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

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# Abstract

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

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

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

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

# Introduction

Participation in healthy behaviours including being physically active[1] and eating a regular breakfast decreases during adolescence[2] as does the quality of breakfast consumed.[3] There appears to be a greater tendency for children from ethnic backgrounds or low-income families to skip breakfast[4] as well as differences by gender, with skipping prevalence consistently higher in adolescent girls compared to boys.[5] Adolescence is an important transitional period representing increased independence during which attitudes towards food choices are formed and can potentially persist into adulthood.[6] Regular breakfast consumption in adolescents has been positively associated with improvements in diet quality[7] and physical activity levels,[8] as well as a reduction in the risk of obesity[5] and cardio-metabolic disease,[9] emphasising the importance of breakfast, and adolescents, as key targets for health interventions.

Theory-based interventions have been shown to be more effective than interventions without a theory component.[10] Applying theories can help to identify causal determinants of behaviours which can then be targeted in interventions. One of the dominant theories in health behaviour is the Theory of Planned Behaviour (TPB).[11] Large meta-analyses support its use[12,13] around healthy eating,[14,15] physical activity[16] and breakfast consumption.[6,17-22] The theory proposes that intentions, formed from attitudes, subjective norms (SN) and perceived behavioural control (PBC), are the most important precursor to perform (or not perform) a behaviour. The more favourable the attitudes and SNs, and the greater the PBC, the stronger the intention to perform the behaviour.[23]

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

attitudes strongly correlated with breakfast behaviours[24]. To explain a greater proportion of the variation in breakfast intentions and behaviours studies are increasingly interested in the individual components of TPB constructs, such as attitudes and SNs, to directly predict behaviour,[6,28,29] and the potentially moderating effects of gender, age and socioeconomic status (SES).[6,25] Conner *et al*.[6] reported that intention to consume healthy items for breakfast in adolescents was most strongly predicted by descriptive norms and affective attitudes, whilst descriptive norms also directly predicted healthy eating behaviours. Considering breakfast consumption frequency in adolescents, attitudes were the strongest predictor over and above all other TPB constructs;[29] however, to date, there are no studies investigating how the individual components of attitudes are associated with breakfast consumption frequency in adolescents.

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

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

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

# Methods

*Participants and recruitment:*

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

*Design and measures:*

Measures were based on previously developed and validated questionnaires,[5,23,31,34] and authors' permissions were obtained prior to use. SES was assessed by the highest level of academic achievement of either parent. Height and weight were self-reported. Body mass index (kg/m$^2$) was calculated and converted to $z$-scores using online software[35] based on UK reference data.[36] Breakfast was defined as the first meal before morning break during the week, or at the weekend, as the first meal before 11am. Response categories were selected based on a previously used questionnaire[5] and recoded for analysis into 'infrequent' (0-2 days), 'frequent' (3-6 days) and 'daily' (7 days) breakfast eaters, representing similar cut points used previously to categorise the risk of developing metabolic conditions[9]. Physical activity levels were assessed by seven day recall using the physical activity questionnaire for adolescents (PAQ-A) which has shown satisfactory reliability and validity in this age group and correlates well with objective measures of physical activity.[34]

TPB questions were developed in accordance with TPB guidelines[23] and items were scored using a five-point Likert scale. *Attitudes* were assessed by agreement to twelve questions, e.g. 'eating breakfast is boring' (strongly disagree-strongly agree), based on a previously developed scale showing

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

*Statistical Analysis*

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

# Results

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

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

*Correlations*

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

*TPB measures*

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

*Predicting intention to eat breakfast*

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

*Predicting breakfast behaviour*

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

# Discussion

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

*Breakfast consumption*

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

*Attitudes*

In the present study, boys and frequent breakfast eaters held more positive attitudes than girls and 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 children[43] and university students[44] 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 adolescence[3] 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 TPB[13] 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

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

*Predicting breakfast behaviour*

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

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

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

*Limitations*

A criticism of the TPB is the notable proportion of behaviour left unaccounted for[49] as well as the potential for additional variables, such as past behaviour, to improve the predictive power of the model.[20] When compared to the health action process approach the TPB was superior in predicting breakfast consumption;[22] however, it is yet to be compared to other theories, specifically those that include additional variables. For 'inclined abstainers' good intentions will not always translate into behaviour and bridging the gap between intention and behaviour remains a pivotal challenge. The cross-sectional nature of this study which measured intention and behaviour simultaneously is likely to inflate the intention-behaviour relationship due to consistency bias, where individuals report intentions consistent with their current behaviour; however, this remains an issue even in prospective studies where a short time interval is used.[50] Furthermore, this study cannot infer conclusions about causality, therefore, interventions to increase breakfast frequency based on these findings should be carefully evaluated.

