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3 1 **Office cake culture: an exploration of its characteristics and associated behaviours and attitudes**
4
5 2 **among UK office workers and implications for workplace health**

6
7 3 **Short title: Office cake culture: implications for workplace health**
8

9
10 4 **Abstract**

11
12 5 Purpose:

13 6 This paper explores the characteristics of office cake (OC) consumption and the associated attitudes
14 7 and behaviours among UK office workers to gain insight into the implications for workplace health.

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16
17 8 Design:

18 9 A cross-sectional online questionnaire was completed by 940 respondents. Data were analysed using
19 10 descriptive statistics and cross-tabulation with Chi-square tests for between-group difference.

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21
22 11 Findings:

23 12 Respondents reported both positive social and negative health-related consequences of OC. OC
24 13 influenced eating behaviour through increased salience and availability, and the effects of social
25 14 influencing. Almost all (94.8%) reported ideal OC frequency to be once/week or less. Gender and
26 15 age significantly affected attitudes and behaviour.

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28
29 16 Research limitations/implications:

30 17 The questionnaire was not validated so data accuracy could have been diminished or biased.
31 18 Portion size was not examined and consumption data was self-reported which could have resulted in
32 19 under-reporting. Only office workers were investigated therefore results may not be applicable to
33 20 other workplaces.

34
35
36 21 Practical implications:

37 22 OC appears to influence both the workplace eating environment and employee eating behaviour. It
38 23 could therefore affect employee health and workplace health promotion programme efficacy.
39 24 However the findings suggest that nudge-based initiatives could reduce OC consumption to make
40 25 workplaces healthier while retaining social benefits.

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42
43 26 Originality/value:

44 27 The present study provides the first data on OC culture and insights on how to address it sensitively.
45 28 It also highlights that sweet treats used for celebration and employee recognition should be
46 29 considered a relevant part of workplace food provision alongside canteens and vending.

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52 30 **Keywords:** cake culture, obesity, workplace, environment, snacking, norms, health, nutrition
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31 Introduction

32 Obesity prevalence continues to rise globally, as do associated co-morbidities and healthcare costs
33 (N. C. D. Risk Factor Collaboration, 2016). Consequently obesity represents a major public health
34 challenge (Public Health England, 2017). The workplace represents an important setting for the
35 promotion of healthy lifestyle behaviours (Engbers et al., 2005; Black, 2008) and has been the focus
36 of numerous studies examining health promotion.

37 Compared to interventions involving diet and/or physical activity, multicomponent workplace health
38 promotion programmes (WHPPs) incorporating environment modification have the greatest effects
39 improving dietary behaviour (Allan et al., 2017), diet quality (Engbers et al., 2005) and weight loss
40 (Verweij et al., 2011). Environment modification can make environments less obesogenic (**Swinburn
41 et al., 2011**) and therefore easier for individuals to make healthier lifestyle choices without
42 conscious effort (Marteau et al., 2012; Salmon et al., 2014).

43 The social nature of offices would suggest that social influencing could affect workplace eating
44 behaviour. Social influences affect the amount and types of food eaten (Herman et al., 2003;
45 Robinson and Higgs, 2013; Cruwys et al., 2015) allowing people to feel they are behaving
46 appropriately in a given group (Herman et al., 2003; Robinson et al., 2011; Cruwys et al., 2015).
47 Interestingly, if available, sweet foods and cake appear to override salient social models and are
48 chosen in preference to other available foods (Pliner and Mann, 2004). Similarly, when eating with
49 friends, people eat significantly more cookies and cake than other available foods (Clendenen et al.,
50 1994; Hetherington et al., 2006). The role of social norms on dietary behaviour has also been
51 examined widely. Descriptive norms represent behaviour that is typical or normal ('what is done')
52 while injunctive norms refer to behaviour considered morally-approved ('what ought to be done')
53 (Deutsch and Gerard, 1955; Cialdini et al., 1990). Descriptive norms influence both healthy and
54 unhealthy eating behaviour (Perkins et al., 2010; Lally et al., 2011; Cruwys et al., 2015) even without
55 other people being present (Burger et al., 2010; Prinsen et al., 2013).

56 Combined as 'subjective norms', descriptive and injunctive norms form one of three constructs
57 within The Theory of Planned Behaviour (TPB) (Ajzen, 1991; Ajzen, 2005) which holds that intention
58 is the best predictor of behaviour. 'Attitude' is the product of beliefs about the consequences of
59 performing or not performing a behaviour and the strength of those beliefs. 'Perceived behavioural
60 control' (PBC) is a product of self-efficacy and perceived barriers to or facilitators of a behaviour. The
61 more positive the combination of these constructs, the stronger the intention to perform a
62 behaviour. The TPB is one of the most widely-tested health behaviour theories (Ajzen, 2011;

1
2
3 63 McEachan et al., 2011; Zoellner et al., 2012) and has been widely used to explore dietary behaviour
4
5 64 (Kelley and Abraham, 2004; Palmeira et al., 2007; Chung and Fong, 2015).

6
7 65 Daily eating patterns may affect weight and health risk (Duffey and Popkin, 2011; Nicklas et al.,
8
9 66 2014; Leech et al., 2015; Murakami and Livingstone, 2016b). Recent decades have seen increases in
10
11 67 eating frequency (Popkin and Duffey, 2010; Kant and Graubard, 2015) and total energy intake from
12
13 68 snacking (Ovaskainen et al., 2006; Piernas and Popkin, 2010; Kant and Graubard, 2015). Snacking is
14
15 69 positively associated with energy intake (Duffey and Popkin, 2011; McCrory et al., 2011; Nicklas et
16
17 70 al., 2014; Kant and Graubard, 2015) and added sugar consumption (Ovaskainen et al., 2006; Louie
18
19 71 and Rangan, 2018) although not always with adiposity (Hampl et al., 2003; Nicklas et al., 2014).
20
21 72 Snacking has been associated with improved diet quality through increased nutrient intake from
22
23 73 fruit and vegetables (Holmback et al., 2010; Zizza et al., 2010; Zizza and Xu, 2012; Hartmann et al.,
24
25 74 2013) but also diminished diet quality from increased energy density, and sugar and fat intake,
26
27 75 (Hartmann et al., 2013; Murakami and Livingstone, 2016a). Cakes and similar sweet baked goods are
28
29 76 the primary energy contributors to snack food (Ovaskainen et al., 2006; Duffey et al., 2013; Nicklas
30
31 77 et al., 2014; Myhre et al., 2015) and are consumed equally by both healthy and unhealthy snackers
32
33 78 (O'Connor et al., 2015). Furthermore, added sugars are associated with obesity (Scientific Advisory
34
35 79 Committee on Nutrition, 2015) and ultra-processed foods such as commercially-produced cakes and
36
37 80 snacks are associated with cancer (Fiolet et al., 2018) and all-cause mortality (Schnabel et al., 2019).

