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The Impact of Lay Beliefs About Willpower and Demands on
Pro-Environmental Dietary Behavior and the Formation of
Environmentally Friendly Dietary Habits

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Abstract in German Language

Viele Menschen haben umweltfreundliche Absichten, jedoch gelingt es ihnen nicht, umweltfreundliches Verhalten in ihren Alltag zu integrieren. Unter den alltäglichen umweltfreundlichen Verhaltensweisen haben Ernährungsgewohnheiten einen besonders großen Einfluss auf die Umwelt. Forschungsergebnisse zeigen, dass der Glaube an unbegrenzte Willenskraft die Umsetzung zielorientierten Verhaltens erleichtern kann, besonders in Situationen mit hohen Anforderungen. Ziel dieser Studie war es, die Auswirkungen von Überzeugungen über Willenskraft und täglichen Anforderungen auf die Einhaltung einer fleisch- und milchreduzierten Ernährung zu untersuchen. Außerdem wurde geprüft, ob Willenskraftüberzeugungen die Entwicklung von Ernährungsgewohnheiten fördern, indem sie die Automatisierung umweltfreundlichen Essverhaltens unterstützen. Die geschmackliche Vorliebe für Fleisch- und Milchprodukte wurde als explorative Variable einbezogen, um die Herausforderungen bei der Umsetzung einer fleisch- und milchreduzierten Ernährung besser zu verstehen. Es wurde angenommen, dass ein Glaube an unbegrenzte Willenskraft mit stärkerem umweltfreundlichem Essverhalten im Alltag verbunden ist (Hypothese 1) und, dass dieser Effekt an Tagen mit höheren Anforderungen stärker ausfällt (Hypothese 2). Des Weiteren wurde angenommen, dass Personen mit einem Glauben an unbegrenzte Willenskraft nach einem bzw. zwei Monaten stärkere umweltfreundliche Ernährungsgewohnheiten zeigen (Hypothese 3), wobei dieser Effekt durch das tägliche umweltfreundliche Essverhalten mediiert wird (Hypothese 4). Zusätzlich wurde vermutet, dass die geschmackliche Vorliebe für Fleisch- und Milchprodukte zu Beginn der Studie einen Haupteffekt auf die Entwicklung umweltfreundlicher Ernährungsgewohnheiten nach ein bzw. zwei Monaten hat (Hypothese 5). Schließlich wurde ein negativer Interaktionseffekt zwischen Willenskraftüberzeugung und der Vorliebe für Fleisch- und Milchprodukte auf die Gewohnheitsstärke erwartet. Dabei wurde angenommen, dass ein Glaube an unbegrenzte Willenskraft einen stärkeren Einfluss auf die Entwicklung von umweltfreundlichen Ernährungsgewohnheiten hat, wenn die geschmackliche Vorliebe für Fleisch- und Milchprodukte hoch ist (Hypothese 6). Teilnehmende (N = 431) einer siebentägigen Online-Tagebuchstudie berichteten über ihre Überzeugungen zur Willenskraft, ihre täglichen Anforderungen und ihr Essverhalten. Zusätzlich wurden sie zu ihrer Vorliebe für Fleisch- und Milchprodukte befragt. Die Stärke ihrer Gewohnheiten in Bezug auf eine fleisch- und milchreduzierte Ernährung wurde nach ein bzw. zwei Monaten erfasst. Alle Hypothesen außer

Hypothese 5 wurden abgelehnt. Die Ergebnisse zeigten, dass Teilnehmende mit einem Glauben an unbegrenzte Willenskraft kein stärkeres umweltfreundliches Essverhalten zeigten als jene mit einem Glauben an begrenzte Willenskraft – selbst an Tagen mit höheren Anforderungen. Folglich förderte der Glaube an unbegrenzte Willenskraft auch nicht die Bildung umweltfreundlicher Ernährungsgewohnheiten. Lediglich die geschmackliche Vorliebe für Fleisch- und Milchprodukte sagte die Gewohnheitsstärke nach ein bzw. zwei Monaten voraus, wobei eine stärkere Vorliebe für diese Produkte mit geringeren umweltfreundlichen Ernährungsgewohnheiten verbunden war. Dies deutet darauf hin, dass sensorische Reaktionen auf Lebensmittel, wie der Geschmack, eine Rolle bei der Förderung einer pflanzenbasierten Ernährung spielen können. Eine explorative Analyse ergab, dass ein stärkerer Glaube an unbegrenzte Willenskraft in Kombination mit einer Vorliebe für Fleisch- und Milchprodukte mit einem leichten Anstieg von deren Konsums verbunden war. Dies widerspricht der theoretischen Annahme, dass Willenskraftüberzeugungen insbesondere bei hohen Versuchungen eine Rolle spielen sollten. Zukünftige Forschung sollte die in dieser Studie identifizierten Limitationen berücksichtigen und die Mechanismen, die an umweltfreundlichem Essverhalten beteiligt sind, weiter untersuchen. Dabei sollte eine größere Bandbreite an Faktoren erforscht werden, um effektive Interventionen zu entwickeln.

Schlagwörter: Überzeugungen zur Willenskraft, tägliche Anforderungen, umweltfreundliches Essverhalten, umweltfreundliche Ernährungsgewohnheiten, geschmackliche Vorliebe für Fleisch- und Milchprodukte

Abstract

Many people report pro-environmental intentions but fail to integrate pro-environmental behavior into their daily lives. Among private-sphere pro-environmental behaviors, dietary choices have a particularly high impact on the environment. Previous research indicates that believing one's willpower is nonlimited facilitates adherence to intended behaviors, especially in the context of high demands. This study aimed to investigate the effect of lay beliefs about willpower and daily demands on following a meat- and dairy-reduced diet. Additionally, the potential of willpower beliefs to predict habit formation by facilitating the repetition and automatization of pro-environmental dietary choices was explored. The liking for meat and dairy products was included as an exploratory variable to understand the complexity of following a meat- and dairy-reduced diet. It was hypothesized that a nonlimited willpower belief would be related to more engagement in daily pro-environmental dietary behavior (hypothesis 1), and this effect would be stronger on days with high demands (hypothesis 2). It was further hypothesized that people with a nonlimited willpower belief would show higher habit strength when surveyed again after one and two months (hypothesis 3), with this effect mediated by daily pro-environmental dietary behavior (hypothesis 4). Additionally, it was anticipated that the liking for meat and dairy products at baseline would have a main effect on habit strength at one- and two-month follow-ups (hypothesis 5). Lastly, a negative interaction between willpower belief and meat and dairy liking on habit strength was expected, with a nonlimited willpower belief having a higher impact on habit strength when meat and dairy liking is high (hypothesis 6). Participants ($N = 431$) of an online daily diary study reported their lay beliefs about willpower, daily demands, and dietary behavior over seven days, and completed a baseline questionnaire on liking for meat and dairy products. Their habit strength for a meat- and dairy-reduced diet was measured at one- and two-month follow-up. All the hypotheses except from hypothesis 5 were rejected. Results showed that participants with a nonlimited willpower belief did not engage in more pro-environmental dietary behavior, even on days with higher demands. Consequently, holding a nonlimited willpower belief did not facilitate the formation of environmentally friendly dietary habits. Only the liking for meat and dairy products predicted habit strength at one- and two-month follow-ups, with higher liking for these products being associated with lower habit strength in following a meat- and dairy-reduced diet. This indicates that sensory responses to food, such as taste, can play a role in facilitating a more plant-based diet. An exploratory analysis

revealed that a stronger nonlimited willpower belief combined with a higher liking for meat and dairy products was associated with a slight increase in their consumption, also contradicting the theoretical assumption that willpower beliefs should particularly play a role when temptations are high. Future research should address the limitations identified in this study and further investigate the mechanisms involved in pro-environmental dietary choices, exploring a more diverse range of factors to develop effective interventions.

Keywords: Lay beliefs about willpower, demands, pro-environmental dietary behavior, environmentally friendly dietary habits, meat and dairy liking

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In light of the growing awareness about the climate emergency the world is currently facing, identifying mechanisms to encourage pro-environmental behaviors has gotten increased attention. Psychological research can make several valuable contributions to studying the execution of these behaviors by examining factors such as attitudes, intentions, beliefs, and underlying cognitive mechanisms that either promote or inhibit pro-environmental actions (Clayton et al., 2015).

What particularly concerns psychological researchers is the strong intention-behavior gap in climate action (Hornsey et al., 2016; Wyss et al., 2022). While the vast majority of Europeans shows awareness about environmental concerns, not many act consistently according to their ideals (European Commission, 2020; European Commission, 2021). Pro-environmental attitudes and intention are only weak predictors for the actual exhibition of pro-environmental behaviors. This is especially true for so called private-sphere pro-environmental behaviors, such as recycling and dietary or mobility choices (Hornsey et al., 2016). Meta-analyses (Armitage & Conner, 2001; Bamberg & Möser, 2007) suggest that intentions account for only around 30% of variance in pro-environmental behaviors. There is growing skepticism among researchers whether theoretical frameworks merely focusing on changing a person's *behavioral intention* provide sufficient basis for developing interventions for prompting actual *behavioral change* (Bamberg, 2013). Ignoring the complexity involved in the development of pro-environmental behaviors may lead to ineffective or misguided policy instruments (Clayton et al., 2015).

Previous research suggests that especially a deeper exploration of *self-regulatory processes* is crucial for predicting behavioral change and the adoption of pro-environmental behaviors (Keller et al., 2019; Nielsen, 2017). Researchers have advocated for extending simple predictive models and exploring the self-regulatory processes that underlie the performance of pro-environmental behaviors (Bamberg, 2013; Nielsen, 2017). Thus, the present research focuses on a specific set of self-regulatory processes that may promote the adoption of pro-environmental behaviors, namely people's lay beliefs about their own self-control resources.

Self-control refers to a wide range of processes by which individuals guide, control and modify different thoughts, feelings, or behaviors to ensure that their goals are met (Baumeister & Heatherton, 1996; Carver & Scheier, 1990; as cited in Nielsen, 2017). Within the study of self-regulatory processes, the concept of *lay beliefs about willpower* (a colloquial term for self-control) have gotten increased attention among researchers. Lay beliefs about willpower describe

individual convictions regarding whether one's willpower is a limited resource that can be easily depleted or an enduring capacity that replenishes itself (Job et al., 2010). Researchers argue that these beliefs play a pivotal role, particularly when individuals face high everyday demands, in determining whether they succeed or fail in exhibiting goal-oriented behaviors (Bernecker & Job, 2015a; Francis & Job, 2018). Research indicates that beliefs about willpower are also associated with the successful demonstration of pro-environmental behavior, especially under conditions of high demand (Jankowski & Job, 2023). This research explores how such lay beliefs about willpower may predict a specific pro-environmental behavior, namely following a meat- and dairy-reduced diet, especially under conditions of high demand such as strenuous mental or physical tasks, time pressure or frustration.

