Will is not enough: Coping planning and action control as mediators in the prediction of fruit and vegetable intake

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Objectives. This study investigates the joint role of coping planning and action control as volitional predictors of changes in the daily consumption of fruit and vegetables.

Design. In a longitudinal online survey, 203 participants completed assessments at baseline (Time 1), 1 week (Time 2), and 2 weeks later (Time 3).

Methods. Structural equation modelling was used to test a series of three nested models. In Model 1, only intention predicted behaviour; in Model 2, both coping planning and action control were tested as mediators between intention and behaviour; and Model 3 specified coping planning and action control as sequential mediators between intention and behaviour.

Results. Model 3 provided the best fit to the data. The mediating role of coping planning and action control between intention and fruit and vegetable intake was confirmed, whereby multiple mediation occurred in a sequential manner, with coping planning preceding action control.

Conclusions. For motivated individuals who are not yet following the recommendations for fruit and vegetable consumption, coping planning and action control reflect a psychological mechanism that operates in changes in fruit and vegetable consumption.

Statement of contribution

What is already known on this subject?
- Intention formation might not be enough to change complex health behaviours, such as dietary behaviours.
- Volitional factors – Such as action planning – Have shown to be important for the translation of intentions into behaviour, particularly for fruit and vegetable intake.
- Other volitional factors such as coping planning and action control have been less studied as potential mediators between intention and fruit and vegetable intake.

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What does this study add?

- This study provides further evidence on the psychological mechanisms of fruit and vegetable intake.
- Coping planning and action control are shown to act jointly in the prediction of fruit and vegetable intake.
- A double mediation was found, attesting the translation of intention into fruit and vegetable intake sequentially by coping planning and action control.

Despite the benefits provided by fruit and vegetables, data from different countries (Lock, Pomerleau, Causer, & McKee, 2004) show that most people eat well below the World Health Organization recommendation of a minimum of 400 g of fruit and vegetables (i.e., approximately five portions) per day. Low fruit and vegetable intake is among the top 10 risk factors contributing to mortality and morbidity worldwide (WHO, 2002). Thus, a better understanding of the cognitive mechanisms that are relevant for the promotion of fruit and vegetable intake is vital for the development of evidence-based interventions. Dietary behaviour change requires not only basic nutritional knowledge, but also motivational and volitional processes, which guide self-regulatory efforts (Adriaanse, Gollwitzer, De Ridder, De Wit, & Kroese, 2011; Verhoeven, Adriaanse, Evers, & De Ridder, 2012).

Motivational and volitional mechanisms of health behaviour change

Research pinpointing the psychological processes that mediate between intentions and behaviour has flourished in recent years in an attempt to bridge the so-called intention–behaviour gap (Sheeran, 2002) and has contributed to the prediction of several health behaviours (e.g., Adriaanse, Vinkers, De Ridder, Hox, & De Wit, 2011; Mann, de Ridder, & Fujita, 2013). The study of volitional processes that help individuals to translate their intentions into action is especially important for complex behaviours where multiple barriers are anticipated. Changing complex behaviour, such as eating at least five portions of fruit and vegetables on a daily basis, requires more than simply formulating an intention, and its implementation may not be achieved through a single act of will, but rather demands considerable self-regulatory effort.

The aim of the present study is to uncover the mechanisms through which intentions to eat fruit and vegetables are translated into actual behaviour. More specifically, we set out to investigate the relevance of two volitional processes (i.e., coping planning and action control) for fruit and vegetable consumption inspired by the Health Action Process Approach Model (HAPA; Schwarzer, 2008).

Health action process approach model

The HAPA provides a framework for the study of both the motivational predictors of intention, such as outcome expectancies, self-efficacy and risk perception, and the volitional predictors of behaviour. Outcome expectancies are beliefs regarding the benefits or costs the individual expects to experience by adopting (or not) the behaviour and are predictors of intentions (Schwarzer, 2008). Self-efficacy is an optimistic belief about one’s personal ability to perform novel or difficult behaviour, even when confronted with potential barriers. The model also includes risk perception as a putative
motivational predictor, but is considered to be negligible in the context of fruit and vegetable consumption (Schwarzer et al., 2007).

Self-efficacy and outcome expectancies contribute jointly to intention formation, but then the ‘good intention’ has to be transformed into action. Both planning, such as coping planning, and mastering self-regulatory skills, that is, successful action control, are crucial volitional processes for this transition.

