

## **Self-Efficacy and Planning Predict Dietary Behaviors in Costa Rican and South Korean Women: Two Moderated Mediation Analyses**

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Dietary planning is supposed to mediate between intentions and dietary behaviors. However, if a person lacks self-efficacy, this mediation might fail. A cross-sectional study in Costa Rica and a longitudinal study in South Korea were designed to examine the moderating role of self-efficacy in the intention–planning–behavior relationship. Intentions, planning, self-efficacy, dietary behaviors, and baseline diet were assessed. Study 1 included 245 women; Study 2 included 358 women. Moderated mediation models were specified in which planning served as a mediator between intentions and behavior. Self-efficacy was specified as a moderator of the intention–planning–behavior relationship. Intentions were translated into dietary behavior by planning. However, levels of self-efficacy moderated this mediation process: The strength of the mediated effect increased along with levels of self-efficacy, even when accounting for baseline dietary behaviors. For planning to mediate the

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intention–behavior relation, people must harbor sufficient levels of self-efficacy. If they lack self-efficacy, either intentions are not well translated into planning, or planning is not well translated into behavior. Further research needs to clarify under which circumstances the moderator effect of self-efficacy operates in the first phase or the second phase of the mediation process.

Keywords: dietary behavior, intentions, moderated mediation, physical activity, planning, self-efficacy

## INTRODUCTION

Gender differences in dietary behaviors have been studied from a health behavior theory perspective (e.g. Renner, et al., 2008). The dietary practices of women are considered to be more healthful than those of men because they tend to consume more fruit and vegetables and less red meat. Women are more often inclined to make dietary changes and to participate in purposeful weight control. Women appear to be more health conscious and are more likely to change nutrition behaviors due to health-related and appearance-related concerns than men. The consistent findings of gender differences in the amounts and kinds of foods consumed may therefore reflect differences in health-related dietary self-regulation (Wardle, Haase, Steptoe, Nillapun, & Jonwutiwes, 2004). The present two studies, which focus on women exclusively, examine self-regulatory mechanisms in dietary changes.

Poor dietary habits are difficult to change. Most social-cognitive theories assume that an individual's intention to change is the best direct predictor of actual change. But people often do not behave according to their intentions. Therefore, intentions need to be supplemented by other, more proximal factors that might facilitate the translation of intentions into action.

Some of these postintentional factors have been identified, such as perceived self-efficacy and planning. However, it is not fully understood how these two factors interplay in bridging the intention–behavior gap. Previous studies have specified them as mediators within a multiple mediator model (e.g. Schwarzer, 2008; Schwarzer, Luszczynska, Ziegelmann, Scholz, & Lippke, 2008). In the present study, an interaction between these two postintentional factors 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.

## Mediation and Moderated Mediation

To study how behavior change takes place, we need to apply mediation analyses. To study for whom a particular change mechanism is valid, we need to study moderation. *Mediation* describes how an effect occurs, that is, how an independent variable (X) affects a dependent variable (Y) via a third

variable that is called an intervening variable or mediator ( $M_c$ ). By this, the total effect of X on Y is decomposed into the direct effect ( $X \rightarrow Y$ ) and the indirect effect ( $X \rightarrow M_c \rightarrow Y$ ). Complete mediation is the case in which X no longer affects Y after  $M_c$  has been controlled, whereas in partial mediation, the path from X to Y is lowered in size but remains significantly different from zero when the mediator is controlled.

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. When the moderator is a continuous variable, one looks for interactions (i.e. one computes a product term). There are two kinds of moderated mediation. The effect of X on the mediator may differ as a function of the moderator ( $M_o$ ), or the mediator may interact with the moderator to cause Y. In the first case, there is an interaction between X and  $M_o$ . In the second case, there is an interaction between  $M_c$  and  $M_o$  (Edwards & Lambert, 2007; Kenny, 2008; MacKinnon, 2008; Preacher, Rucker, & Hayes, 2007). Both kinds of moderated mediation may be of equal value to elucidate the mechanisms of behavior change.