When discussing pro-environmental behaviors that require self-regulation, this study refers to private-sphere behaviors, rather than public-sphere behaviors such as environmental activism or voting for political parties that promote climate action. Among private-sphere pro-environmental behaviors, reducing meat and dairy intake in one's diet has a particularly significant impact on lowering CO₂ emissions (Tukker & Jansen, 2006; Klöckner & Ofstad, 2017). Many people want to adopt sustainable diets but struggle to translate these intentions into action (Fink et al., 2018; Fink et al., 2021). Given the significant impact our diet has on the climate and the intention-behavior gap that has been found with regards to people's nutrition, this study focuses on exploring self-regulatory mechanisms with regards to pro-environmental dietary behavior – operationalized as the reduction of meat and dietary consumption.

In the second part of this study, the focus will shift from self-regulation to the automaticity, or habitual adaptation, of these behaviors to explore potential pathways for sustaining pro-environmental behavior in the long term. Although this transition might appear ambitious, the consideration of habits is crucial for explaining, predicting, and controlling repeated behavior (Wood, 2017). Establishing a habit necessitates the regular repetition of a behavior, which initially requires regulation (Triandis, 1977; cited in Klöckner & Verplanken, 2018). However, such self-regulatory processes demand cognitive effort, making them susceptible to stress, distraction, and everyday demands. In contrast, once a behavior has become a habit, it operates automatically. While self-regulatory behavior must precede every habit through repetition, once established, habits are performed reliably, automatically, and with minimal cognitive effort. Thus, stress, distraction, and reduced willpower impair decision-

making, but do not negatively impact habitual behaviors (Neal et al., 2013). Given the fast-paced nature of modern lifestyles in which people face high levels of stress and everyday demands, researchers assert that developing environmentally friendly habits is the most effective way to sustain long-term pro-environmental behavior (Fujii & Gärling, 2003; Dahlstrand & Biel, 1997; Verplanken & Roy, 2016; Kurz et al., 2015). Therefore, it is essential to study the formation of environmentally friendly habits, beyond merely examining the self-regulatory processes that predict the initial exhibition of pro-environmental behaviors. Thus, in a second stage, the present research explores how lay beliefs about willpower can facilitate the formation of environmentally friendly dietary habits.

Given the strong environmental impact of meat and dairy consumption, it is crucial to identify a broad range of factors that either facilitate or impede efforts to reduce their intake. In the context of dietary behavior, a person's sensory preference for the food they consume is a crucial factor for determining food choices (Kourouniotis et al., 2016; Tepper & Barbarossa, 2020). Thus, an exploratory variable was incorporated into the research framework: the extent to which participants enjoy consuming dairy and meat products. Research on the particular linkage of meat and dairy liking in connection to pro-environmental dietary choices as well as in connection to self-control processes appears limited. The liking and desire for meat and dairy foods can impair the ability to reduce these foods (Wehbe et al., 2022). A study by Becker and Lawrence (2021) discovered that meat liking and on the other hand meat disgust predicted nutritional changes more effectively than self-control. These findings suggest that emotional responses to food, such as liking or disgust, can significantly impact the exhibition of pro-environmental dietary behavior and the development of respective dietary habits. Incorporating variables of meat and dairy liking into the present study aims to better understand how these preferences affect the ability to reduce the consumption of animal products. By examining the role of food preferences, this study seeks to provide a more nuanced understanding of the challenges and opportunities in promoting pro-environmental dietary behaviors.

Self-Regulation Processes and Pro-Environmental Behavior

People need to activate self-control when they are confronted with two behavioral options, where one option generates a proximal reward, while the other serves greater long-term goals (Duckworth et al., 2016). Inherent to the change of behaviors in the environmental domain is the transitional substitution of past, environmentally harmful behaviors with new,

more environmentally friendly ones. During the behavioral change process, people likely encounter difficulties in resisting environmentally harmful past behaviors or temptations, which oftentimes are easier to perform and provide more immediate reward (e.g., taking the car as a more convenient option over using public transport). Overcoming such tendencies requires self-regulation (Nielsen, 2017).

Model of Action Phases (MAP)

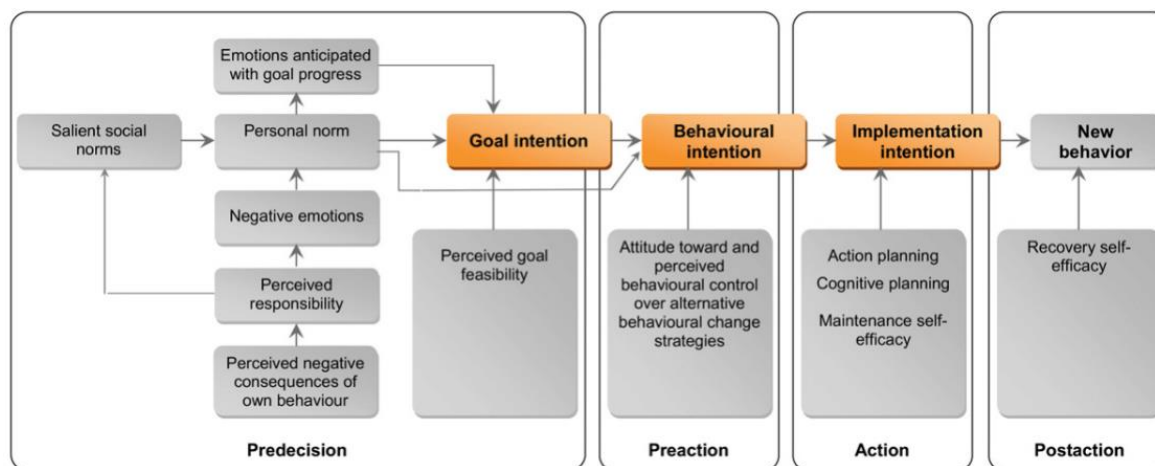
The self-regulative nature of the psychological processes involved in pro-environmental behaviors can be displayed well through stage models (Bamberg, 2013). This study takes the extended version of the model of action phases (MAP, Heckhausen & Gollwitzer, 1987; cited from Bamberg, 2013) as a theoretical base for conceptualizing the behavioral change process. Bamberg's (2013) extended model of action phases (MAP) incorporates elements from both the theory of planned behavior (TPB, Ajzen, 1991), which considers pro-environmental behaviors as rational choices, and the norm activation model (NAM, Schwartz & Howard, 1981), which views these behaviors as pro-social acts driven by the activation of personal norms. Meta-analyses (Bamberg & Möser, 2007; Gardner, 2008) and more recent studies (Wan et al., 2017; Ma et al., 2018) indicate that pro-environmental behavior reflects both constructs. The extended MAP by Bamberg (2013) itself has already been successfully applied to pro-environmental behaviors, such as mobility choices (Bamberg, 2013a) and electric car purchase (Klößner, 2014). The MAP focuses on the steps an individual must take to achieve a goal, divided into four stages. In the first stage, the *pre-decision stage*, individuals deliberate on competing wishes, such as the conflict between fast and comfortable versus environmentally friendly travel, and commit to specific goals, forming a goal intention like "I intend to reduce my car use." The second stage, the *pre-action stage*, involves selecting the most suitable strategy to achieve the goal, resulting in a behavioral intention, for example, "I intend to use public transport." In the third stage, the *actional stage*, individuals implement the chosen strategy, facilitated by an implementation intention, such as "If it's 7:30 a.m., I will go to the bus stop." Finally, in the *post-action stage*, people evaluate their progress and decide if further action is needed, also dealing with temptations to revert to old behaviors. These stages guide the individual through a structured process of behavioral change. Bamberg (2013) integrated constructs from the theory of planned

behavior (TBP) and the norm activation model (NAM) as determinants of three intention types which are viewed as transition points between the four MAP-stages (see Figure 1).

This study focuses on the intention-behavior gap in pro-environmental action. Thus, the formation of a behavioral intention will not be explored in detail; rather, the study's emphasis will lie in understanding how pro-environmental dietary behaviors emerge once an intention has already been established. Consequently, only factors that support the implementation of behavior during the *action phase* will be addressed here. Currently, there is limited empirical knowledge about the factors that play a role during the *action phase* in the MAP. Gollwitzer and Sheeran (2006) proposed that the ability to engage in mental simulation (planning) might be a key factor. Schwarzer (2008) distinguished between two types of planning: coping planning and action planning. Coping planning involves envisioning potential obstacles to performing an intended behavior and creating plans to overcome these challenges (e.g., "If I plan to use the bicycle on Monday but the weather is bad, I will use public transport instead"). Action planning focuses on the specifics of the situation ("when", "where") and the sequence of actions ("how"). Schwarzer (2008) also posited that an individual's confidence in their ability to sustain a difficult behavior (coping self-efficacy) significantly influences the formation of an implementation intention. Schwarzer (2008) further suggests that during the post-action stage, a person's confidence in their ability to resume a challenging behavior following a setback (known as recovery self-efficacy) might enhance the maintenance of the newly adopted behavior.

Figure 1

Model of Action Phases (MAP)



Note. Cited from Bamberg (2013)

Lay Beliefs About Willpower

In addition to a person's confidence in their ability to sustain a behavior, their individual conviction regarding their willpower to carry out this behavior may also play a role. Lay beliefs about willpower might be crucial in putting one's intended behavior into action in the *action phase* of behavioral change. For long, it had been assumed that individuals fail to sustain self-control because their energy gets depleted (e.g., Muraven & Baumeister, 2000). However, more recent research implies that ego-depletion effects might actually be better explained by perceived levels of self-control than an actual depletion of self-control capacities (Chow et al., 2015; Job et al., 2010; Job et al., 2015; Job et al., 2015a; Miller et al., 2012). Changes in the performance of behaviors that require self-control may rather result from the activation of a motivated cognition that either justifies withdrawal from effort, or helps people to sustain it. Lay beliefs about willpower refer to individuals' beliefs about the nature and limitations of willpower. People who hold the view that willpower is limited and easily depleted show ego-depletion and a drop in performance in repeated self-control tasks (Job et al. 2010; Job et al., 2015). This is described as a *limited willpower belief*. People who instead believe that their self-control resources are not depleted in strenuous activities, and that willpower can be self-generating, hold a *nonlimited willpower belief*. In several studies, individuals who reject the view that their willpower is limited, showed no or smaller impairments in repeated demanding self-control tasks (Job et al., 2010; Chow et al., 2015; Miller et al., 2012; Job et al., 2015).

Everyday Demands and Lay Beliefs About Willpower

Self-control capacities have been proven to be relatively stable over time (Cobb-Clark et al., 2022), but whether people succeed at performing goal-oriented behaviors also depends on situational factors. People oftentimes fail to perform behaviors that require self-control when they face high levels of demands. For example, in a study by Zhang and Cai (2022), participants showed higher wasting behavior on stressful days and this relationship was mediated by impaired self-control. Several studies however showed that holding a nonlimited willpower belief can to a certain extent buffer against the detrimental effects of demands on the exhibition of goal-oriented behavior. Willpower beliefs tend to have the most significant impact when individuals face heightened demands, such as increased stress, workload, and fatigue (Francis & Job, 2018). In one study, students with limited willpower belief exhibited poorer self-regulation toward a personal goal during exam periods, while those with a belief in nonlimited willpower

maintained their goal pursuit (Study 4; Job et al., 2010). This link between willpower beliefs and demands was further confirmed in a daily diary study, which found that students with limited willpower beliefs showed less effective goal pursuit on days following a particularly demanding day (Bernecker & Job, 2015a).