*Conclusion*

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

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# Conflict of Interest

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Table 1
Descriptive characteristics of sample as means (± standard deviation) for BMI and age variables and percentages (*n* ) for all other variables [ǂ]

| | Total | Boys | Girls | MW or *t* -test *p* -value |
|---|---|---|---|---|
| Age (years) | 14.0 (0.9) | 14.1 (0.9) | 13.9 (0.9) | .006*^ |
| BMI (*z* -score) | -0.31 (1.5) | -0.04 (1.4) | -0.53 (1.5) | .005*^ |
| *Ethnicity* | | | | .394 |
| Arab/Asian/black | 5.4% (23) | 4.2% (7) | 6.2% (16) | |
| Mixed/other | 4.5% (19) | 4.2% (7) | 4.7% (12) | |
| White | 90.1% (383) | 91.6% (153) | 89.1% (230) | |
| *SES* | | | | .802 |
| No formal education | 1.2% (5) | 1.8% (3) | 0.8% (2) | |
| GCSE or equivalent | 11.7% (50) | 9.4% (16) | 13.1% (34) | |
| A-level or university | 54.5% (234) | 58.2% (99) | 52.1% (135) | |
| Don't know | 32.6% (140) | 30.6% (52) | 34.0% (88) | |
| *PA levels* | | | | < .001**^ |
| Rarely active | 32.2% (138) | 23.7% (40) | 37.8% (98) | |
| Moderately active | 48.6% (208) | 46.2% (78) | 50.2% (130) | |
| Often active | 17.8% (76) | 27.2% (46) | 11.6% (30) | |
| Very active | 1.4% (6) | 3.0% (5) | 4.0% (1) | |
| *Breakfast* | | | | < .001** |
| Breakfast: 0-2 days | 22.4% (97) | 11.7% (20) | 29.3% (77) | |
| Breakfast: 3-6 days | 20.7% (90) | 17.5% (30) | 22.8% (60) | |
| Breakfast: 7 days | 56.9% (247) | 70.8% (121) | 47.9% (126) | |

Abbreviations: BMI, body mass index; PA Levels, physical activity levels (determined by PAQ-A questionnaire); SES, socioeconomic status (determined by parental education). MW: Mann Whitney.
^ *P* -value independent *t* -test of scores (not categories); Significance ** $p < .001$, * $p < .05$ (2-tailed)
[ǂ] Sample *n* varies between questions (maximum *n* =434)

Table 2

Characteristics of participants ($n$ =434) stratified by frequency of breakfast consumption.

Values are means (± standard deviation) or percentages %

| | Frequency of breakfast consumption | | | |
|---|---|---|---|---|
| | 0-2 days | 3-6 days | 7 days | |
| | $n$ = 97 | $n$ = 90 | $n$ = 247 | KW/ANOVA $p$ value |
| Age *(yrs)* | 13.9 (0.8) | 14.0 (0.9) | 14.0 (0.9) | 0.925^ |
| BMI *(z-score)* | -0.11 (1.6) | -0.14 (1.4) | -0.41 (1.5) | 0.284^ |
| *Ethnicity* | | | | 0.117 |
| Arab/Asian/black | 9.6% | 5.7% | 3.7% | |
| Mixed/other | 5.3% | 3.4% | 4.5% | |
| White | 85.1% | 90.8% | 91.8% | |
| *SES* | | | | 0.020* |
| No formal education | 3.1% | 0.0% | 0.8% | |
| GCSE or equivalent | 13.5% | 10.1% | 11.4% | |
| A-level or university | 40.6% | 55.7% | 59.6% | |
| Don't know | 42.7% | 34.1% | 28.2% | |
| *PA levels* | | | | < 0.001**^ |
| Rarely active | 46.8% | 36.4% | 25.2% | |
| Moderately active | 43.6% | 42.0% | 52.8% | |
| Often active | 8.5% | 19.3% | 20.7% | |
| Very active | 1.1% | 2.3% | 1.2% | |

Abbreviations: BMI, body mass index; PA Levels, physical activity levels (determined by PAQ-A questionnaire). SES, socioeconomic status (determined by parental education). KW: Kruskal Wallis test. ^ ANOVA $p$ value of scores (not categories). Significance ** $p$ <.001, * $p$ <.05 (2-tailed)

