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Do perceived norms of social media users' eating habits and preferences predict our own food consumption and BMI?

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1 **Do perceived norms of social media users' eating habits and preferences predict our**
2 **own food consumption and BMI?**

3

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Abstract

In laboratory studies, exposure to social norm messages conveying the typical eating behaviour of others has influenced participants' own consumption of food. Given the widespread use of social media, it is plausible that we are implicitly exposed to norms in our wider social circles, and that these influence our eating behaviour, and potentially, Body Mass Index (BMI). This study examined whether four perceived norms (perceived descriptive, injunctive, liking and frequency norms) about Facebook users' eating habits and preferences predicted participants' own food consumption and BMI. In a cross-sectional survey, men and women university students ($n = 369$; mean age = 22.1 years; mean BMI = 23.7) were asked to report their perceptions of Facebook users' consumption of, and preferences for, fruit, vegetables, energy-dense snacks and sugar sweetened beverages (SSBs), their own consumption of and preferences for these foods, and their BMI. Multiple linear regression revealed that perceived descriptive norms and perceived frequency norms about Facebook users' fruit and vegetable consumption were significant positive predictors of participants' own fruit and vegetable consumption (both $ps < .01$). Conversely, perceived injunctive norms about Facebook users' energy-dense snack and SSB consumption were significant positive predictors of participants' own snack and SSB consumption (both $ps < .05$). However, perceived norms did not significantly predict BMI (all $ps > .05$). These findings suggest that perceived norms concerning actual consumption (descriptive and frequency) and norms related to approval (injunctive) may guide consumption of low and high energy-dense foods and beverages differently. Further work is required to establish whether these perceived norms also affect dietary behaviour over time.

48

49 **KEY WORDS:** Social norms, social media, Facebook, perceptions, food, BMI

1 **Introduction**

2 Obesity represents a major risk factor for developing other chronic diseases such as type 2
3 diabetes, certain forms of cancer, coronary heart disease and other respiratory problems
4 (Kopelman, 2000). As poor dietary behaviour and eating habits are significant contributing
5 factors towards obesity, global public health interventions, such as the '5 a day' programme
6 in the UK, have attempted to encourage fruit and vegetable consumption through health
7 education and advertising campaigns (World Health Organization, 2003). However, these
8 approaches have achieved only limited success (Rekhy & McConchie, 2014).

9
10 Another approach could be to utilise social influences, such as exposure to social norms,
11 implicit rules that communicate the behaviour of the majority. According to Cialdini's social
12 norm theory (e.g. 1998), one way that norms may work is through normative influence,
13 whereby behaviour is copied because it is seen as socially approved of, accepted, or where
14 there is a concern to 'fit in' with a certain group (Cialdini & Goldstein, 2004, Cialdini &
15 Trost, 1998, Deutsch & Gerard, 1955). Another possibility is that norms provide a form of
16 informational social influence, whereby they communicate what is appropriate behaviour in
17 uncertain situations (Cialdini & Trost, 1998; Deutsch & Gerard, 1955). Providing normative
18 information about how the majority of others typically behave has been an effective way of
19 encouraging pro-environmental behaviours, such as towel reuse (Goldstein, 2008), as well as
20 discouraging behaviours which may negatively impact health, such as lowering alcohol
21 consumption in young adults, and risky behaviours such as drink-driving (Neighbors,
22 Larimer & Lewis, 2004; Perkins, Linkenbach, Lewis & Neighbors, 2010).

23

24 Social norms have also had an effect on eating behaviour. In cross-sectional work,
25 participants' perceptions of what others eat have been found to influence their own

26 consumption of calorific foods (Robinson, Ottens & Hermans, 2016) and fruit and
27 vegetables (e.g. Lally, Wardle & Bartle, 2011; Pelletier, Graham & Laska, 2014). Further,
28 using ecological momentary assessments, momentary injunctive norms, or perceptions about
29 whether others present approved of snacking in a specific situation, mediated the relationship
30 between social facilitation and participants also snacking in similar contexts (Schüz,
31 Papadakis & Ferguson, 2018). This suggests that, across various contexts, participants will
32 adjust their own intake to be in line with what they perceive others typically consume.

33

34 Related to this point, experimental evidence has also shown that exposure to normative
35 information can change participants eating behaviour. For example, in experimental studies,
36 descriptive norms reporting that others typically consume a lot of fruit and vegetables or little
37 junk food resulted in participants also eating more fruit and vegetables or fewer calories from
38 junk food (Robinson, et al. 2013; Robinson, Fleming & Higgs, 2014). Thus, exposure to
39 norms about what others actually do (descriptive norms) can result in the corresponding
40 behaviour, including blunting intake of energy-dense foods, as well as increasing fruit and
41 vegetable consumption. These results have also been extended into field settings (e.g. Mollen,
42 Rimal, Rutter & Kok, 2013; Thomas et al., 2017), where exposure to descriptive norms
43 conveying that other workers chose vegetables with their meals, led to an increase in
44 participants choosing vegetables with meals 6 weeks later (Thomas et al., 2017). Therefore,
45 active manipulation of social norm messaging has been used to nudge participants' actual
46 eating behaviour towards healthier choices. It may also be that in laboratory settings,
47 perceptions of how others actually behave are used as a guide to how much is appropriate to
48 eat in these unfamiliar and novel situations (Higgs, 2015).

