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Research report

A dietary planning intervention increases fruit consumption in Iranian women

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ABSTRACT

The study examined whether a dietary planning intervention would help increase fruit consumption among Iranian women focusing on self-regulatory mechanisms in behavior change. We conducted a randomized controlled trial to compare a planning intervention with a control condition in 165 Iranian women (aged 17–48 years). Dependent variable was fruit intake, and dietary planning served as the mediator. After baseline assessment (T1) the intervention group received a leaflet on fruit consumption with a planning sheet. Changes were assessed at 3-weeks (T2) and at 3-months follow-ups (T3). Findings showed that the dietary planning intervention led to an increase in fruit intake. Age moderated this mediation. Changes in dietary planning mediated between intervention and fruit consumption in middle aged women. Dietary planning seems to play a role in the mechanism that facilitates fruit intake among Iranian women. This mediation by planning was found in middle aged women (30–48 years old), but not in young adult women (17–29 years old).

Introduction

A balanced diet low in fat and rich in fiber and vitamins can facilitate health, physical fitness, and maintain body weight. However, dietary habits are difficult to change (Adriaanse, Gollwitzer, de Ridder, de Wit, & Kroese, 2011; Verhoeven, Adriaanse, Evers, & de Ridder, 2012). Changing dietary behaviors requires not only basic knowledge about nutrition, but also motivational and volitional factors that guide self-regulatory processes.

The present study was designed to make a contribution to the understanding of psychological mechanisms that may lead to an increase in fruit consumption. In comparison to fat reduction, calorie restriction, or vegetable intake, fruit intake is intuitively more appealing to many people, and therefore, this constitutes a relatively easy task that is suitable as a starting point for major dietary changes (e.g., Guillaumie, Godin, Manderscheid, Spitz, & Muller, 2012).

Various psychosocial factors are associated with dietary changes. To adhere to the recommendations, one has to become motivated to do so, and if one is motivated, one needs additional self-regulatory skills and behaviors such as planning to translate a dietary goal into action. Contrary to the ability to delay gratification, time discounting is a common tendency to prefer immediate pleasure from eating sweet and fatty foods over delayed benefits of a healthy nutrition. To counteract time discounting, one should make beneficial dietary behaviors more proximal. Instead of choosing long-term weight loss goals, people are better off when formulating short-term behavioral goals, such as eating fruit and vegetables today.

A meta-analysis has documented the role of planning in dietary changes, including fruit consumption (Adriaanse, Vinkers, de Ridder, Hox, & de Wit, 2011). Planning can be promoted effectively among individuals with self-regulatory deficits (Adriaanse et al., 2010). Planning facilitates the translation of intention into action. Studies have, therefore, specified planning as a mediator (e.g., Burkert, Scholz, Gralla, & Knoll, 2011; Gutiérrez-Doña, Lippke, Renner, Kwon, & Schwarzer, 2009; Renner et al., 2008; Richert et al., 2010; Scholz, Nagy, Göhner, Luszczynska, & Kliegel, 2009). Hunter, McNaughton, Crawford, and Ball (2010) provided evidence of a mediating effect of dietary planning on fruit consumption among women. Several randomized controlled trials have documented the evidence in favor of such planning interventions in the context of dietary changes (e.g., Guillaumie et al., 2012; Kellar & Abraham, 2005; Kreausukon, Gellert, Lippke, & Schwarzer, 2012; Luszczynska, Tryburcy, & Schwarzer, 2007; Luszczynska & Haynes, 2009; de Vet, de Nooijer, de Vries, & Brug, 2008; Wiedemann, Lippke, & Schwarzer, 2012). More precisely, adding planning compo-

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nents to interventions has induced larger effects than interventions based solely on information provision (Stadler, Oettingen, & Gollwitzer, 2010). In the study by Wiedemann et al. (2012) fruit and vegetable intake increased with higher number of plans formed by the study participants, indicating that generating multiple plans benefits behavior change. Similarly, in the study by Luszczynska and Haynes (2009) planning led to an average increased fruit and vegetable consumption of 0.45 servings among student nurses and midwives. Thus, planning components appear to be useful self-regulatory intervention strategies to promote dietary behaviors.