The first study to examine this relationship in the environmental domain (Jankowski & Job, 2023) explored how lay beliefs about willpower and everyday demands influence pro-environmental behaviors. Jankowski & Job (2023) hypothesized (1) that a nonlimited willpower belief would be related to more engagement in daily pro-environmental behavior and (2) that this effect would be stronger on days with high demands. In an online diary study involving 387 participants over three days, they examined participants' willpower beliefs, daily demands, and pro-environmental behaviors. Daily pro-environmental behavior was measured using a scale with 21 items, which can be categorized into energy conservation, water conservation, sustainable food choices, waste separation, and transportation choices. The findings supported their hypotheses: a belief in nonlimited willpower was associated with more pro-environmental behavior, especially on demanding days. However, those with consistently high demands across the whole study period engaged in less pro-environmental behavior regardless of their willpower beliefs.

Environmentally Friendly Habits

Even though a nonlimited willpower belief helps to sustain pro-environmental behavior in stressful situations and can buffer the detrimental effects of demands on pro-environmental behavior to a certain extent, daily demands persist to have a negative impact on the performance of these goal-oriented behaviors. In their diary study on daily pro-environmental behavior, Jankowski and Job (2023) found that participants with a nonlimited willpower belief were less impaired in exhibiting their targeted behavior on demanding days compared to participants with a limited willpower belief. However, facing overall high demands across the study period had a negative effect on exhibiting these behaviors, irrespective of the participants' willpower belief. Consequently, to foster the establishment of pro-environmental behaviors that can be sustained over the long term and withstand our stressful daily lives, it is essential to explore mechanisms that enhance the automaticity of these behaviors.

When a behavior is performed for the first time, self-regulation mechanisms and related motivational cognitions predict the exhibition of the behavior (Nielsen, 2017). Over time, when

a behavior is repeated within the same context, it gradually becomes habitual by getting automatically activated in response to cues from the environment (Aarts et al., 1997). The more often a behavior is repeated and achieves the desired outcome, the stronger its influence on future behavior becomes (Triandis, 1977; as cited in Klöckner & Verplanken, 2018). Habits can be defined as cognitive structures that automatically activate future behavior by linking specific situational cues to behavioral patterns (Klöckner & Verplanken, 2018). Establishing a habit requires the regular repetition of a behavior, which initially has to be regulated (Wood, 2017). High self-control is related to having weaker bad habits, such as snacking on unhealthy foods (Adriaanse et al., 2014; as cited in Wood, 2017), and stronger habits of eating healthy snacks, getting adequate sleep, exercising, and doing homework (Galla & Duckworth, 2015; as cited in Wood, 2017). While acting on these beneficial habits does not require significant self-regulation, people with good self-control often develop adaptive habits early on by successfully inhibiting temptations. These good habits then free up cognitive resources to resist further temptations (Wood, 2017). The present study argues that beliefs about willpower should be important when a behavior is novel and when routines have not been established yet. For example, Bernecker and Job (2015) found in a longitudinal study with diabetes type 2 patients that the effects of a person's willpower belief on therapy adherence and psychological adjustment were stronger when the diagnosis was new and when the health behavior was not habitual yet. When the behavior became a routine, self-control as well as willpower belief played a smaller role (Bernecker & Job, 2015).

Habits are proven to be relatively robust to stress, distraction, and depletion of willpower (Neal et al., 2013). Thus, having environmentally friendly habits may be an important way to maintain pro-environmental behaviors in stressful times. Many behaviors in the environmental domain can be considered as habitual because they are embedded into our daily routines (Klöckner & Matthies, 2004). Given their robustness to stress and demands, previous research has argued that habits should be considered as significant explanatory constructs of a sustainable lifestyle (Fujii & Gärling, 2003; Dahlstrand & Biel, 1997; Verplanken & Roy, 2016; Kurz et al., 2015).

Meat and Dairy Liking

In a qualitative study by Wehbe et al. (2022), participants described that their liking and desire for meat and dairy foods, as well as cravings, impaired their ability to reduce these foods, although they wanted to follow a more environmentally friendly diet. Many described that sensory features of foods, such as smell, taste, or texture, triggered their desire to eat them. Consequently, individuals with a stronger preference for meat and dairy may need to exert greater self-control to resist their cravings. For instance, Wehbe et al. (2022) found that participants used various strategies to curb their intake, such as reminding themselves of the negative health consequences of consuming meat and dairy as well as its environmental, generational, and animal welfare impacts. In a longitudinal study, Becker and Lawrence (2021) discovered that a sense of disgust towards meat was a more significant predictor of dietary changes towards a meat-reduced diet than self-control. This finding highlights the importance of understanding how liking for meat and dairy influences the exhibition of pro-environmental dietary behavior.

Present Study

The present research seeks to replicate the findings of Jankowski and Job (2023), using an adapted daily diary study design with a specific focus on pro-environmental dietary behaviors rather than general daily pro-environmental actions. Despite focusing on dietary behavior instead of pro-environmental behavior in general, the mechanisms in place are expected to stay the same as when studying pro-environmental behavior in general. Although little psychological research is available on studying dietary choices in the context of pro-environmental behavior, studies have explored willpower beliefs in the context of health dietary behavior and found that similar mechanisms apply. For example, diabetes type 2 patients performed more goal-oriented healthy dietary behavior when holding a belief in nonlimited willpower (Bernecker & Job, 2015). A large observational study by Pinho et al. (2017) found that a self-reported “lack of willpower” was the strongest barrier to higher consumption of healthy food items.

Thus, in the first two hypotheses, the present study is expected to replicate and extend the findings by Jankowski and Job (2023). They found that a nonlimited willpower belief is related to more engagement in daily pro-environmental behavior and found this effect to be stronger on days with high demands. It is hypothesized that people with a nonlimited willpower belief manage to eat less meat and dairy (hypothesis 1). The effect of willpower belief on meat and

dairy consumption is expected to be stronger when people face high daily demands (hypothesis 2).

Additionally, this study aims to extend the existing research framework by exploring the transition of initially regulated behaviors to automatic ones, thereby examining the formation of environmentally friendly dietary habits. It is anticipated that having a nonlimited willpower belief will have a positive effect on reduced meat and dairy consumption. Lay beliefs about willpower play a role when a behavior is enacted for the first time. In contrast, once a behavior is habitual, mechanisms of self-regulation and related motivated cognitions should no longer play a role, as habits are automatically activated by contextual cues. However, for such contextual links to form at all, a behavior must be displayed oftentimes in succession (Wood, 2017). Previous research indicates that within one to three months rather stable habits can be established (Keller et al., 2021; Weiden et al., 2020; Mullan et al., 2016). Thus, it is hypothesized that people with a nonlimited willpower belief show higher habit strength regarding a meat- and dairy-reduced diet after one and two months (hypothesis 3) and that this effect is mediated by daily dietary pro-environmental behavior (hypothesis 4).

Self-control plays a role when people have to resist temptations or short-term rewards. However, not all of us feel equally tempted by the consumption of animal products. For example, meat disgust and low meat liking is often reported by vegetarians (Amato and Partridge 2013; Beardsworth and Keil 1992; Rozin et al. 1997; cited from Becker & Lawrence, 2021). In a longitudinal study, Becker and Lawrence (2021) found that meat disgust predicted changes in nutrition better than self-control. Liking meat and dairy is often reported as a barrier for people who want to reduce their consumption of these foods (Wehbe et al., 2022). Based on these study results, it can be suspected that individuals who prefer the taste of animal products will also feel more tempted to consume them. It is hypothesized that meat and dairy liking at baseline is related to weaker habit strength at one- and two-month follow-ups (hypothesis 5).

To resist temptations, self-control mechanisms and related motivated cognitions must be activated. When confronted with high demands, it becomes more difficult to activate these self-control mechanisms, making it easier to succumb to temptations, such as a juicy burger after a long day at work. However, not everyone experiences the same level of temptation towards meat and dairy products. In other words, people who like meat and dairy products less may not be as exposed to temptations and food cravings that would require self-control to resist. It is

anticipated that willpower beliefs particularly influence behavior when controlling one's temptations requires cognitive effort (Bernecker & Job, 2017). Thus, it is expected that there is a negative interaction between willpower belief and meat and dairy liking on habit strength, with a nonlimited willpower belief having a higher impact on habit strength when meat and dairy liking is high (hypothesis 6).

Materials and Methods

Power Analysis

A power analysis conducted for the main study model (hypotheses 1–4), based on simulations using effect sizes and variance components from the preliminary study by Jankowski and Job (2023), revealed that a minimum of 364 participants are needed to test the moderation analysis, and 370 participants are required to conduct the mediation analysis. Given the daily diary design of the study, exclusion criteria at baseline as well as the requirement for participants to complete questionnaires at one- and two-month follow-ups, a high dropout rate was anticipated. Therefore, the study aimed for a sample size of 450 participants to ensure sufficient statistical power despite drop-outs.

Procedure

The study participants were recruited from the general population in the DACH region and the study materials were presented in German. The sample was recruited via social media (Facebook, Instagram) and through the participant pool of the University of Vienna. Participants were incentivized with €6 for completing all surveys, including follow-ups, and had the option to win one of two vouchers worth €100 each. The sample in the study by Job and Jankowski (2023) was disproportionately highly composed of university students and participants identifying as female, and the sample's political views leaned towards the left. For the present study, it was attempted to assemble a more diverse sample that reflects the general population better.

While there is extensive research on vegans and vegetarians, the group of individuals whose goal is following a meat- and dairy-reduced diet has not been as thoroughly studied. Although vegan diets are considered the most environmentally sustainable, widespread adoption by Western populations seems improbable. Promoting moderate reductions in meat and dairy consumption among the general public may be a more achievable goal (Wehbe et al., 2022). Thus, the terms “vegetarian” and “vegan” were avoided when advertising the study and also

people who wanted to reduce their consumption of animal products only to a certain extent were encouraged to participate. By applying this advertisement strategy for the study, it was also expected to attract a diverse participant pool and not solely those who sympathize with vegetarianism or veganism as a political ideology, which might constitute a subsample with distinct characteristics such as left-wing political views (cf. Vestergren & Uysal, 2022).

Participants were administered the set of variables presented in the supplement (Appendix A) through Qualtrics software. Baseline variables were assessed at T0. Participants who did not pass a filter item which assessed whether they were in the action stage or post-action stage of the MAP were excluded from the further analysis. Daily consumption of animal products and daily demands were assessed in a diary format on seven consecutive days, starting with Monday (T1) and ending with Sunday (T7). Habit strength was assessed at one-month (T8) and two-month (T9) follow-up. Participants were able to access the initial questionnaire of the study (T0) through a link shared on social media (Facebook, Instagram) or through the participant pool platform of the University of Vienna. Upon completion of T0, participants provided an email address to receive notifications for the subsequent follow-up questionnaires. These follow-up questionnaires, which included the measures for T1 to T7, were sent via email invitations on the Monday, Tuesday, Wednesday, Thursday, Friday, Saturday and Sunday following the completion of the baseline questionnaire. This timeline ensured that the daily diary assessment always began with a Monday. At one- and two-month follow-up, the participants again received invitations via email. The study was administered from February to April 2023.