38
39 81 Workplace snacking has not been widely studied. One study found both unhealthy and healthy
40
41 82 snacking were significantly more likely in the workplace than the home (Liu et al., 2015), and ~~three~~
42
43 83 studies have found that workplace snacks were more likely to be eaten if they were visible,
44
45 84 accessible and convenient (**Painter et al., 2002; Baskin et al., 2016**). One form of workplace snacking
46
47 85 that has become prominent in recent years is the provision of cake and other sweet foods by
48
49 86 employees and management for colleagues to share, so-called 'office cake' (OC). Anecdotally, OC
50
51 87 consumption in the UK originated from employees providing cakes to celebrate social occasions.
52
53 88 Recently it has expanded to include support for charity fundraising efforts, baking inspired by TV
54
55 89 shows, employee rewards, and other morale-boosting events. It has been speculated that OC
56
57 90 consumption leads to increased energy intake, particularly from added sugars, and obesity (Royal
58
59 91 College of Surgeons, 2017). However, no data are available.

60
61 92 The present study explored the characteristics of OC consumption and associated attitudes and
62
63 93 behaviours among UK office workers. Implications for workplace health were assessed. OC was
64
65 94 defined as cakes or other sweet foods (biscuits, pastries, confectionery) provided by employees or
66
67 95 managers to share with colleagues.

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3 96 **Method**

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5 97 ***Study design***

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8 98 A cross-sectional survey was conducted via a self-administered online questionnaire using Online
9
10 99 Surveys (www.onlinesurveys.ac.uk).

11
12 100 **Materials**

13
14 101 The questionnaire was specifically-developed, mainly using items adapted from validated eating
15
16 102 behaviour questionnaires (Stunkard and Messick, 1985; Clark et al., 1991; Fleurbaix Laventie Ville
17
18 103 Sante Study Group, 2004; Schembre et al., 2009; Tapper and Pothos, 2010; Greenwood et al., 2012;
19
20 104 Simmonds et al., 2016). Where possible, item wording and structure reflected that of validated
21
22 105 questionnaires. For example, the Healthy Eating Vital Signs assessment tool validation found that
23
24 106 asking about typical behaviour was more effective than asking about one-day or one-week recall,
25
26 107 and that asking about ‘frequency’ was more effective than ‘servings’ (Greenwood et al., 2012).
27
28 108 Several items were able to reflect validated questionnaire wording more directly. For example, the
29
30 109 item “I find it hard to resist cake even if I’m not hungry or have just eaten a meal” closely reflects
31
32 110 Item 1 of the Three-Factor Eating Questionnaire R-18: “When I smell a delicious food, I find it very
33
34 111 difficult to keep from eating, even if I have just finished a meal” (Fleurbaix Laventie Ville Sante Study
35
36 112 Group, 2004) and Item 13 of the Weight-Related Eating Questionnaire: “When I’m offered delicious
37
38 113 food, it’s hard to resist eating it even if I’ve just eaten” (Schembre et al., 2009). although some
39
40 114 items were developed in response to an informal qualitative enquiry on social media. Some of these
41
42 115 items were used to explore OC behaviour and attitudes eg “I feel regret after eating OC” and “I look
43
44 116 forward to OC”; and others to explore OC-related opinions– e.g. “I would like my workplace to do
45
46 117 more to help me be healthy” and “Do you think there is a healthier alternative to office cake?”.

47
48 118 Items about OC behaviour and attitudes were based on the TPB to allow exploration of respondents’
49
50 119 beliefs about the consequences of OC (attitude), their response to the behaviour and approval of
51
52 120 colleagues (subjective norms) and their ability to control or mitigate their OC own consumption
53
54 121 (PBC). Tables 3 and 4 indicate the corresponding TPB dimension for each item. Although the
55
56 122 questionnaire was not designed or validated to confirm the TPB’s role in OC consumption, the TPB
57
58 123 provided a framework from which to explore OC behaviour. This approach has been used elsewhere
59
60 124 (Tonglet et al., 2004). The questionnaire was developed using the TPB author’s guidelines (Fishbein,
125
126 2010).

126 Following ethical approval, the questionnaire was piloted with a convenient sample (*n* 9).

127 The questionnaire was structured as follows:

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3 128 Section 1: nine items explored existing OC culture in respondents' workplaces e.g. "In a typical
4 working week, on how many occasions are cakes available in your office?" (multiple choice
5 129 response); and "Typically in your office, where are office cakes displayed?" (multiple choice
6 130 response).
7 131
8
9 132 Section 2: 20 items explored respondents' own OC behaviour e.g. "In a typical week, on how many
10 133 occasions do you personally eat office cake?" (multiple choice response); 5-point Likert-style scale
11 134 from Never to Always for items such as "If there is cake available, I eat it" and "It's hard to say no to
12 135 cake if everyone else is eating it"; and 5-point Likert-style scale from Strongly Agree to Strongly
13 136 Disagree for items such as "Office cake has made it harder to control my weight" and "Office cake
14 137 has made it harder for me to eat healthily at work".:-
15 138 Section 3: nine items explored respondents' opinions of OC culture in general e.g. "In your opinion,
16 139 what is the ideal frequency for office cakes?" (multiple choice response); -and 5-point Likert-style
17 140 scale from Strongly Agree to Strongly Disagree for items such as "Overall, office cake is a good thing"
18 141 and "Office cake brings people together".
19
20 142 Section 4: six demographic items requested gender, age group (AG), job role, working pattern and
21 143 self-reported height (m) and weight (kg) from which body mass index (BMI) was calculated.
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23 144 The questionnaire was voluntary, anonymous and confidential to encourage response.
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32 145 ***Sampling***