49

50 Further, different types of norms may have different effects on food intake. For example,
51 injunctive norms (i.e. what others should do or approve of doing) have been found to have
52 negative effects on intended fruit consumption, as well as having no association with fruit,
53 vegetable, unhealthy snack and sugar sweetened beverage (SSB) consumption (Lally et al.,
54 2011; Stok, de Ridder, de Vet & de Wit, 2014). This could suggest that perceived injunctive
55 norms may be less likely to influence food consumption than other norms. However,
56 injunctive norms have predicted healthy food choices (Mollen et al., 2013) as well as
57 snacking in specific situations (Schüz et al., 2018), suggesting instead that the effects of
58 injunctive norms may depend upon the context in which participants' food choice takes place,
59 and may warrant further investigation.

60

61 Additionally, other perceived norms, such as perceptions that peers *frequently* consumed
62 SSBs and sweet pastries have also predicted young adults' own consumption of these foods
63 (Robinson et al., 2016). Similarly, liking norms, that is, suggesting that others enjoy eating
64 vegetables, have also been shown to increase broccoli consumption (Thomas, Liu, Robinson,
65 Aveyard & Higgs, 2016). This suggests that while there is little research considering the
66 associations of these types of norms with food intake, they may be having an impact on our
67 eating behaviour. Thus, more research is needed to investigate if such associations exist.
68 Further, no studies to date have considered all of these perceived norms in a single model, to
69 compare their comparative predictive ability and understand further how they may predict the
70 consumption of different food types.

71

72 Given the rapidly changing landscape for social interactions in the 21st Century, it may also
73 be important to consider the ways that social norms about what we eat and how much we eat
74 are communicated in the digital age. For instance, a relatively new format by which social

75 norms about food choice and intake may now be communicated is through social media.
76 Social media, such as social networking sites, have become an important part of many
77 people's lives in the UK, with the Office for National Statistics (ONS, 2017) reporting that
78 use of the internet for social media has increased from 45% in 2011 to 66% in 2016. Social
79 media use is highly prevalent amongst young adults, with 96% of 16-24-year olds and 88% of
80 25-34-year olds using social media, compared to 27% of over 65-year olds. Of the social
81 media platforms, Facebook is the most popular across the US and UK (SmartInsights,
82 accessed, 6/2019). According to Barre, Cronin and Thompson (2016) 75% of 107 food-
83 related posts analysed on Facebook were of unhealthy foods, suggesting that exposure to
84 energy-dense foods on social media is high. It is therefore plausible that exposure to these
85 posts on platforms such as Facebook, where there is a social context, may be influencing
86 perceptions about eating norms and implicitly influencing our eating behaviour.

87

88 In addition, it is possible that if norms on social media are influencing eating behaviour, that
89 this may have consequences for body weight. Obesity has been found to cluster within social
90 networks, suggesting that our social circles may have an impact on body weight (Christakis
91 & Fowler, 2007), although the mechanism that underpins this remains unclear. As the diets of
92 those we are socially connected to influence our eating behaviour (Higgs & Thomas, 2016;
93 Pelletier et al., 2015), social norms may also influence weight. Indeed, individuals on weight
94 loss programmes whose social networks had norms that encouraged acceptance of unhealthy
95 eating behaviour had poorer weight loss (Leahey, Doyle, Xu, Bihuniak & Wing 2015;
96 Leahey, Kumar, Weinberg & Wing 2012). Thus, if norms are perceived as promoting the
97 consumption of certain foods, social networks could also be influencing body weight as a
98 consequence. However, very few studies have considered the relationship between perceived

99 eating norms, communicated via social media, and young adults' eating habits and their body
100 weight.

101

102 In order to study the effects of perceived norms further, this study aimed to investigate
103 whether four different perceived norms, including perceived descriptive, injunctive, liking
104 and frequency norms, about Facebook users' food and drink consumption, predicted
105 participants own food and drink consumption, and BMI. It was predicted that the four
106 perceived norms about Facebook users' consumption of fruit, vegetables, high energy-dense
107 (HED) snacks and SSBs would positively predict participants own consumption of these
108 foods, as well as positively predict participants body weight (BMI).

109

110 **Method**

111 Participants

112 A total of 494 undergraduate and postgraduate students were recruited through a Psychology
113 Research Participation Scheme, flyers and university mailing lists, and took part in an online
114 survey. Adverts stated that participants should have no current or previous food allergies,
115 diabetes or eating disorders (as this could confound dietary measures) and should be between
116 18-65 years old. Of the 494 participants who signed up, 83 were excluded for incomplete data
117 (i.e. discontinuing the survey before completion), and a further 42 were excluded based on
118 the exclusion criteria (food allergies, diabetes or eating disorders, and age) leaving a final
119 sample of 369 (49 men and 320 women). Participants took part in exchange for course credits
120 or entry into a prize draw for one of three £50 Amazon vouchers. The study was approved by
121 Aston University Life and Health Sciences Committee (#1273) and conducted in accordance
122 with the ethical standards of the 1975 Declaration of Helsinki, as revised in 1983. Informed
123 consent was obtained from all participants.