Participants

The final sample comprised 431 participants, with a majority identifying as female ($n = 344$), followed by male ($n = 80$), and non-binary individuals ($n = 2$). There were five respondents who did not disclose their gender. The age of participants ranged from 18 to 76 years, with a mean age of 32.77 years ($SD = 11.88$). There were seven respondents who did not provide their age. Most participants resided in Austria ($n = 342$), followed by Germany ($n = 78$), Italy ($n = 3$), Switzerland ($n = 2$) and one person ($n = 1$) residing in the Islamic Republic of Iran. There were five respondents who did not disclose their place of residence. The sample was diverse regarding their job status: employed ($n = 223$); university students ($n = 192$); self-employed ($n = 35$); others ($n = 25$); job-searching ($n = 20$); retired ($n = 13$), homemakers ($n = 13$); unfit for work/disabled ($n = 7$) and 5 participants did not disclose their job status. This listing includes

double-counts as various combinations of job-statuses were reported, with 50 participants reporting to be employed and studying being the most common combination. The educational background of the sample was more homogenous, with the majority holding a university degree ($n = 221$), followed by those with a high school diploma (Matura/Abitur, $n = 159$). Other educational levels included vocational training ($n = 28$), secondary school diploma ($n = 13$), compulsory education ($n = 4$), and no formal education ($n = 1$). There were five respondents who did not disclose their educational background. Participants' political attitudes were measured on a scale from 1 (left) to 7 (right). The sample leaned towards the political left with a mean score of 2.74 ($SD = 1.28$). There were 15 respondents who did not provide their political attitude.

On the following Monday (T1), Tuesday (T2), Wednesday (T3), Thursday (T4), Friday (T5), Saturday (T6) and Sunday (T7) participants completed the follow-up questionnaires. Follow-up questionnaires were only sent to participants who passed a filter item which assessed whether they were in the action stage or post-action stage of the MAP. In total, 317 participants were in the action stage or post-action stage of the MAP. Over the week after completing T0, the number of participants who completed the follow-up questionnaires was as follows: 265 (T1), 272 (T2), 270 (T3), 268 (T4), 267 (T5), 257 (T6), 26156 (T7); as well as 282 (T8) and 277 (T9) at one- and two-month follow-ups. For each follow-up questionnaire at T1-T7 (daily diary entries), participants were excluded from the analysis if they completed the questionnaire after the allocated time interval¹ and if they indicated that their data should not be used (self-exclusion). The final sample sizes were 263 (T1), 269 (T2), 268 (T3), 267 (T4), 263 (T5), 253 (T6), 256 (T7) as well as 280 (T8) and 275 (T9).

Materials

This study focuses on specific key variables which are elaborated in detail below. A comprehensive list of all variables gathered during the study is presented in the supplementary materials (see Appendix A). Descriptive statistics and correlations for the variables of primary interest are summarized in Table 1. Additionally, a grand correlation matrix of relevant variables is included in the supplement (Appendix B).

¹ The allocated time interval was from 5pm on the same day to 3am on the following day.

Table 1*Means, Standard Deviations, and Correlations with Confidence Intervals*

Variable	<i>M</i>	<i>SD</i>	1	2	3
1. Meat and dairy liking at T0	57.88	20.40			
2. Willpower belief	3.30	0.71	.01 [-.09, .10]		
3. Average consumption of animal products T1-T7	227.81	198.99	.10 [-.01, .21]	.10 [-.01, .21]	
4. Average demands T1-T7	2.60	0.47	-.01 [-.12, .11]	-.04 [-.15, .07]	.06 [-.05, .18]

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation; higher values in willpower belief indicate a stronger nonlimited willpower belief; the average consumption of animal products is measured and indicated in grams.

* indicates $p < .05$. ** indicates $p < .01$.

Measures at T0**Action Stage in MAP**

According to Bamberg's (2013) extended stage model of self-regulated behavior change, behavior change follows a series of four stages: (1) the *pre-decision stage*, (2) the *pre-action stage*, (3) the *action stage*, and (4) the *post-action stage*. In the action stage, the main question is "How do I implement my decision?". Only people who have previously formed a behavior intention during the pre-action stage can work on implementing this intention into behavior during the action stage (e.g., "When I buy groceries, I know how to replace animal products with vegan alternatives."). People who have already successfully implemented a new behavior, are in the post-action stage, but are subsequently tasked with overcoming temptations and relapses (Klöckner & Ofstad, 2017). Based on this theoretical assumption, participants were presented a filter item assessing whether they were in the action stage or post-action stage at the end of T0. Only participants who met this criterion were included in the study sample. Participants were presented the following statements (cf. Klöckner & Ofstad, 2017) and asked to indicate which best describes their current stage with regards to animal product consumption: "I am satisfied

with the level of my meat (and dairy and egg)² consumption at the moment and see no need to change it.”, “I should reduce my level of meat (and dairy and egg) consumption but at the moment I feel that this is impossible for me.” (*pre-decision stage* – exclusion); “I would like to reduce my meat (and dairy and egg) consumption, but I am at the moment unsure about how to replace it” (*pre-action stage* – exclusion); “I know how I can reduce my meat (and dairy and egg) consumption, but I have not put it into practice” (*action stage* – inclusion); “I have reduced my meat (and dairy and egg) consumption recently (in the last four weeks) and want to maintain this level or even reduce it further” (*post-action stage* – inclusion).

Current Level of Consumption of Animal Products

The participants’ current level of consumption of animal products, with respect to the past four weeks, was assessed with an adapted version of the Food Frequency Questionnaire (Haftenberger et al., 2010). This tool provides a detailed account of individuals' food selections by allowing self-assessment of consumption. By presenting images of food items along with their respective portion weights, participants can estimate their consumption of these items with high accuracy. The resulting data is a numeric score in grams. As several food photos were missing from the original questionnaire, the study team replicated them by weighing meat, dairy, and egg³ products and photographing them in a neutral setting (neutral-colored plate/bowl, white background). Example items included questions such as: “How often did you drink animal milk in the past four weeks (including milk used for coffee or cereals)?” with response options ranging from "never" to "more often than 5 times a day" and “When drinking animal milk, how much do you usually consume?”, with response options from "1/2 glass (or less)" to "4 glasses (or more)". Using a glossary that listed all the food items along with their corresponding portion weights, such as the amount of milliliters in a glass of milk, the study team was able to accurately calculate the daily numeric sum in grams of meat and dairy items consumed by the participants.

² Participants were able choose the reduction of only meat products or the reduction of all animal products as their personal target and subsequently were presented with items that matched their target.

³ Egg products were included in the present analysis. For simplicity and easier reading, the study predominantly refers to 'meat and dairy products', but this term consistently encompasses egg products as well.

Habit Strength

For assessing whether the replacement of meat and dairy products can be considered a habitual behavior, an adapted German version (cf. Thurn, 2014) of the Self-Report Habit Index (SRHI) (Verplanken & Orbell, 2003), consisting of 12 items, was administered. To complete the SRHI, participants were asked whether a target behavior occurs frequently; requires conscious awareness, thought, and effort; is difficult to control; and is self-descriptive. The SRHI has previously been used to study eating behaviors (de Bruijn et al., 2007; as cited in Moreon et al., 2018). In the present study, the SRHI was administered to the participants in two separate versions, once for home-based diet choices and once for eating-out. Sample items of the two adapted SRHI versions include: "Buying food without meat and fish and preparing meals without meat and fish is something [...] I do often; [...]I do almost automatically; [...]" and "What is it like when you order food in a restaurant, takeaway or from a delivery service? Choosing dishes without meat and fish is something [...] I do often; [...]I do almost automatically; [...]". All items were rated on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*). The 12 items are averaged to a summary index with higher scores reflecting a greater habit strength. The two versions for home-based diet choices and for eating-out were summarized into a general measure of habit strength in this analysis.

Meat and Dairy Liking

An adapted version of the visual analogue scale (VAS), used by Becker and Lawrence (2021), was administered to measure explicit liking of animal products. Depending on the dietary aim participants chose, either only meat products or meat, egg and dairy products were presented to them. Pictures were selected from a food pictures database created for psychological research by Blechert et al. (2014), as well as complementary pictures selected from Shutterstock image data-base. They were presented to the participants using a VAS ranging from 0 to 100, according to taste (0 = "very unpleasant" to 100 = "very pleasant").

Lay Beliefs About Willpower

Lay beliefs about willpower were assessed with a scale developed by Bernecker and Job (2015). The measure is comprised of 12 items representing the following subscales: strenuous mental activity (e.g., "When I have focused strongly on something, I feel full of strength and am able to immediately tackle a new challenging task"); resisting temptations (e.g., "As situations

accumulate where I have to resist temptations, it becomes increasingly difficult to restrain myself”); strenuous physical activity (e.g., “After a physically demanding activity, I feel full of energy and can immediately continue with something challenging”). The items are presented on a scale from 1 (*strongly disagree*) to 6 (*strongly agree*) and averaged to a summary index with higher scores indicating a greater agreement with a nonlimited willpower belief.

Measures at T1–T7

Daily Demands

Daily demands were assessed with an adapted German version of the NASA-TLX (Hart & Staveland, 1988). Participants indicated the levels of demands they have experienced on the respective day along six dimensions: mental demands, physical demands, temporal demands, performance, effort, and frustration. The items were presented on a scale from 1 (*low*) to 5 (*high*), with an exception regarding the item on performance which is rated from 1 (*good*) to 5 (*poor*). All items are averaged to an index of anticipated demands with higher scores indicating higher anticipated demands.

Daily Consumption of Animal Products

The participants’ daily level of consumption of animal products was assessed with an adapted version of the Food Frequency Questionnaire (Haftenberger et al. 2010) above. Example items include: “How much animal milk (including milk used for coffee or cereals) did you drink today (since waking up)?” (*none; 8 glasses (or more)*); “How many eggs (e.g., fried egg, scrambled egg, omelet) did you eat today?” (*none; 8 eggs (or more)*).

Measures at T8–T9

At one- and two-month follow-up, measures of habit strength and liking of animal products were repeated. Additionally, participants were asked about significant life events (e.g., changing apartments, having a new relationship), as such events can facilitate breaking with old habits through the removal of context cues (Klöckner & Verplanken, 2018).

Data Analysis

For testing hypothesis 1 and 2, a multilevel model was employed for data analysis due to the longitudinal nature of the dairy study, which was administered to participants over seven consecutive days. This structure results in nested observations within participants, violating the assumption of independence among observations. The data is structured across two levels: level

one represents within-person relationships between variables, while level two captures between-person differences in the strength of these within-person relationships.

Furthermore, the model incorporates random intercepts at the participant level, indicating that each participant has a unique baseline level of meat and dairy consumption. This allows for individual variability in starting points. Fixed effects were utilized for the predictor variable (willpower beliefs), reflecting an expected average effect on the dependent variable (meat and dairy consumption) across the entire dataset. For the moderation analysis in Hypothesis 2, demands were used as both a predictor and moderator with fixed effects, incorporating a random slope.