33 146 Two sampling strategies were used to recruit office workers aged ≥ 18 years. Four demographically-
34 147 diverse organisations were recruited before the survey opened, giving potential access to
35 148 approximately 3500 participants through cluster sampling (Table 1). Organisations agreed to
36 149 distribute questionnaires internally by email to minimise coverage and sampling error. Snowball
37 150 sampling was conducted through the first author's social media and email contacts. Invitations to
38 151 participate were objective and neutral to minimise non-response bias. Participants confirmed
39 152 eligibility and consent by questionnaire submission. In accordance with ethics committee
40 153 requirements, snowball sample participants confirmed they worked in England.
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50 154 ***Data collection***

51 155 Data collection for both strategies occurred between 1st and 31st May 2017. Participants completed
52 156 identical questionnaires, although each participating organisation had a unique identifier to enable
53 157 between-company comparisons.
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57 158 ***Statistical analysis***

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3 159 Descriptive statistics and cross-tabulations were used to analyse demographic data. Chi-square tests
4 were used to test for between-group difference. Kruskal Wallis ANOVA were used to test for BMI
5 160 difference between demographic groups with Mann Whitney-U post hoc tests and Bonferroni
6 161 adjustment. The significance level was set at $p < 0.05$.
7
8 162

9
10 163 After initial data exploration revealed significant differences for AG and gender, variables for Likert-
11 164 type scale items were recoded and condensed to further investigate trends in demographic
12 165 difference. 'Strongly agree' and 'agree' were condensed to 'strongly agree/agree'; 'disagree' and
13 166 'strongly disagree' to 'disagree/strongly disagree'; 'sometimes' and 'about half the time' to
14 167 'sometimes/half the time'; and 'often' and 'always' to 'often/always'. Responses to weekly OC
15 168 refusals 'once/day' and 'several times/day' were also condensed. A similar approach has been taken
16 169 in eating behaviour research (Ball et al., 2010; Hartmann et al., 2013) including workplace studies
17 170 (Tabak et al., 2015; Watts et al., 2016).
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24 171 Data were analysed using the statistical software package IBM SPSS Statistics for Windows version
25 172 23.
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27

28 173 **Results**

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31 174 Across both sampling strategies, 940 respondents completed the questionnaire. Missing data was
32 175 0.4% for gender and 0.5% for AG. Percentages presented were calculated excluding missing data.
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34

35 176 ***Participant characteristics***

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37 177 Organisation D withdrew because the relevant internal permissions had not been given, although
38 178 three people responded independently. Data from both sampling strategies were therefore
39 179 combined to form a single sample of 940 respondents.
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43 180 Table 2 summarises respondents' demographic characteristics. Means are presented \pm one standard
44 181 deviation. Of the total sample, 39.3% were male. The mode AG was 30-49 years (30-49s) (55.6%)
45 182 and 81.0% worked full-time. Mean BMI was $25.9 \pm 5.24 \text{ kg/m}^2$ and was significantly ($p < 0.001$) higher
46 183 in men ($26.1 \pm 4.4 \text{ kg/m}^2$, [95% Confidence Interval (CI) 25.6, 26.5]) than women ($25.7 \pm 5.7 \text{ kg/m}^2$,
47 184 [95% CI 25.3, 26.2]). Mean BMI for the 18-29 AG (18-29s) ($24.3 \pm 4.3 \text{ kg/m}^2$ [95% CI 23.6, 24.9]) was
48 185 significantly ($p < 0.001$ for all) lower than for both 30-49s ($26.2 \pm 5.5 \text{ kg/m}^2$ [95% CI 25.7, 26.7]) and
49 186 ≥ 50 AG (≥ 50 s) ($26.3 \pm 5.1 \text{ kg/m}^2$ [95% CI 25.6, 26.9]). Kruskal Wallis ANOVA found no significant
50 187 difference in BMI according to either OC availability or OC consumption frequency.
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57 188 ***Characteristics of office cake culture***

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3 189 For weekly OC availability and consumption, results are reported for full-time workers (FTWs) only.
4
5 190 OC was typically available at least once-twice/week for 87.0% of respondents. The mode availability
6
7 191 was once-twice/week for 65.8%, with 7.9% reporting daily availability. There was no effect of gender
8
9 192 or AG. 'Hardly any' OC was homemade according to 51.0%. The most commonly-given reasons for
10 193 OC were birthdays/retirements/promotions (93.5%), meeting/event leftovers (55.0%), TV/charity
11 194 events (49.4%) and management rewards (37.8%), while 41.5% said no reason was needed. The
12 195 mode location for OC display was the main working area (70.9%). The most commonly-offered OC
13 196 alternative was fruit (46.9%), although 37.3% said no alternatives were ever available.
14
15
16
17 197 Half (50.5%) the respondents strongly disagreed and disagreed that meeting refreshments provided
18
19 198 sufficient healthy options, with significantly more ≥50s (15.6%) strongly disagreeing than 18-29s
20
21 199 (7.6%).

22 23 200 ***Respondents' own OC behaviour and attitudes***

24
25 201 The mode frequency of typical personal weekly OC consumption (57.8% of respondents) was once-
26
27 202 twice/week. The mode number of refusals of OC (46.6%) was 1-3 times/week with 12.6% refusing
28
29 203 several times/day. The condensed analysis found significantly more women (22.0%) than men
30
31 204 (13.6%) refused at least once/day.

32
33 205 Responses to Likert-type scale items are summarised in Tables 3 and 4.

34
35 206 For attitude-related items, gender had an effect with significantly more women than men
36
37 207 acknowledging negative consequences of OC. There were significant trends for fewer women than
38
39 208 men, and fewer ≥50s than 18-29s to look forward to OC, and for more women than men to feel
40
41 209 regret after eating it.

42
43 210 Subjective norm-related responses were mixed according to the type of norm and were influenced
44
45 211 by AG and gender. Figure 1 shows the mode referent group was 'other'. Analysis of respondents'
46
47 212 qualitative description of 'other' found that all but 11 of the 350 respondents selecting this option
48
49 213 (36.1% of the total sample) defined 'other' as 'myself', 'me', 'no one else' or similar. Significantly
50
51 214 fewer 18-29s responded other/'self' than older AGs, instead citing work colleagues and
52
53 215 family/friends as key referents.

54
55 216 OC behaviour was not substantially affected by injunctive norms with the majority of respondents
56
57 217 reportedly unaffected by colleagues' approval or disapproval of either OC or their (respondents')
58
59 218 own OC behaviour. However, items with a descriptive norm component influenced behaviour for
60
219 the total sample with significant differences for gender and AG. Significantly more women and
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younger respondents were persuaded by colleagues to change their minds about initially refusing OC

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2
3 221 and struggled to refuse OC if others were eating it. The condensed analysis consolidated these
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5 222 findings.

