Research report
Understanding college students' fruit consumption.
Integrating habit strength in the theory of planned behaviour

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Introduction

The promotion of sufficient fruit consumption is an importance public health issue, because sufficient fruit consumption decreases the risk of various cancers (Gundgaard, Nielsen, Olsen, & Sorensen, 2003) and is protective of weight gain (Kromhout, Bloemberg, Seidell, Nissinen, & Menotti, 2001). Despite these demonstrated health benefits, a large proportion of the general population in Western countries is not eating sufficient fruits to obtain these health benefits (World Health Organization, 2003), emphasizing a strong need to understand fruit consumption and developing behavioural change interventions to increase fruit consumption. The theory of planned behaviour (TPB) (Ajzen, 1991) has often been used as a theoretical framework to understand fruit consumption (Blanchard et al., 2009; Bogers, Brug, Van Assema, & Dagnelie, 2004). The TPB proposes that the main determinant of any given behaviour is the intention to perform this behaviour. This intention, in turn, is determined by attitudes towards the behaviour (instrumental and affective evaluations of the behaviour), subjective norms (perceived social pressure from significant other to perform the behaviour), and perceived behavioural control (PBC) (whether performance of the behaviour is easy or difficult and under one's control or not). Underlying the direct measures of attitude are behavioural beliefs, which are subjective evaluations about the specific outcomes or consequences of performing the behaviour, while normative beliefs (i.e. perceptions of specific significant others' preferences about whether one should or should not perform the behaviour) are underlying the direct measures of subjective norms. Control beliefs (i.e. beliefs concerning the ability to perform the behaviour under a variety of circumstances) are factors underlying PBC. Beliefs that can discriminate between intenders and non-intenders or between actors and non-actors are commonly used as persuasive messages in health communication campaigns (Fishbein & Cappella, 2006; Van den Putte & Dhondt, 2005).

In general, the TPB is considered to be a sufficient model for developing health behaviour change interventions (Hardeman et al., 2002) and to understand fruit consumption (Godin & Kok, 1996). Research to date has shown that about a third to a half of the total variance in intention towards fruit consumption can be explained by TPB variables, whereas intention and/or PBC generally explain about a third of the variance in fruit consumption (Blanchard et al., 2009; Bogers, Brug, et al., 2004; Brug, De Vet, De
Nooijer, & Verplanken, 2006; De Bruijn et al., 2007; Lien, Lytle, & Komro, 2002). However, recent findings have also indicated that fruit consumption may not only be the resultant of planned intentions, but that fruit consumption may also become habitual (Brug, Van Lenthe, and Kremers, 2006; De Bruijn et al., 2007). The notion that fruit consumption has a habitual component next to an intentional component has both theoretical and practical implications. Stronger habits may not only make health behaviour less intentional (De Bruijn, Kremers, Singh, Van den Putte, & Van Mechelen, 2009; De Bruijn, Kroese, Onema, & Brug, 2008), but may also be a viable explanation of the limited effectiveness of persuasive health communication on behaviour change (Aarts, Verplanken, & van Knippenberg, 1998; De Bruijn et al., 2007; Verplanken & Aarts, 1999; Verplanken & Wood, 2006).

To date, however, most research that has incorporated a measure of habit strength in TPB-research on fruit consumption has examined additive (Brug, Van Lenthe, et al., 2006; Reinaerts, De Nooijer, Candel, & De Vries, 2007) or interactive effects of habit strength (De Bruijn et al., 2007). There has been little effort to identify salient beliefs that can sufficiently distinguish profiles based on sufficient fruit consumption and motivation and habit strength towards sufficient fruit consumption. Although tailored health communication has proven useful in the promotion of various health behaviours, including fruit consumption (Kroese, Werkman & Brug, 2006; Noar, Bennett, & Harris, 2007) there is as yet present no evidence about belief-based variables that can discriminate, for instance, strongly habitual but insufficient fruit consumers from strongly habitual and sufficient fruit consumers. Consequently, adding measures of fruit consumption habit strength when differentiating target groups may allow for a more precise identification of relevant population segments. Furthermore, it may also allow for more effective tailored health communication messages, because the exploration of such profiles may not only yield important practical knowledge about who to target, but also what persuasive messages these people should be targeted with.

