

1 Applying an extended Theory of Planned Behaviour to 2 predict breakfast consumption in adolescents

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25 Abstract

26 Background/Objectives: Breakfast skipping increases during adolescence and is associated with lower
27 levels of physical activity and weight gain. Theory-based interventions promoting breakfast
28 consumption in adolescents report mixed findings, potentially due to limited research identifying
29 which determinants to target. This study aimed to: (i) utilise the Theory of Planned Behaviour (TPB)
30 to identify the relative contribution of attitudes (affective, cognitive and behavioural) to predict
31 intention to eat breakfast and breakfast consumption in adolescents; (ii) determine whether
32 demographic factors moderates the relationship between TPB variables, intention and behaviour.

33 Subjects/Methods: Questionnaires were completed by 434 students (mean 14 ± 0.9 years) measuring
34 breakfast consumption (0-2, 3-6 or 7 days), physical activity levels and TPB measures. Data were
35 analysed by breakfast frequency and demographics using hierarchical and multinomial regression
36 analyses.

37 Results: Breakfast was consumed every day by 57% of students with boys more likely to eat a regular
38 breakfast, report higher activity levels and more positive attitudes towards breakfast than girls
39 ($p < .001$). The TPB predicted 58% of the variation in intentions. Overall, the model was predictive of
40 breakfast behaviours ($p < .001$), but the relative contribution of TPB constructs varied depending on
41 breakfast frequency. Interactions between gender and intentions were significant when comparing 0-2
42 and 3-6 day breakfast eaters only highlighting a stronger intention-behaviour relationship for girls.

43 Conclusions: Findings confirm that the TPB is a successful model for predicting breakfast intentions
44 and behaviours in adolescents. The potential for a direct effect of attitudes on behaviours should be
45 considered in the implementation and design of breakfast interventions.

46 Introduction

47 Participation in healthy behaviours including being physically active¹ and eating a regular breakfast
48 decreases during adolescence² as does the quality of breakfast consumed.³ There appears to be a
49 greater tendency for children from ethnic backgrounds or low-income families to skip breakfast⁴ as
50 well as differences by gender, with skipping prevalence consistently higher in adolescent girls
51 compared to boys.⁵ Adolescence is an important transitional period representing increased
52 independence during which attitudes towards food choices are formed and can potentially persist into
53 adulthood.⁶ Regular breakfast consumption in adolescents has been positively associated with
54 improvements in diet quality⁷ and physical activity levels,⁸ as well as a reduction in the risk of
55 obesity⁵ and cardio-metabolic disease,⁹ emphasising the importance of breakfast, and adolescents, as
56 key targets for health interventions.

57 Theory-based interventions have been shown to be more effective than interventions without a theory
58 component.¹⁰ Applying theories can help to identify causal determinants of behaviours which can then
59 be targeted in interventions. One of the dominant theories in health behaviour is the Theory of
60 Planned Behaviour (TPB).¹¹ Large meta-analyses support its use^{12,13} around healthy eating,^{14,15}
61 physical activity¹⁶ and breakfast consumption.^{6,17-22} The theory proposes that intentions, formed from
62 attitudes, subjective norms (SN) and perceived behavioural control (PBC), are the most important
63 precursor to perform (or not perform) a behaviour. The more favourable the attitudes and SNs, and the
64 greater the PBC, the stronger the intention to perform the behaviour.²³

65 The TPB has been successfully applied in children and adolescents; explaining between 50-60% of
66 the variance in diet-related intentions, and 6-19% of the variance in behaviours.²⁴ Attitudes were most
67 strongly associated with intention to perform a diet-related behaviour, whilst intention was most
68 strongly associated with behaviour,²⁴ consistent with a previous meta-analysis including adolescents.¹³
69 Only five studies were specific to breakfast,^{6,21,25-27} where two found attitudes most strongly predicted
70 intention to consume healthy items at breakfast.^{25,27} Intention to consume breakfast, measured in only
71 one study,²¹ was most strongly predicted by PBC, followed by attitudes. In line with TPB
72 assumptions, intentions most strongly predicted all breakfast behaviours, followed by PBC; however,

73 attitudes strongly correlated with breakfast behaviours²⁴. To explain a greater proportion of the
74 variation in breakfast intentions and behaviours studies are increasingly interested in the individual
75 components of TPB constructs, such as attitudes and SNs, to directly predict behaviour,^{6,28,29} and the
76 potentially moderating effects of gender, age and socioeconomic status (SES).^{6,25} Conner *et al.*⁶
77 reported that intention to consume healthy items for breakfast in adolescents was most strongly
78 predicted by descriptive norms and affective attitudes, whilst descriptive norms also directly predicted
79 healthy eating behaviours. Considering breakfast consumption frequency in adolescents, attitudes
80 were the strongest predictor over and above all other TPB constructs;²⁹ however, to date, there are no
81 studies investigating how the individual components of attitudes are associated with breakfast
82 consumption frequency in adolescents.