6
7 223 PBC-related responses suggested that OC challenges respondents' self-efficacy, but to differing
8
9 224 extents according to gender and AG. If OC is available, over 90% reported eating it at least
10
11 225 sometimes and 41.5% often or always. Significantly more of these were men than women (48.9%
12
13 226 and 36.6% respectively in the condensed analysis). The condensed analysis also found significantly
14
15 227 more 18-29s than ≥50s reported eating OC often/always if it was available (52.3% and 35.4%
16
17 228 respectively). Significantly more women than men found it hard to resist OC even if they were not
18
19 229 hungry or had just eaten a meal, and to be distracted by it. Most respondents reported being less
20
21 230 likely to eat OC if it was out of view with the condensed analysis finding significantly more women
22
231 (61.8%) than men (52.4%) responded 'often/always'.

23 232 More than half (54.4%) the respondents said they never took action to avoid or compensate for OC
24
25 233 consumption. Of these, significantly more were men and ≥50s than women and 18-29s. Significantly
26
27 234 more women (34.9%) than men (23.9%) said they avoided or compensated for OC consumption
28
29 235 once-twice/week and significantly more 18-29s than ≥50s did so three-four times/week. Increased
30
31 236 exercise and reduced energy intake at other meals were typical examples of compensatory activities.

32 237 ***Participants' opinions about OC***

33 238 Most respondents strongly agreed and agreed that OC 'is a good thing', 'is a great way to show
34
35 239 appreciation', 'brings people together' and 'cheers everyone up' with significantly more 18-29s and
36
37 240 men strongly agreeing. Table 5 shows that nearly all (94.8%) respondents said the ideal OC
38
39 241 frequency was once/week or less. The mode ideal frequency was once/month. There was a
40
41 242 significant trend for women to consider the ideal frequency to be lower than men.

42
43 243 The condensed analysis found significantly more women than men strongly agreed/agreed (38.9%
44
45 244 and 31.5%% respectively) they would support initiatives to reduce OC consumption. Over half of
46
47 245 respondents strongly agreed or agreed they would like their workplace to do more to promote
48
49 246 health, with the condensed analysis revealing significant trends for more women and younger AGs
50
51 247 to strongly agree/agree.

52 248 The most popular alternative to OC was fruit (51.5%), followed by 'cake less often' (47.9%), nuts
53
54 249 (33.0%) and raw vegetables and dips (33.0%).

55 250 ***Between-organisation comparisons***

56
57
58 251 Between-organisation comparisons showed that the demographic profile of each organisation
59
60 252 affected responses in line with findings from the total sample.

1
2
3 253 **Discussion**
4

5 254 To our knowledge, the present study provides the first data on UK OC culture, describing its main
6
7 255 characteristics and office workers' OC-related behaviour and attitudes. Two thirds of FTWs typically
8
9 256 ate OC at least once/week and in most workplaces OC was available up to five times/week. Most OC
10
11 257 is shop-bought, available most commonly to celebrate social occasions, and displayed in the main
12
13 258 office area. OC was generally considered to have morale-boosting characteristics as well as negative
14
15 259 consequences such as facilitating weight gain. Almost all respondents said ideal OC frequency was
16
17 260 once/week or less but only a third agreed they would welcome a workplace initiative to achieve
18
19 261 that. An important finding was that for most items exploring OC behaviour and opinions, gender had
20
21 262 a significant effect, with age significantly effecting some items. Apart from Organisation C having
22
23 263 higher availability and consumption frequency, there were no between-organisation differences,
24
25 264 suggesting OC impacts diverse office environments in similar ways.

26
27 265 That OC was widely available aligns with evidence that an increasing proportion of daily energy
28
29 266 intake is from snacks (Kant and Graubard, 2015), cake and sweet baked goods are the primary
30
31 267 energy-contributors to snack foods (Duffey et al., 2013; Myhre et al., 2015) and snacking is more
32
33 268 likely in the workplace than at home (Liu et al., 2015).

34
35 269 The effects of gender have implications for employers and WHPPs. It is well-established that gender
36
37 270 differences exist in food choice and behaviour (Rolls et al., 1991; Wardle et al., 2004; Li et al., 2012;
38
39 271 Cruwys et al., 2015). The present study found more women than men acknowledged OC's negative
40
41 272 consequences. This is consistent with evidence that women are more likely to avoid energy-dense
42
43 273 foods, eat fruit and vegetables, diet to lose weight and value healthy eating (Rolls et al., 1991; Fagerli
44
45 274 and Wandel, 1999; Wardle et al., 2004). Meanwhile, more men said they never refused OC and did
46
47 275 not acknowledge negative consequences. This aligns with evidence that men have poorer diet
48
49 276 quality (Wardle et al., 2004), food knowledge (Baker and Wardle, 2003) and less regard for healthy
50
51 277 eating behaviours and guidelines (Wardle et al., 2004).

52
53 278 Findings on the effects of social influencing and subjective norms support previous research. While
54
55 279 nearly a third of respondents reported that work colleagues were their OC referents, more reported
56
57 280 they had no referent other than themselves. This may partially explain why respondents were not
58
59 281 influenced substantially by injunctive norms because injunctive norms relate to the approval of
60
282 others. Nevertheless, social modelling has been shown to influence eating behaviour (Herman et al.,
283
284 2003; Vartanian et al., 2015), especially in the workplace (Quist et al., 2014) and among socially-
285
connected people (Christakis and Fowler, 2007; Pachucki et al., 2011). Therefore, self-referents
could have been demonstrating the third-person effect whereby individuals deny being affected by

1
2
3 286 social modelling (Davison, 1983). This has been reported in eating behaviour (Vartanian et al., 2008;
4
5 287 Croker et al., 2009). Because modelling is partly automatic (Cruwys et al., 2015) these individuals
6
7 288 could be more influenced by social influences than they realise.