Therefore, the purpose of the present study was to provide further evidence of the potentially important role of habit strength in the explanation of fruit consumption, as well as to examine which behavioural and control belief-based variables can discriminate profiles created from fruit consumption motivation, fruit consumption habit strength and current fruit consumption. In line with earlier evidence (Brug, Van Lenthe, et al., 2006; De Bruijn et al., 2007, 2008, 2009; Reinaerts et al., 2007), it was hypothesized that (i) habit strength would increase the amount of explained variance in fruit consumption, and (ii) habit strength would moderate the intention-fruit consumption relationship. Although the discriminant analyses were considered exploratory, it was hypothesized that strongly habitual and sufficient fruit consumers would have the most positive behavioural and control beliefs regarding fruit consumption.

Methods

Data for the present study were available from 538 undergraduate students (153 (28.4%) males; mean age = 21.19 (S.D. = 2.57)), from a major city in the Netherlands, who participated for course credits (i.e. 1/100th of the maximum score for the course) in November 2008. Course enrolment was registered for 623 students (188 (30.2%) males; mean age = 21.30 (S.D. = 2.65)), indicating a 86.36% response rate. Logistic regression analysis (0 = did not participate; 1 = participated) showed that age was not significantly associated with participation (OR = 1.08; 95% CI = 0.97–1.16), but female students were significantly more likely to participate than male students (OR = 1.87; 95% CI = 1.16–3.02). Data were collected using an online survey tool that was hosted by the university and students were invited to participate by email and an announcement during college hours. Pretesting the online questionnaire suggested a completion time for the fruit consumption items of about 10 min. There were no selection criteria for participation.

Measures

Fruit consumption was assessed using a questionnaire that has been validated against 7-day diary and biomarkers (Bogers, Van Assema, Kester, Westerterp, & Dagnelie, 2004; Van Assema, Brug, Ronda, Steenhuis, & Oenema, 2002). Respondents were asked to indicate on how many days per week they consumed the following fruits: apples or pears, citrus fruits (such as oranges, lemons, and grapefruits), tangerines, bananas and other fruits (such as grapes). They further indicated the number of servings on such a day. An average amount of pieces of fruit per day was calculated by multiplying frequency with usual amount and dividing the resultant score by seven.

Direct TPB-measures were assessed regarding eating at least two pieces of fruit per day, which is the Dutch norm for fruit consumption. Intention was computed as the mean of the items ‘I intend to eat at least two pieces of fruit per day in the next four weeks’ and ‘I am sure I will eat at least two pieces of fruit per day in the next four weeks (α = .88) using five-point scales (+2 = yes, definitely; −2 = no, definitely not). Instrumental attitude was assessed as the mean of two items tapping the good–bad (+2 = very good; −2 = very bad) and the healthy–unhealthy (+2 = very healthy; −2 = very unhealthy) aspect (α = .87), whereas affective attitude was assessed as the mean of items tapping the pleasant–unpleasant (+2 = very pleasant; −2 = very unpleasant) and the tasteful–tasteless (+2 = very tasteful; −2 = very tasteless) aspect (α = .83). Subjective norm was computed as the mean of four items regarding perceived subjective norm (+2 = yes, definitely; −2 no, definitely not) towards eating at least two pieces of fruit per day in the next four weeks from parents, friends, partner, and fellow students (α = .64). Perceived behavioural control was computed as the mean of the items ‘I find eating at least two pieces of fruit per day in the next four weeks (+2 = very easy; −2 = very difficult’) and ‘I am sure I will succeed in eating at least two pieces of fruit per day in the next four weeks (+2 = yes, definitely; −2 = no, definitely not’) (α = .86).

