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Differential effects of planning and self-efficacy on fruit and vegetable consumption

Jana Richert*, Tabea Reuter, Amelie U. Wiedemann, Sonia Lippke, Jochen Ziegelmann, Ralf Schwarzer

Freie Universität Berlin, Germany

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ABSTRACT

To change dietary behaviors, people must be motivated to do so. But intentions often do not translate into behavior. Strategic planning (as a mediator) is expected to move people from intention to action. However, individuals who lack perceived self-efficacy might fail to apply their plans when encountering challenging situations. Thus, self-efficacy might operate as a moderator variable when it comes to studying the mediator effects of planning on behaviors. This study examines the interactive role of planning and self-efficacy in the context of dietary changes. A longitudinal sample of 411 employees was surveyed twice in terms of their fruit and vegetable consumption over a 4-week interval. Intentions, planning, and fruit and vegetable consumption were specified as a mediator chain with self-efficacy as a moderator at two stages of the putative change process. Baseline behavior served as a covariate in the model. Intentions were translated into dietary behavior by planning. Self-efficacy moderated this mediation at the second stage, reflected by a planning × self-efficacy interaction on fruit and vegetable consumption. The strength of the mediated effect increased along with levels of self-efficacy. Individuals with very low self-efficacy did not benefit from planning. If a person lacks self-efficacy, planning does not seem to translate intentions into fruit and vegetable consumption.

Introduction

Poor dietary habits are difficult to change. Most theories of health behavior assume that an individual's intention to change is the best direct predictor of actual change (Sniehotta, 2009). But people often do not behave according to their intentions. Therefore, the intention construct needs to be supplemented by other, more proximal factors that might facilitate the translation of intentions into action. Some of these post-intentional factors have been identified, such as perceived self-efficacy and planning, although it is not fully understood how they interplay with intentions and behaviors. Previous studies have specified self-efficacy and planning as mediators between intentions and behaviors (e.g., Schwarzer, Luszczynska, Ziegelmann, Scholz, & Lippke, 2008). However, other mechanisms such as moderation or moderated mediation might be possible. In the present study, an interaction between planning and self-efficacy and its effect on the assumed mediation is examined. This is done in order to elucidate the mechanisms that come into play after people have formed an intention to change their dietary behaviors.

* Corresponding author.
E-mail address: jana.richert@fu-berlin.de (J. Richert).

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Mechanisms of dietary change: mediators and moderators

To study *how* behavior change takes place, we need to apply mediation analyses, and to study *for whom* a particular change mechanism is valid, we need to study moderation (MacKinnon & Luecken, 2008). *Mediation* describes how an effect occurs, that is, how an independent variable affects a dependent variable via a third variable that constitutes the mediator. A mediator might emerge in one group (e.g., high self-efficacious persons), but not in another (e.g., low self-efficacious persons). In such a case, self-efficacy operates as a *moderator* of the mediating relationship.

Good intentions are more likely to be translated into action when people plan when, where, and how to perform the desired behavior. Intentions foster planning, which in turn facilitates behavior change. Planning had been found to mediate the intention–behavior relation but some studies failed to find such mediation effects (Norman & Conner, 2005). This suggests that the relationships between intentions, planning, and behavior might also depend on other factors. This represents a case of moderated mediation.

Perceived self-efficacy is a putative moderator for the degree to which planning mediates the intention–behavior relationship. This construct reflects optimistic self-beliefs when overcoming temptations or adopting a novel course of action. Different challenges have

to be met during the course of dietary behavior change. Self-efficacy beliefs are required to master these tasks successfully. Perceived self-efficacy has been found to be important at all points in the health behavior change process (Bandura, 1997) such as dietary behavior (e.g., Mata, Todd, & Lippke, 2010). It is expected to moderate the intention–planning–behavior relation, because people harboring self-doubts might either fail to translate intentions into plans, or they might fail to act upon their plans. For individuals with a high level of self-efficacy, planning might be more likely to facilitate goal achievement because optimistic self-beliefs instigate planning. Also, self-efficacious people feel more confident about translating their plans into actual behavior. In other words, whether intentions affect behavior via planning (mediation) might depend on the individual's level of self-efficacy (moderator).

Four recent studies in the nutrition domain have found preliminary evidence for such an effect, one in Costa Rica and one in South Korea (Gutiérrez-Doña, Lippke, Renner, Kwon, & Schwarzer, 2009), and one in Thailand and one in Germany (Schwarzer et al., in press). The last one had targeted fruit and vegetable consumption, and the three former ones have targeted a low-fat diet. The study in Costa Rica included 245 women factory workers who were surveyed once. The study in South Korea included 358 women who were questioned at two points in time, 6 months apart. Although, in both samples a moderated mediation materialized, there was a difference in the stage of this effect. In Costa Rica, an interaction between planning and self-efficacy on low-fat diet emerged, whereas in South Korea an interaction between intention and self-efficacy on planning emerged. The survey in Thailand included 1718 university students responding cross-sectionally on their fat consumption, and in Germany a longitudinal online-study with 1140 participants was conducted regarding their fruit and vegetable consumption. In the two latter investigations, the intention–planning–diet mediation was moderated by self-efficacy in the same manner as in South Korea. Thus, the preliminary explorations of the mechanisms that operate in dietary changes resulted in inconsistent patterns of moderated mediation.

