Appetite 56 (2011) 183–193

Contents lists available at ScienceDirect

Appetite

journal homepage: www.elsevier.com/locate/appet

Research review

Do implementation intentions help to eat a healthy diet? A systematic review and meta-analysis of the empirical evidence

Marieke A. Adriaanse [a,*], Charlotte D.W. Vinkers [a], Denise T.D. De Ridder [a], Joop J. Hox [b], John B.F. De Wit [c,d]

[a] Department of Clinical & Health Psychology, Utrecht University, PO Box 80140, 3508 TC Utrecht, The Netherlands
[b] Utrecht University, Department of Methodology and Statistics, The Netherlands
[c] Utrecht University, Department of Social and Organizational Psychology, The Netherlands
[d] University of New South Wales, National Centre in HIV Social Research, Australia

ARTICLE INFO

Article history:
Received 17 May 2010
Received in revised form 14 September 2010
Accepted 29 October 2010
Available online 5 November 2010

Keywords:
Implementation intentions
Action planning
Food
Healthy
Unhealthy

ABSTRACT

Objective: This systematic review and meta-analysis examined whether implementation intentions are an effective tool to help people put their intentions to eat a healthy diet into practice. Additionally, it was investigated whether the quality of the outcome measures and the quality of the control conditions that are used in these studies influence implementation intentions' effectiveness. *Methods*: Twenty three empirical studies investigating the effect of implementation intentions on eating behavior were included. In assessing the empirical evidence, a distinction was made between studies that aim to increase healthy eating (i.e., eating more fruits) and studies that aim to diminish unhealthy eating (i.e., eating fewer unhealthy snacks). *Results*: Implementation intentions are an effective tool for promoting the inclusion of healthy food items in one's diet (Cohen's $d = .51$), but results for diminishing unhealthy eating patterns are less strong (Cohen's $d = .29$). For studies aiming to increase healthy eating, it was found that higher quality outcome measures and lower quality control conditions tended to yield stronger effects. *Conclusion*: Implementation intentions are somewhat more effective in promoting healthy eating than in diminishing unhealthy eating, although for some studies promoting healthy eating effect sizes may have been inflated due to less than optimal control conditions.

Contents

* Corresponding author.
E-mail address: M.A.Adriaanse@uu.nl (M.A. Adriaanse).

0195-6663/$ – see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.appet.2010.10.012

Introduction

Eating a healthy diet reduces the likelihood of becoming overweight or chronically ill (Gandini, Merzenich, Robertson, & Boyle, 2000; Hooper et al., 2001). The World Health Organization therefore recommends that people limit their intake of (trans- and saturated) fat, sugar, and salt while increasing the consumption of fruits, vegetables, legumes, whole grains and nuts (http://www.who.int/dietphysicalactivity/diet/en/print.html). Many people are aware of the health benefits of eating a healthy diet (O'Brien & Davies, 2007), and are hence motivated to eat healthily. This general motivation to eat healthily is also illustrated by the many books, workshops, and websites that are available to help individuals eat healthily.

However, the very fact that there are so many sources available that offer help in eating a healthy diet also illustrates the apparent difficulty people have with eating healthily. Indeed, it has been found that although many people have the intention to eat a healthy diet, very few succeed in actually doing so (Kumanyika et al., 2000). This gap between good intentions and actual behavior is not unique to healthy eating behavior, but reflects a common observation in psychological research that intentions alone are generally insufficient to ensure actual goal-directed behavior (Webb & Sheeran, 2006).

One reason why being strongly motivated to perform a certain behavior is not enough to ensure behavioral enactment is that successful goal-striving is dependent on psychological resources, such as memory, attention, and self-control. These resources are limited, however, so that when resources are depleted, several self-regulatory problems may hinder the process of successful goal striving (Gollwitzer & Sheeran, 2006). For example, when we are tired or focused on other activities, we may fail to remember our intentions, or we may miss good opportunities to act on our intentions (Gollwitzer & Sheeran, 2006).

Yet, acting in line with one's intentions is not impossible, even when resources are low. Over the past decade, accumulated evidence has indicated that when goal-intentions are furnished with specific action plans, labeled *implementation intentions*, the self-regulatory problems such as the ones described above hinder goal-striving to a much lesser extent (for an overview see Gollwitzer & Sheeran, 2006). Unlike intentions that merely specify a desired end-state (e.g., "I want to eat more fruits!"), implementation intentions specify the where, when, and how of goal-striving. Specifically, implementation intentions stipulate a particular situation that represents a good opportunity for goal-directed action and then link this situation to a specific goal-directed action which increases the likelihood that this behavior is enacted (e.g., "If I am at home and I want to have some desert after dinner, then I will make myself a fruit salad"; Gollwitzer, 1999).

There are two processes contributing to implementation intentions' effectiveness in promoting goal-directed behavior. First, by specifying a critical situation in advance, this situation becomes strongly accessible in memory, which increases the likelihood that this situation, when encountered, is recognized as a good opportunity to act upon one's intentions. Second, an if-then format is used to link the situation to a specific goal-directed behavior. As a result, control of the behavior is delegated from the self to the specified situation so that the goal-directed behavior is activated *automatically* upon encountering the situation. This means that limited available resources such as memory, attention, and self-control are no longer required to act upon one's intentions (Gollwitzer, 1999; Parks-Stamm, Gollwitzer, & Oettingen, 2007).

Implementation intentions have been found to promote numerous health behaviors, such as vitamin C intake (Sheeran & Orbell, 1999), exercising (Milne, Orbell, & Sheeran, 2002; Prestwich, Lawton, & Conner, 2003; Rise, Thompson, & Verplanken, 2003), and performing breast self-examination (Orbell, Hodgkins, & Sheeran, 1997). Yet, the type of health behavior for which the use of implementation intentions has been tested particularly frequently in recent years is healthy eating. This is not surprising as healthy eating is typically seen as a difficult and complex behavior that is susceptible to self-regulatory failures, despite the presence of strong intentions to eat more healthily (Kumanyika et al., 2000). This not only makes healthy eating a behavior that is in need of supporting strategies like implementation intentions, but it also demonstrates that it is a behavior that is likely to benefit from implementation intentions. After all, the presence of a difficult self-regulatory problem as well as overarching goal-intentions are prerequisites for implementation intentions to be effective (Sheeran, Milne, Webb, & Gollwitzer, 2005).

However, before inclusion of this self-regulatory strategy in interventions and prevention programs can be warranted, it is important to bring together and critically assess the available empirical evidence. Although a relatively recent meta-analysis of implementation intention effects already established that implementation intentions have a medium to large effect on health behavior (Gollwitzer & Sheeran, 2006), this meta-analysis, with studies conducted between 1990 and 2003, only included two published papers on implementation intentions and healthy eating behavior (Armitage, 2004; Verplanken & Faes, 1999).

Although until 2003 few studies had tested the effectiveness of implementation intentions in promoting a healthy diet, in response to the increasing numbers of people struggling with overweight and obesity the number of studies examining psychological strategies to promote healthy eating, such as implementation intentions, has vastly increased in recent years. The present review and meta-analysis constitutes a first attempt to bring together these relatively novel empirical studies to evaluate the effectiveness of implementation intentions in promoting healthy eating behavior.

Following a suggestion by Gollwitzer and Sheeran (2006), results will be described separately for studies that pertain to *increasing* health *promoting* behaviors (e.g., healthy eating behaviors that promote good health, such as increasing fruit and vegetable consumption), and studies that pertain to *decreasing* health *risk* behaviors (e.g., unhealthy eating behaviors that are detrimental to good health, such as saturated fat intake and unhealthy snack consumption). Making an explicit distinction between these two behaviors in the present review is warranted because, in general, diminishing existing unhealthy behaviors is more difficult than initiating new healthy behaviors (Holland, Aarts, & Langendam, 2006). In addition, from the perspective of the increasing number of people becoming overweight or obese, diminishing the intake of unhealthy foods that contain too much (saturated) fat or sugar may currently be the most pressing issue.