Habit strength regarding eating at least two pieces of fruit per day was assessed with the self-reported habit index (SRHI) (Verplanken & Orbell, 2003). This survey measure of habit strength has shown high test-retest reliability (Verplanken & Orbell, 2003), high internal reliabilities regarding fruit consumption (Brug, Van Lenthe, et al., 2006; De Bruijn et al., 2007) and other health behaviours (De Bruijn et al., 2008, 2009), and has been validated against other measures of habit strength (Verplanken, Myrbakk, & Rudi, 2005). Due to the cross-sectional nature of the present study, two items from the SRHI (eating at least two pieces of fruit per day is something (1) I do regularly; (2) I have been doing for a long time) were removed, because these items are related to past behaviour and may artificially inflate the habit strength–fruit consumption relationship. Respondents therefore indicated to what extent they agreed (+2 = totally agree; −2 = totally disagree) with the following ten statements: eating at least two pieces of fruit is something (1) I do regularly, (2) I do automatically, (2) I do without having to consciously remember, (3) that makes me feel strange if I do not do it, (4) I do without thinking, (5) that would require effort not to do it, (6) that belongs to my routine, (7) I start doing before I realize I am doing it, (8) I would find hard not to do, (9) I have no need to consciously remember, (3) that makes me feel strange if I do not do it, (4) I do without thinking, (5) that would require effort not to do it, (6) that belongs to my routine, (7) I start doing before I realize I am doing it, (8) I would find hard not to do, (9) I have no need to consciously remember. (10) that is typically me (α = .95).

Relevant behavioural and control beliefs were assessed using a two-step approach, following guidelines suggested by various
scholars (Ajzen, 1991; Sutton, 2002; Van den Putte & Dhondt, 2005). In the first step, a qualitative group interview amongst a small number of respondents from the target group (i.e. university college students) was held in order to identify the most salient beliefs regarding the specific behaviour of interest. For this qualitative phase, a focus group interview was held amongst 23 undergraduate students during a curriculum hour. Participants were asked to indicate as many outcomes as possible when consuming two pieces of fruit per day. Additionally, they were also asked to indicate as many situations as possible that would make it difficult for them to consume two pieces of fruit per day. In the second step, beliefs that were elicited during this focus group interview were measured quantitatively amongst the 538 undergraduate students described earlier.

Regarding behavioural beliefs, respondents indicated on five-points Likert-scales (+2 = very likely; −2 = very unlikely) whether they believed that eating at least two pieces of fruit in the next four weeks would (1) be bad for their teeth; (2) keep them healthy; (3) make them less likely to consume high caloric snacks in between meals; (4) keep them at their current body weight; (5) make them lose weight; (6) cost them money that they would rather spend on other things; (7) make their hands dirty every time they consumed fruit. Regarding control beliefs, respondents indicated whether they believed that the following situations would make it difficult (+2 = very likely; −2 = very unlikely) for them to eat at least two pieces of fruit per day in the next four weeks: (1) during the weekend; (2) when they were sick; (3) when they were in a hurry; (4) when they were stressed; (5) when they were low on money; (6) during weekdays; (7) during the winter.

Analyses

Initially, basic descriptives and correlations were computed for the study variables. To test the additive and interactive effect of habit strength, hierarchical regression analyses were conducted with fruit consumption as the dependent variable and intention and PBC (step 1), affective and instrumental attitude, and subjective norm (step 2), and habit strength (step 3) as the independent variables. To test the proposed moderator effect, an interaction term habit × intention was added in the fourth step. Before computing this interaction term, habit and intention were mean-centred in order to minimise potentially problematic multicollinearity (Aiken & West, 1991). Simple slope analysis was conducted to decompose a significant interaction term (Aiken & West, 1991). Next, respondents were grouped by habit strength (above median vs. median or lower), intention (above midscale vs. midscale or lower) and fruit consumption (eating less than norm vs. eating equal to or higher than norm), allowing for eight possible profiles (1: strong habit-above norm-positive intention; 2: strong habit-above norm-negative intention; 3: strong habit-below norm-positive intention; 4: strong habit-below norm-negative intention; 5: weak habit-above norm-negative intention; 6: weak habit-below norm-positive intention; 7: weak habit-below norm-positive intention). Behavioural and control beliefs were modelled as predictors of category membership using discriminant function analysis, followed up by analyses of variance. Bonferroni corrections were used to correct for experiment-wise error and Cohen's effect sizes (Cohen, 1988) were used to interpret the meaningfulness of the associations and differences between study variables. For the discriminant function analysis, power analysis indicated that a profile cell size of at least \( n = 20 \) was needed to detect a medium effect size (\( f^2 = .25 \) at alpha = .05).