## Planning Mediates the Intention–Behavior Relation

Good intentions are more likely to be translated into action when people plan how to cope with barriers. Intentions foster planning, which in turn facilitates behavior change. Planning was found to mediate the intention–behavior relation (e.g. Norman & Conner, 2005, Study 2; Scholz, Schüz, Ziegelmann, Lippke, & Schwarzer, 2008; Schwarzer, Schüz, Ziegelmann, Scholz, & Lippke, 2007, Studies 1–3; full mediation, Sniehotta, Scholz, & Schwarzer, 2005; Ziegelmann & Lippke, 2007; Ziegelmann, Luszczynska, Lippke, & Schwarzer, 2007). However, some studies failed to find such mediation effects (Norman & Conner, 2005, Study 1; Schwarzer et al., 2007, Study 4). This suggests that the relationships between intentions, planning, and behavior might also depend on other factors. For example, the degree to which planning mediates between intentions and behavior has been higher in older than in younger individuals (Renner, Spivak, Kwon, & Schwarzer, 2007; Scholz, Sniehotta, Burkert, & Schwarzer, 2007). This represents a case of moderated mediation.

Why does planning facilitate the impact of good intentions on behavior? *Action planning* is more than simply an extension of an intention because it includes specific situation parameters (“when”, “where”) and a sequence of action (“how”). It is more effective than intentions when it comes to the likelihood and speed of performance, partly because behavior might be elicited almost “automatically” when the relevant situational cues are encountered. People do not forget their intentions easily when specified in a when,

where, and how manner (for an overview and meta-analysis, see Gollwitzer & Sheeran, 2006).

A different way of planning is anticipating barriers and generating alternative behaviors to overcome them. This has been called *coping planning* (Scholz et al., 2007; Sniehotta, Scholz, & Schwarzer, 2006). People imagine scenarios that hinder them from performing their intended behavior, and they plan how to cope with such challenging situations. For example: “If I plan to run on Sunday, but the weather does not permit it, I will go swimming instead”, or “If there is something exciting on TV tonight that I do not want to miss, I will reschedule my workout to the afternoon.” Coping planning might be a more effective self-regulatory strategy than action planning, partly because it implies action planning. After people contemplate the when, where, and how of action, they imagine possible barriers and generate coping strategies. Thus, coping planning comes on top of action planning. Planning is an alterable variable. It can be easily communicated to individuals with self-regulatory deficits. Quite a few randomised controlled trials have recently documented the evidence in favor of such planning interventions (e.g. Luszczynska, Tryburcy, & Schwarzer, 2007).

## For Whom Does the Mediation Work? Self-Efficacy as a Minimum Requirement

*Perceived self-efficacy* is one potential 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 stages in the health behavior change process (Bandura, 1997). 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 persons with a high level of self-efficacy, planning might be more likely to facilitate goal achievement because optimistic self-beliefs instigate the execution of planning. Also, self-efficacious people feel more confident about translating their plans into actual behavior. In other words, whether intentions affect behavior via action planning (mediation) might depend on the individual’s level of self-efficacy (moderation).

In a previous study on physical exercise, longitudinal data from an online survey were used to examine these interrelationships (Lippke, Wiedemann, Ziegelmann, Reuter, & Schwarzer, in press). Only those persons who had a sufficiently high level of exercise self-efficacy acted upon their plans. Conversely, participants who were harboring self-doubts failed to act upon their

plans. However, these are first results which need to be replicated using different behaviors, samples, and contexts in order to arrive at reliable conclusions.

## AIMS OF THE TWO STUDIES

Our general assumption is that people need a minimum level of perceived self-efficacy for most processes of health behavior change. Therefore, we aim to cumulate empirical evidence from various samples, contexts, and health behaviors. Our two studies, therefore, analyse whether coping planning (mediator variable) mediates the effect of intentions (independent variable) on dietary behavior (dependent variable) as a function of self-efficacy levels (moderator).

### STUDY 1: PERCEIVED SELF-EFFICACY MODERATES THE INTENTION–PLANNING–BEHAVIOR MEDIATION IN COSTA RICAN WOMEN

The study in Costa Rica was conducted in collaboration with the Freie Universität Berlin to contribute to the cross-cultural validation of research on health behavior change.