**Coping planning**
Reviews have documented the role of planning in health behaviour change, including fruit and vegetable consumption (Adriaanse, Vinkers et al., 2011; Kwasnicka, Presseau, White, & Sniehotta, 2013), and several studies have specified planning as a mediator between intention and action (e.g., Gholami, Lange, Luszczynska, Knoll, & Schwarzer, 2013; Wiedemann, Lippke, Reuter, Ziegelmann, & Schwarzer, 2011).

Planning encompasses both action planning and coping planning. *Action planning* pertains to a mental simulation of when, where, and how one intends to perform the behaviour. It is a task-facilitating strategy that helps link the desired end-state, formulated through intention, to specific situational cues and may therefore be especially important for the initiation of behaviour. *Coping planning* involves anticipating potential obstacles in the process of behaviour enactment and preparing strategies for dealing with such barriers. The number of studies examining action planning and establishing its role in fruit and vegetable intake has increased considerably over recent years (Adriaanse, Vinkers et al., 2011). In contrast, research on coping planning in fruit and vegetable intake is still scarce, although the anticipation of strategies for overcoming barriers has been considered relevant for the maintenance of complex behavioural changes (Scholz, Schü, Ziegelmann, Lippke, & Schwarzer, 2008; Sniehotta, Schwarzer, Scholz, & Schü, 2005). Therefore, in the present study, we will focus on this less explored type of planning.

Studies attest the importance of coping planning for the prediction of behaviour and its effectiveness as an intervention strategy for behavioural change (Kwasnicka et al., 2013). Higher levels of coping planning were associated with the practice of physical exercise (Sniehotta, Schwarzer et al., 2005), and another study demonstrated that an intervention combining action planning with coping planning was more effective in the promotion of physical exercise than an action planning intervention alone, indicating that coping plans may act as a shield to protect action plans from emerging barriers (Sniehotta, Scholz, & Schwarzer, 2006).

There are fewer studies on coping planning for fruit and vegetable consumption; however, available evidence points to similar results. Interventions explicitly including action planning and coping planning prompts promoted significant increases in fruit and vegetable intake at follow-up, and these effects were fully (Guillaumie, Godin, Manderscheid, Spitz, & Muller, 2012) or partially mediated (Wiedemann et al., 2011) by coping planning. Moreover, increases in action planning were only converted into higher fruit and vegetable intake when coping planning had also increased sufficiently (Wiedemann et al., 2011). This suggests that making plans for the implementation of an intention may not suffice to change a particular behaviour, such as fruit and vegetable consumption. Indeed, there is plenty of literature on the barriers for fruit and vegetable intake (e.g., John & Ziebland, 2004), thus suggesting that coping planning might be conducive to achieving the goal of eating sufficient quantities of fruit and vegetables per day.
Action control

To self-regulate their behaviour, individuals must be aware of the desired end-states (awareness of standards), monitor their current behaviour and continuously compare it to the standards they seek (self-monitoring), and endeavour not to act upon impulse or habitual behaviour patterns (effort; Baumeister & Heatherton, 1996). These three self-regulation processes are components of the action control construct (Sniehotta, Scholz, & Schwarzer, 2005), which has been conceptualized as the most proximal determinant of behaviour. Whereas planning must be set beforehand, action control is an ongoing regulatory process that partially occurs during behavioural enactment.

Action control has been found to be a good predictor of behaviour. In a longitudinal study with cardiac rehabilitation patients, action control had the strongest direct effect on physical exercise, when compared with action planning and maintenance self-efficacy. Moreover, the effects of intention on behaviour were mediated by action control (Sniehotta, Scholz et al., 2005). A further two longitudinal studies demonstrated that changes in adopting a low-fat diet and smoking cessation were associated with change in action control over and above the effects of intentions (Scholz, Nagy, Göhner, Luszczsynska, & Kliegel, 2009). Even stronger evidence comes from a study on dental flossing, where a very simple action control intervention (i.e., a dental flossing calendar) promoted an increase in the frequency of flossing among volitional individuals (i.e., those who already had the intention to floss), but did not have any effects on intention (i.e., motivational effects; Schüz, Sniehotta, & Schwarzer, 2007).