124

125 Sample size

126 Using G*Power (3.1.9.3), with power at 80%, alpha = .05, f squared = .04 (small-medium
127 effect size), the minimum number of participants required was 304, but to account for any
128 exclusions/incompletes, we aimed to recruit over this number and so recruited for a period of
129 10 months to ensure a sufficient sample size. Similar studies have used reasonably
130 comparable sample sizes (e.g. Lally et al., 2011; N = 264).

131

132 Design

133 The study used a cross-sectional design, with a regression model consisting of four
134 predictors: perceived descriptive norms (perceived number of servings that *are* consumed by
135 Facebook users), perceived injunctive norms (number of servings that participants perceive
136 *should* be consumed by Facebook users), perceived liking norms (perceived *liking* of food by
137 Facebook users), and perceived frequency norms (perceived *frequency* of consumption by
138 Facebook users). The outcome variables were participants' own consumption of fruit and
139 vegetables and HED snacks and SSBs, as well as participants' BMI (see 'Main analysis'
140 section for more details). Theoretical covariates included mood and appetite and eating style
141 as these are likely to affect participants food consumption (as used in Robinson et al., 2013).
142 Further, time spent on social media and affiliation with Facebook users were also included as
143 covariates as these may determine participants' perceptions of what Facebook users consume.

144

145 Materials

146 Participants completed the following measures, as part of an online survey, delivered via
147 Qualtrics. The order of these was fixed as follows, for all participants:

148

149 **The Student Food and Drink Attitudes Form (SFDAF)** was adapted from Thomas et al.,
150 (2016) to measure normative perceptions about Facebook users' consumption of the different
151 foods and drink. The term 'Facebook users' was left open to interpretation to the participants,
152 to gain insight into perceptions of Facebook users from those with and without accounts. This
153 scale uses open-ended questions to measure perceived descriptive and injunctive norms for
154 each food and drink. For example, '*How many servings of [vegetables] do you think a typical*
155 *Facebook user [should] eat a day?*', where participants respond with a number (e.g. 3), to
156 indicate number of servings. A Visual Analogue Scale (measured from 0, 'Not at all', to 100
157 'Very much') was also used to measure perceived liking norms for each food type (e.g. '*How*
158 *much do you think a typical Facebook user enjoys eating vegetables?*'). To measure norms
159 about frequency of consumption, the question '*how often do you think a typical Facebook*
160 *user eats/drinks...*' was used (as in Robinson et al., 2016). Answers were rated on a 5-point
161 scale from 'Never' (0) to 'Daily, or almost daily' (4).

162

163 **Social Networking/Social media use** was assessed using 9-items adapted for use with
164 Facebook (as in Slater, Varsani & Diedrichs, 2017). This measured whether participants had
165 a Facebook account, frequency of Facebook use (e.g. '*How often do you post a picture to*
166 *your account?*'), time spent using Facebook, the types of posts made, number of accounts
167 'followed' and 'followed by', other social media accounts used and how much time was
168 spent on these. Participants responses were indicated on Likert scales, for example from 1
169 (Never) to 6 (Daily), or through open-ended questions.

170

171 **Mood and Appetite Visual Analogue Scales (VAS)** were used to assess mood and appetite.
172 Participants were asked to indicate on a scale from 0 (Not at all) to 100 (Very much) how

173 alert, drowsy, light-headed, anxious, happy, nauseous, sad, withdrawn, faint, hungry, full,
174 desire to eat and thirsty they felt at the time of the study (as in Thomas et al., 2015).

175

176 **The 21-item revised version of the Three-Factor Eating Questionnaire (TFEQ-21R;**
177 Cappelleri et al., 2009) measured three different forms of eating style, including cognitive
178 restraint (e.g. 'I don't eat some foods because they make me fat'), emotional eating (e.g. 'I
179 start to eat when I feel anxious') and uncontrolled eating (e.g. 'Sometimes when I start eating,
180 I can't seem to stop'). Responses were measured on a Likert scale (i.e. 'definitely true',
181 'mostly true', 'mostly false', 'definitely false').

182

183 **A Lifestyle Questionnaire** (as used in Thomas et al., 2016) was used to obtain demographic
184 information such as gender, age and ethnicity, as well as lifestyle habits such as dietary
185 preferences, medical conditions, alcohol use, whether participants smoked and self-reported
186 height and weight to calculate BMI. This information was also used to verify that participants
187 met the study criteria.

188

189 **The Short-Form Food Frequency Questionnaire (SFFFQ;** Cleghorn et al., 2016;
190 University of Leeds) measured frequency of food consumption of various food types, such as
191 fruit and vegetables, snack foods, dairy, fresh and processed meats and fish, on a Likert scale
192 from 'Never' (0) to '5+ times a day' (7). This was used as a measure of broader dietary
193 behaviour. The questionnaire has been found to be valid compared to longer food frequency
194 questionnaires (Cleghorn et al., 2016).

195

196 **The Multicomponent In-Group Identification Scale** (Leach et al., 2008) was adapted to
197 measure whether participants identify as and affiliate themselves with Facebook users.

198 Questions (e.g. *'The fact that I am a Facebook user is an important part of my identity'*) were
199 measured on a Likert-scale from Strongly Disagree (0) to Strongly Agree (7). These items
200 have been found to be reliable across different identities with Cronbach's α ranging from .86
201 to .93 (Leach et al., 2008).