## Method

*Participants.* All women in the study took part in a health-promotion program in San José, Costa Rica. Analyses were based on 245 women, aged 19 to 62 years ( $M = 40$  years,  $SD = 9.3$ ), of whom 43 per cent were married or living with a partner, 76.5 per cent had completed technical, college or graduate school, 60 per cent were white-collar workers, and 38 per cent were managers or professional workers.

*Procedure.* Participants were recruited by personal invitation at their workplace (public governmental institutions and higher education institutions in San José, Costa Rica). After they gave informed consent, participants were asked to complete a set of scales concerning social-cognitive variables (e.g. self-efficacy, intentions, coping planning) as well as nutrition, physical activity, smoking, and drinking behaviors.

*Measures.* Means, standard deviations, and intercorrelations are displayed in Table 1. Item examples given below are translations from Spanish.

*Intentions* were measured by two items that followed the stem “Which intentions do you have for the next weeks and months?” Item 1: “I intend to eat as healthily as possible.” Item 2: “I intend to eat as little fat as possible

TABLE 1  
Means (*M*), Standard Deviations (*SD*), and Intercorrelations for Intention, Planning, Self-Efficacy, and Dietary Behaviors in 245 Costa Rican Women

	<i>Intention</i>	<i>Planning</i>	<i>Self-Efficacy</i>	<i>Diet</i>
<i>M</i>	12.87	2.78	3.04	2.66
<i>SD</i>	1.71	0.81	0.63	0.58
Intention	1.00			
Planning	.39	1.00		
Self-efficacy	.20	.33	1.00	
Low-fat diet	.35	.31	.19	1.00

Note: All correlations  $p < .01$ .

(i.e. avoid fatty meat, cheese, etc.)” ( $r = .65$ ). Each item was followed by a 7-point scale ranging from *I don’t intend at all* (1) to *I intend strongly* (7). The sum score of these two scales was used as the measure of intention ranging from 2 to 14 (Schwarzer, 2008).

*Coping planning* aims to determine the degree to which individuals are mentally prepared for barriers and how to deal with them (Schwarzer, 2008). Coping planning for a low-fat diet was assessed by one item: “Most people would like to further improve their nutrition habits by taking in less fat. How about you?” “I already have concrete plans for what to do in difficult situations in order to stick to my intentions”, followed by a 4-point scale: (1) *Not at all true*, (2) *Barely true*, (3) *Mostly true*, (4) *Exactly true*.

*Perceived self-efficacy* was assessed by the stem “Certain barriers make it hard to change one’s nutrition habits. How sure are you that you can overcome the following obstacles?” This stem was followed by 11 items, such as “I can stick to a healthy (low-fat or low-salt) diet even if initially the food doesn’t taste as good”, or “I can stick to a healthy (low-fat or low-salt) diet even if my partner does not/my family does not change their nutrition habits.” Answers were given on a 4-point scale: (1) *Not at all true*, (2) *Barely true*, (3) *Mostly true*, (4) *Exactly true* (Cronbach’s alpha = .93).

*Dietary behavior* assessment was introduced with the stem “Some statements about your nutrition habits in general: How much does each statement apply to you?” This was followed by nine items that constitute the low-fat scale, such as: (a) “I avoid cholesterol-rich food”, and (b) “When I drink milk or eat milk products, I choose low-fat products (e.g. low-fat milk).” Responses were made on 4-point scales ranging from 1 (*not at all*) to 4 (*exactly true*) (Cronbach’s alpha = .83).

*Analytical Procedure.* The analyses were based on procedures recommended by Preacher et al. (2007). A moderated mediator model was tested,

where self-efficacy was chosen as a moderator of the planning–behavior relationship, using the MODMED macro (Version 1.1; Model 3) by Preacher et al. (2007). To test the interactions, centered variables were used (Aiken & West, 1991). Moderated mediation is expressed by an interaction between self-efficacy and planning (moderator\*mediator) on behavior (MacKinnon & Luecken, 2008). Missing data were imputed using the Expectation Maximization (EM) algorithm in SPSS 15 (Enders, 2001).