In short, evidence from different studies has converged in indicating the importance of action control as a predictor of behaviour. Fewer studies, however, have tested whether action control mediates the relation between intention and behaviour. Moreover, to the best of our knowledge, no study has explicitly investigated the relevance of action control as a mechanism for explaining fruit and vegetable intake. Nevertheless, there are several reasons for expecting action control to play a role in fruit and vegetable intake. First, holding inappropriate standards (i.e., too high or too low) has been shown to preclude the process of self-regulation (Heatherton & Ambady, 1993), and studies on fruit and vegetable intake have corroborated that a lack of awareness of the discrepancy between one’s present intake and the recommended amount of fruit and vegetable intake hinders higher levels of consumption (e.g., Brug, Debie, Assema, & Weijts, 1995). Second, self-monitoring is particularly relevant for behaviours that should unfold throughout the day, every single day, as is the case of fruit and vegetable consumption. Finally, habit is known to be an important determinant of food choices (e.g., Verhoeven et al., 2012), making behavioural enactment less of an effort, as habitual behaviours become automatic (Verplanken & Wood, 2006). Thus, when the habit of adequate daily fruit and vegetable intake is absent, effort is needed to attain the goal of eating at least five portions a day. On the other hand, the taste of food is a major determinant of consumption (Shepherd, 1999), and some effort might be required for choosing fruit and vegetables over other more tempting foods. In short, efforts must be made by those who want to change their habitual pattern of behaviour to eat more fruit and vegetables and to refrain from acting upon impulses that are not in line with their goals.

Aims of the present study

There is still scarce evidence attesting the relevance of coping planning for fruit and vegetable intake in generally healthy adults, and hardly any of the studies in the literature have specifically addressed action control in the explanation of fruit and vegetable intake.
Hence, we aim to investigate the joint role of coping planning and action control in the context of fruit and vegetable consumption and, more specifically, to test whether they sequentially mediate the relation between intention and fruit and vegetable intake.

A longitudinal design with three assessment points over a 2-week period will be used to test a series of predictions inspired by the HAPA for fruit and vegetable intake:

**Hypothesis 1:** Higher positive outcome expectancies and higher perceived self-efficacy measured at baseline (Time 1) are associated with higher intentions towards fruit and vegetable intake 1 week later (Time 2).

**Hypothesis 2:** Intention to eat fruit and vegetables (T2) predicts actual fruit and vegetable intake a further week later (Time 3).

**Hypothesis 3:** Both coping planning, a more distal process, and action control, a more proximal process, are volitional predictors of behaviour.

**Hypothesis 4:** Coping planning (T2) and action control (T3) sequentially mediate the relation between intentions and fruit and vegetable intake.

**Method**

**Participants**
A total of 236 university students completed the first questionnaire. Thirty-two participants failed to complete one or more of the assessment points, and a further participant was vegetarian. Hence, they were excluded from the sample. The final sample consisted of 203 participants who completed the three measurement points in time. One hundred and seventy-three (85.2%) were women, and the ages of the final sample ranged from 18 to 50 years ($M = 22.19$, $SD = 5.33$). None of the participants had medical restrictions against eating fruit and/or vegetables.

**Procedure**
Participants were recruited from three universities, in exchange for a course credit or a 5€ voucher. The study was presented in one of the following ways: In the classroom before classes by the first author or by a trained researcher who was aware of the study objectives (63.7%); through the mailing lists of student unions (18.1%); through the laboratory of the Psychology Department (18.1%). Those who volunteered to participate provided their e-mail addresses so as to receive the links to the questionnaires (Time 1). One week after receiving the first, participants answered the second questionnaire (Time 2) through the same software, but in an in-lab session, to avoid high rates of dropout. After a further week (Time 3), participants received the link to the third questionnaire via e-mail.

All questionnaires were set up online using Qualtrics software (Qualtrics, Inc., Provo, UT, USA). At the beginning of the first questionnaire, the study was explained in more detail and data confidentiality was assured. Participants then provided their informed consent, in accordance with the ethical standards of the three universities.

**Measures**
All measures of the HAPA constructs were based on those presented in Schwarzer (2008), except the action control measure, where items from Sniehotta, Scholz et al. (2005) were
used as indicators of the second-order factor. The items to measure fruit and vegetable intake are similar to those used by Luszczynska, Tryburcy, and Schwarzer (2007). With the exception of the items on fruit and vegetable intake, all responses were given on a 7-point scale ranging from 1 (totally disagree) to 7 (totally agree).