Method

Literature search

The electronic databases PsycInfo, Pubmed, and Web of Science were searched for journal articles published in English that included the terms "action planning" OR "implementation intentions" AND "eat" OR "food" OR "diet" and that had been published up to December 2009. In the databases PsycInfo and Pubmed the additional search criterion was added that the study should employ a human sample (this criterion was not available in Web of Science). No restrictions were made regarding publication year. This search resulted in a total of 49 different articles. A first selection of articles was made by two raters based on the information given in the abstracts, to assess whether the article described an *empirical* test of the effectiveness of *implementation*

intentions/action plans on a type of *eating behavior*. The use of planning could be either *measured* or *manipulated* and a variety of reliable (food diaries), or less reliable (single item assessments of food intake) outcome measures could be employed as long as the unique effect of planning on eating behavior could be extracted from the results.

Application of these inclusion criteria resulted in 25 relevant articles. Searching through the reference lists of these articles resulted in one additional article to be included (Reuter, Ziegelmann, Wiedemann, & Lippke, 2008). The full-text versions of these 26 articles were subsequently reviewed by two raters for a more stringent test of their appropriateness for the present review. This final, more detailed, review resulted in another five articles to be excluded because after reading the full-text article it became clear that (a) the outcome measure was not eating behavior, but rather proxies of eating behavior such as BMI or stages of change (Armitage, 2006; Luszczynska, Sobczyk, & Abraham, 2007; Wiedemann et al., 2008), (b) the article summarized other studies that were already included (Schwarzer et al., 2007), or (c) results for healthy and unhealthy eating behavior could not be distinguished (Renner et al., 2008).[1] The net result was 21 research articles describing 23 empirical studies.

Overview

The present paper is organized as follows. After presenting an overview of the included studies and a meta-analysis of the overall effectiveness of implementation intentions on eating behavior, we will discuss detailed results for studies that pertain to *increasing healthy* eating behaviors and studies that pertain to *decreasing unhealthy* eating behaviors separately. For each of these two categories, a general description of the *study characteristics* is provided, which includes the specific behavior that was assessed, the design and the sample of the study. Particular attention will be given to the outcome measures employed. After discussing each of these study characteristics, *key findings* of the studies will be reported. Finally, as studies were found to differ substantially with regard to the types of outcome measures that were used and also with regard to the strictness of the control conditions employed, in the meta-analysis it is also investigated whether, within each of the two categories, these variables moderate the effectiveness of the implementation intention manipulation. A summary of the study characteristics and key findings can be found in Table 1.

Meta-analytical strategy

Cohen's d and SE

To estimate the overall effect size and separate effect sizes for studies pertaining to increasing healthy eating and studies that pertain to decreasing unhealthy eating, Cohen's *d* and the corresponding Standard Error (SE) were calculated for all studies. Effect size calculations were based on a comparison of the control group with the planning/implementation intention (II) group on eating behavior, or, in case of cross-sectional data, on the correlation between planning and eating behavior. For studies that used pre- and post measures of eating behavior, the control group was compared to the experimental group on the (latest available) post measure to facilitate comparability with studies that did not include baseline measures of eating behavior.[2] In case multiple control conditions were employed, the effect of the implementation intention was compared against the strictest control condition. When in a study two types of implementation intentions were compared, Cohen's *d* was calculated separately for the effect of each of the implementation intentions against the (strictest) control condition.

When sufficient details regarding the means, standard deviations and sample size for both the implementation intention and the control condition were provided, Cohen's *d* was calculated using the formula: $(M_{\text{II condition}} - M_{\text{control condition}})/\sqrt{(((SD_{\text{II condition}})^2 \times (N_{\text{II condition}} - 1)) + ((SD_{\text{control condition}})^2 \times (N_{\text{control condition}} - 1)))/(NII_{\text{condition}} + N\ N_{\text{control}} - 2))}$. In case this information was not provided, Cohen's *d* was calculated based on the *F*-value for the relevant test, using the formula: $\sqrt{((F \times (N_{\text{II condition}} + N_{\text{control condition}})/(N_{\text{II condition}} \times N_{\text{control condition}})))}$. For the remaining cases where both formulas could not be utilized, but a Cohen's *d* was provided, this Cohen's *d* was used, or another effect size (e.g., *r* or $\eta 2$) was converted to Cohen's *d*.

For all studies, the SE was calculated using the formula $\sqrt{(((N_{\text{II condition}} + N_{\text{control condition}})/(N_{\text{II condition}} \times N_{\text{control condition}})) + (\text{Cohen's } d_2)/(2 \times (N_{\text{II condition}} + N_{\text{control condition}})))}$. In case two different formats of implementation intentions were used, and we thus calculated the effect of each of the implementation intentions compared to the (strictest) control condition separately, the sample size of the control condition was halved in order to prevent spurious inflation of the sample size.

Moderators

In addition to calculating Cohen's *d* and the SE for each of the studies, the quality of the outcome measure and the quality of the control condition were coded as these were expected to have a moderating influence. Four aspects of the outcome measure (the relation with the content of the implementation intentions; the degree of reliance on participants' retrospective ability; the specificity by which food intake was reported; and the time period over which food intake was reported[3]) were coded using scores of 0 (poor), 1 (adequate), or 2 (good), so that the final score of the sum of each of these components had a range of 0 (very poor) to 8 (very good). The quality of the outcome measure was coded by two independent coders ($r = .79$, $p < .001$). After coding, scores that differed 1 point between the two raters were averaged, and scores that differed more than 1 point (16.7% of cases) were discussed until consensus was reached.

The quality of the control group was also coded. Control groups in which participants were, unlike participants in the II group, not instructed to try to eat more healthily, or in which participants received considerably less instructions or feedback (except for the II instructions) than participants in the experimental group were coded as weak (0). Control groups in which all instructions and feedback, except for the II part, were similar to the experimental condition were coded as good (1). Active control groups in which the time spent working on a task related to healthy eating was also kept constant across conditions were coded as very good (2). Any interrater disagreement was resolved through discussion.

[1] Renner et al. (2008) measured the use of planning to eat healthily and was aimed at maintaining a healthy diet, which included diminishing fatty foods as well as increasing vitamin-rich foods. The sample included volunteers from universities, homes for the elderly, clerical institutions, and police departments. Healthy eating behavior was assessed using a scale with five items assessing the inclusion of vitamin-rich/healthy foods and four items addressing the exclusion of fatty foods in participants' diet. Results indicated a weak correlation between planning and dietary behavior for men, $r = .12$, and a moderate relation between planning and dietary behavior for women, $r = .28$.

[2] Baseline food intake did not differ between conditions in any of these studies.

[3] Note that the degree of reliance on participants' retrospective ability and the time period over which food intake was reported are two separate factors that do not necessarily have to overlap. A study that employs a two week daily dairy scores good on both criteria as it has low reliance on participants' retrospective ability (participants only have to remember their food intake for one day), and food intake is reported over a relatively long time period. A 24 h recall measure, however, scores good only on the first criterion: again, participants only have to remember food intake for one day, but this outcome measure only covers participants' food intake over a limited time period.

Table 1
Overview of studies included.