**Results**

*Self-Efficacy Moderates the Planning–Behavior Relationship.* The moderated mediation hypothesis was tested by the ModMed macro (Model 3) that is equivalent to a hierarchical multiple regression model with dietary behavior as the dependent variable; the self-efficacy\*planning interaction was added as the last step. First, planning was predicted by intentions ( $\beta = .39, p < .01$ ). Subsequently, dietary behavior was predicted by intentions ( $\beta = .27, p < .01$ ), coping planning ( $\beta = .20, p < .01$ ), self-efficacy ( $\beta = .11, p < .01$ ), and the self-efficacy\*planning interaction (Moderator\*Mediator,  $\beta = .21, p < .01$ ), accounting for 20 per cent of the variance in dietary behaviors. The significant interaction effect supported the assumption of moderated mediation (Figure 1). Planning partially mediated the intention–behavior relation, and this mediation was moderated by perceived self-efficacy.

Analyses were run on the null hypothesis that the conditional indirect effect does not differ significantly from zero at specific values of the moderator. Coping planning mediated the effect of intentions on dietary behavior only if self-efficacy was reported as being higher than 2.82. Thus, women must have an average score of at least 2.82 on the 1–4 scale to belong to the

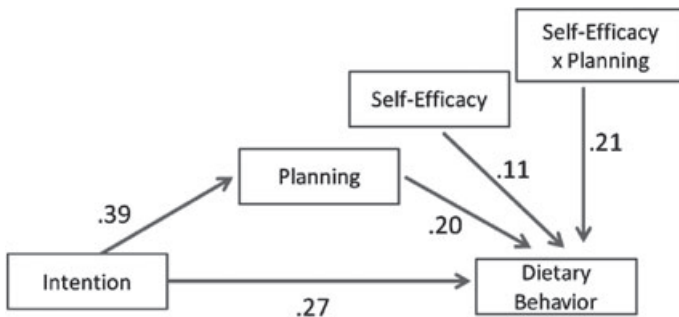


FIGURE 1. Moderated mediation model for Costa Rican women (Study 1).

Note: All coefficients  $p < .01$ .

subgroup in which intentions are translated by planning into behavior ( $p < .05$ ).

## STUDY 2: MODERATED MEDIATION OF DIETARY BEHAVIOR CHANGE IN SOUTH KOREAN WOMEN

The previous analyses have confirmed the partial mediation of the intention–behavior relationship by planning, and the moderation of this mediation by levels of perceived self-efficacy. This predicted dietary behaviors, but not behavioral change. To account for baseline behavior, the analysis needs to be replicated including Time 1 dietary behavior as a covariate. A longitudinal sample of 358 women provided the data. Women had responded to two questionnaires six months apart based on a study conducted in South Korea (Renner et al., 2008).

### Method

*Participants.* Residents of Seoul and Kyungki-do, South Korea, were invited to participate in the first-wave data collection (Time 1). Volunteers were recruited from universities, homes for the elderly, clerical institutions, and police departments. All participants gave informed consent prior to the Time 1 assessment, and again prior to Time 2. Data collection took place in the context of the respective settings. Anonymity was assured, and identification of questionnaires was made possible by a code that was generated by the participants themselves. No compensation was offered. Of the 1,359 persons who participated at Time 1, those 697 were selected for the analysis who had completed another questionnaire at Time 2 six months later, which included self-efficacy, coping planning, and dietary behaviors. From this sample, all women ( $N = 358$ ) were selected for the present reanalysis. Average age was 36 years ( $SD = 18.97$ ), with a range from 17 to 90 years.

*Measures.* Means, standard deviations, and intercorrelations are displayed in Table 2. Items were translated from German and English into Korean by bilingual and bicultural persons and native-language speakers and were verified through back-translations (see Schwarzer, 2008). All items were tested in a pilot study with respect to ambiguity, plausibility, and difficulty in order to reduce the frequency of invalid responses.

*Intentions* were measured with two items, namely (a) “I intend to eat as little fat as possible (such as avoiding fat meat, cheese, etc.)”, and (b) “I intend to eat healthy foods as much as possible” ( $r = .48$ ). Responses were made on 7-point scales ranging from 1 (*I don’t intend at all*) to 7 (*I strongly intend*).

