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The power of habits: Unhealthy snacking behaviour is primarily predicted by habit strength

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Objective. Although increasing evidence shows the importance of habits in explaining health behaviour, many studies still rely solely on predictors that emphasize the role of conscious intentions. The present study was designed to test the importance of habit strength in explaining unhealthy snacking behaviour in a large representative community sample ($N = 1{,}103$). To test our hypothesis that habits are crucial when explaining unhealthy snacking behaviour, their role was compared to the 'Power of Food', a related construct that addresses sensitivity to food cues in the environment. Moreover, the relation between Power of Food and unhealthy snacking habits was assessed.

Design and Methods. A prospective design was used to determine the impact of habits in relation to intention, Power of Food and a number of demographic variables. One month after filling out the questionnaire, including measures of habit strength and Power of Food, participants reported their unhealthy snacking behaviour by means of a 7-day snack diary.

Results. Results showed that habit strength was the most important predictor, outperforming all other variables in explaining unhealthy snack intake.

Conclusions. The findings demonstrate that snacking habits provide a unique contribution in explaining unhealthy snacking behaviour, stressing the importance of addressing habit strength in further research and interventions concerning unhealthy snacking behaviour.

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Statement of contribution

What is already known on this subject?

Although increasing evidence shows the importance of habits in predicting a variety of behaviours (e.g., Aarts, Verplanken, & Van Knippenberg, 1998), including health behaviours (e.g., De Bruijn, 2010), with regard to unhealthy snacking behaviour, only one study demonstrated that habit strength is the most important predictor of unhealthy snacking behaviour (Verplanken, 2006). However, as this study was conducted among a student sample, the role of habits in unhealthy snacking behaviour has as of yet not been examined in a community sample. In addition, the role of habits has not yet been compared to the 'Power of Food', a related construct that addresses sensitivity to food cues in the environment.

What does this study add?

The present study was the first to examine unhealthy snacking behaviour among a large representative community sample (N = 1103), showing that the importance of habits in unhealthy snacking behaviour can be extended to the general population. In addition, the present study included the intention to eat more healthily, habit strength and the Power of Food, and demonstrated that habit strength is the most important predictor of unhealthy snacking behaviour, stressing the importance of addressing habits in further research and interventions concerning unhealthy snacking behaviour.

Many people intend to change their unhealthy behaviours, such as their bad habit of consuming high-caloric foods. For most of them, however, it seems little is needed (e.g., only the smell of fresh baked cookies) to forget about their good intentions and to maintain their old behaviour. Nevertheless, many theories in health psychology identify goal intentions (e.g., 'I intend to eat more healthily!') as the key predictor of behaviour change (e.g., Ajzen, 1991; Carver & Scheier, 1998), thereby assuming that one's behaviour is a result of conscious goals and plans, rather than of situational influences such as the sight or smell of tempting food. In recent years, however, it has been demonstrated convincingly that a large part of our behaviour occurs automatically, without conscious processes being involved (e.g., Aarts, Verplanken, & Van Knippenberg, 1998).

Despite compelling evidence for the importance of automaticity in health behaviour, many studies still rely solely on conscious predictors and fail to include measures of automaticity, such as habit strength, when aiming to predict changes in health behaviour. In the present study, we aim to address this gap in the literature by specifically focusing on the role of habits in predicting unhealthy snacking behaviour. Examining unhealthy snacking behaviour is of particular interest as many people have the intention to eat fewer unhealthy snacks, but often fail to do so (Kumanyika *et al*., 2000). We propose that habits (Verplanken, 2006) play a particularly large role in unhealthy snacking behaviour, which may explain why so many people fail to act upon their good intentions and continue to consume tempting, but unhealthy snacks.

Habits and health behaviour

Habits develop when a specific action to achieve a particular goal is performed repeatedly under the same situational condition, thereby creating a mental association between the goal and the situation triggering the behavioural response (Aarts & Dijksterhuis, 2000; Orbell & Verplanken, 2010; Ouellette & Wood, 1998). The more frequently such a particular behaviour is performed, the more likely that it becomes habitual (Verplanken & Orbell, 2003). Habits are, however, more than just repeated sequences of action (Orbell

& Verplanken, 2010). For one, habits are performed in a stable context, as a response to a particular situation or external cue (Ouellette & Wood, 1998). In addition, and arguably most importantly, habits are performed *automatically* (Aarts & Dijksterhuis, 2000; Orbell & Verplanken, 2010; Verplanken & Aarts, 1999; Verplanken & Orbell, 2003). The notion that habits are automatic entails that they are performed efficiently, effortlessly, unconsciously, unintentionally, and with little controllability (Aarts *et al*., 1998; Bargh, 1994); and precisely these characteristics make habits hard to change when they become unwanted.