Previous research on planning as a mediator has found a moderation by age (Reuter et al., 2010). In that study, planning mediated the effect on physical activity but this was valid only for the older age group. Furthermore, other studies, followed up on this moderation effect by using future time perspective as a moderator instead because future time perspective is usually moderately related to age (Gellert, Ziegelmann, Lippke, & Schwarzer, 2012; Ziegelmann, Lippke, & Schwarzer, 2006). Findings revealed that in persons with a more limited future time perspective, the mediation effect of planning on outcome behavior was stronger than in persons with more expansive time perspectives (Gellert et al., 2012). Given the importance of age, we examine its role as a putative moderator within a broader range, namely in young adult and middle aged Iranian women.

Aims

We investigate the psychological mechanisms through which a dietary planning intervention leads to an increase in fruit consumption in Iranian women. The study was designed as a randomized controlled trial to examine the effects of the intervention in comparison to a control group. It was expected that the intervention group not only scores higher in dietary planning, but also reports higher levels of fruit consumption later on.

Moreover, to explain such a desired outcome, the possible gain in fruit intake needed to be traced back to the self-regulatory intervention ingredient, in this case dietary planning. Thus, in line with the literature cited above, changes in planning were specified as a mediator between the intervention and fruit consumption. Furthermore, it will be investigated whether this mediator effect is moderated by age within the range from 17 to 48 years.

Method

Participants and procedure

We conducted a self-regulation intervention focusing on fruit consumption among Iranian women over a time span of 4 months from February 2012 to May 2012 with three assessment points in time. The study followed APA ethical principles regarding research with human participants and was approved by the internal review board.

Participants were invited to a health promotion program through newspapers. Attending the program was voluntary. Exclusion criteria were any medical contradiction with health recommendations for fruit consumption. A total of 274 women were recruited and informed about the design and procedure of the study, following recruitment nine individuals refused to join the program (for reasons such as not having time, travel plans, and not interested). Thus 265 participants were randomly allocated to an intervention and a control group (Fig. 1). Participants were blinded about the allocation throughout the study. The pre-test (T1) questionnaires included socio-demographic information (e.g., age, marital status, education, weight and height) and socio-cognitive variables as well as fruit intake level at Time 1 of assessment. Only the intervention group received the intervention package (see below). The post-test (T2) questionnaires were mailed after 3 weeks and filled out by 243 participants. Three months later, the follow-up (T3) questionnaire was completed by 165 participants (Fig. 1). Mean age of the longitudinal sample was 33.5 years with SD = 5.10 and a range from 17 to 48 years. Mean BMI was 27.12 (SD = 3.84; ranging from 18.69 to 36.17), 34% of the sample had a high school diploma, 41% had a bachelor degree, 8% had less than high school, and 5% had a master degree or more, and 87% were married. Their mean number of children was 2.43 (SD = 1.04; ranging from 0 to 5).

Measures

Fruit intake was measured with an open answer format: "How many portions of fruit have you eaten on average per day during last week?" One portion of fruit was defined as equivalent to one handful, examples were one handful of chopped fruits or grapes.

Dietary planning was measured by two items: (1) "I have planned what to eat, when to eat, and where to eat a particular fruit", and (2) "I have made a detailed plan on how to maintain fruit intake despite other obligations or interests". Responses were rated on a four-point Likert scale ranging from (1) *not at all true* to (4) *exactly true*, and scale scores were obtained by averaging the responses. Questions were adapted from Schwarzer (2008). Item examples are backtranslations from Persian (Cronbach's α for three points in time were .65, .71 and .76 respectively).