202

203 **The Usual Food and Drink Intake Questionnaire (UFDIQ)** as in Robinson et al., (2013)
204 was used to measure participants' own consumption of fruit, vegetables, HED snacks and
205 SSBs. Usual consumption was recorded using two open ended questions (e.g. *'How many*
206 *servings of [vegetables] do you normally eat a day [did you eat yesterday]?'*), participants
207 liking of foods was measured using VAS (e.g. From 0 (*'Not at all'*) to 100 (*'Very Much'*, *how*
208 *much do you like eating vegetables?'*) and frequency of consumption (e.g. *'How often do you*
209 *eat vegetables?'*) was measured on a 5-point Likert scale ('Never' to 'Daily, or almost
210 daily').

211

212 **Demand Awareness.** Finally, participants were asked what they thought the aims of the
213 study were using an open-ended question (*'What do you think the aims of this study were?'*).

214

215 Procedure

216 Participants were told that they were taking part in a study on social media and lifestyle
217 habits. The exact aims of the study were withheld until the end of the study, in order to not
218 bias behaviour. Participants completed the survey online using Qualtrics. After reading a
219 participant information sheet and providing informed consent, the following measures were
220 completed: SFAF, Social Networking Use, Mood and appetite VAS, TFEQ-21, Lifestyle
221 Questionnaire (including self-reported height and weight), SFFFQ, Student/Facebook
222 Affiliation Questionnaire, UFDIQ and Demand Awareness. Participants were debriefed,

223 thanked for their time and credited or entered into the prize draw. The study took
224 approximately 20 minutes to complete. Data collection took part from February 2018-
225 November 2018.

226

227 Analysis

228 Main analysis

229 Multiple linear regression was used to investigate whether the four perceived norms
230 (descriptive, injunctive, liking, frequency) of Facebook users' consumption of fruit and
231 vegetables and HED snacks and SSBs predicted participants' own consumption of these, as
232 well as their BMI, as outlined in the design. To create a parsimonious model and based on
233 significant positive correlations, fruit and vegetables were combined into a single metric, as
234 were HED snacks and SSBs. This was done for both consumption of these foods (by the
235 participant) and perceived consumption (by the Facebook users). So, for example, the four
236 perceived norms (descriptive, injunctive, liking and frequency) about Facebook users' fruit
237 *and* vegetable consumption combined, were entered as predictors, and participants'
238 consumption of fruit *and* vegetables combined, was entered as an outcome.

239

240 Principal component analyses

241 Principal component analysis (PCA) was carried out with Varimax rotation for measures of
242 Facebook affiliation. This yielded 3 factors with eigenvalues >1 , which explained a total of
243 67% of the variance. Factors included 'positive aspects of Facebook use' (items related to
244 being pleased, glad, proud, feeling good, having things in common and being similar to
245 Facebook users), 'affiliation to Facebook users' (items related to being committed to being a
246 Facebook user, Facebook as an important aspect of participants identity and how they see
247 themselves, having a bond and solidarity with Facebook users and often thinking about their

248 identity as a Facebook user) and ‘similarity of Facebook users’ (items related to Facebook
249 users being similar and having things in common with each other). A PCA was also
250 conducted on the VAS (mood and appetite). This yielded 4 factors with eigenvalues >1,
251 which accounted for a total of 69% of the variance. Factors included ‘feeling unwell’ (light
252 headedness, nausea, anxiety), ‘appetite’ (hunger, thirst, full, desire to eat), ‘negative
253 emotions’ (sad, happy, withdrawn), where happy was reverse coded to reflect a negative
254 state, and ‘alertness’ (alert, drowsy).

255

256 Covariate analysis

257 The following theoretical covariates were correlated (Pearson’s r) with the outcome measures
258 to determine whether they should be entered as covariates in the regression models: mood
259 and appetite measures (VAS PCA items); eating style (TFEQ-R21 subscales); time spent on
260 social media; and affiliation with Facebook users (Facebook PCA items). Measures were
261 included as covariates if they significantly correlated with the outcome measure ($p < .05$).

262

263 **Results**

264 *Participant characteristics*

265 The final sample consisted of 369 participants. The mean age for the sample was 22.1 years
266 of age, 87% ($n = 320$) were women and 13% ($n = 49$) were men. Ethnic background; 48%
267 White, 34% Asian, 9% Black, 5% mixed ethnicities and 4% ‘Other’. Participants average
268 BMI was within a healthy range (mean = 23.7, standard deviation = 5.10), 8% had an
269 underweight BMI (BMI <18.5), 63% had a healthy BMI (BMI of 18.5-24.9), 21% had an
270 overweight BMI (BMI of 25.0-29.9) and 8% had an obese BMI (BMI \geq 30.0). Eight percent
271 were smokers and 62% drank alcohol. For food frequency (SFFQ), on average, participants
272 consumed fruit and vegetables 2-3 times a week, salad once a week, crisps and sweet snacks

273 2-3 times a week and SSBs once a week. Measures from the SFFFQ were positively and
 274 significantly correlated with measures from the UFDIQ; i.e. frequency measures for fruit,
 275 vegetables, SSB and junk food intake (all $r_s \Rightarrow 0.5$; all $p_s < 0.001$), and measures of amount
 276 consumed for fruit and vegetables (both $r_s \Rightarrow 0.8$; all $p_s < 0.001$). Hence, UFDIQ measures
 277 were used in all subsequent analyses. For further information regarding social media use, and
 278 other measures, see Tables 1, 2 and 3.