Study	Healthy vs. unhealthy eating	Specific type of eating behavior	Design	Main outcome measure	Time between plan and outcome measure	Sample	Effect
Achtziger et al. (2008; Study 1)	Unhealthy	High fat unhealthy snacks	Experiment with II and control condition	Retrospective self-report of the number of times specific high fat snack was consumed	1 week	Students, 20% men	Participants in the II condition consumed the unhealthy snack 1.6 times less compared to baseline. Participants in the control condition only consumed the unhealthy snack 0.7 times less.
Adriaanse et al. (2009; Study 1)	Unhealthy	Unhealthy snack consumption	Experiment with three conditions: control, situational II, motivational II	7 day snack diary	Right after manipulation	Female students	No effect of either II on unhealthy snack intake.
Adriaanse et al. (2009; Study 2)	Unhealthy	Unhealthy snack consumption	Experiment with three conditions: control, situational II, motivational II	7 day snack diary	Right after manipulation	Female students	No effect of situational II on unhealthy snack intake, but an effect of motivational II on unhealthy snack intake of −90 kcal on average per day.
Armitage (2004)	Unhealthy	Fat intake	Experiment with II and control condition	FFQ assessing intake of 63 foods over past month	1 month	Men and women from a medium sized company, 40% male	Only in the II condition, total fat intake (−3.94 g), saturated fat intake (−1.62 g), and the proportion of energy derived from fat (−0.75%) were significantly reduced compared to baseline.
Armitage (2007)	Healthy	Fruit	Experiment with II and control condition	2 items assessing fruit intake over previous 2 weeks	2 weeks	Students; 20% male	Increase of 0.19 portions of fruit per day in the II condition and no increase in control group.
Chapman et al. (2009)	Healthy	Fruit and vegetable	Experiment with 3 (intervention format: control vs. specific II vs. global II) × 2 (pre-intervention instructions: instructions vs. no instruction) design	1 item assessing fruit and vegetable intake over past week	1 week	Students, 26% male	Increase of 0.50 portions in the specific II condition compared with 0.31 in the global II condition (effect of global plan was ns.) and 0.01 in the control condition. No effect of pre-intervention instructions.
De Nooijer et al. (2006)	Healthy	Fruit	Experiment with II and control condition	14 item FFQ assessing fruit intake over 1 month + 1 item measuring self-assessed change + 1 item measuring the number of days that participants ate an extra serving of fruit	1 week	Random sample of a Dutch internet panel aged 18 years and older, 49% male	No effect on FFQ or on self-assessed change. Participants in the II condition did score significantly higher on the number of days one extra serving of fruit was consumed.
De Vries et al. (2008; Study 1)	Healthy	Fruit and vegetable	Experiment with three conditions: generic health education letter, tailored health education letter, tailored health education letter + action planning	Self-reported frequency and quantity of consuming fruit and vegetables	9 months	Random sample obtained through Dutch national telephone company	No effect of implementation intentions.
De Vries et al. (2008; Study 2)	Unhealthy	Fat	Experiment with three conditions: generic health education letter, tailored health education letter, tailored health education letter + action planning	Self-reported frequency and quantity of consuming fruit and vegetables	9 months	Random sample obtained through Dutch national telephone company	No effect of implementation intentions.

Table 1 (*Continued*)

Study	Healthy vs. unhealthy eating	Specific type of eating behavior	Design	Main outcome measure	Time between plan and outcome measure	Sample	Effect
Gratton et al. (2007)	Healthy	Fruit and vegetable	Experiment with three conditions: the volitional (II) group, the motivational group, and an irrelevant II control group.	7-day food diary	2 weeks	Children aged 11–16 years, 50% male	Significant increase of 0.52 portions of fruit a day in volitional group, compared to 0.31 in motivational group and −.04 in irrelevant II group.
Jackson et al. (2005)	Healthy	Fruit and vegetable	Experiment with three conditions: control group, TPB only group, TPB + II group	24 h recall of all foods and drinks consumed	7, 28 and 90 days	Cardiac patients, 59% male	No effect of condition.
Kellar and Abraham (2005)	Healthy	Fruit and vegetable	Experiment with two conditions: control + motivation and planning intervention	3 items assessing success in consuming the required daily intake of fruit and vegetables (RDIF) over past week	1 week	Students, 11% male	The intervention group ate the RDIFV on more days (3.03) than the control group (2.28) at follow-up.
Luszczynska and Cieslak (2009)	Healthy	Fruit and vegetable	Prospective design assessing correlation between planning and fruit consumption 6 months later	2 self-report items assessing intake over previous 2 weeks	6 months	Myocardial infarction survivors, 64% male	Correlation $r = .21$, $p < .10$.
Luszczynska and Haynes (2009)	Healthy	Fruit and Vegetable	Experiment with II and control condition	1 item assessing fruit intake on a typical day and 1 item assessing vegetable intake on a typical day	4 months	Student nurses and midwives, 11% male	Significant effect of condition: the control group participants consumed on average 2.41 portions of F and V per day, whereas the intervention group participants consumed 2.65 portions of F and V daily.
Luszczynska, Scholz, et al. (2007)	Unhealthy	Saturated fat intake	Experiment with II and control condition	The meat/snacks section of the RFS: 15 items assessing frequency of intake of meats, dairy products, spreads, and snacks over the past month	6 months	Post-uncomplicated-MI patients, 64% male.	Participants in the implementation intention condition reduced their daily total fat intake by 9 g.
Luszczynska, Sobczyk, et al. (2007)	Healthy	Fruit and vegetable	Experiment with three conditions: control, self-efficacy, self-efficacy + action plan	2 items assessing self-reported intake over previous 2 weeks	6 months	Adults aged 18–60, 34% male	The self-efficacy and self-efficacy and action plan group both increased their fruit and vegetable intake by an equal amount.
Otis and Pelletier (2008; Study 2)	Healthy	Healthy eating behavior	Cross-sectional	Healthy eating habits scale assessing general tendency to eat healthy foods	n.a.	Female students	Approach planning correlated highly with healthy food choices (.54) as did avoidance planning (.31).
Prestwich et al. (2008)	Unhealthy	Saturated fat	Experiment with 3 (implementation intention: standard, reasoning, none) × 2 (protection motivation manipulation: yes/no) design	Food frequency lists assessing the frequency participants consumed 63 common foods over the previous month	1 month	Students and young professionals, 24% male	Standard and reasoning implementation intentions were successful in reducing the proportion of food energy derived from saturated fat, (average reduction of 0.65%) but the effects of the standard implementation intention were dependent on participants' reading of the motivational message.
Reuter et al. (2008; Study 2)	Healthy	Fruit and vegetable	Experiment with II and control condition	Single item assessing the portions of fruit and vegetables consumed over the past 4 weeks	4 weeks	Employees from a logistics service company; 84% male	Only in the implementation intention group did participants increase their fruit intake by 0.7 portions a day.
Scholz et al. (2009: Study 1)	Healthy	Extra low fat foods	Prospective design assessing the correlation between action planning and low fat food intake 3 months later	Five items assessing the tendency to eat low-fat products	3 months	Participants of an online nutrition program; 18% male	Change in action planning was significantly correlated with change in low fat food intake ($r = .45$).