**Outcome expectancies**
The positive outcome expectancy measure started with 'If I ate five portions of fruit and vegetables a day …’ and was followed by four items (T1, Cronbach’s \( \alpha = .79 \)) such as ‘I would improve my health’.

**Perceived self-efficacy**
To assess perceived self-efficacy, four items (T1, Cronbach’s \( \alpha = .87 \)) were used. The first item was ‘I believe I can eat five or more portions of fruit and vegetables a day’, and for the next three items, this stem was followed by barriers such as ‘even if I have to establish a detailed plan not to forget to eat fruit and vegetables’.

**Intention**
Three items (T2, Cronbach’s \( \alpha = .95 \)) such as ‘I intend to eat at least five portions of fruit and vegetables a day from today on’ were used to access intention regarding the daily intake of at least five portions of fruit and vegetables.

**Coping planning**
To assess coping planning, the stem ‘I already have concrete plans …’ was followed by three items (T2, Cronbach’s \( \alpha = .92 \)) such as ‘what to do in difficult situations in order to stick to my intentions’.

**Action control**
Action control was measured by three items (T3, Cronbach’s \( \alpha = .93 \)), each of which addressed a different component of action control: ‘Presently, I evaluate my behaviour in order to confirm that I am eating at least five portions of fruit and vegetables a day’, for comparative self-monitoring; ‘The intention to eat five portions of fruit and vegetables a day is always present in my mind’, for awareness of standards; and ‘I make an effort to act in accordance with my intention to eat five or more fruit and vegetables a day’ for self-regulatory effort.

**Fruit and vegetable intake**
Two items, one for fruit and one for vegetables, were used to measure fruit and vegetable intake: ‘Within the (last 2 weeks [T1]/last week [T3]), how many (pieces of fruit/portions of vegetables) (have you eaten/did you eat) on a typical day?’, followed by some examples of what could be considered a portion of vegetables (e.g., soup or one bowl of salad) and by the explanation that a glass of juice could be considered a portion of fruit provided that it was freshly squeezed and 100% fruit. Similar items were validated against a food frequency questionnaire and dietary biomarkers (Steptoe et al., 2003). Responses were
given on a 6-point scale ranging from 0 (less than one piece/portion a day) to 5 (more than four pieces/portions a day).

**Confirmatory factor analysis**
To evaluate the quality of fit of the proposed measurement model to the correlational structure of the observed variables, a confirmatory factor analysis was performed. Seven factors were specified (i.e., outcome expectancies, perceived self-efficacy, intention, coping planning, action control, and fruit and vegetable intake, both at baseline and at Time 3) and were allowed to freely intercorrelate. All factors were standardized by fixing their variances to 1.00. The final measurement model presented a good fit: $\chi^2(168) = 278.45$, $p < .001$, $\chi^2/df = 1.66$, CFI = .96, TLI = .95, RMSEA = .057, 90% CI (0.045; 0.069), indicating that the items measured the seven proposed constructs.

**Data analysis**
Structural equation modelling (SEM) with AMOS 20 was performed using the variance–covariance matrix of the indicators. All parameters were estimated by bootstrapping, generated from 5,000 samples. Bootstrapping is a nonparametric resampling procedure that does not require the normality of the sample distribution and is recommended for mediation analyses (Hayes, 2009).\(^1\) SEM was chosen to analyse the data as it enables the testing of the global adjustment of complex models and an estimation of their parameters, while controlling for measurement errors. After deletion of dropout participants, there were no missing data in the database.

To explore the volitional mechanisms capable of mediating between behavioural intentions and fruit and vegetable intake at Time 3, three nested models were estimated. The models included the motivational variables (outcome expectancies and perceived self-efficacy) that were measured at Time 1, as predictors of intention measured at Time 2. Intention and coping planning (measured at Time 2), and action control (measured at Time 3) were specified as predictors of fruit and vegetable intake at Time 3. Moreover, to test the hypothesized sequential mediation, an additional path from coping planning to action control was specified. Past behaviour (i.e., baseline fruit and vegetable intake) was included in all models as a direct predictor of fruit and vegetable intake at Time 3. All the predictors were specified as latent variables. All motivational variables and past behaviour (i.e., variables measured at Time 1) were allowed to correlate.