In recent years, the importance of habits in predicting the performance of health behaviours has been acknowledged in studies investigating a variety of behaviours such as fruit intake (De Bruijn, 2010; De Bruijn, Kremers, De Vet, De Nooijer, Van Mechelen, & Brug, 2007) and exercising (De Bruijn & Rhodes, 2010). Remarkably, however, the role of habit strength has not been investigated frequently in the context of unhealthy eating behaviours such as fat intake or snack consumption. To date, only one study showed the importance of habits in fat intake (De Bruijn, Kroeze, Oenema, & Brug, 2008), and one study demonstrated that habits predicted unhealthy snacking above and beyond constructs derived from the Theory of Planned Behaviour (such as intention and attitude) (Verplanken, 2006). Importantly, both studies included restricted samples such as students (Verplanken, 2006) or participants of a nutrition education intervention (De Bruijn *et al*., 2008). Despite their importance, the role of habits in unhealthy snacking behaviour has as of yet not been examined in a community sample.

The lack of studies investigating the role of habits in predicting unhealthy food intake, particularly in community samples, is in line with the observation that the large majority of interventions that aim to decrease unhealthy food intake do so by educating people about healthy eating and by motivating them to eat more healthily (Korinth, Schiess, & Westenhoefer, 2009). Yet, if the targeted behaviour is performed habitually, better knowledge and increased motivation are insufficient to achieve behaviour change. In other words, current interventions that focus on traditional predictors of health behaviour, such as attitudes and intentions, are unlikely to be effective when unhealthy snacking behaviour is largely habitual (Verplanken & Wood, 2006; Wansink, 2010). More insight into the role of habits in unhealthy snacking behaviour in a community sample would therefore not only serve to explain why the effects of many existing interventions are rather disappointing (Wansink, 2010), but would also push the field forward with regard to designing more effective interventions in the area of healthy eating and weight management.

In the present study, we seek to gain more insight into the role of habits in predicting unhealthy food intake. Specifically, we aim to investigate whether habits provide an important and unique contribution in explaining unhealthy snacking behaviour. To that purpose, we will employ the most well known and frequently used measure of habit strength, the Self-Reported Habit Index (SRHI; Verplanken & Orbell, 2003) that addresses the extent to which a behaviour is performed frequently, automatically, and as an expression of one's identity. To investigate the relative importance of unhealthy snacking habits, we will also include another important, and conceptually related predictor of unhealthy food intake – the Power of Food (Lowe *et al*., 2009).

The Power of Food is a construct that taps into an individual's psychological sensitivity to the food-abundant environment (Lowe *et al*., 2009). The current widespread availability of highly palatable but unhealthy snacks leads people in constant temptation of consuming food. However, not all people react to this environment in the same way. As the reinforcing value of food varies among individuals (Saelens & Epstein, 1996), some people may be more responsive to food temptations than others (Lowe *et al*., 2009).

This responsiveness is addressed in the Power of Food Scale (PFS). Specifically, the PFS measures the appetitive drive to consume hedonic foods, induced by the sensitivity to cues in the food environment (Lowe *et al*., 2009). The Power of Food construct explicitly involves the allure of unhealthy but highly palatable foods, rather than food in general (Lowe *et al*., 2009). Moreover, the PFS exclusively refers to an environment where people have abundant access to food, and specifically addresses the sensitivity to the hedonic aspects of this food environment (Lowe & Butryn, 2007). The PFS employs questions such as 'If I see or smell a food I like, I get a powerful urge to have some', to measure this sensitivity (Lowe *et al*., 2009). The PFS thus does not measure actual intake of unhealthy yet hedonic foods, but rather taps into people's sensitivity to food cues in today's food-abundant environment and may thus serve as a predictor of unhealthy food intake (Lowe *et al*., 2009). Indeed, recent evidence shows the importance of the Power of Food in predicting unhealthy eating behaviour (e.g., Cappelleri *et al*., 2009; Forman, Hoffman, McGrath, Herbert, Brandsma, & Lowe, 2007).

