable. This would  
184 also enable these items (taking into account their use, e.g. in combination with other breakfast  
185 components) to be compared with the average breakfast intake for UK adults, reported as 1425kJ  
186 Energy, 24g total sugars, 11g fat, and 5g saturated fat<sup>1</sup>. The trend for breakfast consumption away  
187 from home and on-the-go is part of our changing foodscape of how we access, consume and relate

188 to food. Other meals are also adjusting and this is reflected in the rapid and substantial growth in  
189 food delivery apps<sup>27</sup>.

190

191 The fibre content of OTG products varied; some of the highest levels were observed in breakfast  
192 drinks, and are attributed to the inclusion of soluble wheat fibre, inulin, fruit puree and oat flour.

193 With a median value of 5.5g for breakfast drinks, this in itself looks favourable when considering  
194 the recommendation for fibre of 30g/day<sup>28</sup> and the approximate 20% that breakfast should  
195 contribute<sup>26</sup>, as well as the nation's current fibre intake which fails to meet recommendations<sup>29</sup>.

196

197 Most breakfast OTG products did not stand up to scrutiny, particularly with respect to sugar and  
198 less so, total fat. Interestingly, this conflicts with consumers' perceptions of OTG products as a  
199 healthier alternative to flavoured breakfast cereals which are perceived as high in sugar<sup>3</sup>. This  
200 perception has also led to the consumption of breakfast OTG products outside breakfast, e.g.  
201 breakfast biscuits as an alternative to regular biscuits<sup>30</sup>. There is a need to raise public awareness of  
202 the nutrient content in OTG products, and to challenge perceptions relating to their 'healthiness'.

203 This could complement action from consumer organisations and charities in the UK and beyond<sup>31-</sup>  
204 <sup>33</sup>, highlighting sugar levels in breakfast biscuits<sup>32</sup>, and breakfast drinks<sup>33</sup>. Further, evidence has  
205 suggested the value of messages emphasising variations of breakfast foods internationally, and the  
206 arbitrariness of breakfast traditions (and the foods typically consumed for breakfast)<sup>34</sup>. Such  
207 messages may have a role in improving consumers' food choice habits for breakfast, as well as  
208 initiating development in the sector as other breakfast OTG product ranges and formats are  
209 introduced.

210

211 This study's findings also point to the need to reformulate breakfast OTG products, specifically  
212 with respect to sugar content. Reformulation appears feasible given the 47% decrease in salt content  
213 of UK breakfast cereals between 1995 and 2015<sup>35</sup>, whilst sugar content in breakfast cereals

214 remained high, attributed to a lack of a sugar reduction strategy<sup>35</sup>. Since 2017 the UK has been  
215 undertaking a sugar reduction programme to “remove sugar from everyday products”<sup>36</sup>. Current  
216 efforts focus on specific food types including biscuits, morning goods such as croissants, and  
217 breakfast cereals<sup>37</sup>; given the continuing demand for the OTG format from breakfast consumers<sup>38</sup>,  
218 further emphasis should be placed on these items. With new product ranges entering the  
219 marketplace<sup>39</sup>, reformulation is warranted. Considering the level of progress to date with the UK’s  
220 sugar reduction programme (2.9% overall reduction in average sugar content between 2015 and  
221 2018), then this may be a challenge – although more progress was evident for breakfast cereals  
222 specifically (reduction of 8.5%)<sup>40</sup>, and there are indications of further reductions, including across  
223 different formats. Reformulation efforts to increase dietary fibre in breakfast cereals is also likely to  
224 become more important<sup>41</sup>, particularly as the low national levels of fibre intake<sup>29</sup> attract more  
225 attention. Interestingly, inclusion of dietary fibre in some of the OTG products in this study was  
226 evident, and this may point to further developments to come.

227

228 Previous research indicates that FoP labelling could convey substantial improvements to energy  
229 and nutrient intakes<sup>42</sup>. Most breakfast OTG products did not utilise such labelling; this is pertinent,  
230 as most would have a ‘red light’ for total sugars; and consumers are more likely to avoid products  
231 profiled with ‘red lights’<sup>43</sup>. FoP labelling may also challenge consumers’ perception of items as a  
232 healthy alternative and support better consumer decisions as levels of nutrients varied across  
233 products. There has been growing pressure for manufacturers to adopt FoP labels, and interestingly,  
234 a large breakfast cereal manufacturer announced that it would introduce FoP labels for the majority  
235 of its breakfast cereals in the UK<sup>44</sup>.

236

237 The data collected provide a valuable record of breakfast OTG products and their nutritional  
238 composition. They also offer a reference point against which subsequent data may be compared, to  
239 indicate improvements (or otherwise) in the extent and nutritional composition of products. There is

240 however, limited potential for the data to be used in, for example dietary assessment, given the  
241 extent of nutrients considered. Data were collected in-store, and from retailers and manufacturers'  
242 websites, and it is important to note that results of this study are reliant on their accuracy and  
243 products available at the time of the study. Total sugar, and not free sugar content, was considered  
244 in this work. Given that some manufacturers are taking action to reduce free sugar content in  
245 products to accommodate the dietary guidelines around free sugars<sup>28</sup>, research is recommended to  
246 examine this further. This study was limited to packaged products and did not include for example  
247 freshly bakery items such as croissants. Further, data collected relate to products available in one  
248 city and do not account for regional differences, nor own-label products from smaller supermarkets.  
249

## 250 **Conclusions**

251 Most breakfast OTG products were high in total sugar, medium in total fat, low in saturated fat, and  
252 low in salt content. Nutritional composition of breakfast OTG products varied significantly between  
253 product types. Reformulation to reduce sugar content in breakfast OTG products is needed;  
254 indications are that this is feasible and should be embraced within the current sugar reduction  
255 programme in the UK. Likewise, efforts to promote better food choice by consumers should be  
256 pursued. Given the growing role of breakfast on-the-go, there is now the opportunity for new  
257 product development to contribute to a reduction in the population's sugar intake.

258

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