The sequence of estimated models ranged from a more constrained model, where only intention predicted behaviour (Model 1), to a less constrained model, where the volitional predictors were tested as multiple mediators between intention and behaviour (Model 2), to an unconstrained model, where the two volitional predictors were specified as sequential mediators between intention and behaviour (Model 3). Paths not used in models 1 and 2 were constrained to 0. In Model 3, all parameters were freely estimated.

To evaluate the overall fit of the different models, several goodness-of-fit indices were used, such as the chi-square test, the comparative fit index (CFI), the Tucker–Lewis index

\(^1\) Although the reported results are from bootstrapping, analysis using a normal theory approach yielded similar results.
(TLI), and the root mean square error of approximation (RMSEA), representing absolute (i.e., $\chi^2/df$), comparative (i.e., CFI and TLI) and residual aspects of fit (i.e., RMSEA). A $\chi^2/df$ under 2.0 is indicative of overall goodness of fit (Arbuckle, 2008). For CFI and TLI, values over .90 indicate acceptable model fit and values over .95 a very good fit (Bentler, 1990; Bentler & Bonnet, 1980). For RMSEA, values under .08 indicate an adequate model fit (Hu & Bentler, 1999). To compare the fit among the three competing models estimated with the same data, we additionally used the Akaike information criterion (AIC), with lower values being indicative of better and more parsimonious fit (Kline, 2011), and the chi-square difference test (Bollen, 1989).

**Results**

**Dropout analysis**

A dropout analysis was conducted to verify whether there were any differences at baseline between those who completed all three measurement points in time and those who did not. A multivariate analysis of variance (MANOVA) showed no significant differences regarding levels of fruit and vegetable intake and baseline social-cognitive determinants between the longitudinal sample and those who dropped out. Furthermore, an analysis of variance (ANOVA) revealed no significant differences in age, and a chi-square test revealed no gender differences between the groups.

**Descriptive statistics**

Table 1 presents the means, standard deviations, and intercorrelations between all latent variables included in the model at the corresponding time of measurement, including baseline level of fruit and vegetable intake.

The average fruit and vegetable intake was 2.59 portions ($SD = 2.15$) at baseline and 2.43 ($SD = 1.90$) at Time 3, with 89.2% (87.7%, at Time 3) of the sample not attaining consumption of five portions of fruit and vegetables a day. All variables showed significant associations with each other, but all correlations were weak to moderate, meaning that they were measuring different constructs. All determinants had positive significant associations with fruit and vegetable intake. Fruit and vegetable intake at Time 1 showed the highest correlation with fruit and vegetable intake at Time 3, which reflects some stability of fruit and vegetable intake over a 2-week period.

<table>
<thead>
<tr>
<th>Table 1. Descriptive statistics and correlations of the latent variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Outcome expectancies (T1)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>5.84</td>
<td>0.79</td>
</tr>
<tr>
<td>2. Perceived self-efficacy (T1)</td>
<td>.23**</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>4.75</td>
<td>1.32</td>
</tr>
<tr>
<td>3. Intention (T2)</td>
<td>.36**</td>
<td>.40**</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>4.94</td>
<td>1.38</td>
</tr>
<tr>
<td>4. Coping planning (T2)</td>
<td>.36**</td>
<td>.35**</td>
<td>.59**</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>3.97</td>
<td>1.50</td>
</tr>
<tr>
<td>5. Action control (T3)</td>
<td>.45**</td>
<td>.33**</td>
<td>.62**</td>
<td>.61**</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>4.12</td>
<td>1.71</td>
</tr>
<tr>
<td>6. FV intake (T1)</td>
<td>.14</td>
<td>.31**</td>
<td>.34**</td>
<td>.24**</td>
<td>.20**</td>
<td>–</td>
<td>–</td>
<td>2.59</td>
<td>2.15</td>
</tr>
<tr>
<td>7. FV intake (T3)</td>
<td>.12</td>
<td>.28**</td>
<td>.47**</td>
<td>.36**</td>
<td>.42**</td>
<td>.60**</td>
<td>–</td>
<td>2.43</td>
<td>1.90</td>
</tr>
</tbody>
</table>

Note. **$p < .01$.**
Figure 1. Models 1 (a), 2 (b) and 3 (c) with standardized coefficient estimates. Note. *p < .05; **p < .01; ***p < .001.
Model 1: Intention as a predictor of fruit and vegetable intake
The first estimated model (Figure 1a) had intention as the only predictor of fruit and vegetable intake at Time 3, besides the level of fruit and vegetable intake at Time 1 (i.e., past behaviour), and the model fit was good: \( \chi^2(180) = 340.82, \chi^2/df = 1.89, \text{CFI} = .95, \text{TLI} = .94, \text{RMSEA} = .067, p (\text{RMSEA}) = .007, \text{AIC} = 442.82. \)