8
9 289 The lack of injunctive norm effect also aligns with evidence that injunctive norms are less effective
10
11 290 than descriptive norms in influencing eating behaviour (Stok et al., 2014; Cruwys et al., 2015).
12
13 291 Responses to the items with a descriptive norm component suggest OC consumption could be
14
15 292 influenced by descriptive norms, particularly among women and younger people. In particular, the
16
17 293 present study might help raise employers' awareness of how different types of norm-related
18
19 294 communication affect health behaviours (Croker et al., 2009; Stok et al., 2015). Information-based
20
21 295 messages typically rely on injunctive norms (eg 'eat salad for lunch') which are less effective than
22
23 296 messages based on descriptive norms (eg 'salad is one of our most popular dishes') (Rivis and
24
25 297 Sheeran, 2003; Croker et al., 2009; Mollen et al., 2013; Higgs and Thomas, 2016). One such message
26
27 298 provided by the present study's findings would be: '95% of office workers think the ideal frequency
28
29 299 for cake is once/week or less'. In the absence of adequate healthy descriptive norm information,
30
31 300 highlighting healthy intentions could be an effective way to promote healthy behaviour eg 'most
32
33 301 employees are committed to eating healthily' (Croker et al., 2009).

34
35 302 PBC-related data indicated OC was generally hard to resist, with women struggling more than men.
36
37 303 These results support research using other behavioural models that found women have significantly
38
39 304 greater eating-related self-determined motivation than men (Ryan and Deci, 2000; Leblanc et al.,
40
41 305 2015) and higher dietary restraint (Stunkard and Messick, 1985; Provencher et al., 2003). Women
42
43 306 also generally show higher diet-related disinhibition levels than men (Stunkard and Messick, 1985;
44
45 307 Provencher et al., 2003) which could explain why more women than men reported being distracted
46
47 308 by OC and found it hard to resist even if they were not hungry.

48
49 309 No gender difference was found in OC consumption frequency. This was unexpected because,
50
51 310 compared to men, women have a higher number of daily eating occasions (Kant and Graubard,
52
53 311 2015) and higher snacking frequency (Hartmann et al., 2013; O'Connor et al., 2015).

54
55 312 The present study presents a picture of men being more able to take OC or leave it without anxiety,
56
57 313 guilt or concern for the consequences, whereas women appear more likely to be aware of OC and
58
59 314 less able to resist it, despite being cognisant of negative health consequences. This could make OC a
60
315 difficult topic to discuss in the workplace. Employers should consider how a workplace's gender
316
317 profile could affect initiatives to address OC consumption and other dietary-related initiatives. The
effects of gender on workplace eating and snacking should be explored further.

1
2
3 318 ***The effect of age***
4

5 319 AG affected some responses, particularly those investigating OC's morale-boosting attributes and
6
7 320 PBC. More 18-29s than ≥50s ate OC if it was available and acknowledged its morale-boosting
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9 321 characteristics. 18-29s can be broadly classified as Generation Y (GenerationY.com, 2015), the
10
11 322 generation most likely to snack, with 24% considered 'super snackers' who snack four or more
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13 323 times/day (Topper, 2015). Generation Y are accustomed to frequent snacking whereas older people
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15 324 may tend to regard snacks as an occasional treat, potentially explaining why snacking frequency
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17 325 declines with age (Topper, 2015). This could also explain why fewer ≥50s than 18-29s considered OC
18
19 326 a good way to show appreciation and has implications for employee performance management and
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21 327 motivation.

22 328 Data on how age effects eating behaviour are scarce but the present study's findings are consistent
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24 329 with studies using the Three-Factor Eating Questionnaire (Stunkard and Messick, 1985) which found
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26 330 restraint scores increased and disinhibition and hunger scores decreased with age (Drapeau et al.,
27
28 331 2003; Harden et al., 2009; Löffler et al., 2015). The present study shows the behaviour and attitudes
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30 332 towards OC of younger employees differ to those of older employees, possibly mediated by social
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32 333 influencing, descriptive norms and generational effects. Further research would help establish
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34 334 whether age effects could inform dietary behaviour interventions within and outside the workplace.

35
36 335 ***The effect of the environment on OC consumption***

37 336 The present study demonstrates several ways in which the presence of OC appears to influence
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39 337 eating behaviour, supporting previous research findings that the physical food environment affects
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41 338 dietary behaviour (Graham et al., 2013), including in the workplace (Kleef et al., 2012; Velema et al.,
42
43 339 2018). First, OC was mostly displayed openly in the working area and almost all respondents said if it
44
45 340 is available they eat it at least sometimes. This suggests an OC display prompts consumption which
46
47 341 is consistent with evidence that the thought, sight or smell of palatable food stimulates hunger and
48
49 342 motivation to eat (Ferriday and Brunstrom, 2011; Ramaekers et al., 2014). Additionally, nearly all
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51 343 respondents said they thought they were less likely to eat OC if it is out of view, which is consistent
52
53 344 with evidence that consumption decreases as food becomes more inaccessible (Meiselman et al.,
54
55 345 1994; Scott et al., 2011; Maas et al., 2012) including in the workplace (**Painter et al., 2002**).
56
57 346 Furthermore, habitual disinhibition is a strong behavioural correlate with weight gain in older
58
59 347 women (Hays and Roberts, 2008) therefore a regular OC display could create conditions in which
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348 individuals, particularly women, habitually respond by eating available OC. Lastly, an environment
349 where OC consumption increases could lead to formation of new social norms and social modelling
350 which encourages OC consumption (Cruwys et al., 2015).

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3 351 'Choice architecture', or 'nudging' techniques express desired behaviours as descriptive norms
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5 352 without choice being removed or forced in any direction (Thaler R. & Sunstein, 2009). Nudging has
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7 353 improved eating behaviours (Mela, 2006; Thaler R. & Sunstein, 2009; Bucher et al., 2016), including
8
9 354 in the workplace (Thorsen et al., 2010; Kleef et al., 2012; Velema et al., 2018), and has reduced
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11 355 energy intake without individuals realising or feeling dissatisfied (Petrescu et al., 2016). Nudging
12
13 356 could therefore be acceptable to employees as a way to reduce OC consumption.

14 357 Over half the respondents reported OC made it harder to eat healthily at work. The present study
15
16 358 found no association between BMI and either OC availability or consumption frequency although it
17
18 359 was not designed to do so. Nonetheless, almost a third of respondents reported OC had contributed
19
20 360 to weight gain, so research to investigate relationships between OC, obesity and its comorbidities
21
22 361 would be worthwhile.