The statistical analyses for testing hypotheses 1 and 2 were performed utilizing the *lme4* package (v1.1.35.1; Bates, Mächler, Bolker, & Walker, 2015) and *lmerTest* package (v3.1.3; Kuznetsova, Brockhoff, & Christensen, 2017) within the R software environment (R Core Team, 2023). In hypotheses 3 and 4, the relationship between individuals' willpower beliefs at baseline (T0) and the strength of environmentally friendly dietary habits at follow-ups is explored. Hypotheses 5 and 6 investigate the influence of liking of meat and dairy products on habit strength at follow-ups, as well as the interaction between willpower beliefs and the liking of meat and dairy on habit strength. These analyses utilized data from the baseline measurement (T0) and the one- and two-month follow-up timepoints, which do not follow a multi-level structure. Therefore, multiple linear regression analyses were conducted. The statistical analyses for testing hypotheses 3 to 6 were performed utilizing the *stats* package (R Core Team, 2023) and *psych* package (Revelle, 2023) within the R software environment.

Results

Predicting Daily Pro-Environmental Behavior From Lay Beliefs About Willpower

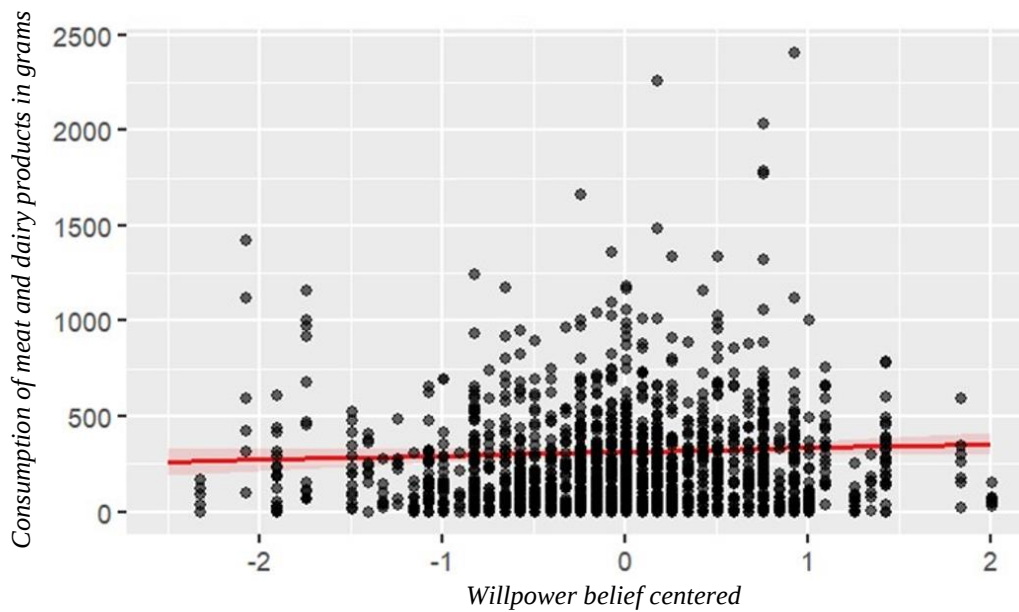
The first linear multi-level model (see Table 2, Figure 2) shows no statistically significant relationship between a nonlimited willpower belief and daily pro-environmental dietary behavior. Contrary to the expectations in hypothesis 1 and contrary to the findings of Jankowski and Job (2023), people with a nonlimited willpower belief on average consumed slightly more meat and dairy products throughout the seven-days study period, thus performed less daily pro-environmental dietary behavior ($b = 20.76$, $CI = [-6.68, 48.20]$, $p = .139$). However, this observed trend did not reach statistical significance.

Table 2*Results of Linear Mixed Model Analysis for Hypothesis 1*

Fixed Effects	Estimate	Std. Error	df	t value	Pr(> t)
Intercept	83.64	17.18	320.64	4.87	< .001 ***
Willpower belief (centered)	20.76	14.00	297.27	1.48	.139
Vegan dietary aim	231.00	20.57	297.79	11.23	< .001 ***
No dinner consumed	-40.25	10.36	1736.80	-3.88	< .001 ***

Note. *p < .05, **p < .01, ***p < .001.

Higher values in willpower belief indicate a stronger nonlimited willpower belief; dietary aim is coded 0 = vegetarian, 1 = vegan; dinner is coded as 0 = had dinner, 1 = had no dinner yet.

Figure 2*Results of Linear Mixed Model Analysis for Hypothesis 1: Relationship Between Willpower Beliefs and the Consumption of Meat and Dairy Products*

Note. Higher values in willpower belief indicate a stronger nonlimited willpower belief.

In the model, the effect of the participants' dietary aims (either reducing meat products or reducing both meat and dairy products) on the consumption of meat and dairy products was controlled for. The analysis revealed a highly significant positive effect of dietary aim on the consumption of meat and dairy products throughout the seven-days study period ($b = 231.00$, $CI = [190.68, 271.32]$, $p < .001$). These results were anticipated due to the nature of the outcome variable's design: participants' intake of meat and dairy products was measured in grams on a numeric scale. Consequently, participants who aimed to adopt a more vegan diet were asked to also indicate their consumption of milk and dairy products, leading to higher numeric food intake values than for participants who were only asked to indicate their consumption of meat.

Similarly, the effect of whether participants had already consumed dinner was also examined. Each day in the seven-days study period, participants were asked to indicate if they had already eaten dinner, with responses recorded in a dichotomous format (yes/no). The results show that participants who indicated that they had not yet eaten dinner reported significantly lower levels of meat and dairy consumption ($b = -40.25$, $CI = [-60.56, -19.94]$, $p < .001$). This finding suggests that the timing of the questionnaire relative to participants' dinner consumption had a substantial impact on their reported intake of meat and dairy products, thereby serving as a validation check for the attentiveness and accuracy of their responses.

Predicting Daily Pro-Environmental Behavior From Lay Beliefs About Willpower and Demands

Secondly, the effects of the variable of demands on the outcome variable of pro-environmental dietary behavior were explored using a linear multilevel model.

Interaction Effects Between Demands and Willpower Beliefs on Pro-Environmental Dietary behavior.

For examining the interaction effects between demands and willpower belief on pro-environmental behavior, two variables of demands were created: first demands were centered within clusters (CWC) and second, the average demands of each person were centered at grand mean (GMC). Centering within clusters (CWC) involves creating each person's mean for the situational variable demands and subtracting it from the raw variable to produce the person-centered variable. Centering at grand mean (GMC) refers to calculating the overall mean of the

situational variable demands across all individuals and then subtracting it from each person's average score across T1-T7 to create the grand-mean-centered variable. The grand mean centered average demands take into account the overall mean of a person across all situations (T1-T7), regardless of intraindividual differences. It distinguishes the effects of demands between persons, but not between situations (Masur, 2018).

In this advanced model (see Table 3, Figure 3), the interaction between willpower beliefs and within-person demands (CWC) is not statistically significant ($b = 5.66$, $CI = [-13.15, 24.46]$, $p = .555$). The interaction between willpower beliefs and between-person demands (GMC) shows a slight positive trend suggesting that individuals with a higher nonlimited willpower belief, combined with higher overall demands, tend to show a higher consumption of animal products. However, this effect is not statistically significant ($b = 62.54$, $CI = [-1.93, 127.01]$, $p = .058$).

Table 3

Results of Linear Mixed Model Analysis for Hypothesis 2

Fixed Effects	Estimate	Std. Error	df	t value	Pr(> t)
Intercept	228.00	11.47	297.06	19.88	< .001 ***
Willpower belief (centered)	34.39	16.80	297.10	2.05	.042 *
Demands (CWC)	2.32	7.41	1523.58	0.31	.754
Demands (GMC)	34.32	25.11	315.93	1.37	.173
Willpower belief (centered) × Demands (CWC)	5.66	9.58	1523.58	0.59	.555
Willpower belief (centered) × Demands (GMC)	62.54	32.83	311.08	1.91	.058

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Higher values in willpower belief indicate a stronger nonlimited willpower belief.

Figure 3

Results of Linear Mixed Model Analysis for Hypothesis 2: Predicted Levels of Meat and Dairy Product Consumption in Grams, Plotted Against Centered Willpower Beliefs, With Varying Levels of Perceived Demands (GMC)



Note. Higher values in willpower belief indicate a stronger nonlimited willpower belief.

Predicting the Formation of Environmentally Friendly Dietary Habits From Lay Beliefs about Willpower

Turning away from the initial stage of behavior formation, it was assessed whether individuals with a nonlimited willpower belief exhibited higher habit strength regarding a meat- and dairy-reduced diet after one and two months, exploring mechanisms behind the maintenance of environmentally friendly dietary habits.

After One Month.

A multiple linear regression model (see Table 4) was applied to explore the relationship between habit strength after four weeks and the predictor willpower belief, as well as the predictor habit strength at baseline, which was added as a control variable. The regression model was statistically significant ($F(2, 275) = 109.6, p < .001$), and accounted for approximately 44% of the variance in habit strength after four weeks (adjusted $R^2 = .44$). The regression coefficients indicated that habit strength at baseline was a significant predictor for habit strength at one-

month follow-up ($\beta = 0.66, p < .001$). The variable of primary interest, willpower belief, however was not a significant predictor ($\beta = 0.05, p = 0.356$).

Table 4

Results of Linear Regression Analysis for Hypothesis 3 at One-Month Follow-Up

Predictor	Estimate	Std. Error	t value	Pr(> t)
Intercept	1.20	0.22	5.40	< .001 ***
Willpower belief	0.05	0.06	0.93	.356
Habit strength at T0	0.66	0.04	14.74	< .001 ***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Higher values in willpower belief indicate a stronger nonlimited willpower belief.

After Two Months.

Another multiple linear regression model (see Table 5) was applied for predicting habit strength after eight weeks. The regression model was overall statistically significant ($F(2,269) = 94.14, p < .001$), and accounted for approximately 41% of the variance in habit strength at two-month follow-up (adjusted $R^2 = .41$). Again, the regression coefficients indicated that habit strength at baseline was a significant predictor for habit strength at two-month follow-up ($\beta = .066, p < .001$). Likewise to one-month follow-up, willpower belief was not a significant predictor for habit strength at two-month follow-up ($\beta = -0.02, p = .737$).

Table 5

Results of Linear Regression Analysis for Hypothesis 3 at Two-Month Follow-Up

Predictor	Estimate	Std. Error	t value	Pr(> t)
Intercept	1.55	0.24	6.47	< .001 ***
Willpower belief	-0.02	0.06	-0.34	.737
Habit strength at T0	0.66	0.05	13.72	< .001 ***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Higher values in willpower belief indicate a stronger nonlimited willpower belief.

The mediation analysis, which was supposed to predict whether daily pro-environmental dietary behavior would mediate the effect of willpower belief on habit strength at two-month follow-up was excluded from the analysis, as the main effect was not found. According to Baron and Kenny's criteria (Baron & Kenny, 1986) and more contemporary guidelines (e.g., Hayes, 2012) establishing a significant direct effect is a prerequisite for exploring mediation effects. Without a robust direct effect between willpower belief and habit strength, the conditions necessary for meaningful mediation analysis were not met.