Although the Power of Food differs substantially from habits as it taps into a precondition for consuming unhealthy foods (i.e., the sensitivity to food cues), whereas habits tap into characteristics of the actual behaviour (i.e., repetitiveness and automaticity; Verplanken & Orbell, 2003), there is also considerable conceptual overlap between the two constructs. Specifically, in addition to being repetitive and automatic, another characteristic of habits is that they are performed in stable contexts (e.g., Wood & Neal, 2007; Wood, Tam, & Guerrero Witt, 2005). Although context stability is not addressed directly by the SRHI as this is a feature of the conditions under which habits are created and performed, rather than of the habitual behaviour itself, still, habits develop only in case the behaviour is performed repetitively *in a stable context*. In other words, habits are created only when a behaviour is frequently triggered by the same food-related external or internal cues. The Power of Food, addressing the sensitivity to these food-related cues, could thus very well be strongly related to the degree to which the eating behaviour is habitual. Assuming that the Power of Food and unhealthy snacking habits have sufficient discriminant validity, it could even be expected that habit strength could potentially mediate the relation between the Power of Food and unhealthy snacking behaviour,[1] as it makes sense to assume that those individuals who are more sensitive to food-related cues in the environment may be more likely to create strong unhealthy eating habits, which in turn predicts more unhealthy snacking behaviour. In the present study, therefore, both the habit to eat unhealthy snacks and the Power of Food are considered as predictors of unhealthy snack intake in order to investigate their (unique) predictive validity in explaining unhealthy snacking behaviour as well as their underlying relation.

Present study

The present prospective study was designed to test our hypothesis that habit strength is the most important predictor of unhealthy snacking behaviour in a large community sample. The objective of the present study is two-fold. First, we aim to examine whether habit strength is a unique predictor of unhealthy snacking behaviour or whether it is merely another measure to tap into people's sensitivity to food cues, like the Power of Food. It is expected that the concepts of the Power of Food and habits are both

[1] *We would like to thank Bas Verplanken for his valuable suggestion to include this mediation analysis.*

predictors of unhealthy snack intake and that they are also closely related, but not to such an extent that their discriminant validity is compromised. Second, we seek to examine how these constructs relate to each other and whether habit strength possibly mediates the relationship between the Power of Food and unhealthy snacking behaviour.

Habit strength was also compared to the intention to eat more healthily, as the most commonly included 'traditional' predictor of health behaviours. On the one hand, people are often motivated to eat more healthily, but on the other hand, it is expected that people are automatically triggered to eat unhealthy snacks and, despite their good intentions, to have little control over their habits. By including these two conflicting forces of habit and intention, the relative importance of automatic behaviours and consciously formulated intentions can be investigated. It is expected that habit strength is the most important predictor of unhealthy snacking behaviour, above and beyond constructs such as the Power of Food and intention.

Method

Participants

This study draws on data of the Longitudinal Internet Studies for Social Sciences (LISS) panel of CentERdata, a large Internet survey panel that is based on a true probability sample of households drawn from the population register by Statistics Netherlands (De Vos, 2010). Two thousand and twenty-one members of the LISS panel were randomly selected and invited to participate in the study. Of these, 1,383 agreed to participate (response rate: 68.4%). Participation was defined as filling out an online snack diary for at least 4 of the 7 days (see *Procedure*). A drop-out analysis was conducted to test significant differences in age, education, Body Mass Index (BMI: kg/m^2), perceived health consequences, Power of Food, intention to eat more healthily, and habit strength (see *Questionnaire*) between participants and non-respondents. Analyses showed that participants were older (mean age 51.40 vs. 47.05 years), had a lower intention to eat healthily ($M = 3.09$ vs. $M = 3.22$), and a slightly weaker habit to eat unhealthy snacks ($M = 2.43$ vs. $M = 2.63$) than non-respondents (all ps $< .05$). However, all effect sizes were very small (all $\eta_p^2 \leq .01$).