23 362 *Ideal OC frequency*

24
25 363 Of interest is the discrepancy between almost unanimous support for an ideal OC frequency of
26
27 364 once/week or less, and the relative lack of support for interventions to achieve lower OC
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29 365 consumption levels. Gender could be a factor: significantly more women than men said they would
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31 366 support an initiative to reduce OC and would welcome more WHPP. Another factor could relate to
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33 367 commensality, defined as people eating and drinking together at the same time (Kerner, 2015).
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35 368 Commensality has been associated with improved cooperation and performance among workgroups
36
37 369 (Kniffin et al., 2015), cooperation and trust (Allen-Arave et al., 2008; Mameli, 2013) and connection
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39 370 between eating companions (Alley, 2012). Morale-boosting consequences of OC reported by
40
41 371 respondents could result from their subliminal recognition of the benefits of commensality. It is
42
43 372 therefore possible that respondents assumed OC reduction would mean reduction in opportunities
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45 373 to socialise. A contrasting proposal is that reducing OC frequency could enhance commensality
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47 374 benefits by making OC a treat to look forward to with people gathering together. This could be
48
49 375 considered more socially beneficial than the current prevalent situation where cake is displayed
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51 376 openly all day for people to help themselves to, with no group social interaction at all. It would be
52
53 377 useful to investigate this and explore which elements of OC culture people value most - the cake
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55 378 itself, social interaction or having a break from work for example.

56
57 379 The question arises that if 95% of respondents considered once/week or less to be the ideal OC
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59 380 frequency and the second most popular OC alternative was 'cake less often', why is availability high?
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381 Social influences affect the amount and type of foods eaten (Herman et al., 2003; Cruwys et al.,
382 2015) and social modelling occurs because individuals seek social cues that indicate appropriate
383 behaviour (Herman et al., 2003; Robinson, 2015) and ways to affiliate and ingratiate (Hermans et al.,

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3 384 2009; Robinson et al., 2011; Cruwys et al., 2015). In a workplace setting, this would suggest that
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5 385 individuals wanting to achieve workgroup acceptance are more likely to comply with established OC
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7 386 culture norms than risk alienation by refusing it or challenging it. The present study provides an
8
9 387 evidence-based method to counteract this. As previously suggested, a descriptive norm-based
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11 388 message that 95% of office workers consider the ideal frequency for OC to be once a week or less
12
13 389 could nudge employees towards new norms, healthier eating behaviours and healthier workplaces.

14 390 *Relatedly, social influencing and modelling theories contribute to some descriptions of social*
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16 391 *contagion theory (Marsden, 1998). Social contagion may be responsible for the spread of positive*
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18 392 *and negative health-related behaviours including smoking (Christakis and Fowler, 2008), happiness*
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20 393 *(Fowler and Christakis, 2008) and obesity (Christakis and Fowler, 2007) so it is reasonable to propose*
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22 394 *that it may provide a mechanism for increasing OC availability and consumption. Additionally, as in*
23
24 395 *the present study, social contagion has been shown to be affected by gender (Christakis and Fowler,*
25
26 396 *2007). Furthermore, social contagion may affect work colleagues differently to friends (Christakis and*
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28 397 *Fowler, 2008; Fowler and Christakis, 2008).* *Future research to explore workplace eating through the*
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30 398 *lens of social contagion theory would be useful.*

31 399

32 400 The present study demonstrates that when considering the health of the workplace eating
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34 401 environment, food provision by employers - canteens, vending etc - should not be considered in
35
36 402 isolation. Food supplied by employees, managers and clients should also be taken into account as
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38 403 part of that workplace's food environment. Furthermore, by impacting employee eating behaviour,
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40 404 OC could undermine WHPP effectiveness, reducing return on workplace health investment.

41 **Recommendations**

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43 406 Recommendations for employers can be drawn from the present study's findings. Making changes
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45 407 to the workplace environment to reduce the salience of OC and create new social norms would help
46
47 408 employees make healthier food choices without effort. Initiatives to gain acceptance that OC access
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49 409 be restricted to time-limited occasions, and keeping OC out of sight until those occasions, would
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51 410 prevent mindless OC consumption and distraction. Encouraging healthier OC alternatives extends
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53 411 choice and commensal inclusivity. Starting a conversation that leads to fewer OC occasions,
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55 412 informed by descriptive norm-based messages, would provide commensality benefits from social
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57 413 occasions that employees can look forward to. Recognising that a workplace's gender and AG
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59 414 profile creates differences in OC-related attitudes may improve chances of effective change.
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3 415 Communicating with health-related messages based on descriptive norms rather than injunctive
4 norms is more likely to change dietary behaviour.
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6
7 417 ***Strengths/limitations***
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9 418 The present study has some strengths. It supplies the first data on the well-recognised but poorly-
10 419 understood OC phenomenon and contributes to the literature on the effects of gender and age on
11 420 social influences on eating behaviour. The sampled population was large enough to provide
12 421 significant results and, unlike many studies investigating obesity and dietary behaviour, 39.3% of the
13 422 participants were male which improved the representative quality of the sample and adds to the
14 423 literature on male eating behaviour. It also provides insights into constructive ways to improve
15 424 employee health and therefore public health through achievable adjustments to workplace culture
16 425 and environments.
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18 426 There were limitations. The questionnaire was non-validated so data accuracy could have been
19 427 diminished. Relatedly, some items were not optimally operationalised which could have led to
20 428 measurement and response bias. Insufficient items were included to explore the effect of descriptive
21 429 norms. Portion size was not examined and consumption data was self-reported which could have
22 430 resulted in under-reporting. The social media-based recruitment strategy could have been subject to
23 431 response bias. Differences in comparator group size could have skewed between-AG comparisons.
24 432 Only office workers were investigated therefore results may not be applicable to other workplace
25 433 environments such as factories, hospitals or retail. Similar studies in other workplace environments
26 434 are warranted.
27

28 435 **Conclusion**
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30 436 In UK offices, OC appears to influence the physical workplace environment and dietary behaviour
31 437 through increased salience and availability, and social influencing effects. OC behaviour and
32 438 attitudes vary widely and are significantly affected by gender and age, therefore WHPP design
33 439 should reflect salient gender and age profiles. There is consensus on ideal OC frequency which
34 440 suggests nudge techniques to reduce salience and frequency of OC and reduce OC consumption
35 441 could make workplaces healthier while retaining commensality benefits.
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731 **Tables**