In support of the first hypothesis, both perceived self-efficacy and positive outcome expectancies measured at baseline were positively and significantly associated with intentions measured 1 week later (Time 2), \( \beta = .35 \) and \( \beta = .33, p < .001 \), accounting for 30% of the variance in intention. Moreover, as stated in the second hypothesis, intention was positively and significantly related to fruit and vegetable intake a further week later (Time 3), \( \beta = .35, p < .001 \), and alone accounted for 35% of the total variance of fruit and vegetable intake at Time 3. Together with the baseline intake level of fruit and vegetables, the total variance explained increased to 75%.

Model 2: Coping planning and action control as multiple mediators of the relationship between intention and fruit and vegetable intake
In the second model, the paths between coping planning and behaviour and between action control and behaviour were freely estimated (Figure 1b). The model fit was again good: \( \chi^2(178) = 336.10, \chi^2/df = 1.89, \text{CFI} = .95, \text{TLI} = .94, \text{RMSEA} = .066, p (\text{RMSEA}) = .01, \text{AIC} = 442.10 \), and the model enabled explanation of 37% of the variance of behaviour (and 80% with past behaviour).

Intention was a strong and significant predictor of both coping planning, \( \beta = .64, p < .001 \), explaining 42% of its variance, and of action control, \( \beta = .67, p < .001 \), explaining 46% of its variance. Coping planning failed to directly predict fruit and vegetable intake at Time 3, \( \beta = .03, p = .73 \), but action control proved to be a significant predictor of fruit and vegetable intake, \( \beta = .19, p = .04 \). Thus, our third hypothesis was partially confirmed. The inclusion of both volitional predictors lowered the effect of intention over behaviour, \( \beta = .21, p = .06 \), revealing partial mediation of the effect of intention on behaviour through action control, \( \beta = .14, 95\% \text{ CI} (0.03; 0.34). \)

Model 3: Coping planning and action control as sequential mediators of the relationship between intention and fruit and vegetable intake
In Model 3, the path from coping planning to action control to behaviour was freely estimated. This model (Figure 1c) also presented a good fit to the data: \( \chi^2(177) = 309.17, \chi^2/df = 1.75, \text{CFI} = .96, \text{TLI} = .95, \text{RMSEA} = .061, p (\text{RMSEA}) = .059, \text{AIC} = 417.17 \).

Intention remained a strong predictor of coping planning, \( \beta = .63, p < .001 \), and of action control, \( \beta = .42, p < .001 \). Coping planning also predicted action control, \( \beta = .39, p < .001 \), and together with intention enabled explanation of 53% of its variance. In turn, action control directly predicted fruit and vegetable intake at Time 3, \( \beta = .20, p = .05 \).

The more complex double mediation was then tested. This three-path mediation examined whether the effect of intention on fruit and vegetable intake was sequentially mediated by coping planning and action control. The indirect effect of intentions on behaviour doubly mediated by coping planning and action control was reliable (Table 2). The direct path from intention to behaviour remained significant, which is indicative of partial mediation, albeit decreasing from \( \beta = .35, p < .001 \) to \( \beta = .21, p = .03 \), when the indirect path was included. Thus, our fourth hypothesis was confirmed, with both coping
planning and action control sequentially mediating the effects of intention on fruit and vegetable intake.

Without past behaviour, the model explained 38% of the variance in fruit and vegetable consumption at Time 3. The third model showed the lower AIC, which is indicative of a better fit. Moreover, when contrasting the third model with the first one, there was a significant increase in the model fit, $\Delta \chi^2(3) = 31.64, p < .001$, and the same occurred when comparing Model 3 with Model 2, $\Delta \chi^2(1) = 26.92, p < .001$. Thus, Model 3, where the sequential mediation was considered, was the best among the tested models.