Coping planning was assessed with a two-item scale. The item stem “I have made a detailed plan regarding . . .” was followed by the items (a) “. . . what



TABLE 2  
Means (*M*), Standard Deviations (*SD*), and Intercorrelations for Intention, Planning, Self-Efficacy, and Dietary Behaviors (T1 = Time 1, T2 = Time 2) in *N* = 358 South Korean Women

	<i>Intention</i>	<i>Planning</i>	<i>Self-Efficacy</i>	<i>Diet T1</i>	<i>Diet T2</i>
<i>M</i>	8.07	2.38	2.88	2.59	2.65
<i>SD</i>	2.49	0.71	0.63	0.55	0.52
Intention	1.00				
Planning	.37	1.00			
Self-efficacy	.30	.21	1.00		
Diet T1	.29	.35	.38	1.00	
Diet T2	.28	.42	.36	.68	1.00

Note: All correlations  $p < .01$ .

to do in difficult situations in order to stick to my intentions”, (b) “. . . how to deal with relapses” ( $r = .75$ ). Responses were made on 4-point scales ranging from 1 (*not at all*) to 4 (*exactly true*).

*Perceived self-efficacy* was assessed using the same 11 items that were used in Study 1 (Cronbach’s alpha = .94).

*Dietary behavior* was assessed at two points in time. The assessment was introduced with the stem “Some statements about your nutrition habits in general: How much does each statement apply to you?” This was followed by nine items that constitute the low-fat scale, such as: (a) “I avoid cholesterol-rich food”, and (b) “When I drink milk or eat milk products, I choose low-fat products (e.g. low-fat milk).” Responses were made on 4-point scales ranging from 1 (*not at all*) to 4 (*exactly true*), Cronbach’s alpha = .75.

*Analytical Procedure.* Moderated mediator models were tested where self-efficacy served as a moderator. Moreover, baseline behavior was included as a covariate, using the MODMEDC macro (Version 1.0; Models 2 and 3) by Preacher et al. (2007). To test the interactions, centered variables were used (Aiken & West, 1991). Moderated mediation can be expressed by an interaction between either self-efficacy and planning (Model 3) or self-efficacy and intentions (Model 2). Missing data were imputed using the Expectation Maximization (EM) algorithm in SPSS 15 (Enders, 2001).

## Results

Moderated mediation analyses were first run to replicate the findings of Study 1. However, Model 3 did not yield a significant moderation effect, which means that the self-efficacy\*planning interaction did not reach significance. But Model 2 did, indicating that the moderation effect exists at a different

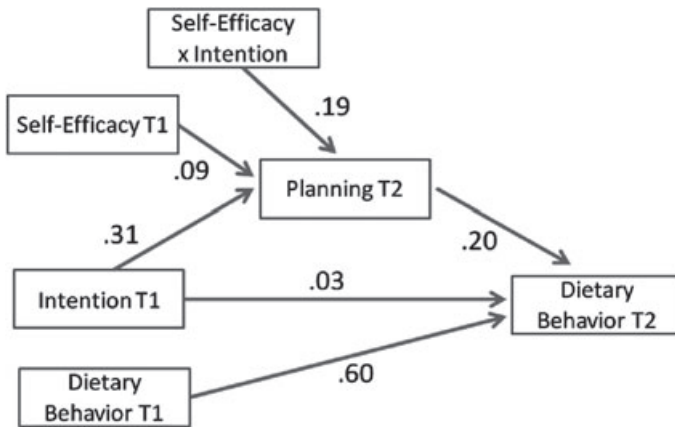


FIGURE 2. Moderated mediation model for South Korean women (Study 2).

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

point in the mediating mechanism (see Figure 2). The path diagram consists of a mediator model (to explain planning) and a dependent variable model (to explain behavior). First, intentions ( $\beta = .31$ ,  $p < .01$ ) emerged as the best predictor of coping planning, followed by the interaction between intentions and self-efficacy ( $\beta = .19$ ,  $p < .01$ ), whereas the main effect of self-efficacy was rather negligible ( $\beta = .09$ ,  $p < .01$ ), overall accounting for 18 per cent of the planning variance.