Aims

Due to these inconsistent patterns, the present longitudinal study has been conducted to shed more light on the mechanisms of dietary change. It examines the question whether planning (mediator variable) mediates the effect of intentions (independent variable) on dietary behavior (dependent variable) as a function of self-efficacy levels (moderator). In particular, it is of interest at which point in the process of change such an effect might occur.

Methods

Participants and procedure

A study on dietary habits was conducted in a large German logistics service company. During a routine medical check-up, employees were invited by the physician to participate in a health promotion program which was aimed at dietary changes. Individuals diagnosed with one or more of the following conditions were excluded from the study: manifest diabetes mellitus, acute myocardial infarction within the last year, contraindication for fruit and/or vegetable consumption (e.g., fructose intolerance). After giving informed consent, participants filled in an online-questionnaire in the presence of a psychology graduate student who was in charge of supervising the procedure. Four weeks later, self-reported changes in fruit and vegetable intake as well as self-efficacy were measured. Those who also answered the follow-up questionnaire constituted the longitudinal sample ($N = 411$; 47.4% of baseline). This sample comprised of 80 women and 331 men and had a mean age of 43 years, $SD = 6.2$, ranging from 20 to 59 years. The original sample at Time 1 ($N = 868$) did not differ significantly from the longitudinal sample ($N = 411$) in terms of age, sex, intention, planning, self-efficacy, and dietary behaviors.

Table 1
Means (M), standard deviations (SD), and intercorrelations for intention, planning, self-efficacy, and dietary behaviors (T1 = Time 1, T2 = Time 2) in $N = 411$ employees.

	Intention	Planning	Self-efficacy	Diet T1	Diet T2
M	2.61	2.19	2.62	2.76	3.22
SD	0.84	0.86	0.91	1.40	1.56
Intention	1.00				
Planning	.45	1.00			
Self-efficacy	.49	.45	1.00		
Diet T1	.50	.34	.38	1.00	
Diet T2	.40	.54	.64	.49	1.00

Note: all correlations $p < .01$.

Measures

Means, standard deviations, and intercorrelations are displayed in Table 1. All scales were tested in several prior studies with respect to psychometric properties (see Schwarzer et al., in press). Responses were made on four-point scales ranging from not at all true (1) to exactly true (4).

Intentions were measured with two items, namely: (a) "I intend to eat at least five servings of fruit or vegetable per day" and (b) "I intend to eat fruit or vegetables with meals or between meals" ($r = .54$).

Planning was measured with two items, such as, "I have already precisely planned when, where, and how to eat five servings of fruit or vegetables throughout the day" ($r = .78$).

Perceived self-efficacy

The self-efficacy scale comprised three items, such as "I am confident that I can eat five servings of fruit and vegetables a day" (Cronbach's $\alpha = .87$).

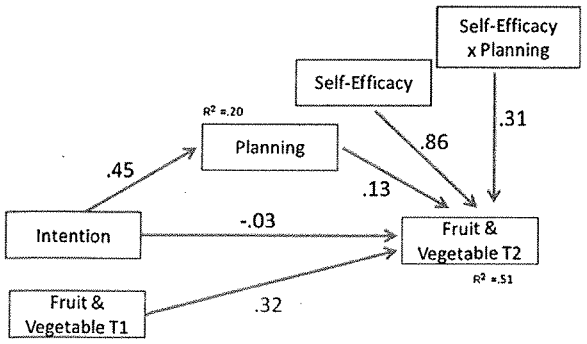
Dietary behavior was assessed at two points in time. After providing the definition of "one serving", fruit and vegetable intake was measured using an open-ended item: "In the last 4 weeks, how many servings of fruit and vegetable did you eat on an average day?" Fruit and vegetable intake at Time 1 averaged 2.76 servings per day, $SD = 1.40$, which is below the WHO recommendations for fruit and vegetable intake (5 a day; WHO, 2003).

Analytical procedure

The analyses were based on procedures recommended by Preacher, Rucker, and Hayes (2007). A moderated mediator model was tested, where self-efficacy was chosen as a moderator of the intention–planning as well as the planning–behavior relationship, using the MODMED macro (Version 1.1; Models 2 and 3) by Preacher et al. (2007). To test the interactions, variables were centered (Aiken & West, 1991). Moderated mediation is expressed by an interaction between self-efficacy and intention on planning, or self-efficacy and planning on behavior, respectively (MacKinnon & Luecken, 2008). Missing data at Time 1 were imputed using the Expectation Maximization (EM) algorithm in (Enders, 2001). To account for baseline behavior, Time 1 dietary behavior was included as a covariate.