Participants with a BMI below 18.50 (which may indicate a pathological eating disorder; WHO, 2003; $N = 20$), older than 70 years (because BMI scores are no longer reliable for people older than 70 years; Dutch Nutrition Centre, 2010a; $N = 124$), who reported complete meals instead of snacks ($N = 43$), and who did not complete the entire questionnaire ($N = 2$) were excluded from the analyses. This resulted in a sample consisting of 1,103 participants (488 men, 615 women, mean age 48.74 years, $SD = 14.10$, mean BMI 25.72, $SD = 4.51$, including normal weight and overweight participants). Of these participants, 34% had a low level of education (elementary school or lower general secondary education), 33% finished a middle education level (intermediate vocational education, higher general secondary education, or pre-university education), and 33% held a diploma in higher education (higher vocational education or university). Most participants were married (59%), 28% had never been married, 10% were divorced, and 3% were a widow(er).

Procedure

Participants of the LISS panel were approached to join a large Internet survey on snacking behaviour. Respondents who agreed to participate filled out the survey online.

Participants were asked to fill out several questionnaires regarding their eating behaviour, which were part of a larger survey. The study was conducted in July 2010. Approximately 1 month after administering the questionnaires, participants were approached again and requested to keep an online snack diary for 7 days, reporting their healthy and unhealthy snacks once a day. After completing the study, participants were debriefed and thanked.

Questionnaire

Demographic variables

Demographic variables were provided by CentERdata, including gender, age, weight, height, education level, and marital status.

Habit strength

Participants filled out the SRHI (Verplanken & Orbell, 2003) which was adapted to measure the habit to eat unhealthy snacks (Cronbach's $\alpha = .95$). The SRHI includes 12 items that address behaviour repetition, automaticity (lack of control and awareness, efficiency), and expressed identity (e.g., 'Eating unhealthy snacks is something I do frequently/ I do automatically/ that's typically "me" '.). Participants rated their answers on 7-point scales from 1 (*totally disagree*) to 7 (*totally agree*).

Intention

The intention to eat more healthily was measured by two items ('I want to/plan to eat more healthily'. $r = .79$, $p < .001$), on 5-point scales from 1 (*totally disagree*) to 5 (*totally agree*).

Power of Food

Participants filled out the PFS (Lowe *et al*., 2009; measuring the psychological sensitivity to today's food-abundant environment with 15 items (e.g., 'If I see or smell a food I like, I get a powerful urge to have some'. Cronbach's $\alpha = .89$). Participants rated their answers on 5-point scales from 1 (*totally disagree*) to 5 (*totally agree*).

Perceived health consequences

To control for possible individual differences in perceived health consequences of unhealthy eating, three items were used ('To what extent do you think eating habits have consequences for heart and vascular diseases/obesity/cancer?' Cronbach's $\alpha = .74$) which could be answered on 4-point scales ranging from 1 (*no consequences*) to 4 (*large consequences*).

Snack diary

Participants monitored their snack intake by keeping a 7-day online snack diary. This diary, which has been previously used and developed in collaboration with a registered dietician (e.g., Adriaanse, De Ridder & De Wit, 2009), consisted of one column with 12 options for healthy snacks (e.g., apple) and one column with 13 options for unhealthy snacks (e.g., cookie). For both snack categories, also an option 'other' was provided, where participants could specify what 'other' snack they had consumed during that day. A snack was defined as any food consumed in between the regular meals (breakfast,

lunch, and dinner). When participants reported taking a snack, they were additionally asked to specify how much of that snack they had consumed, in appropriate units ('pieces' for fruit or 'handful' for chips). Participants were instructed to fill out the diary every evening when they did not expect to eat anymore for that day, even if they had not consumed any snacks. As the present study focuses on unhealthy snacking behaviour, only unhealthy snacks will be taken into account.

Data analyses

Caloric intake from unhealthy snacks was calculated in average amount of kilocalories per day, by multiplying each reported snack with the average amount of calories that snack contains, multiplied by the amount of that snack taken. Averages were derived from the Dutch Nutrition Centre (2010b). Data were analyzed using SPSS software version 16.0 (SPSS Inc., Chicago, IL).

Results

Descriptive statistics and correlations

Mean scores, standard deviations, and correlations from all study variables are presented in Table 1. Participants consumed approximately 327 kcal from unhealthy snacks on average per day and reported a moderate sensitivity to food cues, a moderate intention to eat more healthily, high perceived health consequences, and low-to-moderate unhealthy snacking habits. Having a higher intention to eat more healthily was positively correlated to caloric intake from unhealthy snacks, the Power of Food, and habit strength. In addition, the Power of Food and habit strength were highly positively correlated and shared approximately 21% of their variance.