Table 1 shows that mean fruit consumption was 1.74 (S.D. = 1.53) pieces of fruit per day, with 368 respondents (68.4%) meeting the Dutch norm of eating at least two pieces of fruit per day. Positive scores were found for affective and instrumental attitude, while PBC, subjective norm and intention were around midscale. Mean score for habit strength indicated that, in general, the sample had a relatively weak habit towards eating two pieces of fruit per day.

Table 1

|                          | Mean (S.D.) | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|--------------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 1. Fruit consumption     | 1.74(1.33)  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 2. Intention             | -0.09(1.13) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 3. Affective attitude    | 1.71(.52)   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 4. Instrumental attitude | 1.11(.83)   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 5. Subjective norm       | .03(.67)    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 6. PBC                   | .14(1.17)   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 7. Habit strength        | -0.51(9.2)  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 8. Bad for teeth         | .36(1.09)   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 9. Stay healthy          | .74(.73)    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 10. No snacks            | -0.02(1.17) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 11. Maintain weight      | .44(.98)    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 12. Loose weight         | -0.58(9.4)  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 13. Costs money          | .88(1.13)   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 14. Dirty hands          | 1.02(1.24)  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 15. During weekend       | .50(1.16)   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 16. When sick            | .89(1.13)   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 17. When in a hurry       | -0.47(1.21) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 18. When stressed        | .41(1.12)   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 19. Low on money         | .08(1.35)   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 20. During; weekdays     | .80(1.01)   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 21. During; the winter   | .79(1.01)   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |

PBC = Perceived Behavioural Control.

\( r \geq .09 \) (\( p < .005 \)); \( r \leq .11 \) (\( p < .01 \)); \( r > .15 \) (\( p < .0001 \)).

Small effect: \( r > .10 \); medium effect size: \( .30 \leq r < .50 \); large effect size: \( r \geq .50 \).
who consumed more fruit per day had higher scores on behavioural beliefs related to staying healthy and costing more money. Furthermore, they perceived themselves more likely to eat at least two pieces of fruit per day in stressful situations, when they were in a hurry, when they were low on money, during the winter and on weekdays. Similar associations were found for those with a more positive intention. Additionally, a more positive intention was associated with a more positive belief regarding fruit consumption as a means to loose weight and as a means to consume less high caloric snacks in between meals. The behavioural beliefs ‘eating two pieces of fruit per day keeps me healthy’ and ‘eating two pieces of fruit per day costs money’ were significant correlates of both affective and instrumental attitude, while, with the exception of the control belief ‘when sick’, all control beliefs were significantly associated with PBC. Those who perceived eating two pieces of fruit per day was easier during the weekend and when stressed or in a hurry had a stronger habit towards fruit consumption. Those who believed that eating two pieces of fruit per day would cost them money also had a stronger habit. Effect sizes were mostly small to medium.

**Regression and interaction analysis**

Table 2 presents the results from the stepwise regression analyses. In the first step, both intention and PBC were significant predictors of fruit consumption. The second step showed that only attitude was an additional significant predictor of fruit consumption, while the third step showed that habit strength was the strongest predictor of fruit consumption. Finally, the fourth step revealed a significant habit × intention interaction ($\beta = .13, p = .01$). Decomposing this interaction by means of simple slope analysis showed that intention was a significant predictor of fruit consumption across the three levels of habit strength, but this relationship was more than twice as strong at lower ($\beta = .39, p < .001$) and medium ($\beta = .34, p < .001$) levels of habit strength than at higher levels ($\beta = .16, p = .006$) of habit strength (see Fig. 1).