Intervention and control conditions

In the experimental condition, participants received an intervention package at the end of their pre-test questionnaire. According to the behavior change technique definitions by Michie et al. (2011), the intervention consisted of technique 1 (i.e., provide information on consequences of behavior in general), with WHO recommendations on healthy nutrition, e.g., consumption of at least five portions of fruit and vegetables per day (WHO, 2002), also technique 21 (provide instruction in how to perform the behavior) with samples of the behavior (e.g., taking an extra serving of vegetables or a side salad with your lunch). Moreover the intervention included dietary planning exercises for fruit consumption in line with techniques 7 (action planning), and 8 (barrier identification/problem solving) (Michie et al., 2011). Participants were asked specifically to generate plans for two occasions with specifying the place, accompanying person, the time or meal, day of week and which kind of fruit they wanted to consume (by the questions where, with whom, which meal or time, when and what). Moreover, they were asked to generate two situations which may impede the planned behavior, and a strategy to overcome the barriers (for example, "If I stay out all day long and cannot consume fruit during the day, then I will have a fruit salad for dinner").

In the control condition, participants only received the questionnaires at three assessment points without an intervention.

Both groups were provided with an email address and a telephone number for more information if desired.

Analytical procedure

All analyses were run with SPSS 20. Dropout analyses compared retained participants with those lost after T1 and T2 using *t*-tests for continuous measures and χ^2-tests for categorical measures. Randomization checks tested baseline differences between participants in the two study conditions by means of ANOVAs for continuous and χ^2-tests for categorical measures. To examine intervention effects, repeated measures analyses of variance were

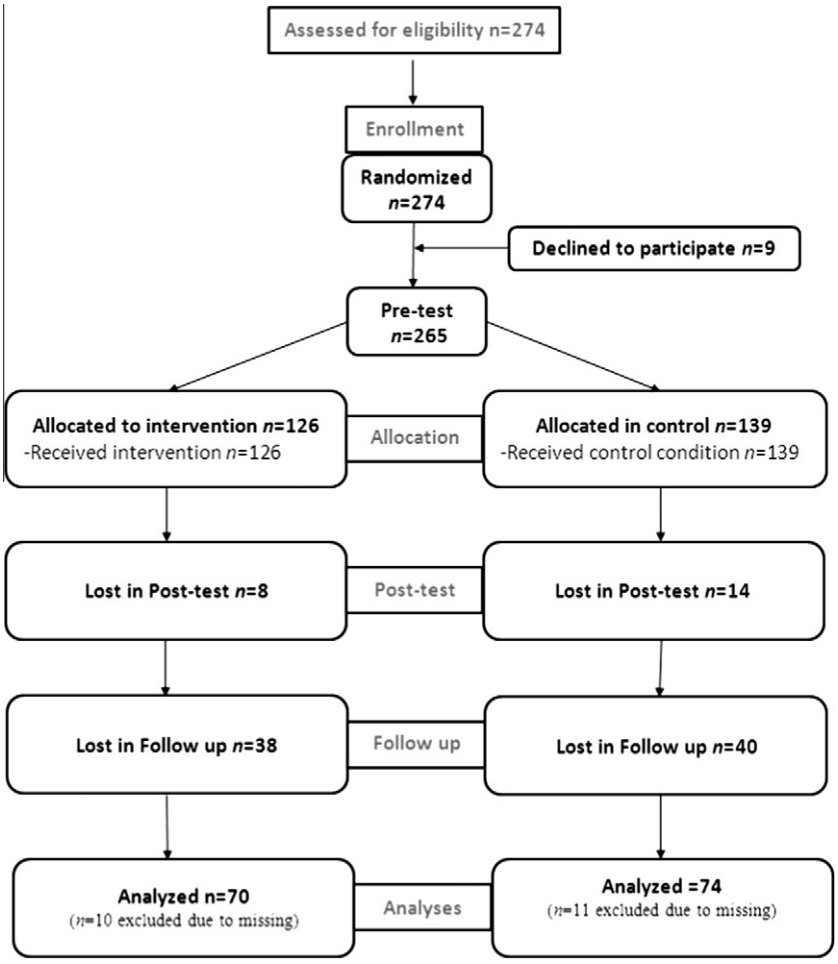

Fig. 1. Flowchart with numbers of participants who attended the intervention and control conditions.