Table 3. Mean scores (± standard deviation) for Theory of Planned Behaviour variables by all sample and gender (upper table) and breakfast consumption (lower table)

| | | Aff_Att | | Beh_Att | | Cog_Att | | SN | | PBC | | Int | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All | ($n$ = 425) | 3.76 | (1.1) | 3.62 | (1.2) | 3.41 | (1.1) | 3.74 | (0.8) | 4.04 | (1.3) | 6.69 | (2.2) |
| Boys | ($n$ = 168) | 4.02[a] | (1.0) | 3.98[a] | (1.0) | 3.62[a] | (1.0) | 3.90[a] | (0.7) | 4.42[a] | (1.0) | 7.23[a] | (1.8) |
| Girls | ($n$ = 257) | 3.58 | (1.2) | 3.38 | (1.2) | 3.28 | (1.1) | 3.64 | (0.8) | 3.80 | (1.4) | 6.34 | (2.4) |
| | | Aff_Att | | Beh_Att | | Cog_Att | | SN | | PBC | | Int | |
| 0-2 days | ($n$ = 96) | 2.71 | (0.9) | 2.21 | (0.8) | 2.41 | (0.9) | 3.03 | (0.7) | 2.30 | (1.0) | 3.39 | (2.0) |
| 3-6 days | ($n$ = 90) | 3.42 | (1.0) | 3.15 | (1.0) | 3.00 | (1.0) | 3.52 | (0.7) | 3.84 | (1.1) | 6.72 | (1.6) |
| 7 days | ($n$ = 247) | 4.26[b] | (0.9) | 4.30[b] | (0.7) | 3.94[b] | (0.9) | 4.10[b] | (0.6) | 4.79[b] | (0.5) | 7.85[b] | (0.7) |

Attitude measures: Aff_Att: affective; Beh_Att: behavioural; Cog_Att: cognitive, SN: subjective norm; PBC: perceived behavioural control (maximum score 5); Int: intention to eat breakfast (maximum score 8). [a] Significantly higher than girls ($p$ <.01, 2-tailed). [b] Significantly higher than 0-2 days & 3-6 days ($p$ <.001, 2-tailed).

**Table 4** Standardised betas, t and p values within hierarchical multiple regression model testing influence of demographic variables and TPB variable predict intentions to eat breakfast, whether gender moderates the relationship between TPB variables and intentions

| | *β* | *t* | *p* |
|---|---|---|---|
| Step 1 | | | |
| Constant | | 10.52 | *p*<.001 |
| Gender | -.16 | -3.24 | *p*=.001 |
| Age | .01 | .27 | *p*=.789 |
| PAQ | .17 | 3.50 | *p*=.001 |
| Step 2 | | | |
| Constant | | 17.97 | *p*<.001 |
| Gender | .03 | 1.05 | *p*=.296 |
| Age | .05 | 1.48 | *p*=.139 |
| PAQ | .03 | 1.03 | *p*=.305 |
| Cognitive attitudes | .11 | 2.60 | *p*=.010 |
| Behavioural attitudes | .16 | 2.85 | *p*=.005 |
| Affective attitudes | -.02 | -.31 | *p*=.753 |
| Subjective norm | .12 | 3.20 | *p*=.001 |
| Perceived behavioural control | .53 | 10.48 | *p*<.001 |
| Step 3 | | | |
| Constant | | 17.42 | *p*<.001 |
| Gender | .03 | .95 | *p*=.342 |
| Age | .05 | 1.62 | *p*=.107 |
| PAQ | .04 | 1.13 | *p*=.260 |
| Cognitive attitudes | .13 | 1.76 | *p*=.079 |
| Behavioural attitudes | .04 | .39 | *p*=.699 |
| Affective attitudes | -.03 | -.30 | *p*=.761 |
| Subjective norm | .16 | 2.44 | *p*=.015 |
| Perceived behavioural control | .60 | 5.53 | *p*<.001 |
| Gender x Cognitive attitudes | -.01 | -.14 | *p*=.888 |
| Gender x Behavioural attitudes | .16 | 1.57 | *p*=.116 |
| Gender x Affective attitudes | .01 | .11 | *p*=.912 |
| Gender x Subjective norm | -.06 | -.88 | *p*=.378 |
| Gender x Perceived behavioural control | -.081 | -.77 | *p*=..442 |

Notes: Gender dummy coded 1=female

Tests the moderation of gender (female = 1 on the dependent variable intentions. All predictors are standardised.

$R^2$ = .069 for Step 1(p<.001); $\Delta R^2$ =.582 for step 2 (*F* change =129.575, p<.001) $\Delta R^2$ =.004 for step 3 (*F* change .866, p=.5

**Table 5** *Multinomial logistic regression model predicting breakfast eating (0-2 days, 3-6 days, 7 days) from demographic and TPB variables*