Results

First, an interaction between intention and self-efficacy on planning was tested ("first stage moderated mediation"; Edwards



Note. All coefficients $p < .01$ (except for the intention-behavior relation).

Fig. 1. Moderated mediation model for fruit and vegetable consumption in $N = 411$ employees. *Note:* all coefficients $p < .01$ (except for the intention–behavior relation).

& Lambert, 2007), as in three of the four previous studies. No moderated mediation effect was found. "Second stage moderated mediation" was tested (as in the Costa Rica study) which yielded the following results. Perceived self-efficacy ($\beta = .86$, $p < .01$) emerged as the best predictor of behavior, followed by baseline behavior ($\beta = .32$, $p < .01$), and the interaction between planning and self-efficacy ($\beta = .31$, $p < .01$). Together, these variables accounted for 51% of the variance in planning. The self-efficacy × planning interaction indicates that there is a "second stage moderation effect" (see Fig. 1). There is no direct effect of intentions on behavior. Thus, there is a full mediation of the intention–behavior relation via planning, moderated by self-efficacy.

This analysis corroborated the hypothesized mediation effect, and underscores the finding that planning translates intentions into behavior, conditional upon the value of self-efficacy. This mediation did not materialize within the subgroup of individuals with low levels of self-efficacy. Employees needed a value above 2.78 on the 1–4 point scale to allow for a significant mediation effect.

Discussion

It was hypothesized that perceived self-efficacy may be a necessary precondition for the initiation or maintenance of dietary behaviors. Self-efficacious persons hold optimistic beliefs about their capability to control their diet, which might help them to enact their planning. Therefore, self-efficacious people might be more likely to translate their plans into action. In other words, planning would not translate intentions into behavior if people harbor severe self-doubts. The hypothesized moderator effect emerged, underscoring the particular contribution that perceived self-efficacy can make to our understanding of mechanisms of dietary changes. Mediation obviously does not apply to everyone in the same way. There are subgroups of people for whom a putative causal mechanism does not hold true. In the present case, this is the subgroup of poorly self-efficacious individuals.

When comparing the present finding to those of the four previous studies (Gutiérrez-Doña et al., 2009; Schwarzer et al., in press), there were some differences in the way that the moderator effect transpired. In three of the studies, there was a first stage moderation which is an interaction between intention and self-efficacy on planning. Only in the Costa Rica study, the same finding emerged as in the present one ("second stage moderation": interaction between planning and self-efficacy on dietary behavior). The Costa Rica study was only a cross-sectional one, with low-fat diet as the outcome variable. In terms of study aims and context, the German longitudinal online-study on fruit and vegetable consumption was closest to the present one but resulted in a "first stage" moderation effect. Thus, there is still no clear pattern across all five studies that would allow conclusions about a more universal mechanism of dietary change.

Some limitations are to be mentioned. All variables were self-reported. Enrichment of self-reported behavior by more refined or objective measures is desirable. There is no easy way to directly examine the validity of such self-reports. However, in general, self-reports of dietary behavior have been found sufficiently valid (Armitage & Conner, 2001).

Moreover, this is not an experimental study and does not allow for causal inferences. Experimental causal chain designs would be an option to examine the intention–behavior mediation by planning (Reuter, Ziegelmann, Wiedemann, & Lippke, 2008).

Nevertheless, the present study is innovative because it extends the well-known mediator model by a moderating factor. This can guide future research aimed at varying the kinds and number of such moderators to accumulate further evidence on the mechanisms of dietary change. Research also needs to compare various moderated mediation models to extend our understanding of health behavior change in different contexts, for different behaviors, and for different subgroups of individuals.

The present research can facilitate the design of interventions as planning is an alterable variable. It can be easily communicated to individuals with such self-regulatory deficits. Quite a few randomized controlled trials have documented the evidence in favor of such planning interventions (e.g., Luszczynska, Sobczyk, & Abraham, 2007a). It has become obvious that individuals with very low self-efficacy are handicapped when it comes to the adoption of healthy dietary behaviors. People who report low perceived self-efficacy may not benefit from planning interventions. It does not make much sense to merely teach them how to plan their behavior better or how to improve their intention levels. They first need to gain more confidence in their own resources to change or maintain a healthy diet even when barriers prevail. This might be promoted in self-efficacy interventions before offering planning treatments (Luszczynska, Tryburcy, & Schwarzer, 2007b). Self-efficacy can be improved by direct mastery experience, modeling, or persuasion. For example, one can practice resisting temptations in small steps and provide positive feedback for success.

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