computed with fruit intake, and dietary planning as dependent variables at three points in time, and experimental conditions as the between-subjects factor. A moderated mediation model to predict T3 fruit intake was specified with baseline fruit intake as a covariate, using the PROCESS macro by Hayes (2012). Moderated mediation was expressed by an interaction of age and change in dietary planning (T2) (moderator∗mediator) on behavior, which affects the mediation process. Change scores (Time 3 minus Time 1) of dietary planning served as mediators (MacKinnon, 2008). Statistical significance was determined by bootstrapping using 5000 resamples. In addition, we applied an extension of the Johnson–Neyman technique to moderated mediation (MacKinnon, Fairchild, & Fritz, 2007). This technique tests the significance of the indirect effect within the observed range of values of the moderator until the value of the moderator is identified, for which the conditional indirect effect is just statistically significant at a pre-set level (here, $\alpha = .05$). Values of the moderator for which the mediation effect is significant constitute the region of significance.

Results

Drop-out analyses

Attrition analysis indicated that individuals who continued study participation were slightly older compared with those who did not ($M_{\text{Responder}} = 33.54$, $SD_{\text{Responder}} = 5.25$; $M_{\text{Non-Responder}} = 32.11$, $SD_{\text{Non-Responder}} = 5.10$; $t(230) = -2.10$; $p < .05$). There were no differences in fruit intake, dietary planning, and BMI (all $p > .05$).

Randomization check

Results revealed no baseline differences across the two study conditions regarding fruit intake, planning and age (all $p > .05$). However, individuals in the intervention group had a slightly lower mean of BMI ($M_{\text{Intervention}} = 26.01$, $SD_{\text{Intervention}} = 3.14$; $M_{\text{Control}} =$

Table 1
Means and Standard Deviations (SDs) of fruit intake and planning in both groups, and comparison between groups.

Variable/group	Pre-test					Post-test					Follow up				
	M	SD	*t*	*p*	*d*	M	*SD*	*t*	*p*	*d*	M	SD	*t*	*p*	*d*
Fruit intake			−1.64	.10	−0.21			.21	.83	0.03			2.00	<.05	0.30
Intervention	3.45	1.81				3.69	1.83				4.52	2.01			
Control	3.87	2.17				3.63	1.97				3.90	2.02			
Dietary planning			−1.28	.20	−0.15			1.73	.08	0.23			1.48	.14	0.22
Intervention	2.87	.65				3.02	.69				3.07	.70			
Control	2.98	.73				2.86	.66				2.91	.74			

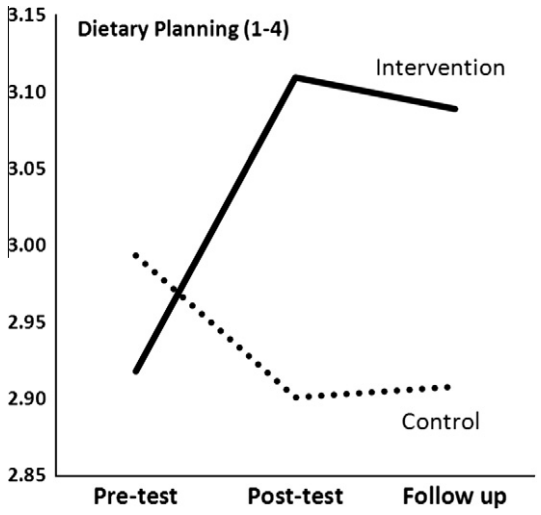

Fig. 2. Levels of dietary planning in the two experimental conditions at three points in time.