Predicting consumption of unhealthy snacks

A hierarchical multiple regression analysis was conducted to test our hypothesis that habit strength is the most important predictor of unhealthy snacking behaviour. Caloric

Table 1. Bivariate correlations, mean scores, and standard deviations for study variables

	1	2	3	4	5	6	7	8
Daily unhealthy snack intake (kcal)	-							
Gender (1 = men, 0 = women)	−.07*	-						
Age	−.02	−.07*	-					
BMI	.03	−.02	.21**	-				
Perceived health consequences (4-points scale)	.02	−.07*	.00	−.09**	-			
Intention (5- points scale)	.10**	.00	−.23**	−.13**	.02	-		
Power of Food (5-points scale)	.15**	−.07*	−.20**	.15**	.02	.28**	-	
Habit strength (7-points scale)	.23**	−.05	−.23**	.12**	−.12**	.28**	.46**	-
M	326.98	44%	48.74	25.72	3.11	3.11	2.47	2.46
SD	227.50		14.10	4.51	.57	.87	.56	1.30

*$p < .05$; **$p < .01$.

Table 2. Standardized regression coefficients and explained variance from hierarchical regression analyses with caloric intake from unhealthy snacks as dependent variable, and gender, age, BMI, marital status, education, (step 1); perceived health consequences, intention, Power of Food (step 2); and habit strength (step 3) as independent variables ($N = 1{,}103$)

	Step 1		Step 2			Step 3		
	β	R^2	β	R^2	*F*-change (df)	β	R^2	*F*-change (df)
Gender	.08*	.01	.09**	.04	14.826 (2)	.07*	.06	33.484 (1)
Age	−.05		.00			.03		
BMI	.04		.00			−.01		
Married	.01		.03			.03		
Low education	.03		.02			.02		
Middle education	.01		.01			.01		
Perceived health consequences	.03		.03			.05		
Intention			.07*			.04		
Power of Food			.14**			.06		
Habit strength						.20**		

*$p < .05$; **$p < .01$.

intake from unhealthy snacks was used as the dependent variable. The following variables were entered as predictors: gender, age, BMI, education level, and marital status in step 1; the intention to eat more healthily, perceived health consequences, and Power of Food in step 2; and habit strength in step 3. The results of this analysis are shown in Table 2. All three steps were significant. In step 1, only gender significantly predicted caloric intake from unhealthy snacks, showing that men had a higher caloric intake from unhealthy snacks. In step 2, intention to eat more healthily and the Power of Food were additionally significant predictors, indicating that participants with a higher intention to eat more healthily and participants who were more sensitive to the Power of Food had a higher caloric intake from unhealthy snacks. However, when habit strength was added in the final step, only gender and habit strength remained significant predictors, indicating that men and participants with a stronger habit to eat unhealthy snacks had a higher caloric intake from unhealthy snacks. Moreover, the results showed that habit strength was clearly the most important predictor of daily intake of kilocalories from unhealthy snacks.

To test for potential interaction effects from habit strength with the other variables, eight separate regression analyses were conducted, adding an interaction term for habit strength by, respectively, gender, education level, BMI, marital status, age, perceived health consequences, intention to eat more healthily, and the Power of Food in an additional fourth step. Interaction terms were computed by centring each variable and multiplying it by the centred value of habit strength in order to reduce possible multi-collinearity (Aiken & West, 1991). Regression analyses showed that none of the interaction terms caused an improvement of the model (all $\Delta R^2 < .01$). A post-hoc power analysis indicated that this lack of significant interactions was not due to low power as the current sample size ensured sufficient power (>.80) to detect significant effects with an effect size as small as $\eta^2 = 0.007$.