Table 1 (*Continued*)

Study	Healthy vs. unhealthy eating	Specific type of eating behavior	Design	Main outcome measure	Time between plan and outcome measure	Sample	Effect
Sullivan and Rothman (2008)	Unhealthy	Unhealthy snacks	Experiment with II and control condition	7 day snack diary	Right after manipulation and one week after manipulation	Students, 17% male	There was no significant effect of plans specifying which healthy snack to eat instead. However participants who planned which unhealthy snack not to eat consumed about 90 kcal a day less on unhealthy snacks than participants in the control condition (but fat intake did not differ). After two weeks participants in this implementation intention condition still consumed about 56 kcal less on unhealthy snacks (and fat intake was now also 2.32 g a day lower in this implementation intention condition).
Van Osch et al. (2009; Study 1)	Healthy	Fruit	Prospective design assessing correlation with action planning and fruit consumption 1 month later	Two items assessing average fruit intake over previous week	1 month	Members of an online survey panel of a private research company, 47% male	Action planning significantly predicted fruit consumption ($r = .33$).
Van Osch et al. (2009; Study 2).	Unhealthy	Snacks	Prospective	Self-reported frequency of consumption of 1. Fatty snacks, 2. Salty snacks, 3. Sugary snacks, 4. Candy bars, and 5. Savory snacks	1 month	Members of an online survey panel of a private research company, 47% male	Action planning was a marginally significant negative predictor of snack consumption ($r = -0.22$).
Verplanken and Faes (1999)	Healthy	Healthy eating behavior	Experiment with II and control condition	5-day food diary translated in composite score of healthiness	Right after manipulation	Students	Implementation intentions resulted in higher scores for healthy eating behavior (6.63) compared to control participants (5.45).

Results

Overall results

Overview of included studies

Fourteen studies investigated the efficacy of implementation intentions in increasing healthy eating behaviors (Armitage, 2007; Chapman, Armitage, & Norman, 2009; De Nooijer, De Vet, Brug, & De Vries, 2006; Gratton, Povey, & Clark-Carter, 2007; Jackson et al., 2005; Kellar & Abraham, 2005; Luszczynska & Cieslak, 2009; Luszczynska & Haynes, 2009, Study 2; Luszczynska, Tryburcy, & Schwarzer, 2007; Otis & Pelletier, 2008; Reuter et al., 2008, Study 2; Scholz, Nagy, Goehner, Luszczynska, & Kliegel, 2009, Study 1; Van Osch et al., 2009, Study 1[4]; Verplanken & Faes, 1999).

Eight studies investigated the efficacy of implementation intentions in reducing unhealthy eating behaviors (Achtziger, Gollwitzer, & Sheeran, 2008, Study 1; Adriaanse, De Ridder, & De Wit, 2009, Study 1 and 2; Armitage, 2004; Luszczynska, Scholz, & Sutton, 2007; Prestwich, Ayres, & Lawton, 2008; Sullivan & Rothman, 2008; Van Osch et al., 2009, Study 2[4]). One study (De Vries, Kremers, Smeets, Brug, & Eijmael, 2008) involved both components of eating behavior. Results for this study will therefore be discussed in both sections: the healthy eating behavior outcome measure will be discussed in the healthy eating behavior section, and the unhealthy eating behavior outcome measure will be discussed in the unhealthy eating section. As a result, the total number of studies on healthy eating behaviors is fifteen and the total number of studies on unhealthy eating behaviors is nine.

Meta-analysis

First, a homogeneity test (*Q*-test) was conducted to investigate whether the variance across studies can be primarily attributable to sampling error or whether there are additional systematic differences across studies (Lipsey & Wilson, 2001). Homogeneity was rejected, $Q = 10.93$, $p = .000$, indicating that the variance between studies could not be attributed to sampling error alone. Consequently, random effects models were used to calculate mean effect sizes. Use of the random effects model is recommended for meta-analyses including a limited number of studies with relatively small sample sizes (Lipsey & Wilson, 2001).

The overall effect size was .43 and this effect size was significantly different from zero, $p = .000$ (95% confidence interval of 0.28–0.57). An effect size of .43 is a small to medium effect according to Cohen's (1988) classification of effect size. Results of a fail-safe *N* analysis (Rosenthal, 1979) revealed that 1479 hidden studies that are not significant at 5% are required to render the combined results insignificant, indicating that serious publication bias is highly unlikely.

A meta-analysis analysis of variance analogue using Restricted Maximum Likelihood estimation was conducted to investigate our main research question, that is, if the average effect size for studies promoting healthy eating behavior was significantly larger than the average effect size for studies aiming to diminish unhealthy eating behavior. Results showed that the difference between the two categories is fairly large, with a medium effect size of .51 for healthy eating and a small effect size of .29 for unhealthy eating behavior. Both effect sizes were significantly different from zero ($p = .000$ and $p = .004$ respectively), and the difference in effect size between the two categories was marginally significant, $p = .09$. As only a limited number of studies are available in each category ($N = 15$ and $N = 9$), and the average sample size in each study is relatively small (median = 126), the power to detect even such a relatively large difference in effect size is low. Hence, obtaining a marginally significant difference in effect sizes is highly suggestive, and a further description of the separate categories is warranted.

Results for healthy eating behaviors

Systematic review

Specific behavior. Fifteen studies involved promoting healthy eating behaviors. Specifically, three studies focused on increasing fruit consumption (Armitage, 2007; De Nooijer et al., 2006; Van Osch et al., 2009, Study 1), nine studies focused on increasing fruit and vegetable consumption (Chapman et al., 2009; De Vries et al., 2008, Study 1; Gratton et al., 2007; Jackson et al., 2005; Kellar & Abraham, 2005; Luszczynska & Cieslak, 2009; Luszczynska & Haynes, 2009, Study 2; Luszczynska, Tryburcy, et al., 2007; Reuter et al., 2008), two studies aimed to increase overall 'healthy eating behaviors' (Otis & Pelletier, 2008; Verplanken & Faes, 1999), and one study aimed to promote the inclusion of low-fat foods (Scholz et al., 2009, Study 1).

Design. Of these fifteen studies, four studies were correlational, with one study utilizing a cross-sectional design (Otis & Pelletier, 2008, Study 2), and three studies using a prospective design (Luszczynska & Cieslak, 2009; Scholz et al., 2009; Study 1; Van Osch et al., 2009, Study 1). The other eleven studies had an experimental design with control groups ranging from making irrelevant implementation intentions to completely passive control groups that only filled out questionnaires or received information about eating a healthy diet. The quality of the control conditions was rated 0.36 ($SD = .51$) on average on our scale ranging from 0 (poor) to 2 (very good).

Five of the experimental studies also included additional control conditions to assess whether the effect of implementation intentions was stronger than another type of strategy/intervention, or existed above and beyond the effect of other factors. Specifically, one study compared the effectiveness of an implementation intention intervention to a motivation intervention (Gratton et al., 2007), and three studies investigated whether implementation intentions were effective above and beyond the effect of; (a) giving a self-efficacy boost (Luszczynska, Tryburcy, et al., 2007), (b) filling out a Theory of Planned Behavior questionnaire (Jackson et al., 2005), (c) providing pre-intervention instructions that inform participants about the potential benefits of forming plans (Chapman et al., 2009), or (d) receiving a tailored information letter (De Vries et al., 2008).

Two studies investigated whether different formats of implementation intentions had differential effects on eating behavior. Specifically, these studies looked at effects of global vs. specific plans (Chapman et al., 2009), or of approach food planning (e.g., "I think about the quality of food I will eat") vs. avoidance food planning (e.g., "I think about the set of responses to be used when I encountered situations where I tend to overeat"; Otis & Pelletier, 2008).

Sample. The sample included men and women from diverse groups. Four studies incorporated student samples. The other studies included people from diverse backgrounds/settings, such as children, employees of a logistics service company, or cardiac patients (see Table 1).

Outcome measures. Measures of eating behavior were obtained in the days right after the manipulation/assessment of planning or up to 9 months later. The measures used to assess eating behavior also differed strongly in terms of their reliance on participants' ability to recall their eating behaviors, as different types of measures were used (e.g., ranging from food diaries to one-item self-report measures), the time period over which eating behavior was assessed differed substantially (e.g., ranging from 24 h, ranging from 'an average or typical day' up to 'one month'), and

[4] The studies reported in this paper are not labeled Study 1 and Study 2, but as these are in fact two separate studies, we labeled the study targeting fruit intake Study 1, and the study targeting snack intake Study 2.

there were differences in specificity of the measures of eating behaviors (e.g., ranging from overall healthy eating behavior to the consumption of fruit intake).