Second, baseline behavior was the best predictor of Time 2 low-fat diet ( $\beta = .60$ ,  $p < .01$ ), followed by planning ( $\beta = .20$ ,  $p < .01$ ), whereas intentions did not make a contribution, overall accounting for 51 per cent of the behavior variance. Thus, there is a full mediation of the intention–behavior relation via planning, moderated by self-efficacy.

This analysis corroborated the hypothesised mediation effect, conditional upon the value of self-efficacy, underscoring the finding that planning translated intentions into behavior, but not within the subgroup of individuals who had very low levels of self-efficacy. Women needed an above-average self-efficacy value of 2.28 on the 1–4 scale to allow for a significant mediation effect ( $p < .05$ ).

## GENERAL DISCUSSION

The present study has confirmed the common assumption that planning can operate as a mediator of the intention–behavior relationship. The main contribution, however, lies in the extension of the mediator model into a

moderated mediation model and its replication with baseline behavior as a covariate. It was hypothesized that perceived self-efficacy may be a necessary precondition for the mediation process. Self-efficacious persons hold optimistic beliefs about their capability to control their dietary behaviors, which might help them to generate plans or to enact their planning. Therefore, self-efficacious people might be more likely to translate their intentions into action. In other words, planning does not translate intentions into behavior if people have severe self-doubts. Only people who report very low self-efficacy do not benefit from planning. The present findings in two samples corroborate a previous longitudinal study on physical exercise (Lippke et al., in press).

This leads to the importance of the study. *First*, moderated mediation elucidates the mechanisms of dietary change. 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. However, other research has found other relevant moderators, such as sex (Renner et al., 2008), age (Renner et al., 2007), subjective residual life-expectancy (Ziegelmann, Lippke, & Schwarzer, 2006), or intention (Wiedemann, Schüz, Sniehotta, Scholz, & Schwarzer, in press).

Moderated mediation is a multifaceted phenomenon. There are various statistical models that pertain to particular cases in which a mediation process can be moderated by a third or fourth variable. In our two studies, two models supported our hypotheses. Although both studies have resulted in the same overall conclusion, there remains a minor difference in the putative mechanisms. The conditional indirect effects come from two different locations in the chain of events. In Study 1, self-efficacy operated upon the planning–behavior relationship, whereas in Study 2 self-efficacy operated upon the intention–planning relationship. The cross-sectional nature of the first study does not seem to be a reason for this inconsistency because the same finding emerged in the previous longitudinal study on physical activity (Lippke et al., in press). Thus, further studies need to examine at which exact point self-efficacy is needed most to translate intentions into behavior. However, the main conclusion of all three studies is that self-efficacy operates as a moderator in the self-regulation process.

*Second*, the question arises how the present research can facilitate the design of interventions. It is obvious that individuals with very low self-efficacy are handicapped when it comes to the adoption of healthy dietary behaviors. It does not make much sense to 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 (Luszczynska et al., 2007).

Some limitations are to be mentioned. The first study was cross-sectional. Only the replication of its results by the second—longitudinal—study creates

added value. Together with the previous German study (Lippke et al., in press) on physical exercise, there are now three independent studies that have accumulated evidence for self-efficacy as a moderator of the intention–planning–behavior relationship.

Data were self-reported, and enrichment of the dietary behavior data by more refined or objective measures is desirable. There is no possibility to examine directly the validity of these self-reports. However, in general, self-reports of dietary behavior have been found sufficiently valid (Armitage & Conner, 2001). Moreover, these are nonexperimental data that do not allow for causal inferences. Experimental causal chain designs are also needed to examine the intention–behavior mediation by planning (Reuter, Ziegelmann, Lippke, & Schwarzer, 2008).

Nevertheless, the present studies are innovative because they extend the well-known mediator model by moderating processes. This can be an example for future research that varies the kinds and number of such moderators, which would help to accumulate further evidence on the mechanisms of dietary change. Further research needs to compare various moderated mediation models to extend our understanding of the mechanisms of health behavior change in different contexts, for different behaviors, and for different subgroups.

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