Mediation analysis

To further explore the relationship between habit strength and Power of Food in predicting consumption of unhealthy snacks, we examined whether habit strength mediates the relation between the PFS and unhealthy snacking behaviour according to the steps by Baron and Kenny (1986). Using multiple regression analyses, it was first examined whether the PFS predicted caloric intake from unhealthy snacks. There was indeed a significant effect ($\beta = 0.15$, $p < .001$). In a second regression analysis, it was found that the PFS was related to habit strength ($\beta = 0.46$, $p < .001$). A third regression analysis that included the PFS and habit strength as predictors, showed that habit strength indeed predict caloric intake from unhealthy snacks ($\beta = 0.20$, $p < .001$). Moreover, results from this third regression analysis indicated that the effect of the PFS predicting caloric intake from unhealthy snacks reduced substantially when controlling for habit strength ($\beta = 0.06$, $p = .07$).

A Sobel test was subsequently performed to test whether this drop in Beta weight was significant (Sobel, 1982). This analysis was also found significant, $p < .001$, suggesting that habit strength mediates the relation between the PFS and caloric intake from unhealthy snacks. Notably, no evidence was found for a mediation effect of the PFS on the relation between habit strength and caloric intake from unhealthy snacks, as this relation remained similar after controlling for the PFS ($\beta = 0.20$, $p < .001$; without controlling: $\beta = 0.23$, $p < .001$).

Discussion

The present study was designed to examine the role of habit strength in explaining unhealthy snacking behaviour, using prospective data from over 1,100 participants from a representative community sample. To determine whether habits have unique predictive power that is essential when predicting unhealthy snacking behaviour, we also included the PFS. This construct is related to habits in that it also emphasizes the importance of environmental cues. However, the Power of Food merely taps into a precondition for consuming unhealthy foods, namely, the sensitivity to food cues, whereas habits address characteristics of the actual behaviour (i.e., repetitiveness and automaticity). Before habit strength was included in the analysis, it was found that the Power of Food was a significant predictor of unhealthy snacking behaviour, suggesting that it is indeed important in explaining this behaviour. However, in line with our hypothesis, when habit strength was added to the analysis, the Power of Food was no longer a significant predictor of snack intake. This result signifies that although habit strength has some conceptual overlap with the Power of Food, it also contains an important unique contribution. In fact, habit strength turned out to be the most important predictor of unhealthy snacking behaviour, outperforming all other variables. Moreover, additional analyses showed that unhealthy snacking behaviour is predicted by habits regardless of gender, education level, BMI, marital status, age, perceived health consequences, intention, or the Power of Food, indicating that the effect of habits is very robust and, unlike most other variables important in explaining eating behaviour, have implications regardless of other characteristics.

As the Power of Food and habit strength were strongly correlated and there were theoretical grounds for suspecting that habit strength could possibly explain part of the relation between the Power of Food and unhealthy snacking behaviour, a mediation analysis was conducted. This analysis indeed showed that habit strength mediates the

relation between Power of Food and unhealthy snacking behaviour, implying that people who are highly sensitive to food cues are more likely to create strong unhealthy snacking habits, which in turn triggers more unhealthy snacking behaviour. Notably, no evidence was found for a mediating effect of the Power of Food on the relation between habit strength and unhealthy snacking behaviour. Although these results provide an important and novel first insight into the relation between Power of Food and habit strength on unhealthy food consumption, it is important to note that the present results have to be interpreted with caution, as in our study, habit strength and Power of Food were measured at the same time and causality can therefore not be assumed.

The result that unhealthy snacking behaviour is primarily predicted by habit strength is in line with previous research by Verplanken (2006). However, our findings also extend this research as the present study was the first to investigate the role of unhealthy snacking habits in a large community sample, suggesting that the importance of habits in unhealthy snacking behaviour can be extended to the general population. Moreover, in addition to establishing the direct effect of habits on unhealthy snack intake, the present study was novel in for the first time demonstrating how habits may explain the previously found relation (e.g., Forman *et al*., 2007) between the Power of Food and unhealthy food intake. The present findings thereby add to the growing body of literature showing the predictive validity of habits in health behaviour (i.e., De Bruijn, 2010; De Bruijn *et al*., 2007) and emphasize that habits should not be neglected when explaining health behaviour.

In the present study, some interesting correlations were found that warrant more attention. For one, it was found that intention to eat more healthily was positively related to habit strength, which may seem surprising. Note, however, that the present measure of intention assessed the intention to eat *more* healthily and thus captured the motivation to *change* one's eating behaviour. It is thus to be expected that people who have a habit to eat unhealthy snacks, and consequently consume more snacks, have a stronger motivation to change their food intake than those people whose eating habits are already relatively healthy. A similar rationale holds for the relation between intention to eat more healthily and unhealthy snack intake, as people who consume many unhealthy snacks are likely to be more motivated to change this behaviour than people who already eat few unhealthy snacks.