Specifically, two studies employed food diaries that allowed for multiple entries per day, thereby limiting the reliance on participants' retrospective recall. These food diaries recorded overall food intake over 5 days (Verplanken & Faes, 1999), or fruit and vegetable intake over 7 days (Gratton et al., 2007). The other studies employed weaker measures of eating behavior, ranging from 24 h recall measures of fruit intake (Jackson et al., 2005), Food Frequency Lists assessing fruit intake over 1 month (De Nooijer et al., 2006), single or two to three item questionnaires to assess fruit intake, vegetable intake, or Recommended Daily Intake of Fruits and Vegetables (RDIFV) on an 'average day in the past one/four weeks' (Luszczynska & Cieslak, 2009; Luszczynska & Haynes, 2009) or over periods of one to two weeks (Armitage, 2007; Chapman et al., 2009; De Vries et al., 2008, Study 1; Kellar & Abraham, 2005; Luszczynska, Tryburcy, et al., 2007; Van Osch et al., 2009, Study 1), or even 4 weeks (Reuter et al., 2008, Study 2). Finally, two studies used a scale assessing the tendency to eat low-fat foods (Scholz et al., 2009; Study 1), or the tendency to consume healthy foods (Otis & Pelletier, 2008, Study 2). The quality of the outcome measure was rated 4.23 (SD = 1.87) on average on our 0–8 point scale (see "Meta-Analytical Strategy" for details on the coding system).

Key findings. Twelve of the fifteen studies, including the two studies that employed the strongest outcome measure – the food diary –, found positive effects of implementation intentions on increasing healthy eating behavior. The formation of implementation intentions resulted in (a) an increase of 0.18 portions of fruit a day (Armitage, 2007), (b) an increase of about half a portion of fruit and vegetables a day (Chapman et al., 2009; Gratton et al., 2007; Luszczynska & Haynes, 2009; Reuter et al., 2008, Study 2), (c) the consumption of the RDIF as well as one piece of fruit and four pieces of vegetables on more days (3.03) than the control group (2.28; Kellar & Abraham, 2005), (d) higher scores on overall healthy eating behavior as assessed in a food diary (Verplanken & Faes, 1999), (e) an increase in eating a portion of fruit or vegetables from about 1.5 times a day to twice per day (Luszczynska, Tryburcy, et al., 2007). Further, correlational studies revealed (f) a weak to moderate positive association (r = .21) between planning and fruit and vegetable intake (Luszczynska & Cieslak, 2009), between change in action planning and change in low-fat food intake (r = .22; Scholz et al., 2009, Study 1), and between action planning and fruit consumption (r = .33; Van Osch et al., 2009, Study 1,) and (g) moderate to strong correlations between planning and healthy eating habits (r = .53 and r = .31 respectively; Otis & Pelletier, 2008).

One of these twelve studies additionally indicated that the effect of implementation intentions was stronger than a motivation intervention (Gratton et al., 2007). Another study indicated that the effect of implementation intentions existed above and beyond the effect of pre-intervention instructions (Chapman et al., 2009). In contrast, Luszczynska et al. (2007c) failed to find evidence for the effectiveness of implementation intentions over and above the effect of a self-efficacy intervention in predicting fruit and vegetable intake.

Two of these twelve studies further indicated that different formats of implementation intentions may indeed have differential effects. Chapman et al. (2009) found that specific if-then plans had a stronger effect on fruit and vegetable intake than global plans, and Otis and Pelletier's (2008) findings indicated that approach planning had a stronger effect on healthy eating habits (r = .54) than avoidance planning (r = .31).

Finally, three studies failed to find any evidence for the effectiveness of implementation intentions (De Vries et al., 2008, Study 1; Jackson et al., 2005) or only found effects on some, but not all outcome measures (De Nooijer et al., 2006). De Vries et al. (2008) did not find any effects of the planning manipulation on fruit or vegetable intake. Jackson et al. (2005) also did not find any effects of formulating implementation intentions, either when compared to an information only control condition or to an information + Theory of Planned Behavior questionnaire control condition. De Nooijer et al. (2006) found evidence for the effectiveness of implementation intentions on only one of three dependent measures that were employed: the number of days that participants were able to consume an extra portion of fruit. In contrast, implementation intentions did not yield any effects on the Food Frequency List for fruit consumption, nor on self-reported change in fruit intake.

Meta-analysis. As was stated earlier, the overall effect size of studies in this category was .51. A homogeneity test (Q) was conducted to investigate whether within this category there was variance between studies that cannot be attributed to sampling error. Homogeneity was rejected, Q = 20.16, p = .000, indicating that there were systematic differences across studies due to factors other than sampling error. Consequently, a meta-regression was conducted to investigate whether the effectiveness of implementation intentions in increasing healthy eating behavior is moderated by quality of the control condition and/or quality of the outcome measure. Results indicated that the influence of both variables on the effectiveness of implementation intentions were significant. Specifically, studies that included outcome measures of a higher quality tended to show stronger effects, B = .16, p = .00. Moreover, studies that use stricter control conditions tended to report weaker effects, B = −.25, p = .04.

Summary. Taken together, the results of twelve of these fifteen studies provide considerable support for the notion that implementation intentions have a medium size effect on increasing fruit and vegetable consumption, as assessed with different outcome measures, as well as when employing different control conditions. Moreover, results indicate that it is important to use good outcome measures as these are more likely to demonstrate stronger effects. Probably, this is because lower quality outcome measures are not sensitive enough or rely too heavily on retrospective recall to accurately detect the full effectiveness of implementation intentions. Finally, it has to be noted, that although overall medium size effects were found, results indicate that the strongest effects were found in studies employing the weakest control conditions, which indicates that some effect sizes may possibly have been inflated in some studies due to employing weak control conditions.

Results for unhealthy eating behaviors

Systematic review

Specific behavior. Nine studies investigated the efficacy of implementation intentions in reducing unhealthy eating behaviors. Specifically, five studies focused on diminishing unhealthy snack consumption (Achtziger et al., 2008, Study 1; Adriaanse et al., 2009, Study 1 and 2; Sullivan & Rothman, 2008; Van Osch et al., 2009, Study 2), and four studies aimed to diminish (saturated) fat intake (Armitage, 2004; De Vries et al., 2008; Luszczynska, Scholz, et al., 2007; Prestwich et al., 2008).

Design. One study was correlational and employed a longitudinal design (Van Osch et al., 2009, Study 2). Eight studies had an experimental design with control groups ranging from completely passive control groups in which participants only filled out questionnaires or received information letters (Achtziger et al., 2008, Study 1; Adriaanse et al., 2009, Study 1; Armitage, 2004; De Vries et al., 2008; Prestwich et al., 2008; Sullivan & Rothman, 2008) to control conditions in which participants received a structured interview (Luszczynska, Scholz, et al., 2007), or active control

conditions in which participants made a listing of favorite healthy snacks (Adriaanse et al., 2009, Study 2).

Two studies included additional control conditions to assess the relative or additional strength of the implementation intention intervention compared to a protection motivation manipulation (Prestwich et al., 2008), or compared to receiving a tailored information letter (De Vries et al., 2008).