Impact of Meat and Dairy Liking on Habit Strength

A further analysis investigated whether baseline liking for meat and dairy products influences habit strength at one- and two-month, and whether an interaction effect exists between willpower belief and liking on habit strength.

Impact of Liking for Meat and Dairy Products on Habit Strength After One Month.

A multiple linear regression (see Table 6) was conducted to predict habit strength at one-month follow-up, based on participants' liking of meat and dairy products and willpower beliefs at baseline. The regression model was overall statistically significant ($F(2,275) = 31.31$, $p < .001$), with an adjusted R^2 of .18, indicating that approximately 18% of the variance in habit strength at one-month follow-up was explained by the model. Participants' liking for meat and dairy products reported at baseline was a significant predictor ($b = -0.02$, $p < .001$), suggesting that lower initial liking for meat and dairy products is associated with more habit strength at one-month follow-up. Willpower beliefs, however, did not significantly predict habit strength ($b = 0.09$, $p = .177$).

The variable of liking for meat and dairy products was assessed using a VAS ranging from 0 to 100, according to taste (0 = "very unpleasant" to 100 = "very pleasant"). To account for the wide range of scaling in this measure, standardized Beta coefficients were added to the regression analysis. Standardized Beta coefficients are useful for interpretation when variables differ significantly in their scales, as they allow for comparison of effect sizes across variables on one common scale. Standardization involves transforming both the independent and dependent variables so that they have a mean of zero and a standard deviation of one (Landis, 2005). The standardized Beta for liking for meat and dairy products is -0.43, which is substantially larger than the unstandardized coefficient ($b = -0.02$). This indicates that the variable has a moderate to

strong negative relationship with habit strength, which aligns with the expectation that lower preference for meat and dairy are associated with higher habit strength.

Table 6

Results of Linear Regression Analysis for Hypothesis 5 at One-Month Follow-Up

Predictor	Estimate	Std. Error	t value	Pr(> t)	Standardized Beta
Intercept	3.98	0.26	15.48	< .001 ***	-
Meat and dairy liking at T0	-0.02	0.00	-7.83	< .001 ***	-0.43
Willpower belief	0.09	0.07	1.36	.177	0.07

Note. *p < .05, **p < .01, ***p < .001.

Higher values in willpower belief indicate a stronger nonlimited willpower belief.

Interaction between willpower belief and liking on habit strength after one month.

The applied regression model (see Table 7), which included the interaction term, explained for 18% of the variance in habit strength at one-month follow-up (adjusted $R^2 = .18$) and was overall statistically significant ($F(3,274) = 21.25, p < .001$). Again, the liking for meat and dairy products reported at baseline had a significant negative effect on habit strength at one-month follow-up ($b = -0.03, p = .009$). The interaction between meat and dairy liking and willpower belief was not significant ($b = 0.00, p = .295$), indicating that the effect of liking for meat and dairy products on habit strength at one-month follow-up did not significantly vary with levels of willpower. Also, using the standardized Beta coefficient, the interaction effect between liking for meat and dairy products and willpower beliefs on habit strength at one-month follow-up was not significant ($\beta = 0.08$).

Table 7*Results of Linear Regression Analysis for Hypothesis 6 at One-Month Follow-Up*

Predictor	Estimate	Std. Error	t value	Pr(> t)	Standardized Beta
Intercept	4.62	0.67	6.90	< .001 ***	-
Meat and dairy liking at T0	-0.03	0.01	-2.67	.009 **	-0.70
Willpower belief	-0.11	0.20	-0.55	.585	-0.09
Meat and dairy liking at T0 x Willpower belief	0.00	0.00	1.05	.295	0.08

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Higher values in willpower belief indicate a stronger nonlimited willpower belief.

Impact of Liking for Meat and Dairy Products on Habit Strength After Two Months.

A multiple linear regression (see Table 8) was conducted to predict habit strength at two-month follow-up, based on participants' liking of meat and dairy products and willpower beliefs at baseline. The regression model was overall statistically significant ($F(2,269) = 31.58$, $p < .001$), with an adjusted R^2 of .18, indicating that approximately 18% of the variance in habit strength at two-month follow-up was explained by the model. Participants' liking for meat and dairy products reported at baseline was a significant predictor ($b = -0.02$, $p < .001$), suggesting that lower initial liking for meat and dairy products is associated with more habit strength at two-month follow-up. Willpower beliefs, however, did not significantly predict habit strength ($b = 0.01$, $p = .9$). Again, standardized Beta coefficients were calculated to complement the regression analysis. The standardized coefficients reveal that liking for meat and dairy products has a moderate to strong negative effect on habit strength ($\beta = -0.44$), again aligning with the expectation that lower preference for meat and dairy are associated with higher habit strength.

Table 8*Results of Linear Regression Analysis for Hypothesis 5 at Two-Month Follow-Up*

Predictor	Estimate	Std. Error	t value	Pr(> t)	Standardized Beta
Intercept	4.44	0.27	16.63	< .001 ***	-
Meat and dairy liking at T0	-0.02	0.00	-7.95	< .001 ***	-0.44
Willpower belief	0.01	0.07	0.13	.9	0.01

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Higher values in willpower belief indicate a stronger nonlimited willpower belief.

Interaction Between Willpower Belief and Liking on Habit Strength After Two Months.

The applied regression model (see Table 9), which included the interaction term, explained for 18% of the variance in habit strength at two-month follow-up (adjusted $R^2 = .18$) and was overall statistically significant ($F(3,268) = 21.27$, $p < .001$). Again, the liking for meat and dairy products reported at baseline also had a significant negative effect on habit strength at two-month follow-up ($b = -0.03$, $p = .009$). The interaction between meat and dairy liking and willpower belief was not significant ($b = 0.00$, $p = .396$), indicating that also at two-month follow-up the effect of liking for meat and dairy products on habit strength did not significantly vary with levels of willpower. Similarly, the standardized Beta coefficient indicated that the interaction effect between liking for meat and dairy products and willpower beliefs on habit strength at the two-month follow-up was not significant ($\beta = 0.07$).

Table 9*Results of Linear Regression Analysis for Hypothesis 6 at Two-Month Follow-Up*

Predictor	Estimate	Std. Error	t value	Pr(> t)	Standardized Beta
Intercept	4.99	0.70	7.15	< .001 ***	-
Meat and dairy liking at T0	-0.03	0.01	-2.63	.009 **	-0.65
Willpower belief	-0.16	0.21	-0.76	.446	-0.13
Meat and dairy liking at T0 x Willpower belief	0.00	0.00	0.85	.396	0.07

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Higher values in willpower belief indicate a stronger nonlimited willpower belief.

Explorative Analysis

Among the tested relationships in this study, only the hypothesis that meat and dairy liking influences habit strength for adhering to a meat- and dairy-reduced diet was confirmed. One possible explanation for the lack of significant findings regarding willpower belief is that participants with stronger dietary habits may not rely on their willpower beliefs to reduce their intake of meat and dairy products, as they might simply dislike these foods. Thus, self-control mechanisms to resist these food may not need to be activated.

To further explore this possibility, an additional exploratory analysis was conducted by reanalysing the multilevel model from hypothesis 2. This analysis incorporated an interaction term between willpower belief and meat and dairy liking to examine their combined effect on meat and dairy consumption. In line with the theoretical framework of this study, it was assumed that a nonlimited willpower belief would exert a stronger influence on dietary behavior when liking for meat and dairy is high. This expectation was based on the notion that self-control mechanisms, such as willpower beliefs, are activated primarily when individuals face greater temptations (Bernecker & Job, 2017).

As shown in Table 10, the exploratory analysis revealed no changes in the results for willpower beliefs. The interaction between liking and willpower beliefs yielded an unexpected finding. Specifically, higher liking of meat and dairy products in combination with a stronger nonlimited willpower belief was associated with a slight, statistically significant, increase in meat and dairy consumption ($b = 1.75$, $CI = [0.11, 3.38]$, $p = .036$). It is important to note that the Beta coefficient is small because meat and dairy liking was measured on a 100-point scale (a one-point increase on the liking scale corresponds to an additional 1.13 grams of meat and dairy consumed per day). The result of this exploratory analysis does not support the assumption that, particularly when goal-oriented behavior is challenging to achieve (e.g., when there is a strong liking for a desired food one aims to avoid), a nonlimited willpower belief facilitates the accomplishment of the target behavior.

Table 10*Results of Linear Mixed Model Analysis for the Explorative Analysis*

Fixed Effects	Estimate	Std. Error	df	t value	Pr(> t)
Intercept	226.18	11.42	296.15	19.81	< .001 ***
Willpower belief (centered)	25.61	16.54	294.19	1.55	.123
Meat and dairy liking at T0 (centered)	1.13	0.58	296.75	1.96	.051
Willpower belief (centered) x Meat and dairy liking at T0 (centered)	1.75	0.83	296.59	2.10	.036*

Note. *p < .05, **p < .01, ***p < .001.

Higher values in willpower belief indicate a stronger nonlimited willpower belief.

Discussion

The present study built upon the foundational research conducted by Jankowski and Job (2023), which explored general daily pro-environmental behaviors using a similar diary format. Jankowski and Job (2023) found an expected association between a nonlimited willpower belief and increased daily pro-environmental behavior and with the impact of willpower beliefs being stronger when participants faced higher demands across the study period. These anticipated results were not confirmed in the present study.

The results revealed that participants with a nonlimited willpower belief did not engage in more pro-environmental dietary behavior, even on days with higher demands. The interaction between willpower beliefs and demands shows a slight positive trend, suggesting that individuals with a stronger nonlimited willpower belief, combined with higher overall demands, tend to show a higher consumption of animal products. However, this effect is not statistically significant. A nonlimited willpower belief was not associated with the formation of environmentally friendly dietary habits. Liking for meat and dairy products emerged as the sole predictor of habit strength at one- and two-month follow-ups, with a stronger preference for these foods correlating with lower habit strength for a meat- and dairy reduced diet. An exploratory analysis found that a stronger nonlimited willpower belief, combined with a high liking for meat and dairy, was linked to a slight increase in their consumption, also not aligning with theoretical assumptions.

The failure to replicate Jankowski and Job's (2023) findings, despite a similar study design, is surprising. The same scales were used to assess willpower beliefs (Bernecker & Job, 2015) and demands (NASA-TLX, Hart & Staveland, 1988). The difference in sample demographics, which was more age-diverse and included fewer students than Jankowski and Job's (2023) study, is also unlikely to explain the discrepancy, as previous research has found effects of willpower beliefs in diverse populations (e.g., Job et al., 2010; Bernecker & Job, 2015; Job et al., 2015). Therefore, the divergence may lie in the outcome variable – specifically, the behavior being studied – pro-environmental dietary behavior, operationalized as the reduction of meat and dairy consumption, instead of generalized daily pro-environmental behavior.