Previous research examining the role of habits in health behaviour has often shown that habits have a moderating effect on the role of intentions in behaviour. Specifically, these studies generally find that intentions strongly predict behaviour in case of weak habits, but that in case of strong habits, intentions are hardly predictive (e.g., De Bruijn, 2010; Verplanken & Aarts, 1999; Verplanken & Wood, 2006). In the present study, no evidence was found for such an interaction effect. One explanation for this finding may be that in the present study, measures for habit strength and intention comprised two different behaviours, that is, the habit to eat unhealthy snacks and the intention to eat more healthily. Although eating more healthily encompasses many healthier eating behaviours, and thus also consuming less unhealthy snacks, still this measure is conceptually more broad, which might explain the absence of an interaction effect in the present study. However, as evidence can be found in the literature for both the presence (e.g., De Bruijn, 2010) and the absence (e.g., Verplanken & Faes, 1999) of the moderating role of intention on the relation between habit and behaviour, this is an issue that needs further investigation in future research.

The present findings may shed new light on existing interventions that aim to alter unhealthy eating behaviour. Considering that habit strength is the most important

predictor of unhealthy snack intake, interventions trying to change people's knowledge and intentions are likely to have only minimal effects (Orbell & Verplanken, 2010; Verplanken & Wood, 2006). This does not mean that intentions should not be targeted in interventions, because having a strong motivation is often a prerequisite for interventions that focus specifically on changing habits, such as implementation intentions (Adriaanse, Gollwitzer, De Ridder, De Wit, & Kroese, 2011). However, additional skills or techniques are required in order to act upon this intention and actually change unhealthy snacking behaviour.

For example, Wansink (2010) has suggested that a technique called 'The Power of Three' could help to replace old eating habits with good ones. This entails that for 1 month, people choose three behaviours they will change each day and are asked at the end of the day which of these changes they have accomplished. In this way, people are more mindful of their behaviour, and, if performed consistently, it could result in the replacement of the old behaviour with a new, positive habit (Wansink, 2010).

Another promising option is the use of implementation intentions (Gollwitzer, 1999). Increasing evidence shows that implementation intentions are very successful in changing unwanted habits, including the replacement of unhealthy snacking habits with healthy ones (Adriaanse *et al*., 2011). Implementation intentions specify where, when, and how to act to obtain a particular goal (Gollwitzer, 1999). Using just one sentence following the structure of 'If situation X arises, then I will perform goal-directed behaviour Y' (e.g., in case of having the habit to eat chocolate when bored; 'If I am bored and feel like eating a snack, then I will eat an apple'), this tool shows very promising results in changing unhealthy snacking habits (Adriaanse *et al*., 2009), and, because of its simple format, may be very applicable to be used in interventions targeting unhealthy snacking behaviours.

A few limitations of the present study should be noted. First, one disadvantage of the survey design used in the present study is the interpretability of causality. Based on the findings, no firm conclusions can be drawn on whether snacking habits induce consumption of unhealthy snacks, or vice versa. However, the present study adopted a prospective design, obtaining questionnaires about 1 month before unhealthy snacking behaviour was measured, which may largely preclude this concern. A second limitation is that unhealthy snack consumption was assessed using self-report measures. Although monitoring food intake by means of a diary is vulnerable to incomplete data or underreporting, it is found to be a high-quality outcome measure to asses snack intake (Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011) and is regarded as a highly valid method, most closely resembling actual food intake (De Castro, 2000). Specifically, compared to most studies investigating food intake, the present study could be considered methodologically very strong, as only few studies use (a) prospective designs with a 1-month time interval, (b) employ a 7-day snack diary in (c) over 1,100 participants of a community sample.

The present study adds to our understanding of eating behaviour, showing that habits play an essential role in explaining unhealthy snacking behaviour. It is important to note that the present study is conducted in a large community sample, adding to the generalizability of the findings to the general population. Therefore, we believe that the current findings give new insight into unhealthy snacking behaviour and the importance of habits, showing that habits provide a unique contribution in explaining eating behaviour by showing that unhealthy snacking behaviour is primarily predicted by habit strength.

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