279

280 **Table 1.** Frequencies and percentages for social media use

Measure	N (= 369)	Percentage (%)
Facebook Account - Yes	299	81
Facebook Account - No	70	19
<i>Time spent on Facebook*</i>		
No time	22	6
Less than 10 min	85	23
10-30 mins	86	23
30-60 mins	62	17
Over an hour	44	12
<i>Use of other social media accounts*</i>		
Yes	286	76
No	13	81

281 * Responses to both measures were for participants who said 'yes' to having a Facebook account

282

283 **Table 2.** Participants' consumption, perceptions, mood and eating style (mean and standard
 284 deviation)

Measure	Mean (SD)
<i>Participants daily consumption (servings)</i>	
Fruit and vegetables combined	3.7 (2.0)
HED snacks and SSBs combined	2.9 (1.9)
<i>Perceived consumption by others (servings)</i>	
Fruit and vegetables combined	3.8 (1.7)
HED snack and SSBs combined	6.9 (2.9)
<i>Facebook Perceptions and Affiliation</i>	
Positive aspects of Facebook	3.2 (1.2)
Affiliation to Facebook users	2.3 (1.1)

Perceptions of Facebook users	2.9 (1.4)
<i>VAS</i>	
Feeling unwell	20.2 (19.0)
Appetite	51.3 (25.1)
Negative emotions	31.2 (20.7)
<i>TFEQ-R21</i>	
Uncontrolled eating	2.3 (0.6)
Cognitive restraint	2.6 (0.7)
Emotional eating	2.1 (0.8)

285 SSBs = Sugar Sweetened Beverages; HED = High energy Dense; VAS = Visual Analogue Scales;
 286 TFEQ = Three-Factor Eating Questionnaire.

287 Key: *Facebook Perceptions and Affiliation* (whether participants identify and affiliate with Facebook
 288 users) rated from Strongly agree (1) to Strongly Disagree (7); *VAS* (mood and appetite) rated from 0
 289 (Not at all) to 100 (Very much); *TFEQ-R21* (eating style) rated Definitely false (1) to Definitely true
 290 (4).

291

292 **Table 3.** Participant characteristics for perceived consumption and participants own consumption
 293 (mean and standard deviation)

Measure	Type of norm			
	Descriptive Mean (SD)	Injunctive Mean (SD)	Liking Mean (SD)	Frequency Mean (SD)
<i>Participants perceived consumption by others (servings)</i>				
Vegetables	1.9 (1.1)	4.1 (2.4)	40.9 (18.5)	3.3 (0.8)
Fruit	1.9 (0.9)	3.8 (1.4)	59.5 (17.6)	3.5 (0.7)
HED snacks	3.8 (1.7)	1.4 (1.0)	86.6 (13.8)	3.9 (0.5)
SSBs	3.1 (1.7)	1.2 (1.1)	82.9 (14.8)	3.7 (0.6)
<i>Participants own consumption (servings)</i>				
Vegetables	2.0 (1.4)	-	68.4 (24.2)	4.6 (0.8)
Fruit	1.7 (1.1)	-	76.4 (21.9)	4.5 (0.8)
HED snacks	1.8 (1.3)	-	78.4 (21.7)	4.4 (0.8)
SSBs	1.1 (1.2)	-	61.1 (30.1)	3.7 (1.3)

294 SSBs = Sugar Sweetened Beverages; HED = High energy Dense

295 Key: Descriptive: how much is actually consumed; Injunctive: how much should be consumed;
 296 Liking; how much a food is liked; Frequency: how often a food is consumed

297 **Associations between covariates, consumption and BMI**

298 Pearson's correlations for theoretical covariates revealed that the three types of eating style
299 (uncontrolled eating, cognitively restrained eating and emotional eating, as defined by the
300 TFEQ) were significantly positively correlated with fruit and vegetable consumption and
301 HED snack and SSB consumption (with the exception of cognitively restrained eating, which
302 was negatively associated with HED snack and SSB consumption), as well as BMI (all ps
303 $<.01$). and were therefore controlled for. None of the other measures correlated with the
304 outcomes and were not included as covariates.

305

306 ***Predictors of participants' food consumption***

307 Multiple linear regression revealed that the final models with perceived descriptive,
308 injunctive, liking and frequency norms, as well as the three eating styles (uncontrolled,
309 cognitive restraint and emotional eating) significantly predicted participants consumption of
310 fruit and vegetables, ($F(7) = 6.90, p = <.001, r = .35$), and HED snack and SSBs ($F(7) =$
311 $18.97, p = <.001, r = .54$). Perceptions of how many servings of fruit and vegetables
312 Facebook users eat (perceived descriptive norms), as well as perceptions about how often
313 Facebook users eat fruit and vegetables (perceived frequency norms) both significantly
314 predicted participants own fruit and vegetable consumption. Uncontrolled, as well as
315 cognitive restrained eating styles, also significantly predicted participants' self-reported fruit
316 and vegetable consumption. See Table 4.