**Discriminant analysis**

Of the eight possible groups, three groups were too small to detect a medium effect size and were subsequently not included in the discriminant function analyses. This left five profiles ($n = 493$) in the final analyses (profile 1: strong habit–meeting norm-intention to eat according to norm ($n = 125$); profile 2: strong habit–not meeting norm-intention to eat according to norm ($n = 90$); profile 3: strong habit–not meeting norm-intention to eat according to norm ($n = 42$); profile 4: weak habit–not meeting norm-intention to eat according to norm ($n = 71$); profile 5: weak habit–not meeting norm–no intention to eat according to norm ($n = 165$)) (see Table 3). One significant discriminant function was found ($\chi^2(56) = 169.41, p < .001$; Eigenvalue = .304; canonical correlation = .48; Wilk’s $\lambda = .70$), that correctly identified 44.2% of the cases. The main behavioural beliefs correlated with this function were (1) costs money, and (2) staying healthy, whereas the main control beliefs correlated with this function were (1) when I’m in a hurry, (2) when stressed, (3) when low on cash, (4) during weekdays, and (5) during the winter (see Table 3). In the post hoc analyses, the behavioural belief ‘costs money’ significantly discriminated profile 1 from all other profiles, with the exception of profile 2. Furthermore, the behavioural belief ‘staying healthy’ significantly discriminated between profile 1 and profile 5, while the behavioural belief ‘loose weight’ significantly discriminated between profile 4 and profile 5. Regarding the control beliefs,
strength than at higher levels of habit strength. Similar findings
the association between intention and fruit consumption was
Furthermore, results also confirmed the moderation hypothesis:
component, but also has a habitual and automatic component.
evidence that fruit consumption does not only have an intentional
Bruijn et al., 2008, 2009). The present findings provide further
confirming earlier evidence in other age groups (Brug, Van Lenthe,
correlate of fruit consumption in the multivariate analysis,
explained variance in fruit consumption and was the strongest
hypotheses. Habit strength significantly increased the amount of
intentional and habitual profiles. Regarding the additive and
explanation of fruit consumption within the framework of the TPB.
Discussion
The present study aimed to replicate earlier findings regarding the
additive and interactive effects of habit strength in the
explanation of fruit consumption within the framework of the TPB.
An additional purpose of the present study was to examine
behavioural and control beliefs as distinguishers of behavioural,
intentional and habitual profiles. Regarding the additive and
interactive effects of habit strength, findings were in line with the
hypotheses. Habit strength significantly increased the amount of
explained variance in fruit consumption and was the strongest
correlate of fruit consumption in the multivariate analysis,
confirming earlier evidence in other age groups (Brug, Van Lenthe,
et al., 2006; Reinaerts et al., 2007) and other health behaviours (De
Briijn et al., 2008, 2009). The present findings provide further evidence that fruit consumption does not only have an intentional component, but also has a habitual and automatic component.
Furthermore, results also confirmed the moderation hypothesis:
the association between intention and fruit consumption was
more than twice as strong at lower and medium levels of habit
strength than at higher levels of habit strength. Similar findings
have been reported before in a prospective study on adult fruit
consumption (De Briijn et al., 2007), indicating that stronger fruit
consumption habits make it a less intentional behaviour. Notably,
associations between intention and fruit consumption for low and
medium levels of habit strength in this latter study were almost
identical to those found in the present study, suggesting some
consistency in the association between intention and fruit
consumption at those levels of habit strength. This similar pattern
of results also demonstrates the ability of the TPB to explain both
cross-sectional and prospective behavioural measures of fruit
consumption, reflecting similar findings from the physical activity
research domain (Rhodes & Plotnikoff, 2006; Symons Downs &
Hausenblas, 2005).