Additionally, Prestwich et al. (2008) investigated the differential effect of two different types of implementation intentions (regular implementation intentions vs. implementation intentions specifying the reason not to eat fatty foods in the then-part) on diminishing saturated fat intake. The studies by Adriaanse et al. (2009; Study 1 and 2) also compared two different types of implementation intentions (implementation intention specifying "the why of eating" vs. implementation intentions specifying "the where and when of eating" in the if-part). Sullivan and Rothman (2008) compared the effectiveness of plans specifying which healthy snack to eat in a critical situation vs. plans specifying which unhealthy snack not to eat in a critical situation.

Control conditions were passive in six of the eight experimental studies. Two studies did employ an active control condition, but in one of those studies this active control condition was still limited as participants in the experimental condition received extensive feedback and positive reinforcement, which the control condition did not (Luszczynska, Scholz, et al., 2007). Quality of the control conditions was on average rated 0.71 (*SD* = 1.92) on a 0–2 scale.

A noteworthy characteristic of the eight experimental studies was that – although they all had the objective of reducing unhealthy snack/(saturated) fat intake – they differed in their formulation of the implementation intentions. Instructions for implementation intentions ranged from (a) planning to *ignore* thoughts about an unhealthy snack food (Achtziger et al., 2008), (b) planning to *substitute* a unhealthy snack by a healthy snack upon encountering a critical situation (Adriaanse et al., 2009: Studies 1 and 2; Sullivan & Rothman, 2008), (c) planning to *not* eat a unhealthy snack in a critical situation (Sullivan & Rothman, 2008), (d) planning to perform a *new behavior and* to *not* buy foods high in saturated fat in a critical situation (Prestwich et al., 2008), (e) planning to repeat a motivational message to oneself in a critical situation (e.g., "If I'm in the supermarket and tempted to buy a food that is high in saturated fat then I will say to myself: I don't want to die of a heart attack"; Prestwich et al., 2008, p. 1553), (f) simply asking participants to plan to eat a low-fat diet "while paying attention to the situations in which the plan will be implemented" (Armitage, 2004), (g) an extensive planning protocol that included an exact specification which food/snacks to eat when and how to prepare these foods (Luszczynska, Scholz, et al., 2007), to (h) a set of five pre-formulated action plans which participants were simply asked to adopt (De Vries et al., 2008).

Sample. Four studies incorporated student samples (Achtziger et al., 2008; Study 1; Adriaanse et al., 2009, Study 1 and 2; Sullivan & Rothman, 2008), and the other studies included a diverse sample ranging from a random sample obtained from the Dutch national telephone company (De Vries et al., 2008) to post-uncomplicated-MI patients (Luszczynska, Scholz, et al., 2007).

Outcome measures. Measures of eating behavior were obtained in the days right after the manipulation up to 9 months later. Again, measures of eating behavior differed strongly in terms of their reliance on participants' retrospective recall of their eating behaviors: eating behavior had to be recalled over shorter (one week) or longer (one month) timeframes and there were tremendous differences in the scope of the food intake which had to be recalled (e.g., recalling the intake of one specific snack vs. the intake of 63 foods).

Specifically, three studies (Adriaanse et al., 2009; Studies 1 and 2; Sullivan & Rothman, 2008) assessed the intake of several specific snacks by listing them in 7-day snack diaries. The other studies employed weaker measures of eating behavior, ranging from a questionnaire about the intake of meats, dairy products, spreads, and snacks over the past month (Luszczynska, Scholz, et al., 2007), a food frequency list assessing intake of 63 foods in the past month (Armitage, 2004; Prestwich et al., 2008) or 19 products/product groups (De Vries et al., 2008), a 5 item questionnaire assessing the consumption of fatty snacks, salty snacks, sugary snacks, candy bars, and savory snacks (Van Osch et al., 2009, Study 2), to a one item self-report measure of the number of times a specific snack was consumed during the previous week (Achtziger et al., 2008). The quality of the outcome measure was on average rated 4.83 (*SD* = 1.92) on our 0–8 point scale (see "Meta-Analytical Strategy" for details on the coding system).

Key findings. Three of the nine studies found positive effects of formulating implementation intentions on the outcome measures (Achtziger et al., 2008; Armitage, 2004; Luszczynska, Scholz, et al., 2007). Luszczynska, Scholz, et al. (2007) reported that participants in the implementation intention condition reduced their daily total fat intake by 9 g which translates into a reduction in caloric intake of 81 kcal. Armitage (2004), however, found a somewhat smaller effect: implementation intentions resulted in a reduction of daily total fat intake of 3.94 g, which contains 35 kcal. Finally, Achtziger et al. (2008) reported that participants who formulated implementation intentions ate 1.6 fewer unhealthy snacks during a one-week follow up compared to before formulating implementation intentions.

Three studies found evidence for the effectiveness of one type of implementation intention, but not for another type of implementation intention (Adriaanse et al., 2009, Study 2; Prestwich et al., 2008; Sullivan & Rothman, 2008). Adriaanse et al. (2009; Study 2) reported that an implementation intention specifying "the why of eating" in the if-part of the plan resulted in reduction of 90 kcal a day from unhealthy snacks, but the implementation intention specifying the traditional "when and where of eating" did not significantly reduce unhealthy snack intake.

Prestwich et al. (2008) found that standard implementation intentions were effective in reducing the percentage (−2.21 percent) of energy derived from saturated fat when combined with a protection motivation message, but not without this message. Implementation intentions specifying the reason for eating a low fat diet in the then-part were effective in reducing energy derived from saturated fat, regardless of whether they were combined with a protection motivation message, although this effect was rather small (the weighed average reduction of proportion of energy derived from saturated fat was .065 percent).

Lastly, Sullivan and Rothman (2008) did not find a significant effect of plans specifying which healthy snack to eat instead of an unhealthy one. However, among participants who planned which unhealthy snack *not* to eat, there was a significant effect of implementation intentions: participants in the implementation intention condition consumed about 90 kcal a day less on unhealthy snacks than participants in the control condition (but fat intake did not differ), and after two weeks participants in this implementation intention condition still consumed about 56 kcal less on unhealthy snacks (and fat intake was now also 2.32 g a day lower in the implementation intention condition).

The final three studies either did not show any effects or only marginally significant effects of implementation intentions on unhealthy eating behavior. Van Osch et al. (2009; Study 2) found only a marginally significant effect of action planning on diminishing unhealthy snack consumption. De Vries et al. (2008) and Adriaanse et al. (2009; Study 2), did not find any effects of the planning manipulation on fat intake.

Meta-analysis. As was stated earlier, the overall effect size for studies in which implementation intentions were targeted at

decreasing unhealthy eating behavior was .29. A homogeneity test (Q) was conducted to investigate whether within this category there were systematic differences across studies variance that cannot be attributed to sampling error. Homogeneity was accepted, $Q = 1.41$, $p = .49$, indicating that any variance that exists across studies is most likely due sampling error. In line with this observation, a meta-regression investigating the moderating role of quality of the control condition and/or quality of the outcome measure did not yield any significant effects, p's $> .59$.

Summary. Although some of the results are quite promising (e.g., Achtziger et al., 2008; Armitage, 2004; Luszczynska, Scholz, et al., 2007), the overall effect size of studies in this category was only small (.29). This small effect could not be attributed to some studies employing weak control conditions or weak outcome measures, as effects within the unhealthy eating category were homogenous and both variables did not significantly predict the strength of effects.

Discussion

Considerable support was found for the notion that implementation intentions can be effective in increasing healthy eating behaviors, with twelve studies showing an overall medium effect size of implementation intentions on increasing fruit and vegetable consumption. Although several studies employed rather weak outcome measures that relied heavily on retrospective recall or that assessed food intake over a limited time frame, we can be relatively confident that the use of weaker outcome measures has not severely influenced results. That is, the studies employing the stronger dependent measures (e.g., a 7 day food diary) indicated the largest effects (e.g., Gratton et al., 2007), whereas the studies that failed to demonstrate any significant effects (De Vries et al., 2008; Jackson et al., 2005) or only found partially significant results (De Nooijer et al., 2006), generally employed weaker outcome measures.