83 Attitudes can consist of three underlying components; affective (feelings towards the behaviour),
84 behavioural (action tendencies with respect to the behaviour) and cognitive attitudes (beliefs about the
85 behaviour).³⁰ Scales to reliably measure the components of attitudes have been validated in children,³¹
86 but their use has not yet been reported in adolescents. Understanding the nature of attitudes could help
87 inform future interventions to increase the frequency of breakfast consumption. Currently there are
88 few TPB breakfast interventions reporting mixed findings.^{19,32,33} In university students an intervention
89 to increase breakfast consumption was based on attitudes and PBC; however, there were no changes
90 in TPB scores or breakfast behaviours at follow up.¹⁹ In a school-based intervention targeting all TPB
91 variables there were significant improvements in adolescents' TPB scores (except SN) in the control
92 and intervention groups, but no significant increase in breakfast consumption was reported.³² In
93 contrast, a smaller study in adolescents reported significant increases in knowledge and TPB scores,
94 concurrent with significant increases in breakfast consumption in the intervention group.³³ This study
95 had two aims:

96 (i) To utilise the TPB to identify the relative contribution of TPB constructs, particularly the
97 components of attitudes, in the predication of intention to eat breakfast and breakfast
98 consumption frequency in adolescents.

99 (ii) To determine whether demographic factors, particularly gender, moderates the relationship
100 between TPB variables, intention and behaviour.

101 Methods

102 *Participants and recruitment:*

103 All 66 secondary schools in Oxfordshire were invited to participate. Thirteen schools expressed
104 interest and received detailed information. Six schools opted out due to time constraints therefore,
105 questionnaires were distributed to seven schools (four comprehensive, three independent). Students
106 aged 13-17 years were eligible; participation was voluntary and anonymous and parents were given
107 the opportunity to opt their child out of the study. Procedures were approved by the Ethical
108 Committee at Oxford Brookes. Paper questionnaires ($n=452$) were distributed to students via teachers,
109 all of which were returned. One school opted to distribute the online link from which 57 responses
110 were received. Questionnaires missing gender were excluded, along with obviously fictional
111 responses, leaving a total of 434 completed questionnaires (85% completion rate).

112 *Design and measures:*

113 Measures were based on previously developed and validated questionnaires,^{5,23,31,34} and authors'
114 permissions were obtained prior to use. SES was assessed by the highest level of academic
115 achievement of either parent. Height and weight were self-reported. Body mass index (kg/m^2) was
116 calculated and converted to z -scores using online software³⁵ based on UK reference data.³⁶ Breakfast
117 was defined as the first meal before morning break during the week, or at the weekend, as the first
118 meal before 11am. Response categories were selected based on a previously used questionnaire⁵ and
119 recoded for analysis into 'infrequent' (0-2 days), 'frequent' (3-6 days) and 'daily' (7 days) breakfast
120 eaters, representing similar cut points used previously to categorise the risk of developing metabolic
121 conditions⁹. Physical activity levels were assessed by seven day recall using the physical activity
122 questionnaire for adolescents (PAQ-A) which has shown satisfactory reliability and validity in this
123 age group and correlates well with objective measures of physical activity.³⁴

124 TPB questions were developed in accordance with TPB guidelines²³ and items were scored using a
125 five-point Likert scale. *Attitudes* were assessed by agreement to twelve questions, e.g. 'eating
126 breakfast is boring' (strongly disagree-strongly agree), based on a previously developed scale showing