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733 **Table 1: Descriptions of organisations recruited for the cluster sample**

Organisation	Description	Location	Employee description
A	Engineering and innovation function of an international manufacturer. Approximately 800 staff	The Midlands	Predominantly educated to at least graduate level. Professional plus admin staff
B	UK office of international operator in transport and infrastructure solutions. Approximately 1000 staff	Southern England	Predominantly educated to at least graduate level. Professional plus admin staff
C	Health-based charity. Approximately 250 staff	Mainly London, plus smaller offices around the UK	Mix of education level. Professional plus admin staff
D	Group of three local authorities. Up to 1500 staff.	Home counties	Mix of education level. Professional plus admin staff

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736 **Table 2: Demographic characteristics of survey respondents**

	Cluster sampling				Snowball sampling n (%)	Total sample n (%)
	Organisation A n (%)	Organisation B n (%)	Organisation C n (%)	Organisation D n (%)		
Number of respondents	173 (18.4)	107 (11.4%)	38 (4.0)	3 (0.03)	619 (65.9)	940 (100)
Gender						
Male	126 (73.3)	61 (57.5)	6 (15.8)	0 (0)	175 (28.3)	368 (39.3)
Female	46 (26.7)	45 (42.4)	32 (84.2)	3 (100)	442 (71.6)	568 (60.7)
Total	172 (100)	106 (100)	38 (100)	3 (100)	617 (100)	936 (100)
Missing	1	1	-	-	2	4
Age group						
18-29 years	57 (33.1)	17 (15.9)	6 (15.8)	0	92 (15.0)	172 (18.4)
30-49 years	83 (48.3)	54 (50.5)	23 (60.5)	1 (33.3)	359 (58.4)	520 (55.6)
≥50 years	32 (18.6)	36 (33.6)	9 (23.7)	2 (66.7)	164 (26.7)	243 (26.0)
Total	172 (100)	107 (100)	38 (100)	3 (100)	615 (100)	935 (100)
Missing	1	-	-	-	4	5
Pro-rata work time						
Full time	170 (98.3)	100 (93.5)	32 (84.2)	2 (66.7)	457 (73.8)	761 (81.0)
80%	2 (1.2)	4 (3.7)	2 (5.3)	1 (33.3)	78 (12.6)	87 (9.3)
60%	1 (0.6)	3 (2.8)	3 (7.9)	0	53 (8.6)	60 (6.4)
50%	0	0	0	0	18 (2.9)	18 (1.9)
≤40%	0	0	1 (2.6)	0	13 (2.1)	14 (1.5)
Total	173 (100)	107 (100)	38 (100)	3 (100)	619 (100)	940 (100)
Missing	-	-	-	-	-	-
Mean BMI (kg/m²)	26.0	26.5	24.5	-	-	25.9

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739 **Table 3: Responses from questionnaire Likert-type scale items ‘Never’ to ‘Always’**

Item (TPB construct explored)	Demographic group	Never n (%)	Sometimes n (%)	About half the time n (%)	Often n (%)	Always n (%)
If OC is available, I eat it (PCB)	Total	76 (8.1)	369 (39.3)	105 (11.2)	256 (27.2)	134 (14.3)
	Men/Women 18-29/30-49/≥50		(33.7/42.8) ^a (29.7/38.5/47.7) ^b	(8.4/13.0) ^a	(32.6/27.9/21.8) ^b	(21.2/9.9) ^a
I find it easy to refuse OC (PBC)	Total	115 (12.2)	230 (24.45)	119 (12.7)	225 (23.9)	251 (26.7)
	Men/Women 18-29/30-49/≥50					
I get distracted by the thought, smell or sight of OC (PBC)	Total	360 (38.3)	305 (32.4)	65 (6.9)	151 (16.1)	59 (6.3)
	Men/Women 18-29/30-49/≥50	(44.6/34.0) ^a		(4.9/8.3) ^a		
If I refuse OC, colleagues persuade me to change my mind (Inj + Desc)	Total	453 (48.2)	320 (34.0)	59 (6.3)	887 (9.3)	21 (2.2)
	Men/Women 18-29/30-49/≥50	(57.3/42.1) ^a (40.1/45.4/60.1) ^b	(26.6/39.1) ^a (32.0/38.3/27.2) ^b	(11.6/5.2/4.9) ^b		
I feel regret after eating OC (Att)	Total	356 (37.9)	311 (33.1)	65 (6.9)	134 (14.3)	74 (7.9)
	Men/Women 18-29/30-49/≥50					
I feel I cause offense if I refuse OC (Inj)	Total	572 (60.9)	217 (23.1)	41 (4.4)	91 (9.7)	19 (2.0)
	Men/Women 18-29/30-49/≥50		(22.1/20.4/29.2) ^b			
It's hard to say no if everyone else is eating OC (Desc)	Total	395 (42.0)	256 (27.2)	75 (8.0)	151 (16.1)	63 (6.7)
	Men/Women 18-29/30-49/≥50	(51.1/35.9) ^a (36.6/39.8/50.6) ^b	(22.6/30.5) ^a		(22.1/16.3/10.7) ^b	
I feel hurt if OC I've brought to share is refused (Inj)	Total	676 (71.9)	139 (14.8)	41 (4.4)	62 (6.6)	22 (2.3)
	Men/Women 18-29/30-49/≥50	(77.7/68.1) ^a (62.2/73.7/75.3) ^b	(22.1/12.7/14.0) ^b	(4.7/5.4/1.6) ^b	(3.8/8.5) ^a	
I am made to feel uncomfortable if I refuse OC (Inj)	Total	736 (78.3)	125 (13.3)	44 (4.7)	28 (3.0)	7 (0.7)
	Men/Women 18-29/30-49/≥50					
I find it hard to resist OC even if not hungry/have just eaten (PBC)	Total	303 (32.2)	286 (30.4)	85 (9.0)	168 (17.9)	98 (10.4)
	Men/Women 18-29/30-49/≥50	(37.5/28.7) ^a	(23.3/30.4/36.2) ^b	(17.4/8.8/3.7) ^b		
If OC is out of view I am less likely to eat some (PBC)	Total	157 (16.7)	142 (15.1)	95 (10.1)	284 (30.2)	262 (27.9)
	Men/Women 18-29/30-49/≥50	(21.7/13.2) ^a				
I look forward to OC (Att)	Total	191 (20.3)	290 (30.9)	140 (14.9)	177 (18.8)	142 (15.1)
	Men/Women 18-29/30-49/≥50	(23.4/18.0) ^a (12.8/17.3/31.7) ^b	(26.1/34.2) ^a (22.7/31.2/36.6) ^b		(26.7/19.2/12.3) ^b	(22.1/16.0/8.2) ^b