Results from the meta-regression analysis also statistically support this observation, as the quality of the outcome measure was significantly positively related to the effect of implementation intentions on eating behavior. Results from the meta-regression also yielded a problematic finding, as it was found that studies employing weaker control conditions generally show stronger effects. This is problematic, as this observation may indicate that the overall effect size of studies promoting healthy eating patterns may be inflated due to some studies using less than optimal control conditions.

Results for studies investigating implementation intentions' effectiveness in decreasing unhealthy eating behaviors (mostly reducing fat and unhealthy snack intake) were less strong than results for studies regarding increasing healthy eating behaviors. Overall, studies pertaining to unhealthy eating demonstrated a small effect size of .29, which is considerably (albeit only marginally significantly) lower than the effect size found for promoting of healthy eating.

Results for diminishing unhealthy eating also appear to be less consistent: Although several studies showed promising effects of implementation intentions in reducing unhealthy eating behaviors (e.g., Achtziger et al., 2008; Armitage, 2004; Luszczynska, Scholz, et al., 2007; Luszczynska, Tryburcy, et al., 2007), two thirds of the studies did not find such positive effects (Adriaanse et al., 2009; De Vries et al., 2008; Study Van Osch et al., 2009, Study 2) or only found positive effects for one type of implementation intention but not for another (Adriaanse et al., 2009, Study 2; Prestwich et al., 2008; Sullivan & Rothman, 2008). In addition to these mixed findings, and similar to studies in the healthy eating category, several studies employed relatively weak control conditions and outcome measures. However, unlike in the healthy eating category, meta-regression results indicated that quality of the outcome measure and quality of the control condition did not moderate implementation intention effectiveness for studies in the unhealthy eating category.

As a matter of fact, the effect sizes within this category were homogenous, meaning that at present there is no evidence for any systematic variance across studies at all. Still, as results are only based on a limited number of studies in this category (diminishing unhealthy eating), potential moderating factors should not be completely discarded. For example, implementation intentions' effectiveness in diminishing unhealthy eating behavior may be influenced by the type of plan people formulate and/or the manner in which people formulate their plans. Indeed, a large variety of implementation intention formats were used in the studies targeting unhealthy eating behavior. Although this could not be statistically tested because no implementation intention format was used in more than one study, it is likely that different formats of plans may have differential effects on eating behavior.

To illustrate, in the literature on implementation intentions, at least three different types of implementation intentions have been proposed to benefit goal striving that concerns diminishing existing unwanted behaviors (Sheeran et al., 2005; Gollwitzer et al., 2005); (a) implementation intentions linking a critical cue for the unwanted behavior to a new, desired behavior (e.g., a person who always eats junkfood when bored could make the following implementation intention: 'If I am bored and I want to snack, then I will make myself a fruit salad'); (b) implementation intentions specifying to ignore the critical cue ('If situation X occurs, then I will ignore this situation'); and (c) implementation intentions that directly specify *not* to perform the unwanted habitual behavior upon encountering the critical situation for that behavior (e.g., 'If I am bored, then I will *not* eat junkfood'). As recent research indicates that different formats of implementation intentions may be effective under different conditions (e.g., Parks-Stamm et al., 2010), comparing the effectiveness of these different formats of implementation intentions to establish which format is most effective under which conditions is a promising avenue for future research.

On a related note, another striking difference between studies was the extent to which implementation intentions instructions were delivered in an autonomy supportive manner. That is, whereas some studies let participants formulate their own plans (e.g., Adriaanse et al., 2009), other studies provided participants with pre-formulated plans (e.g., De Vries et al., 2008). It is likely that this factor has a moderating effect on implementation intentions' effectiveness on eating behavior, as prior research has shown the importance of promoting the formation of personally relevant plans (Koestner et al., 2006). In line with this, results by Adriaanse et al. (2009) indicated that implementation intention to reduce unhealthy snack intake were only effective when participants were allowed to chose their own critical cue for the if-part of their implementation intention (Study 2), but not when they were assigned a specific cue (Study 1). Although we were unable to include implementation intention instructions as a moderator in the present meta-analysis due to the limited amount of studies, it seems prudent that future research takes into account the importance of using autonomy supportive instructions.

Conclusion

Taken together, it can be concluded that studies aiming to promote healthy eating behaviors and studies aiming to diminish unhealthy eating behaviors by means of implementation intentions yield quite different results. In case of promoting healthy eating behaviors, results are promising, with quite a large number of studies reporting positive effects of implementation intentions, and an overall medium effect size. However, when aiming to diminish unhealthy eating patterns by means of implementation intentions, the evidence is less convincing, with fewer studies

reporting positive effects, and an overall effect size that is small. In future studies, researchers should try and employ stricter control conditions as well as better outcome measures. Additionally, future research should be specifically concerned with investigating the efficacy of implementation intentions in diminishing unhealthy eating behaviors. In doing so, these studies should also compare the efficacy of different types of implementation intentions, as these may have differential effects on unhealthy food consumption.

References[5]

*Achtziger, A., Gollwitzer, P. M., & Sheeran, P. (2008). Implementation intentions and shielding goal striving from unwanted thoughts and feelings. *Personality and Social Psychology Bulletin, 34*, 381–393.

*Adriaanse, M. A., De Ridder, D. T. D., & De Wit, J. B. F. (2009). Finding the critical cue. Implementation intentions to change one's diet work best when tailored to personally relevant reasons for unhealthy eating. *Personality and Social Psychology Bulletin, 35*, 60–71.

*Armitage, C. J. (2004). Evidence that implementation intentions reduce dietary fat intake. A randomized trial. *Health Psychology, 23*, 319–323.

Armitage, C. J. (2006). Evidence that implementation intentions promote transitions between the stages of change. *Journal of Consulting and Clinical Psychology, 74*, 141–151.

*Armitage, C. J. (2007). Effects of an implementation intention-based intervention on fruit consumption. *Psychology and Health, 22*, 917–928.

*Chapman, J., Armitage, C. J., & Norman, P. (2009). Comparing implementation intention interventions in relation to young adults' intake of fruit and vegetables. *Psychology and Health, 24*, 317–332.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

*De Nooijer, J., De Vet, E., Brug, J., & De Vries, N. K. (2006). Do implementation intentions help to turn good intentions into higher fruit intakes? *Journal of Nutrition Education & Behavior, 38*, 25–29.

*De Vries, H., Kremers, S. P. J., Smeets, T., Brug, J., & Eijmael, K. (2008). The effectiveness of tailored feedback and action plans in an intervention addressing multiple health behaviors. *American Journal of Health Promotion, 22*, 417–425.

Gandini, S., Merzenich, H., Robertson, C., & Boyle, P. (2000). Meta-analysis of studieson breast cancer risk and diet. The role of fruit and vegetable consumption and the intake of associated micronutrients. *European Journal of Cancer, 36*, 636–646.

Gollwitzer, P. M. (1999). Implementation intentions. Strong effects of simple plans. *American Psychologist, 54*, 493–503.

Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement. A meta-analysis of effects and processes. *Advances in Experimental Social Psychology, 38*, 69–119.

Gollwitzer, P. M., Bayer, U. C., & McCulloch, K. C. (2005). The control of the unwanted. In R. R. Hassin, J. S. Uleman, & J. A. Bargh (Eds.), *The new unconscious* (pp. 485–516). Oxford, UK: Oxford University Press.