127 acceptable validity and reliability in 9-11 year olds.³¹ The scale was piloted with adolescents ($n=20$)
128 from a non-participating school. Following feedback, three questions with potentially ambiguous
129 wording were modified. The new scale was checked using Cronbach's alpha (α) which resulted in the
130 subsequent exclusion of one item. The final 12-item scale showed high internal consistency ($\alpha=.88$).
131 A principal-components factor analysis was performed from which key attitude components
132 (affective, behavioural and cognitive) were identified and factor loadings compared with previously
133 validated research.³¹ *Subjective norms* were assessed by four questions, e.g. 'people who are
134 important to me think I should eat breakfast regularly' (strongly disagree-strongly agree) ($\alpha=.84$).
135 *Perceived behavioural control* was assessed by two questions, e.g. 'for me eating breakfast regularly
136 would be' (very easy-very difficult) ($\alpha=.81$). *Intention* to eat breakfast was assessed using 1 item:
137 'over the next week, I intend to eat breakfast on the following days'. *Behaviour* was assessed using 1
138 item: 'during the past 7 days, on how many days did you eat breakfast?'

139 *Statistical Analysis*

140 Data were analysed using IBM SPSS software V22. Spearman correlations, independent t -tests for
141 continuous variables and non-parametric tests (Mann Whitney and Kruskal Wallis) for ordinal
142 variables were used to determine associations or differences in breakfast frequency, age, gender, BMI,
143 SES, physical activity levels and ethnicity. Pairwise comparisons were performed using a Bonferroni
144 correction. Principal-components analysis with Varimax rotation and Kaiser normalisation was used
145 to ensure the key attitude constructs were separate factors. Component scores representing the three
146 attitude components of affective, behavioural and cognitive attitudes were retained for prediction
147 analysis using multiple hierarchical regression analyses for intention to eat breakfast and multinomial
148 logistic regression for breakfast eating frequency.

149 Results

150 In total 434 students were included in the analyses (263 girls, range 13-17 years). Over half of
151 students (57%) consumed breakfast daily whilst 22% ate breakfast between 0-2 days (Table 1). Boys
152 were more likely to report eating breakfast daily ($p<.001$) and were significantly older ($p<.005$),
153 heavier ($p<.01$) and more physically active ($p<.001$) than girls (small effect: $r=.24$, $r=.14$, $r=.16$, $r=.22$
154 respectively).

155 When analysed by breakfast frequency (Table 2) significant differences were observed between SES
156 ($H(3)=9.84$, $p=.020$) and physical activity levels ($F(2,425)=7.52$, $p<.001$). Post-hoc analysis revealed
157 that median breakfast frequency score was significantly higher in students from the highest
158 socioeconomic group (3.0) compared to students reporting "don't know" (2.0) to the question of
159 parent's level of education ($p=.028$). Students who ate breakfast daily were more active (mean PA
160 score 1.98) than students who ate breakfast on 0-2 days (mean PA score 1.64) ($p<.001$).

161 *Correlations*

162 Significant positive correlations were found between breakfast consumption and all TPB variables
163 (range $r=.41$ to $r=.78$; $p<.001$). Intention was most strongly correlated with PBC whereas breakfast
164 consumption most strongly correlated with behavioural attitudes, PBC and intention ($r>.7$; $p<.001$).

165 *TPB measures*

166 Boys and girls generally responded positively to eating breakfast with mean scores above the
167 midpoint of the scale (Table 3; upper table); however, boys scores were significantly higher than girls
168 on all TPB measures ($p<.01$). When split by breakfast frequency (Table 3; lower table) significant
169 differences were observed such that eating breakfast more frequently was associated with having
170 positive affective, behavioural and cognitive attitudes as well as greater SNs, PBC and intention to eat
171 breakfast ($p<.001$).

172 *Predicting intention to eat breakfast*

173 Hierarchical multiple regression determined if the addition of the TPB variables improved the
174 prediction of intention to eat breakfast over and above demographics and physical activity (PA) levels
175 (Table 4). Demographics and PA were entered first (step 1) and explained a small (6.9%) but
176 significant proportion of the variance ($R^2=.069$, $F(3,397)=9.76$, $p<.001$). Significant beta weights
177 were identified for gender and PA such that stronger intentions were associated with being a boy and
178 being more active. The addition of the TPB variables (step 2) explained an additional 58.2% of the
179 variance ($\Delta R^2=.582$, $F(8,397)=90.61$, $p<.001$). The beta weights indicated that all TPB variables,
180 except affective attitudes, were significant positive predictors of intentions such that stronger
181 intentions were associated with having a positive attitude (behavioural, cognitive), stronger SNs and
182 in particular, greater PBC. Including the TPB variables in the model reduced the predictive power of
183 gender and PA to non-significance. Adding the interactions between TPB variables and gender at an
184 additional step did not add to the predictive power of the model which indicated that gender did not
185 moderate the relationship between TPB variables and intentions.