The present study also sought to explore discriminating beliefs
between several profiles: divisions were made by habit strength,
current fruit consumption and current motivation towards fruit
consumption. Importantly nearly three quarters of this sample were not meeting the norm for fruit consumption. Beliefs regarding monetary costs of fruit consumption as well as beliefs regarding stressful situations and situations of urgency significantly discriminated sufficient consumers from insufficient consumers. Consequently, interventions that aim to increase fruit consumption amongst segments of the population that are currently not meeting the norm for fruit consumption may need to emphasize a sense of controllability in stressful situations and situations of urgency. It is also important to note that, of these insufficient consumers, more than half did not intend to eat according to the fruit norm. Findings indicated that, amongst these insufficient consumers, intenders could be distinguished from non-intenders by beliefs regarding stressful situations, although this was only the case amongst those who were weakly habitual insufficient fruit consumers. No beliefs were found that could discriminate unmotivated and insufficient fruit consumers across the two levels of habit strength. Similarly, no beliefs significantly discriminated strongly habitual, motivated but insufficient fruit consumers from their less habitual peers.

An additional interesting finding was that, although interventions that aim to increase (motivation towards) fruit consumption generally emphasize that fruits are healthy and relevant for weight management, behavioural beliefs related to health and weight were relatively unable to distinguish the five profiles. For instance, the belief that eating at least two pieces of fruit per day was health beneficiary only distinguished strongly habitual and motivated sufficient fruit consumers from insufficient and unmotivated fruit consumers. Furthermore, although epidemiological evidence points to the usefulness of sufficient fruit consumption for weight management (Gundgaard et al., 2003; Kromhout et al., 2001; World Health Organization, 2003), beliefs regarding maintaining weight as a consequence of sufficient fruit consumption could not discriminate between the five profiles. The positive mean scores for health outcomes and weight management in the present study indicate that positive outcomes of sufficient fruit consumption regarding health and weight management are now arguably well known in the general population and, combined with the finding that these beliefs were not able to distinguish the five profiles, suggest that health practitioners developing interventions aimed