Pro-environmental dietary behavior may indeed differ from other pro-environmental behaviors such as waste management, transportation choices or energy saving. In the present study, among pro-environmental motives, many study participants listed health motivations, animal welfare, saving money, and other reasons for reducing their meat and dairy consumption. Although this diversity in motives is common in meat- and dairy-reduced dietary goals (e.g., De Backer & Hudders, 2014; Grassian, 2020; Hielkema & Lund, 2021; Lacroix & Gifford, 2019; Rothgerber, 2015; cited from Wehbe et al., 2022), it was still expected that willpower beliefs would influence participants' ability to demonstrate their target behavior. Regardless of the additional motives beyond pro-environmental concerns, this behavior should be classified as goal-oriented. Lay beliefs about willpower have proven to play a role for the exhibition of a wide range of goal-oriented behaviors (e.g., Job et al., 2010; Bernecker & Job, 2015; Bernecker & Job, 2015a; Job et al., 2015), suggesting that the multiplicity in motives should not have diminished the expected impact of willpower beliefs on participants' actions.

The intention-behavior gap regarding pro-environmental food choices, however, may be particularly complex. To translate dietary intention into action, it is likely that not only internal mechanisms—such as action planning, maintenance self-efficacy, and willpower theory—are crucial, but also a broader array of external factors needs to be taken into account. Fink et al. (2018) conducted six workshops in different German cities, collecting qualitative data on factors leading to the intention-behavior gap in reducing meat and dairy intake. Participants reported more external factors (989) than internal factors (168), such as information, skills, abilities, emotions, and compulsions, which could contribute to closing the intention-behavior gap. External factors included availability, advertising, pricing of sustainable food alternatives,

and education about sustainable nutrition. These findings suggest that addressing the intention-behavior gap regarding environmentally friendly food choices requires consideration of various factors, including external ones. When external constraints such as limited availability of options or financial resources come into play, engaging in environmentally sustainable behavior may exceed considerations of self-control or willpower, as such actions may simply not be feasible.

A closer look at the multiple linear regression models conducted for hypotheses 3 to 6 also suggests that further factors may need to be considered when exploring the formation of environmentally friendly dietary habits. The models including willpower belief and habit strength at baseline as predictors for habit strength at one-month and two-month follow-up explained 44% and 41% of the variance respectively, with the majority of this variance likely attributable to the control variable of habit strength at baseline. Models examining whether liking for meat and dairy products influenced habit strength at one- and two-month follow-ups, as well as the interactions between meat and dairy liking and willpower belief, each explained only 18% of the variance and only meat and dairy liking was a significant predictor. These results imply that additional factors not captured in the current analyses play a significant role in the establishment of environmentally friendly dietary habits as 60–80% of the variance in habit strength at follow-ups remains unexplained by the present multiple linear regression models.

Another consideration is that participants were not committed enough to adhere to their dietary goals during the study period. The study results however show that at baseline participants were committed to their goal and also found it attainable at moderate-high level ($M = 3.64$), measured on a Likert scale ranging from one to five (goal commitment and attainability subscale; Brunstein et al., 1998). Additionally, it is possible that participants had already established environmentally friendly dietary habits before the study began. The mean score for habit strength at baseline was at a moderate level ($M = 2.83$) on a Likert scale ranging from one to five, with higher values indicating stronger habit strength. According to the theoretical framework and empirical background underpinning this study, the presence of pre-established environmentally friendly dietary habits however should not negate the expectation that participants with a nonlimited willpower belief would exhibit stronger daily goal-oriented behaviors. Even if the target behavior had already been automated (to a certain extent) prior to participation in the study, a nonlimited willpower belief should still correlate with pro-environmental dietary behavior, as willpower beliefs are assumed to be stable over time and to

have initially facilitated the repetition and further automatization of the behavior. The absence of this connection suggests that other factors may be influencing the outcomes.

One further reason for the unexpected results may be the influence of social desirability bias. The present study used precise measurements of pro-environmental behavior by asking participants to detail their daily food intake in an exact manner. This may have reduced the likelihood of falsifying responses to appear more socially desirable. In contrast, more generalized questions or retrospective self-assessments used in other studies may be more susceptible to social desirability bias (cf. Hébert et al., 1995; Goldstein et al., 2017). Similarly, assessments of willpower belief could be influenced by social desirability, with individuals potentially reporting a belief in nonlimited willpower to align with norms of being "high achievers." The precise measurement of pro-environmental behavior might have prevented the observation of "artificial correlations" of a nonlimited willpower belief with goal-oriented behavior when both variables are influenced by social desirability. However, this argument should be approached cautiously, as the connection between a nonlimited willpower belief and goal-oriented behavior has been demonstrated in controlled laboratory settings (e.g., Miller et al., 2012; Job et al., 2015a), and many studies have accounted for social desirability influences (e.g., Jankowski & Job, 2023). Despite these considerations, social desirability remains a factor that must always be taken into account.

Another explanation for the unexpected study results could be attributed to biophysiological factors and individual convictions regarding the necessity of consuming (animal-based) proteins. Individuals with a nonlimited willpower belief might generally consume more calories, especially protein-rich foods like meat and dairy products. The present study did not measure meat and dairy intake in relation to total calorie consumption or in relation to vegan protein intake. It is well-proven in biological science that high-protein food intake can influence physical abilities (Liu et al., 2022; Bradlee et al., 2017), and high-protein nutrients are often found in animal products. Certain amino acids found in red meat or eggs can enhance cognitive capacities and mental performance (Formica et al., 2020; Markus et al. 2010). Although many researchers argue that proteins and nutrients from meat and dairy products can be adequately replaced with vegan and vegetarian alternatives (Kyriakopoulou et al., 2021; Päivärinta et al., 2020), people may still believe that they need these components specifically from animal-based sources. It is possible that individuals with a nonlimited willpower belief – who tend to think

their energy does not get depleted and that they can persist indefinitely – also hold this conviction about the necessity of animal-based proteins. Alternatively, they may *actually* require more protein-rich foods due to their higher levels of physical and mental activity, making it more challenging to replace all their proteins with plant-based alternatives. In the current dataset, participants' physical and mental activity levels were not directly measured. However, daily demands were assessed, which may serve as a related construct to physical and mental activity. No significant correlation was found between the average demands experienced across the seven-days diary period and willpower beliefs reported at baseline ($r(298) = -.04, p = .48, 95\% \text{ CI } [-0.15, 0.07]$). This result may somewhat weaken the argument presented above, as participants with a nonlimited willpower belief did not engage in more demanding activities.

Generally, the mechanisms behind food choices are very complex. Sensory responses to the taste, smell, and texture of foods help determine food preferences and eating habits. There are multiple links between taste perceptions, taste preferences, food preferences, and food choices, and the amount of food consumed. Taste responses are influenced by a range of genetic, physiological, and metabolic variables (Drewnowski, 1997).

Wehbe et al.'s (2022) qualitative study on the factors facilitating the reduction of meat and dairy intake offers valuable insights into the complexity of dietary behaviors. Participants cited hunger as a barrier to reducing meat and dairy and reported not feeling satisfied after vegetarian meals. Participants also found it easier to reduce meat consumption in summer than in winter, due to a craving for comforting foods during colder months. In this regard, it is relevant to note that most participants in the present study completed their diary entries during the cold months of February and March. Some participants in Wehbe et al.'s (2022) study linked their cravings to perceived nutritional deficiencies, such as iron and vitamin B12, and described how moods like forgetfulness, distraction, laziness, stress, or boredom increased their desire for meat or dairy. Some participants reported experiencing feelings of idleness and fatigue towards the end of the week or day. In these situations, they opted for comfort, familiarity, and convenience rather than making the more challenging effort to resist meat and dairy.

Interestingly, previous studies suggest that the process of reducing meat and dairy consumption typically adheres to a specific sequence influenced by food status hierarchy (Grassian, 2020; cited from Wehbe et al., 2022) and perceived similarities between humans and

animals (Rothgerber, 2014; cited from Wehbe et al., 2022). People who reduce their consumption often start by avoiding red meat, then progress to white meat, dairy, eggs, and finally seafood, whereas this sequence can vary among individuals (Calton et al., 2014; cited from Wehbe et al., 2022). It is possible that participants in the present study reduced certain types of meat before others, but these nuances were not captured in the utilized version of the FFQ questionnaire (Haftenberger et al., 2010), which produced an overall numeric sum score. In line with this, another limitation of the used questionnaire is that it did not include more nuanced indicators of pro-environmental dietary choices, such as the purchase of organic, regional, and seasonal food products.

One hypothesis of the present study, however, was confirmed: people with a higher liking for meat and dairy products reported weaker habit strength for meat- and dairy-reduced dietary habits at the one-month and two-month follow-ups. This finding holds significant practical implications. If the sensory preference for these products has an influence on their consumption, it could be a valid policy measure to promote the production and affordability of energy-efficient meat and dairy alternatives that closely mimic the taste and texture of traditional meat and dairy products. Encouraging the development and consumption of these alternatives could facilitate the transition to more sustainable dietary habits by reducing reliance on animal-based foods (Papies, Barsalou, et al., 2020; Turnwald & Crum, 2019; cited from Wehbe et al., 2022).

General Limitations

The study only included participants who already had at least a rough idea of how to limit their consumption of animal products. This selectiveness was appropriate for testing the formulated hypotheses, as it ensured that participants exhibited a certain level of behavior intention. However, this approach excluded individuals who had not yet decided to change their diet (pre-decision stage; cf. Klöckner & Ofstad, 2017) or those considering dietary changes but unsure how to proceed (pre-action stage; cf. Klöckner & Ofstad, 2017). Consequently, the study does not provide insights into facilitating stage progression in these earlier stages of behavioral change.

A further potential limitation of this study concerns the gender distribution of the sample. A significant majority of participants were women (79.81%), making the findings more representative for females. This imbalance in the study sample may reflect broader demographic

patterns: according to the 2019 Austrian Health Interview Survey, men in Austria consume twice as much meat as women (STATISTIK AUSTRIA, 2024). Similar trends are observed in Germany and Switzerland, where men consume more meat than women (Ahrens, 2024; Ahrens, 2024a). Based on cultural norms and gender norms, men tend to have less positive attitudes towards vegan and vegetarian food preferences than women (Modlińska et al., 2020; Rosenfeld & Tomiyama, 2021). The latter findings may suggest that men tend to be at an earlier stage of behavioral change, as negative attitudes could hinder the formation of intentions to reduce meat and dairy consumption. Consequently, studies and interventions may need to be gender-sensitive, with efforts targeting men focusing on earlier stages of the behavioral change process in exploring the psychological barriers that hinder their adoption of meat and dairy-reduced consumption habits.

Another general limitation of the study may lie in the transferability of the study results to other *high impact* pro-environmental behaviors. Many private-sphere pro-environmental behaviors follow a structure that can be considered as habitual, such as eating habits, recycling, or switching off the lights when leaving the room. Among those pro-environmental behaviors that have a *high impact* on the environment, however, only nutrition and daily means of transport can be considered as habitual. Other high impact behaviors, such as avoiding travel by plane or choosing sustainable housing, rather refer to occasional long-term choices, which are also bound several external factors, such as transportation infrastructure or peoples' economic means. Thus, the present study results may not be transferrable to other pro-environmental behaviors with equally high impact on the environment.