186 *Predicting breakfast behaviour*

187 Multinomial logistic regression was conducted with demographic and TPB predictors to predict
188 breakfast frequency category (0-2, 3-6, 7 days). The model was significantly predictive of breakfast
189 frequency ($R^2=.61$ (Cox & Snell), $.72$ (Nagelkerke) $\chi^2(18)=377.75$, $p<.001$) (Table 5). Compared to
190 those who ate breakfast 0-2 days, those who ate it 3-6 days had higher PBC (OR=2.33), intentions
191 (OR=1.60), and behavioural attitudes (OR=2.40). Compared to those who ate breakfast 0-2 days,
192 those who ate it 7 days had higher PBC (OR=2.91), intentions (OR=1.97), SNs (OR=2.44) and
193 behavioural attitudes (OR=6.93), indicating differences between the TPB components when
194 comparing adolescents who eat breakfast infrequently, frequently and daily. The addition of the
195 interactions terms between gender and intentions (Table 6) were significant when comparing 0-2 day
196 breakfast eaters to 3-6 days only ($p=.004$), demonstrating a stronger relationship between intentions
197 and behaviours for females than males, but only between infrequent and frequent breakfast eaters.

198 Discussion

199 The findings presented here confirm that a high proportion of adolescents do not eat a regular
200 breakfast and this was more apparent in girls and those reporting less positive attitudes, SNs and PBC
201 towards breakfast. Previous research was extended by considering a TPB model which included the
202 three components of attitudes, and utilising a validated scale used formerly in children.³¹ PBC most
203 strongly predicted intention to eat breakfast, but there were significant contributions from cognitive
204 and behavioural attitudes, and SNs. Compared to infrequent breakfast eaters, behavioural attitudes
205 most strongly predicted breakfast consumption in adolescents who reported eating breakfast daily or
206 frequently.

207 *Breakfast consumption*

208 The current study found that breakfast was consumed every day by significantly more boys than girls
209 supporting findings from a large UK survey where 61% of adolescent boys (11-15 years) consumed
210 breakfast on every school compared to 51% of girls,³⁷ and 73% of adolescent boys (10-16 years)
211 always ate breakfast compared to 61% of girls,³⁸ both ($p<.001$). In contrast to previous breakfast
212 studies^{39, 40} there were no significant differences between breakfast frequency and ethnicity or SES,
213 apart from the highest socio-economic group who reported eating breakfast more frequently than
214 those who did not know their parent's level of education. Because almost a third of students reported
215 'don't know' to the question of parent's education, SES was excluded from further analyses; however,
216 previous research suggests an association between SES and breakfast eating,⁴ highlighting the
217 importance of accounting for this when developing interventions. Significant associations between PA
218 levels and breakfast consumption were reported in agreement with observations of higher PA levels in
219 adolescents who regularly eat breakfast.³⁸ This may be linked to suggestions that breakfast eating
220 could act as a marker for other health promoting behaviours.³⁸

221 *Attitudes*

222 In the present study, boys and frequent breakfast eaters held more positive attitudes than girls and
223 infrequent breakfast eaters, respectively. Positive attitudes towards breakfast are commonly associated

224 with being more likely to eat breakfast regularly in adolescents^{18,29} and children,^{41,42} therefore
225 targeting adolescents who infrequently consume breakfast by promoting positive attitudes represents a
226 viable target for interventions. However, there is little evidence to support which attitude components
227 to target. Breakfast interventions outside of the TPB targeting attitudes are currently limited to
228 children⁴³ and university students⁴⁴ where increases in positive attitudes towards breakfast were
229 coupled with an increase in breakfast consumption,⁴⁴ or improvement in the quality of breakfast
230 consumed.⁴³ As breakfast quality also declines during adolescence³ targeting attitudes may potentially
231 improve other aspects of breakfast consumption.

232 *Predicting intention to eat breakfast*

233 TPB measures predicted 58% of the variation in intention to eat breakfast above age, gender and PA
234 levels alone. This compares with a meta-analysis reporting 50% of the variation in intentions of
235 dietary behaviours explained by the TPB¹³ and is close to values reported in adolescents ranging from
236 28% to 58% variation.²¹ In addition to PBC and SNs, the current study observed significant
237 contributions from cognitive and behavioural attitudes, supporting previous research highlighting the
238 importance of adolescents' attitudes in the prediction of intention to eat breakfast.²¹ Affective attitudes
239 did not contribute to intentions which was in contrast to suggestions that affective attitudes are a
240 better predictor of intentions than cognitive attitudes.⁴⁵ This may suggest that adolescents' feelings
241 towards breakfast are not important for this behaviour, but more research in this area is required.