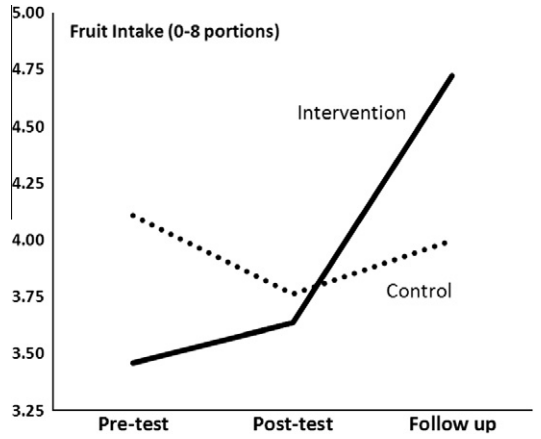

Fig. 3. Levels of fruit intake in the two experimental conditions at three points in time.

27.63, $SD_{Control} = 4.19$; $t(106) = 2.25$; $p < .05$). Repeating central analyses while controlling for BMI did not alter our findings. For model parsimony in the following models without this covariate are reported.

Intervention effects

Means, standard deviations, and group comparison statistics for all variables are summarized in Table 1.

To examine the intervention effects at posttest (T2) and follow-up (T3), repeated measures ANOVAs were computed.

For *dietary planning*, no effect for time emerged, $F(1,147) = 0.47$, $p = .50$, and no main effect for experimental group, $F(1,147) = 1.39$, $p = .24$. An interaction between group and time emerged, $F(1,147) = 4.21$, $p = .04$, $\eta^2 = .03$ (see Fig. 2). This finding can serve as a manipulation check, as the main treatment component was practicing dietary planning.

For *fruit consumption*, a main effect of time emerged, $F(1,156) = 7.87$, $p = .006$, $\eta^2 = .05$, but no treatment effect, $F(1,156) = .006$, $p = .94$. There was an interaction between treatment and time, $F(1,156) = 11.08$, $p \leqslant .001$, $\eta^2 = .07$ (see Fig. 3).

Moderated mediation analysis

The following analysis addresses the question of whether the key intervention ingredient, dietary planning was instrumental in the change of fruit consumption levels. For this purpose, changes in dietary planning (T3-T1) were considered to serve as a mediator between the interventions and the behavioral outcome, fruit consumption. Mediation analyses, controlling for baseline behavior, did not yield the expected results. When exploring a conditional process, however, it was found that age moderated the hypothesized mediation. There was a significant interaction between age and changes in dietary planning ($b = .09$, $p = .04$) on fruit consumption at follow-up. Fig. 4 displays the moderated mediation model with unstandardized parameter estimates. The process from experimental conditions via planning changes to later fruit consumption works in women aged 30–48 years (region of significance) but not in those aged 17–29, as identified by the Johnson–Neyman technique and bootstrapping.

Discussion

This study examined whether a brief nutrition intervention would make a difference on fruit consumption. Iranian women were randomly assigned to a psychological intervention or control group. The intervention was theory-guided, with a particular focus on dietary planning. Repeated measures analyses comparing these two groups at pretest, posttest, and follow-up yielded significant time by group interactions for the two dependent variables: fruit consumption and dietary planning. It was found that participants receiving the intervention consumed more fruit than participants