317

318 However, for participants HED snack and SSB consumption, in the final model, only
319 perceptions of how many servings of HED snacks and SSBs Facebook users *should* eat
320 (perceived injunctive norms) was a significant predictor. Again, an uncontrolled eating style
321 also significantly predicted participants own HED snack and SSB consumption, as well as
322 cognitive restrained eating style. See Table 4.

323

324 ***Predictors of participants' BMI***

325 The regression model with the four perceived norms about Facebook users' fruit and
326 vegetable consumption and the three eating styles significantly predicted BMI, $F(7) = 3.64$, p
327 $= .001$, $r = .26$. However only emotional eating was a significant predictor of participants'
328 BMI. The model with perceived norms about Facebook users' HED snack and SSB
329 consumption and the eating styles also significantly predicted BMI, $F(7) = 3.82$, $p = .001$, $r =$
330 $.27$, however, as above, only emotional eating was a significant predictor.

V2

331 **Table 4.** Predictors of food and drink consumption, and BMI

Predictor	Outcome																			
	Participants fruit and vegetable consumption					Participants HED snack and SSB consumption					Participants BMI (fruit and veg norms as predictors)				Participants BMI (HED snack and SSB norms as predictors)					
	β	SE	S β	95% CI		β	SE	S β	95% CI		β	SE	S β	95% CI		β	SE	S β	95% CI	
			Lower	Upper				Lower	Upper				Lower	Upper				Lower	Upper	
<i>Perception of norm corresponding to outcome variable</i>																				
Descriptive	.22	.08	.19**	.07	.37	.06	.04	.09	-.02	.13	-.07	.19	.19	-.45	.31	-.06	.16	.12	-.28	.17
Injunctive	.05	.04	.07	-.03	.13	.35	.06	.35***	.24	.46	.04	.10	.10	-.16	.23	-.03	.17	.17	-.37	.31
Liking	-	.003	-.06	-.01	.003	.006	.004	.08	-.002	.01	-	.01	.01	-.09	.02	-	.01	.01	-.03	.02
	.004										.001				.002					
Frequency/ often	.21	.08	.14**	.04	.37	.003	.12	.001	-.24	.25	.01	.22	.22	-.43	.44	.26	.37	.40	-.46	.99
<i>TFEQ-R21 (covariates)</i>																				
Uncontrolled eating	-.43	.20	-.14*	-.82	-.05	.39	.18	.12*	.03	.75	.34	.52	.52	-.68	1.36	.24	.55	.55	-.84	1.31
Cognitive restrained	.44	.14	.16**	.16	.72	-.69	.13	-	-.95	-.44	.65	.38	.38	-.10	1.39	.70	.39	.39	-.08	1.47
								.26***												
Emotional eating	.23	.15	.10	-.06	.52	.23	.13	.10	-.12	.41	1.37	.39	.39***	.60	2.14	1.46	.40	.40***	.68	2.24

V2

332 HED = high energy-dense; SSB = sugar sweetened beverages; * $p < .05$, ** $p < .01$, *** $p < .001$

Journal Pre-proof

333 *Post-hoc Mediation analysis*

334 Given that there was no direct effect of the perceived norms on BMI in the regression
335 models, exploratory mediation analysis was carried out to investigate if there was an indirect
336 effect of each of the perceived norms, about Facebook users' consumption of fruit and
337 vegetables, and HED snack and SSB consumption, on participants BMI, through participants
338 own consumption of these foods (see Figure 1 below for model).

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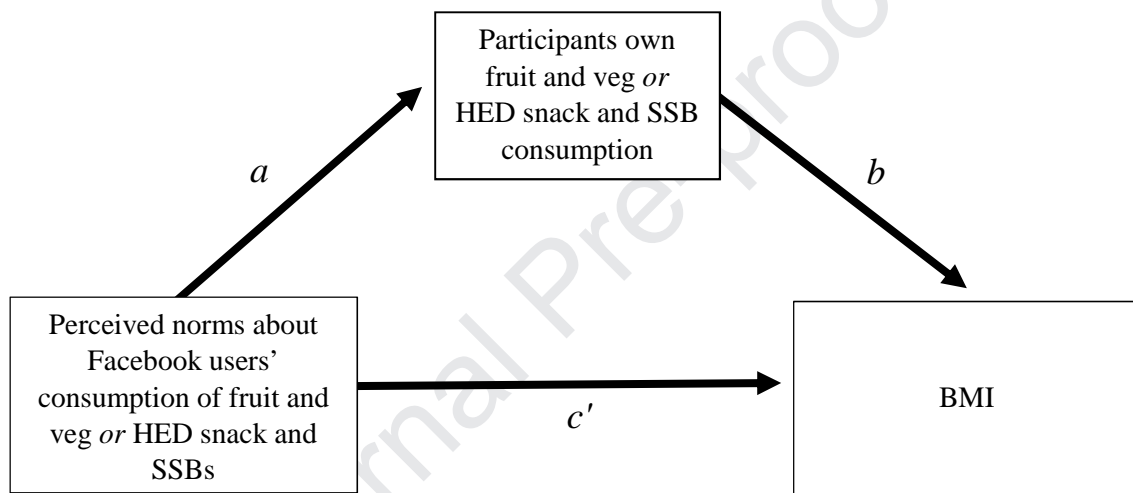
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349 **Figure 1:** Mediation model of effect of perceived norms on BMI, via participants' food/drink
350 consumption.