242 SNs were significant predictors of intention to eat breakfast and breakfast consumption, supporting
243 Martens *et al.*²⁹ who reported SNs and attitudes as significant predictors of adolescents' intention to
244 eat breakfast. Findings suggest that SNs could be a viable focus for breakfast interventions in
245 adolescents, particularly as studies in university students generally report a low predictive power of
246 SN in regards to breakfast frequency.^{19,20} SNs consist of two distinct dimensions; injunctive norms
247 (linking influential roles of significant others) and descriptive norms (improving behaviours in
248 significant others). Detailed examination of SNs was beyond the scope of this study; however,
249 interventions targeting the social influences and modelling of peers or family, as suggested by

250 associations between the dietary intakes of parents and siblings with those of adolescents,⁴⁶
251 particularly with regards to breakfast,⁴⁷ may be successful targets in this age group.

252 *Predicting breakfast behaviour*

253 Demographics, PA and the TPB predicted a large amount of the variation in breakfast behaviours.
254 Behavioural attitudes most strongly predicted breakfast consumption, followed by PBC, when
255 comparing those who ate breakfast 0-2 days with the other two groups. Previous research used only a
256 single construct for attitudes, but also reported that adolescents' attitudes were the strongest predictor
257 of breakfast consumption.²⁹ Perceptions of time loaded strongly on the behavioural attitudes
258 components which may account for the strong association with behaviour. Barriers towards regular
259 breakfast consumption in adolescents are frequently reported to revolve around a lack of time as well
260 as food availability, stress and weight control.⁴ Interventions targeting practical approaches to
261 overcome some of these concerns warrant further research. PBC contributes less when volitional
262 control is high therefore; interventions should target increasing perceptions of control over breakfast
263 consumption in adolescents who infrequently consume breakfast. For example, access to healthy
264 breakfast items in the home or at school may increase the perception of available resources and
265 opportunities to consume a regular breakfast.

266 The addition of interaction terms was only significant between gender and intentions when comparing
267 those who ate breakfast 0-2 days with those eating breakfast 3-6 days. Understanding differences in
268 breakfast behaviours between boys and girls warrants further research. The current study observed
269 significant differences between gender BMI z-scores which may support suggestions that breakfast
270 skipping is used as a method of weight control, particularly in girls.⁴⁸

271 Taken together the model suggests that targeting TPB variables in interventions might increase
272 breakfast consumption frequency although the predictive power varied depending on how frequently
273 breakfast was reported to be consumed. To increase breakfast consumption in adolescents who
274 infrequently consume breakfast, interventions should aim to change PBC, intentions, SN and
275 behavioural attitudes; however, in groups who already eat breakfast, SNs may be less important
276 predictors of behaviour.

277 *Limitations*

278 A criticism of the TPB is the notable proportion of behaviour left unaccounted for⁴⁹ as well as the
279 potential for additional variables, such as past behaviour, to improve the predictive power of the
280 model.²⁰ When compared to the health action process approach the TPB was superior in predicting
281 breakfast consumption;²² however, it is yet to be compared to other theories, specifically those that
282 include additional variables. For ‘inclined abstainers’ good intentions will not always translate into
283 behaviour and bridging the gap between intention and behaviour remains a pivotal challenge. The
284 cross-sectional nature of this study which measured intention and behaviour simultaneously is likely
285 to inflate the intention-behaviour relationship due to consistency bias, where individuals report
286 intentions consistent with their current behaviour; however, this remains an issue even in prospective
287 studies where a short time interval is used.⁵⁰ Furthermore, this study cannot infer conclusions about
288 causality, therefore, interventions to increase breakfast frequency based on these findings should be
289 carefully evaluated.

290 *Conclusion*

291 These findings provide good support for considering an extended TPB to strengthen the prediction of
292 intention to eat breakfast and breakfast behaviours in adolescents. Given the evidence for differences
293 in the predictive power of the TPB and the limited number of effective breakfast interventions in
294 adolescents, it is vital to target interventions appropriately.

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297 **Conflict of Interest**

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