### Table 2. Decomposition of the effect of intention on fruit and vegetable intake at Time 3, controlling for fruit and vegetable intake at Time 1

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>95% CI</th>
</tr>
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<tbody>
<tr>
<td>Total effect</td>
<td>.35</td>
<td>0.22, 0.50</td>
</tr>
<tr>
<td>Indirect effects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coping planning</td>
<td>.06</td>
<td>−0.04, 0.18</td>
</tr>
<tr>
<td>Action control</td>
<td>.18</td>
<td>0.03, 0.37</td>
</tr>
<tr>
<td>Both mediators</td>
<td>.15</td>
<td>0.01, 0.31</td>
</tr>
<tr>
<td>Direct effect</td>
<td>.21</td>
<td>0.02, 0.40</td>
</tr>
</tbody>
</table>

Notes. CI = confidence interval. Estimates are standardized coefficients.

Discussion

The present three-wave longitudinal study has examined the psychological mechanisms that might operate in the context of fruit and vegetable consumption. The main focus of the study was on the post-intentional processes and, more specifically, on the role of coping planning and action control as mediators of the relation between intentions and fruit and vegetable intake. As hypothesized, both volitional processes sequentially contributed to the translation of intentions into actual behaviour. This is a new finding, although in line with that of Sniehotta, Scholz et al. (2005), where action control was found to mediate the relation between action planning and physical activity, suggesting that planning must be converted into closer monitoring of behaviour to affect fruit and vegetable intake. In fact, although the relationship between intention and behaviour was not mediated by coping planning alone (i.e., when the estimation was based on a two-path, single mediator model), the sequential mediation by coping planning and action control was found to be significant, offering support for such reasoning. Moreover, the time lag between measures of the different processes is also suggestive of the validity of the assumption that planning is a more distal volitional predictor, whereas action control is a more proximal volitional predictor of fruit and vegetable intake.

Double mediation occurred in a sequential manner, with action control following coping planning within the volitional process. Future studies should examine whether the outlined mediational chain varies according to the individual’s stage of readiness to adopt this particular behaviour and make use of experimental designs to attest for causality.
Other research, in which perceived self-efficacy was selected instead of action control in addition to coping planning (Kreausukon, Gellert, Lippke, & Schwarzer, 2012), has found similar mediation processes, with both constructs simultaneously mediating the relationship between the type of intervention and fruit and vegetable consumption. Coping planning has also been identified as a mediator between experimental conditions and fruit consumption, whereas action planning served this function only for vegetable consumption (Guillaumie et al., 2012), raising the question as to whether analyses should be more behaviour specific, separating fruit from vegetables.

Adding planning components to interventions has induced larger effects than interventions based solely on information provision (Stadler, Oettingen, & Gollwitzer, 2010). Furthermore, several randomized controlled trials have accumulated evidence in favour of the established mediators, coping planning, and action control, for dietary (e.g., Guillaumie et al., 2012; Kreausukon et al., 2012; Lange et al., 2013) and other types of behaviour (e.g., Sniehotta et al., 2006). Thus, planning components and ongoing monitoring appear to be useful self-regulatory intervention strategies to promote dietary changes. Future research should examine the circumstances under which other mediators operate (e.g., self-efficacy, action planning, social norms) and whether moderating effects can be identified.

Our first two hypotheses were also confirmed and are in line with other studies on fruit and vegetable intake (see Guillaumie, Godin, & Vézina-Im, 2010), where higher positive outcome expectancies and perceived self-efficacy measured at baseline were associated with higher intentions towards fruit and vegetable intake 1 week later, and intention predicted fruit and vegetable intake a further week later.

Some limitations of this study need to be addressed. The research design was non-experimental which does not allow for causal inferences, although there was at least a temporal order to justify the mediation model. Also, the fact that intention and coping planning were assessed in the same data collection point, as well as action control and behaviour, calls for some prudence in the interpretation of the present findings. All data were self-reported, and no objective measures were available. This can generate bias as people may forget to record consumed food items or to cover up poor eating habits. In spite of this potential bias, there was stability in the average of reported fruit and vegetable consumption over the 2-week period, attesting that, at least throughout the study, mere measurement effects did not occur. Moreover, the fact that the sample consisted primarily of women should be taken into account when generalizing the present findings.

The present study contributes to cumulating evidence of the usefulness of the chosen constructs and the demonstrated sequential mediation design. Moreover, it highlights the relevance of action control in the context of fruit and vegetable consumption and how it works in conjunction with coping planning in the translation of behavioural intentions into actual fruit and vegetable intake. This is important, as by revealing the mechanisms involved in fruit and vegetable consumption, a valuable backdrop for future intervention studies is provided.

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References


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