351

352 All analyses revealed that there was no significant mediation. To be precise, there was no
353 significant indirect effect of the four perceived norms about Facebook users' fruit and
354 vegetable consumption or HED snack and SSB consumption, on BMI, via participants'
355 consumption of fruit and vegetables or HED snack and SSBs, respectively (all $ps > .05$).

356

357 **Discussion**

358 We examined whether four different perceived norms about Facebook users' consumption of
359 fruit, vegetables, HED snack foods and SSBs predicted participants own consumption of
360 these foods. Our results revealed that descriptive and frequency norms about how much and
361 how frequently participants perceived Facebook users to consume fruit and vegetables
362 positively predicted participants own consumption of fruit and vegetables, whereas, perceived
363 injunctive norms about what others should eat positively predicted participants' consumption
364 of HED snack foods and SSBs. Thus, the more participants perceived Facebook users to
365 consume fruit and vegetables, the more participants consumed themselves. Whilst the more
366 HED snacks and SSBs they perceived Facebook users should consume, the more they
367 consumed themselves. However, there were no associations between perceived liking norms
368 and participants food or drink consumption. Similarly, the four perceived norms did not
369 predict BMI, suggesting that social media and our social networks may communicate norms
370 about others eating habits, which implicitly influence our own eating habits, but may not
371 necessarily influence BMI.

372

373 As demonstrated by previous work (e.g. Lally et al., 2011; Robinson et al., 2016; Thomas et
374 al. 2017), participants' perceptions of others' eating habits predicted their own self-reported
375 food consumption, with participants matching their consumption to their perception of the
376 norm. Moreover, these results suggest that norms communicating what others actually do (i.e.
377 descriptive/frequency norms) may guide consumption of low energy-dense foods, as in
378 previous work (e.g. Robinson et al., 2014; Thomas et al. 2017; Stok et al., 2012), whereas
379 perceived norms relating to social approval (i.e. injunctive norms) may guide consumption of
380 HED snack foods and beverages (e.g. Schüz et al, 2018). One possible explanation for
381 perceived descriptive and frequency norms predicting consumption of LED foods could be
382 that, due to the high frequency of HED food related posts (Barre et al., 2016), social media

383 may provide less or no information about others' consumption of fruit and vegetables. This
384 may make social media an unusual context in which to gauge eating norms for fruit and
385 vegetable consumption (i.e. participants are less certain of *how much* and *how frequently*
386 people are consuming fruit and vegetables, as they receive less information about this). As
387 Higgs (2015) suggests, in unfamiliar contexts, participants tend to use descriptive norms
388 about what others *actually* eat to guide their own consumption, because norms about what
389 others actually do provides information that we can base our own behaviour on. Therefore,
390 perceptions of how much and how frequently social media users consume fruit and
391 vegetables, even if this based on very little information, may have been most influential in
392 predicting participants' consumption, because it is the *most useful* norm for guiding
393 consumption of these foods in this context.

394

395 In contrast, consumption of HED snack foods and SSBs, which are typically perceived as
396 'unhealthy', may be more related to social endorsement and approval. Or in other words,
397 matching consumption to the perceived injunctive norm for HED snacks and SSBs may have
398 occurred because the act of doing so is less likely to incur a negative judgement, within a
399 social media context, where desire for social acceptance is likely to be high (Clark, Algoe &
400 Green, 2018). Therefore, normative information about what others *approve* of may be more
401 useful in guiding consumption of HED snack foods and SSBs, which may have more
402 (negative) social connotations attached to them. It is also important to note that Facebook,
403 like many other social platforms, allow users to signal their approval with various tools (e.g.
404 the like button). Thus, it is possible that these digital social environments are uniquely
405 conveying approval, in a way that is different from everyday perceptions of norms among our
406 peers. An emergent question is whether the norms we perceive in our digital social circles are
407 more salient, or exert a greater influence, than the norms we perceive in the physical world

408 around us? This is an important question, as the answer may also indicate whether certain
409 environments and norms are more amenable and useful for social norm interventions to
410 enhance healthy eating.

411

412 Taken together, these findings add to the literature to suggest that there may be variability in
413 how norms influence food consumption. Measuring these concurrently within a single study,
414 for the first time, provides evidence that different types of norms may selectively predict the
415 consumption of different types of food, expanding previous evidence considering the effect
416 of norms or types of food in isolation, or compared to other types of messages (e.g. Robinson
417 et al. 2013; Stok et al., 2012; Lally et al., 2011). This knowledge could be used to develop
418 and test social norm-based interventions, to specifically target the consumption of high or low
419 energy-dense foods, through exposure to different norms via experimentally manipulated
420 social media posts or encouraging people to follow highly liked healthy eating social media
421 accounts. Further this evidence suggests that exposure to descriptive norms concerning fruit
422 and vegetable consumption may present the optimum social norm intervention to enhance
423 consumption of these foods. Similarly, exposure to injunctive norms regarding the
424 consumption of HED snacks and beverages may be particularly effective in blunting their
425 consumption.