740 TPB, Theory of Planned Behaviour; OC, office cake; Att, attitude; Inj; injunctive norm; Desc; descriptive norm; PBC,
741 perceived behavioural control

742 ^a: values differ significantly between genders at p<0.05

743 ^b: values differ significantly between age groups at p<0.05

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745 **Table 4: Responses from questionnaire Likert-type scale items ‘Strongly agree’ to ‘Strongly disagree’**

Item (TPB construct explored)	Demographic groups	Strongly agree n (%)	Agree n (%)	Undecided n (%)	Disagree n (%)	Strongly disagree n (%)
OC has contributed to increase in my weight (Att)	Total	73 (7.8)	221 (23.6)	174 (18.6)	257 (27.5)	211 (22.5)
	Men/women 18-29/30-49/≥50	(5.4/9.3) ^a	(17.9/27.3) ^a (21.5/27.1/17.3) ^b			(28.8/18.5) ^a (20.3/19.8/30.0) ^b
OC has made it harder for me to control my weight (Att)	Total	64 (6.8)	268 (28.6)	122 (13.0)	271 (29.0)	211 (22.5)
	Men/women 18-29/30-49/≥50	(4.3/8.5) ^a	(24.2/31.5) ^a			(30.7/17.3) ^a (22.7/19.6/28.8) ^b
OC makes a weight loss diet harder to stick to (Att)	Total	142 (15.1)	409 (43.5)	103 (11.0)	154 (16.4)	132 (14.0)
	Men/women 18-29/30-49/≥50		(36.7/47.9) ^a	(14.1/8.8) ^a		(17.9/11.4) ^a
OC has made it harder for me to eat healthily (Att)	Total	89 (9.5)	264 (28.1)	136 (14.5)	270 (28.7)	181 (19.3)
	Men/women 18-29/30-49/≥50	(7.1/11.1) ^a				(25.8/15.0) ^a (16.9/16.5/26.7) ^b
OC is a good thing	Total	121 (12.9)	448 (47.7)	208 (22.1)	115 (12.2)	48 (5.1)
	Men/women 18-29/30-49/≥50	(17.9/9.7) ^a (19.2/12.1/10.3) ^b				(1.7/4.6/8.2) ^b
OC is great way to show appreciation	Total	109 (11.6)	519 (55.2)	143 (15.2)	135 (14.4)	34 (3.6)
	Men/women 18-29/30-49/≥50	(15.5/9.2) ^a (17.4/11.5/7.8) ^b	(64.5/53.8/51.9) ^b	(9.3/16.0/17.7) ^b	(6.4/15.6/17.3) ^b	
OC brings people together	Total	161 (17.1)	596 (63.4)	79 (8.4)	82 (8.7)	22 (2.3)
	Men/women 18-29/30-49/≥50	(24.4/17.3/11.5) ^b			(3.5/9.6/10.7) ^b	
OC cheers everyone up	Total	178 (18.9)	598 (63.6)	96 (10.2)	53 (5.6)	15 (1.6)
	Men/women 18-29/30-49/≥50	(23.1/16.2) ^a (29.7/18.5/11.9) ^b	(57.9/67.6) ^a			(1.2/0.8/3.3) ^b
I would support an initiative to reduce OC consumption	Total	104 (11.1)	235 (25.0)	278 (29.6)	238 (25.3)	85 (9.0)
	Men/women 18-29/30-49/≥50		(20.1/28.2) ^a		(29.1/23.1) ^a	(12.2/6.9) ^a
I would like my work-place to do more to help my health	Total	172 (18.3)	317 (33.7)	196 (20.9)	195 (20.7)	60 (6.4)
	Men/women 18-29/30-49/≥50		(29.6/36.4) ^a		(16.3/19.8/26.3) ^b	(8.4/5.1) ^a

746 TPB, Theory of Planned Behaviour; OC, office cake; Att, attitude; Inj; injunctive norm; Desc; descriptive norm; PBC,
747 perceived behavioural control

748 ^a: values differ significantly between genders at p<0.05

749 ^b: values differ significantly between age groups at p<0.05

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751 **Table 5: Ideal office cake frequency**

	Never n (%)	Once per month n (%)	Once per fortnight n (%)	Once per week n (%)	Twice per week n (%)	Daily n (%)	Total n (%)
Gender							
Male	28 (7.6) ^a	120 (32.6) ^a	90 (24.5) ^a	104 (28.3) ^a	14 (3.8) ^a	12 (3.3) ^a	368 (100)
Female	29 (5.1) ^a	267 (47.0) ^b	129 (22.7) ^a	120 (21.1) ^b	17 (3.0) ^a	6 (1.1) ^b	568 (100)
Total	57 (6.1)	387 (41.3)	219 (23.4)	224 (23.9)	31 (3.3)	18 (1.9)	936 (100)
Age group							
18-29 years	5 (2.9) ^c	52 (30.2) ^c	53 (30.8) ^c	48 (27.9) ^c	10 (5.8) ^c	4 (2.3) ^c	172 (100)
30-49 years	22 (4.2) ^c	233 (44.8) ^d	121 (23.3) ^{c,d}	120 (23.1) ^c	14 (2.7) ^c	10 (1.9) ^c	520 (100)
≥50 years	29 (11.9) ^d	102 (42.0) ^d	45 (18.5) ^d	56 (23.0) ^c	7 (2.9) ^c	4 (1.6) ^c	243 (100)
Total	56 (6.0)	387 (41.4)	219 (23.4)	224 (24.0)	31 (3.3)	18 (1.9)	935 (100)

752 ^{a, b}: Values with different superscript letters differ significantly between genders at p<0.05

753 ^{c, d}: Values with different superscript letters differ significantly between age groups at p<0.05

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755 **Figure Legend**

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757 Figure 1: Respondents' most influential referent according to age group (■, total sample [*n*
758 935]; □, 18-29s [*n* 172]; ■, 30-49s [*n* 520]; ■, ≥50s [*n* 243]). a, b: values with different
759 superscript letters differ significantly at $p \leq 0.05$.

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