**Table 3**

<table>
<thead>
<tr>
<th>Beliefs</th>
<th>Correlation with discriminant function</th>
<th>1 (n = 125) Mean (S.D.)</th>
<th>2 (n = 90) Mean (S.D.)</th>
<th>3 (n = 42) Mean (S.D.)</th>
<th>4 (n = 71) Mean (S.D.)</th>
<th>5 (n = 165) Mean (S.D.)</th>
<th>F_{4,488}</th>
<th>Post hoc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad for teeth</td>
<td>-.06</td>
<td>.25 (.09)</td>
<td>.42 (.01)</td>
<td>.21 (.00)</td>
<td>.35 (.31)</td>
<td>.39 (.10)</td>
<td>.55</td>
<td>1 &gt; 5</td>
</tr>
<tr>
<td>Stay healthy</td>
<td>.30</td>
<td>.86 (.66)</td>
<td>.82 (.70)</td>
<td>.52 (.71)</td>
<td>.77 (.76)</td>
<td>.60 (.76)</td>
<td>3.70 ***</td>
<td>1 &gt; 5</td>
</tr>
<tr>
<td>No snacks</td>
<td>.24</td>
<td>.06 (1.15)</td>
<td>.14 (1.15)</td>
<td>-.24 (1.08)</td>
<td>.27 (1.17)</td>
<td>-.27 (1.15)</td>
<td>4.02 **</td>
<td>1 &gt; 4,5,2 &gt; 5</td>
</tr>
<tr>
<td>Maintain weight</td>
<td>.07</td>
<td>.49 (.97)</td>
<td>.49 (.95)</td>
<td>.43 (.94)</td>
<td>.37 (.99)</td>
<td>.40 (.98)</td>
<td>.31</td>
<td></td>
</tr>
<tr>
<td>Loose weight</td>
<td>.15</td>
<td>-.58 (.93)</td>
<td>-.47 (.85)</td>
<td>-.57 (.83)</td>
<td>-.39 (.95)</td>
<td>-.75 (.97)</td>
<td>2.47 **</td>
<td>4 &gt; 5</td>
</tr>
<tr>
<td>Costs money</td>
<td>.64</td>
<td>1.42 (.78)</td>
<td>1.08 (.94)</td>
<td>.52 (1.27)</td>
<td>.83 (1.10)</td>
<td>.49 (1.24)</td>
<td>15.27 ***</td>
<td>1 &gt; 3,4,5,2 &gt; 5</td>
</tr>
<tr>
<td>Dirty hands</td>
<td>.03</td>
<td>1.02 (1.25)</td>
<td>1.17 (1.09)</td>
<td>.93 (1.16)</td>
<td>.89 (1.37)</td>
<td>1.02 (1.22)</td>
<td>.59</td>
<td></td>
</tr>
<tr>
<td>During weekend</td>
<td>.19</td>
<td>.74 (1.16)</td>
<td>.52 (1.12)</td>
<td>.57 (1.10)</td>
<td>.32 (1.14)</td>
<td>.40 (1.16)</td>
<td>2.14</td>
<td></td>
</tr>
<tr>
<td>When sick</td>
<td>.05</td>
<td>1.05 (1.16)</td>
<td>.82 (1.18)</td>
<td>.93 (1.26)</td>
<td>.76 (1.21)</td>
<td>.93 (1.07)</td>
<td>.90</td>
<td></td>
</tr>
<tr>
<td>When in a hurry</td>
<td>.52</td>
<td>.09 (1.24)</td>
<td>-.41 (1.12)</td>
<td>-.62 (1.08)</td>
<td>-.48 (1.21)</td>
<td>-.81 (1.17)</td>
<td>10.68 ***</td>
<td>1 &gt; All</td>
</tr>
<tr>
<td>When stressed</td>
<td>.48</td>
<td>.86 (1.10)</td>
<td>.56 (1.01)</td>
<td>.38 (1.06)</td>
<td>.18 (1.10)</td>
<td>.12 (1.12)</td>
<td>9.53 ***</td>
<td>1 &gt; 4,5,2 &gt; 5</td>
</tr>
<tr>
<td>Low on money</td>
<td>.32</td>
<td>.57 (1.28)</td>
<td>-.11 (1.22)</td>
<td>-.02 (1.54)</td>
<td>.07 (1.35)</td>
<td>-.12 (1.33)</td>
<td>5.76 ***</td>
<td>1 &gt; 2,5</td>
</tr>
<tr>
<td>During weekdays</td>
<td>.32</td>
<td>1.08 (.97)</td>
<td>.78 (.96)</td>
<td>.52 (.99)</td>
<td>.75 (.95)</td>
<td>.64 (1.05)</td>
<td>4.35 ***</td>
<td>1 &gt; 3,5</td>
</tr>
<tr>
<td>During winter</td>
<td>.29</td>
<td>1.07 (1.06)</td>
<td>.78 (.99)</td>
<td>.50 (.99)</td>
<td>.79 (.86)</td>
<td>.68 (.99)</td>
<td>3.94 **</td>
<td>1 &gt; 3,5</td>
</tr>
</tbody>
</table>

1 = strong habit-meeting norm-intention to eat according to norm; 2 = strong habit-not meeting norm-intention to eat according to norm; 3 = strong habit-not meeting norm-no intention to eat according to norm; 4 = weak habit-not meeting norm-intention to eat according to norm; 5 = weak habit-not meeting norm-no intention to eat according to norm.

* p < .05.
** p < .01.
*** p < .001.
at increased fruit consumption may no longer need to emphasize these positive health outcomes, but may rather emphasize beliefs underlying controllability of behaviour.