426

427 Interestingly, while our hypothesis that perceived norms would positively predict
428 participants' food and drink consumption was partially supported, perceived liking norms did
429 not significantly predict participants' food and beverage consumption. At first glance, this
430 seems at odds with previous research showing that manipulation of liking norms can produce
431 an increase in vegetable consumption (Thomas et al., 2016). However, actively exposing
432 participants to a liking norm that has been selected on the basis of appearing positive and

433 persuasive, is clearly different to assessing passive perceptions of liking. Also, as noted in
434 Thomas and colleagues' previous work (2016), there is often a disparity between liking and
435 consumption. For example, in Thomas et al.'s study, participants ate more of the broccoli
436 even though they liked it less, reminding us that we may eat foods that we do not like because
437 of health reasons, and vice versa, we may not consume a food, although we like it, for health
438 or other reasons. Thus, here, the lack of association between participants' perceptions of how
439 much others like a given food or drink, and their own consumption, may reflect the fact that
440 other factors such as health and liking predict consumption of a food. For instance, we may
441 accurately perceive that most people like HED snacks, but liking may not be the most
442 important factor in determining whether we consume them ourselves. It may also be that
443 social approval is valued over and above perceptions of liking or enjoyment of a food, in
444 certain contexts or with certain norm referent groups.

445
446 Unexpectedly, the four different perceived norms about Facebook users' consumption of
447 foods and beverages did not predict participants BMI. Further, there was no indirect effect of
448 perceived norms on BMI via consumption (the mediator). Participants perceived their peers
449 to consume more HED foods and drinks than they themselves did, and based on previous
450 research (e.g. Leahey et al., 2012), it would be expected that these perceived norms might
451 predict body weight. However, unlike this sample, who on average had a healthy BMI
452 weight, Leahey and colleagues research was focussed on individuals who were
453 overweight/obese, which may account for the null result here. Another explanation is that
454 participants match their behaviour to the norm, even if these norms are momentary or within
455 specific contexts (Schüz et al. 2018). As perceptions about Facebook users' consumption are
456 likely to be based on posts which are constantly changing, it follows that norms on Facebook
457 could also be momentary, if they are dependent on these posts. Therefore, while participants

458 may shift their short-term food consumption to match these norms (explaining how these
459 norms predict intake), BMI, which is a long-term reflection of food consumption and energy
460 balance, may not be predicted by momentary norms. If BMI is indeed partly a long-term
461 consequence of norms in networks (e.g. Leahey et al. 2015), then it would be useful to study
462 whether perceptions about social media users' eating habits affect participants' dietary
463 behaviour and BMI over time; this would provide a more robust test of whether perceived
464 norms actually predict BMI.

465

466 Although this study used a large sample, including both men and women, and represented a
467 variety of ethnicities, there are some limitations to consider. Firstly, the use of self-report
468 measures means that participants' perceptions of the norm, consumption and BMI may be
469 inaccurate or biased, though these measures are typical of this field (e.g. Lally et al., 2011;
470 Robinson et al., 2016). Secondly, when using BMI, there are many notable caveats with this
471 measure, such as the inability to consider percentage of body fat (Nuttal, 2015), though again,
472 it is a widely used metric. Thirdly, as with much of the cross-sectional social norms research,
473 it is possible that a so-called false-consensus effect may have occurred (Robinson, 2015),
474 with the cross-sectional design of the research making it difficult to determine whether
475 participants own perceptions of what they consume informed their perceptions of what
476 Facebook users consume or vice-versa. However, in this study, due to our a-priori predictions
477 that perceptions about Facebook users' consumption would predict participants'
478 consumption, this was the only direction that was tested, but we note the inherent limitation
479 of this approach. One way to address the three limitations above would be to follow on from
480 this work with experimental laboratory studies, measuring actual food consumption, using
481 additional physiological measures such as waist circumference or body composition, and
482 directly manipulating norms within social media settings to examine causality.

483

484 Additionally, in this study it was not a requirement for participants to be Facebook users to
485 take part, though the vast majority were (81%). Although we do not have the capacity to
486 meaningfully examine users versus non-users with this data set, future work might further
487 explore whether the perception of norms in a social circle that one does not reside within (i.e.
488 an out-group), does not influence or predict consumption, or whether the unique properties of
489 social media and digital social circles circumvents this, such that the norms of an out-group
490 are influential. Despite these limitations, this study is one of the first to consider whether
491 different types of norms predict participants eating habits and BMI, in a social media context.
492 To our knowledge, this study provides the first evidence to suggest that our wider online
493 social circles may be implicitly influencing our eating habits via normative perceptions.
494 Moreover, the influence of norms on intake appears to be nuanced, with theoretical
495 implications of how and why these norms have selective predictive ability.

496

497 **Conclusions**

498 This study has demonstrated that perceived descriptive and frequency norms about what
499 Facebook users *actually* eat predicted participants' own fruit and vegetable consumption,
500 whereas norms relating to social approval predicted their own consumption of HED foods
501 and SSBs. This suggests that certain social norms may be more or less influential in
502 determining the types of food that we choose to consume, and that the norms we perceive in
503 our social media circles predict our food choices, though further work is required to explore
504 causality. Perceived norms about Facebook users eating habits did not predict BMI in this
505 cross-sectional study, however, future work will consider the long-term effects that perceived
506 norms may have on eating habits and BMI.

507

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509

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