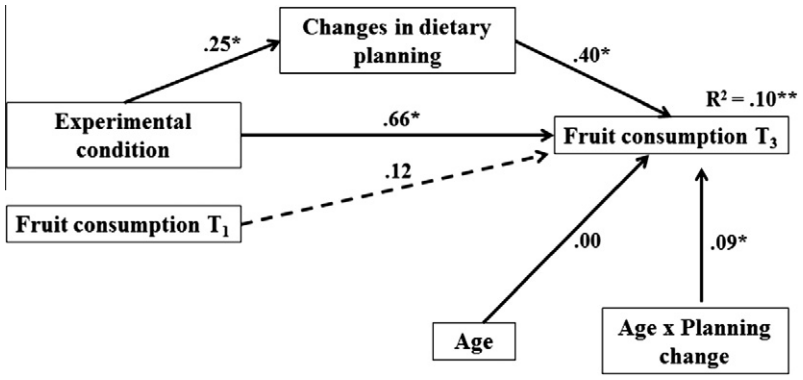

Fig. 4. Effects of experimental conditions (1 = treatment, 0 = control) via changes in dietary planning on fruit intake, moderated by age, controlling for baseline fruit consumption. Mean centered solution with unstandardized coefficients; bootstrapped with 5000 resamples. $^{**}p < .01$, $^{*}p < .05$.

in the control condition. The same intervention effect emerged for dietary planning.

A further question was whether planning simply constitutes an outcome of the intervention, or whether it might reflect the ingredient of the intervention package and would, thus, operate as an agent for behavior change. To examine the mechanism of behavior change we specified and confirmed a path model where changes in dietary planning served as a mediator between experimental conditions and later fruit consumption.

In a moderated mediation approach, age has turned out to serve as a moderator of the mediator-outcome path in the present analyses whereas other demographics were not involved in the mechanism of change. The moderator effect points to the limited range of the mediation process. The mediation effect of experimental conditions at T1 on fruit intake at T3 via changes in dietary planning was only valid for the middle aged women (30–48 years old) whereas in the young adult women (aged 17–29) no significant mediation took place. A very similar finding had emerged in research on physical activity changes (Reuter et al., 2010). There, planning also mediated the effect on physical activity but this was valid only for the middle aged group. Also studies using future time perspective as a moderator (Gellert et al., 2012; Ziegelmann et al., 2006), have found that older adults or individuals with more limited future time perspective, benefit more from self-regulation strategies in comparison with younger adults.

According to the selection, optimization, compensation model (Baltes & Baltes, 1990; Freund & Baltes, 2002; Reuter et al., 2010), the results can be interpreted as indicating a stronger planning–behavior link in middle-aged women as compared to young adult women, because these middle-aged women have more experience in terms of goal achievement which leads them to enact their plans and achieve their health goals despite barriers by increasing their effort or selecting their most important health goal. Additionally, since conscientiousness seems to be increasing during adulthood (McCrae, 2002), middle aged women may have more practice in planning and can benefit from it to a larger degree than younger women.

There are some limitations. Assessments were self-reported, and fruit intake was measured retrospectively. Retrospective methods are vulnerable to unintentional misreporting (e.g., due to recall errors). One could overcome this limitation by using on-going dietary assessments such as food diaries, where individuals record details of foods at the time of consumption or shortly afterwards (e.g., Kolar et al., 2005). But measurement error depends on the accuracy of the reported intake by the participant in the same way: Individuals may forget to record food items consumed, or to cover up poor eating habits. Besides, we have collapsed action planning and coping planning into a two-item scale, labeled dietary planning. For an assessment of action planning and coping planning as separate constructs, more items for each indicator would be preferable. Moreover, we observed some degree of systematic age-related dropout in this sample. Our findings should thus be interpreted with caution as they might apply to women of a more limited (upper) middle-aged population only. This drop-out mechanism, however, was accounted for in our central explanatory model.

Nevertheless, the theory-guided intervention design may have further elucidated the mechanisms of dietary change processes, using fruit consumption as an example. The findings partly replicate similar studies with different health behaviors and, thus, make a contribution to our cumulative knowledge about self-regulatory components in health behavior change. Moreover, the present study investigates age and planning regarding fruit consumption in Iranian women. In comparison to most studies on the same topic, the present one uses a different and rarely studied sample. Future research should examine under which circumstances other mediators operate (e.g., self-efficacy, action control, social norms) and whether other moderating effects in addition to age can be identified, and also should look at the effect of cultural differences.

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