*Gratton, L., Povey, R., & Clark-Carter, D. (2007). Promoting children's fruit and vegetable consumption. Interventions using the Theory of Planned Behaviour as a framework. *British Journal of Health Psychology, 12*, 639–650.

Holland, R. W., Aarts, H., & Langendam, D. (2006). Breaking and creating habits on the working floor. A field-experiment on the power of implementation intentions. *Journal of Experimental Social Psychology, 42*, 776–783.

Hooper, L., Summerbell, C. D., Higgins, J. P. T., Thompson, R. L., Capps, N. E., Smith, G. D., et al. (2001). Dietary fat intake and prevention of cardiovascular disease. A systematic review. *BMJ, 322*, 757–763.

*Jackson, C., Lawton, R., Knapp, P., Raynor, D. K., Conner, M., Lower, C., et al. (2005). Beyond intention. Do specific plans increase health behaviours in patients in primary care? A study of fruit and vegetable consumption. *Social Science and Medicine, 60*, 2383–2391.

*Kellar, I., & Abraham, C. (2005). Randomized controlled trial of a brief research-based intervention promoting fruit and vegetable consumption. *British Journal of Health Psychology, 10*, 543–558.

Koestner, R., Horberg, E. J., Gaudreau, P., Powers, T., Di Dio, P., Bryan, C., et al. (2006). Bolstering implementation plans for the long haul. The benefits of simultaneously boosting self-concordance or self-efficacy. *Personality and Social Psychological Bulletin, 32*, 1547–1558.

Kumanyika, S. K., Van Horn, L., Bowen, D., Perri, M. G., Rolls, B. J., Czajkowski, S. M., et al. (2000). Maintenance of dietary behavior change. *Health Psychology, 19*((Suppl. 1) 1), 42–56.

Lipsey, M. W., & Wilson, D. B. (2001). *Practical meta-analysis*. Thousand Oaks, CA: Sage.

*Luszczynska, A., & Cieslak, R. (2009). Mediated effects of social support for healthy nutrition. Fruit and vegetable intake across 8 months after myocardial infarction. *Behavioral Medicine, 35*, 30–37.

*Luszczynska, A., & Haynes, C. (2009). Changing nutrition physical activity, and body weight among student nurses and midwives effects of a planning intervention and self-efficacy beliefs. *Journal of Healthy Psychology, 8*, 1075–1084.

*Luszczynska, A., Scholz, U., & Sutton, S. (2007). Planning to change diet. A controlled trial of an implementation intentions intervention to reduce saturated fat intake among patients after myocardial infarction. *Journal of Psychosomatic Research, 63*, 491–497.

Luszczynska, A., Sobczyk, A., & Abraham, C. (2007). Planning to lose weight. Randomized controlled trial of an implementation intention prompt to enhance weight reduction among overweight and obese women. *Health Psychology, 4*, 507–512.

*Luszczynska, A., Tryburcy, M., & Schwarzer, R. (2007). Improving fruit and vegetable consumption. A self-efficacy intervention compared with a combined self-efficacy and planning intervention. *Health Education Research, 22*, 630–638.

Milne, S., Orbell, S., & Sheeran, P. (2002). Combining motivational and volitional interventions to promote exercise participation. Protection motivation theory and implementation intentions. *British Journal of Health Psychology, 7*, 163–184.

O'Brien, G., & Davies, M. (2007). Nutrition knowledge and body mass index. *Health Education Research, 22*, 571–575.

Orbell, S., Hodgkins, S., & Sheeran, P. (1997). Implementation intentions and the theory of planned behavior. *Personality and Social Psychological Bulletin, 23*, 945–954.

*Otis, N., & Pelletier, L. G. (2008). Women's regulation styles for eating behaviors and outcomes. The mediating role of approach and avoidance food planning. *Motivation and Emotion, 32*, 55–67.

Parks-Stamm, E. J., Gollwitzer, P. M., & Oettingen, G. (2007). Action control by implementation intentions. Effective cue detection and efficient response initiation. *Social Cognition, 25*, 248–266.

Parks-Stamm, E., Gollwitzer, P., & Oettingen, G. (2010). Implementation intentions and test anxiety. Shielding academic performance from distraction. *Learning and Individual Differences, 20*, 30–33.

Prestwich, A., Lawton, R., & Conner, M. (2003). The use of implementation intentions and the decision balance sheet in promoting exercise behaviour. *Psychology and Health, 18*, 707–721.

*Prestwich, A., Ayres, K., & Lawton, R. (2008). Crossing two types of implementation intentions with a protection motivation intervention for the reduction of saturated fat intake. A randomized trial. *Social Science and Medicine, 67*, 1150–1558.

Renner, B., Kwon, S., Yang, B.-H., Paik, K.-C., Kim, S. H., Roh, S., et al. (2008). Social-cognitive predictors of dietary behaviors in South Korean men and women. *International Journal of Behavioral Medicine, 15*, 4–13.

*Reuter, Ziegelmann, Wiedemann, & Lippke, (2008). Dietary planning as a mediator of the intention behaviour relation. An experimental causal chain design. *Applied Psychology, 57*, 194–207.

Rise, J., Thompson, M., & Verplanken, B. (2003). Measuring implementation intentions in the context of the theory of planned behavior. *Scandinavian Journal of Psychology, 44*, 87–95.

Rosenthal, R. (1979). The 'file-drawer problem' and tolerance for null results. *Psychological Bulletin, 86*, 638–641.

*Scholz, U., Nagy, G., Goehner, W., Luszczynska, A., & Kliegel, M. (2009). Changes in self-regulatory cognitions as predictors of changes in smoking and nutrition behaviour. *Psychology and Health, 24*, 545–561.

Schwarzer, R., Schuz, B., Ziegelmann, J. P., Lippke, S., Luszczynska, A., & Scholz, U. (2007). Adoption and maintenance of four health behaviors. Theory-guided longitudinal studies on dental flossing, seat belt use, dietary behavior, and physical activity. *Annals of Behavioral Medicine, 33*, 156–166.

Sheeran, P., & Orbell, S. (1999). Implementation intentions and repeated behaviour. Augmenting the predictive validity of the theory of planned behaviour. *European Journal of Social Psychology, 29*, 349–369.

Sheeran, P., Milne, S. E., Webb, T. L., & Gollwitzer, P. M. (2005). Implementation intentions. In M. Conner & P. Norman (Eds.), *Predicting health behavior* (2nd ed., pp. 276–323). Buckingham, UK: Open University Press.

*Sullivan, H. W., & Rothman, A. J. (2008). When planning is needed. Implementation intentions and attainment of approach versus avoidance health goals. *Health Psychology, 27*, 438–444.

*Van Osch, L., Beenackers, M., Reubsaet, A., Lechner, L., Candel, M., & De Vries, H. (2009). Action planning as predictor of health protective and health risk behavior. An investigation of fruit and snack consumption. *International Journal of Behavioral Nutrition and Physical Activity 6 art no 69.*

*Verplanken, B., & Faes, S. (1999). Good intentions, bad habits, and effects of forming implementation intentions on healthy eating. *European Journal of Social Psychology, 29*, 591–604.

Webb, T. L., & Sheeran, P. (2006). Does changing behavioral intentions engender behavioral change? A meta-analysis of the experimental evidence. *Psychological Bulletin, 132*, 249–268.

Wiedemann, A. U., Lippke, S., Reuter, T., Schüz, B., Ziegelmann, J. P., & Schwarzer, R. W. (2008). Prediction of stage transitions in fruit and vegetable intake. *Health Education Research, 24*, 596–607.

World Health Organization. (2010). *Global strategy on diet, physical activity and health* Retrieved May 3, 2010 from http://www.who.int/dietphysicalactivity/diet/en/index.html..

[5] References with an * are used in the review and meta-analysis.