Although results from the present study suggest that beliefs regarding stressful situations and situations of urgency are relevant messages that should be emphasized in health communication interventions aimed at increasing fruit consumption (Fishbein & Cappella, 2006), it is important to note the potential limitation of persuasive communication strategies in changing strongly habitual behaviours. Traditionally, such strategies have often transferred information targeted at the most salient beliefs regarding the behaviour of interest in order to change attitudinal, normative and control beliefs and motivation in a more healthy direction (McGuire, 1989; Van den Putte & Dhont, 2005). However, the weaker and often non-significant association between intention and behaviour at higher levels of habit strength implies that altered intentions do not necessarily lead to noticeable behavioural changes (De Bruijn et al., 2007, 2008, 2009; Gardner, 2009; Kremers & Brug, 2008; Verplanken, Aarts, Knippenberg, & Moonen, 1998). Furthermore, persuasive strategies often necessitate the recipient to pay attention to, and actively process, the provided information in order to maximize their effect on the targeted beliefs. Nevertheless, experimental evidence points to selective and limited information processing at higher levels of habit strength. Strong habits automatically initiate heuristic and low effort strategies (Aarts & Dijkstra, 2000; Aarts, Verplanken, & van Knippenberg, 1997; Verplanken & Aarts, 1999), rather than cognitively demanding strategies that are needed to maximize the effect of persuasive messages (Eagly & Chaiken, 1993; McGuire, 1989). Thus, whereas the discriminant analyses indicated that beliefs regarding stressful situations and situations of urgency may make sufficient fruit consumption more likely, persuasive messages transferring these beliefs may go unprocessed or unnoticed amongst those with strongly habitual insufficient fruit consumption. Importantly, more than a quarter of the sample in the discriminant analyses were strongly habitual, but insufficient fruit consumers. Although generalization of these findings to the population at large may be difficult, they do illustrate that a significant proportion of the target audience may not be readily persuaded by traditional health communication efforts. Based on this potentially problematic issue, several researchers have argued for the inclusion of a measure of habit strength during intervention design in order to determine whether the target population should be targeted with traditional persuasive efforts or alternative behavioural change strategies (De Bruijn et al., 2009; Verplanken & Wood, 2006), such as environmental interventions (Kremers, De Bruijn, Droomers, Van Lenthe, & Brug, 2007) or implementation intention strategies (Gollwitzer, 1999). Although all of these strategies have been successful at changing health behaviour in a more positive direction (Armitage, 2004; Brug, Van Lenthe, et al., 2006), they have rarely explored the moderating of habit strength on intervention effectiveness (Kremers et al., 2007; Webb, Sheeran, & Luszczynska, 2009). Clearly, more research is needed to delineate the theoretical and practical role of habit strength in the understanding of health behaviour.

A few limitations of the present study should be noted. First, cross-sectional data were used in which fruit consumption, cognitions and habit strength were assessed contemporaneously, which may artifically inflate associations between TPB variables (Budd, 1987). Although the items related to behaviour were deleted from the SRHI to partially counter this effect and the findings were in line with a recent prospective study (De Bruijn et al., 2007), cross-sectional designs nevertheless violate the causal ordering in the TPB (Budd, 1987; Liska, 1984). Furthermore, the lack of a prospective behavioural measure did not allow the creation of a profile based on successful intention translation.

Based on evidence from the physical activity domain (Rhodes & Plotnikoff, 2006; Rhodes, Plotnikoff, & Courneya, 2008), the inclusion of such a profile may reveal additional relevant targets for interventions by adding an action control profile. Second, self-reported behavioural measures were used to assess fruit consumption, which may have led to an underreporting or exaggeration of true values. Nevertheless, the questionnaire used in the present study has been validated against biomarkers and has shown medium-sized correlations with plasma concentrations of vitamin C and total and specific carotenoids (Bogers, Van Assema, et al., 2004), indicating that this questionnaire is a suitable measure for assessing fruit consumption (Van Assema et al., 2002). Third, a convenience sample of university students was used, making generalization to the general Dutch population difficult. Lower-educated people often have an unhealthier lifestyle (Van Lenthe et al., 2004), suggesting that different profiles (i.e. a lower proportion of sufficient fruit consumers) and discriminating beliefs may exist in lower-educated population segments. Consequently, future studies may need to investigate if the patterns found in the present study persist across various population segments. Fourth, data-driven cut-off points were made for habit strength to differentiate weak and strong habits. At present, research in habit strength has not yet been able to identify validated cut-off points for different levels of habit strength, making such data-driven cut-off points inevitable at present.

Despite these limitations, the results from the present study add to a growing body of research (Brug, Van Lenthe, et al., 2006; De Bruijn et al., 2007, 2008, 2009; Gardner, 2009) that illustrates the theoretical and practical relevance of incorporating a survey-based measure of habit strength in the explanation of nutrition and physical activity.

References