| | | 95% CI for Odds Ratio | | |
|---|---|---|---|---|
| | B (SE) | Lower | Odds Ratio | Upper |
| Breakfast 0-2 days vs 3-6 days | | | | |
| Intercept | -1.74 (4.31) | | | |
| Gender | -2.91 (.56) | .25 | .748 | 2.25 |
| Age | .19 (.30) | .67 | 1.21 | 2.16 |
| PAQ | .61 (.39) | .86 | 1.85 | 3.96 |
| Cognitive attitudes | -.40 (.33) | .34 | .67 | 1.29 |
| Behavioural attitudes | .874(.36)* | 1.19 | 2.40 | 4.83 |
| Affective attitudes | -.29 (.34) | .39 | .75 | 1.45 |
| Subjective norm | .06 (.34) | .55 | 1.06 | 2.07 |
| PBC | .84 (.28)* | 1.34 | 2.33 | 4.04 |
| Intention | .47 (.12)** | 1.27 | 1.60 | 2.00 |
| Breakfast 0-2 days vs 7 days | | | | |
| Intercept | -2.08 (4.79) | | | |
| Gender | .05 (.62) | .31 | 1.06 | 3.54 |
| Age | .27 (33) | .68 | 1.32 | 2.49 |
| PAQ | .46 (.44) | .67 | 1.58 | 3.74 |
| Cognitive attitudes | .07 (.37) | .53 | 1.07 | 2.19 |
| Behavioural attitudes | 1.94 (.42)** | 3.06 | 6.93 | 15.74 |
| Affective attitudes | -.66 (.39) | .24 | .52 | 1.10 |
| Subjective norm | .89 (.41)* | 1.09 | 2.44 | 5.44 |
| PBC | 1.07 (.34)* | 1.49 | 2.91 | 5.68 |
| Intention | .68 (.176)** | 1.40 | 1.97 | 2.79 |

Notes: Reference category for gender = male * = p<.005 ** p<.001

$R^2$ = .61 (Cox & Snell), .72 (Nagelkerke) $\chi^2$ (18) = 377.75, $p$<.001

**Table 6** *Multinomial logistic regression model predicting breakfast eating (0-2 days, 3-6 days, 7 days) from demographic and TPB variables including gender as a moderator*

| | | 95% CI for Odds Ratio | | |
|---|---|---|---|---|
| | B (SE) | Lower | Odds Ratio | Upper |
| Breakfast 0-2 days vs 3-6 days | | | | |
| Intercept | -.92 (4.87) | | | |
| Gender | -2.50 (1.04)* | .01 | .08 | .63 |
| Age | .20 (.33) | .64 | 1.22 | 2.32 |
| PAQ | .71 (.46) | .83 | 2.03 | 4.98 |
| Cognitive attitudes | -.54 (.57) | .19 | .59 | 1.77 |
| Behavioural attitudes | .50 (.5) | .56 | 1.64 | 4.80 |
| Affective attitudes | .14 (.71) | .28 | 1.15 | 4.63 |
| Subjective norm | -.40 (.71) | .17 | .67 | 2.77 |
| PBC | .85 (.68) | .61 | 2.33 | 8.87 |
| Intention | .13 (.22) | .74 | 1.14 | 1.75 |
| Gender x affective attitudes | -.50 (.85) | .12 | .61 | 3.18 |
| Gender x behavioural attitudes | .54 (.74) | .40 | 1.71 | 7.32 |
| Gender x cognitive attitudes | .05 (.73) | .25 | 1.05 | 4.38 |
| Gender x subjective norm | .97 (.85) | .51 | 2.65 | 13.86 |
| Gender x PBC | .29 (.79) | .29 | 1.33 | 6.15 |
| Gender x Intention | .55 (.28)* | 1.01 | 1.73 | 2.97 |
| | | | | |
| Breakfast 0-2 days vs 7 days | | | | |
| Intercept | -1.41 (5.20) | | | |
| Gender | -1.74 (1.03) | .02 | .18 | 1.33 |
| Age | .27 (.35) | .66 | 1.31 | 2.61 |
| PAQ | .60 (.49) | .69 | 1.81 | 4.78 |
| Cognitive attitudes | .36 (.58) | .46 | 1.44 | 4.50 |
| Behavioural attitudes | 1.98 (.62)* | 2.15 | 7.28 | 24.67 |
| Affective attitudes | -1.22 (.75) | .07 | .29 | 1.29 |
| Subjective norm | .29 (.75) | .31 | 1.33 | 5.83 |
| PBC | .86 (.73) | .57 | 2.37 | 9.81 |
| Intention | .44 (.27) | .92 | 1.56 | 2.63 |
| Gender x affective attitudes | .86 (.91) | .39 | 2.37 | 14.20 |
| Gender x behavioural attitudes | .00 (.85) | .19 | 1.00 | 5.34 |
| Gender x cognitive attitudes | -.57 (.77) | .13 | .57 | 2.56 |
| Gender x subjective norm | 1.22(.94) | .54 | 3.39 | 21.47 |
| Gender x PBC | .55 (.86) | .32 | 1.74 | 9.35 |
| Gender x Intention | .49 (.39) | .76 | 1.64 | 3.51 |

Notes: Reference category for gender = male * = p<.005

$R^2$ = .63 (Cox & Snell), .42 (Nagelkerke) $\chi^2$ (30) = 397.294, $p$<.001