Conclusion

The present study aimed to replicate and extend the findings of Jankowski and Job (2023) by examining the role of willpower beliefs in promoting pro-environmental dietary behavior and environmentally friendly dietary habits. Despite using a similar methodology and theoretical framework, the anticipated association between a nonlimited willpower belief and increased pro-environmental dietary behavior was not confirmed. Several potential explanations for these unexpected results were identified, including the complexity of dietary behavior compared to other pro-environmental behaviors, the influence of external factors, potential influences of social desirability and biophysiological factors as well as methodological considerations.

One hypothesis that was confirmed is that individuals with a higher preference for meat and dairy reported weaker habit strength for a meat- and dairy-reduced diet at follow-ups. This suggests practical implications for policy measures aimed at promoting sustainable dietary habits through appealing meat and dairy alternatives.

Future research should take into account the limitations identified in this study. By addressing these areas, future studies may be able to further explore the factors that facilitate or hinder the adoption of environmentally friendly food choices and contribute to more effective interventions.

References

- Aarts, H., Verplanken, B., & van Knippenberg, A. (1997). Habit and information use in travel mode choices. *Acta Psychologica*, 96(1-2), 1–14. [https://doi.org/10.1016/s0001-6918\(97\)00008-5](https://doi.org/10.1016/s0001-6918(97)00008-5).
- Ahrens, S. (2024, September 24). *Täglicher Verzehr von Fleisch in Deutschland nach Geschlecht bis 2024*. Statista. <https://de.statista.com/statistik/daten/studie/12254/umfrage/verzehrhaeufigkeit-von-fleisch-oder-wurst-in-deutschland-2008/#:~:text=Zum%20Zeitpunkt%20des%20Jahres%202024,konsumieren%2C%20gegen%20dem%20Vorjahr%20gestiegen>.
- Ahrens, S. (2024a, May 22). *Schweiz - Fleischverzicht nach Geschlecht 2022*. Statista. <https://de.statista.com/statistik/daten/studie/683958/umfrage/fleischverzicht-in-der-schweiz-nach-geschlecht/#:~:text=Beim%20Verzicht%20auf%20Fleisch%20zeigt,sind%20es%205%2C3%20Prozent>.
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T).
- Armitage, C. J., & Conner, M. (2001). Efficacy of the theory of planned behavior: A meta-analytic review. *British Journal of Social Psychology*, 40, 471–499. <https://doi.org/10.1348/014466601164939>.
- Bamberg, S. (2013). Changing environmentally harmful behaviors: A stage model of self-regulated behavioral change. *Journal of Environmental Psychology*, 34, 151–159. <https://doi.org/10.1016/j.jenvp.2013.01.002>.
- Bamberg, S. (2013a). Applying the stage model of self-regulated behavioral change in a car use reduction intervention. *Journal of Environmental Psychology*, 33, 68–75. <https://doi.org/10.1016/j.jenvp.2012.10.001>.
- Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behavior. *Journal of Environmental Psychology*, 27(1), 14–25. <https://doi.org/10.1016/j.jenvp.2006.12.002>.
- Baron, R., & Kenny, D. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations.. *Journal of personality and social psychology*, 51 6, 1173-82 . <https://doi.org/10.1037/0022-3514.51.6.1173>.
- Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, 67(1), 1-48. <https://doi.org/10.18637/jss.v067.i01>.

- Becker, E., Lawrence, N. (2021). Meat disgust is negatively associated with meat intake - evidence from a cross-sectional and a longitudinal study. <https://doi.org/10.31234/osf.io/4dtjk>.
- Bernecker, K., & Job, V. (2015). Beliefs About Willpower Are Related to Therapy Adherence and Psychological Adjustment in Patients With Type 2 Diabetes. *Basic and Applied Social Psychology*, 37(3), 188–195. <https://doi.org/10.1080/01973533.2015.1049348>.
- Bernecker, K., & Job, V. (2015a). Beliefs about willpower moderate the effect of previous day demands on next day's expectations and effective goal striving. *Frontiers in Psychology*, 6. <https://doi.org/10.3389/fpsyg.2015.01496>.
- Bernecker, K., & Job, V. (2017). Implicit Theories About Willpower in Resisting Temptations and Emotion Control. *Zeitschrift für Psychologie*, 225, 157–166. <https://doi.org/10.1027/2151-2604/a000292>.
- Bertrams, A., & Dickhäuser, O. (2009). Kurzform der self-control scale. *PsycTESTS Dataset*. <https://doi.org/10.1037/t60760-000>.
- Blechert J., Meule A., Busch N. A., Ohla K. (2014). *Food-pics: an image database for experimental research on eating and appetite*. *Front Psychol.* (5) 617. <https://doi.org/10.3389/fpsyg.2014.00617>.
- Bradlee, M., Mustafa, J., Singer, M., & Moore, L. (2017). High-Protein Foods and Physical Activity Protect Against Age-Related Muscle Loss and Functional Decline. *The Journals of Gerontology: Series A*, 73, 88–94. <https://doi.org/10.1093/gerona/glx070>.
- Chow, J. T., Hui, C. M., & Lau, S. (2015). A depleted mind feels inefficacious: Ego-depletion reduces self-efficacy to exert further self-control. *European Journal of Social Psychology*, 45(6), 754–768. <https://doi.org/10.1002/ejsp.2120>.
- Clayton, S., Devine-Wright, P., Stern, P. C., Whitmarsh, L., Carrico, A., Steg, L., Swim, J., & Bonnes, M. (2015). Psychological research and global climate change. *Nature Climate Change*, 5(7), 640–646. <https://doi.org/10.1038/nclimate2622>.
- Cobb-Clark, D. A., Kong, N., & Schildberg-Hörisch, H. (2022). The stability of self-control in a population representative study. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4114503>.
- Cumming, G. (2014). *The New Statistics: Why and How*. *Psychological Science*, 25, 7-29. <https://doi.org/10.1177/0956797613504966>.
- Dahlstrand, U. and Biel, A. (1997). Pro-environmental habits: propensity levels in behavioral change. *Journal of Applied Social Psychology* 27(7), 588–601. <https://doi.org/10.1111/j.1559-1816.1997.tb00650.x>.

- De Bruijn, G.-J., Kremers, S. P., De Vet, E. E., De Nooijer, J., Van Mechelen, W., Brug, J. (2007). Does habit strength moderate the intention–behavior relationship in the theory of planned behavior? the case of fruit consumption. *Psychology & Health*, 22(8), 899–916. <https://doi.org/10.1080/14768320601176113>.
- Drewnowski, A. (1997). Taste preferences and food intake.. *Annual review of nutrition*, 17, 237-53 . <https://doi.org/10.1146/ANNUREV.NUTR.17.1.237>.
- Duckworth, A. L., Gendler, T. S., Gross, J. J. (2016). Situational Strategies for self-control. *Perspectives on Psychological Science*, 11(1), 35–55. <https://doi.org/10.1177/1745691615623247>.
- Ernährung. STATISTIK AUSTRIA. (2024, June 4). <https://www.statistik.at/statistiken/bevoelkerung-und-soziales/gesundheit/gesundheitsverhalten/ernaehrung>
- European Commission. (2020). Attitudes of European citizens towards the environment. Special Eurobarometer 501. Luxembourg: Office for Official Publications of the European Communities. <https://europa.eu/eurobarometer/surveys/detail/2257>.
- European Commission. (2021). Climate Change. Special Eurobarometer 513. Luxembourg: Office for Official Publications of the European Communities. IBSN 978-92-76-38399-4
- Fink, L., Ploeger, A., & Strassner, C. (2018). Participative Processes as a Chance for Developing Ideas to Bridge the Intention-Behavior Gap Concerning Sustainable Diets. *Sustainability*. <https://doi.org/10.3390/SU10124434>.
- Fink, L., Strassner, C., & Ploeger, A. (2021). Exploring External Factors Affecting the Intention-Behavior Gap When Trying to Adopt a Sustainable Diet: A Think Aloud Study. *Frontiers in Nutrition*, 8. <https://doi.org/10.3389/fnut.2021.511412>.
- Formica, M., Gianoudis, J., Nowson, C., O’Connell, S., Milte, C., Ellis, K., & Daly, R. (2020). Effect of lean red meat combined with a multicomponent exercise program on muscle and cognitive function in older adults: a 6-month randomized controlled trial.. *The American journal of clinical nutrition*. <https://doi.org/10.1093/ajcn/nqaa104>.
- Francis, Z., & Job, V. (2018). Lay beliefs of willpower. *Social and Personality Psychology Compass*, 12. <https://doi.org/10.1111/SPC3.12381>.
- Fujii, S., Gärling, T. (2003). Development of script-based travel mode choice after forced change. *Transportation Research Part F: Traffic Psychology and Behavior*, 6(2), 117–124. [https://doi.org/10.1016/s1369-8478\(03\)00019-6](https://doi.org/10.1016/s1369-8478(03)00019-6).
- Gardner, B. D. (2008). What drives car use? Modelling psychological antecedents of travel mode choice. University of Sussex, Dphil. <https://doi.org/10.31237/osf.io/u4nyj>.

- Goldstein, A., Vilhena-Churchill, N., Munroe, M., Stewart, S., Flett, G., & Hoaken, P. (2017). Understanding the Effects of Social Desirability on Gambling Self-Reports. *International Journal of Mental Health and Addiction*, 15, 1342-1359. <https://doi.org/10.1007/s11469-016-9668-0>.
- Gollwitzer, P., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology*, 38, 69-119. [https://doi.org/10.1016/S0065-2601\(06\)38002-1](https://doi.org/10.1016/S0065-2601(06)38002-1).
- Haftenberger, M., Heuer, T., Heidemann, C., Kube, F., Krems, C., Mensink, G. B. M. (2010). Relative validation of a food frequency questionnaire for National Health and Nutrition Monitoring. *Nutrition Journal*, 9(1). <https://doi.org/10.1186/1475-2891-9-36>.
- Hart, S. G., & Staveland, L. E. (1988). Development of NASA-TLX (Task Load Index): Results of empirical and theoretical research. *Advances in Psychology*, 139–183. [https://doi.org/10.1016/s0166-4115\(08\)62386-9](https://doi.org/10.1016/s0166-4115(08)62386-9).
- Hayes, A. F. (2012). PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling [White paper]. Retrieved from <https://imaging.mrc-cbu.cam.ac.uk/statswiki/FAQ/SobelTest?action=AttachFile&do=get&target=process.pdf>
- Hébert, J., Clemow, L., Pbert, L., Ockene, I., & Ockene, J. (1995). Social desirability bias in dietary self-report may compromise the validity of dietary intake measures.. *International journal of epidemiology*, 24 2, 389-98 . <https://doi.org/10.1093/IJE/24.2.389>.
- Hornsey, M. J., Harris, E. A., Bain, P. G., & Fielding, K. S. (2016). Meta-analyses of the determinants and outcomes of belief in climate change. *Nature Climate Change*, 6(6), 622–626. <https://doi.org/10.1038/nclimate2943>.
- Jankowski, J. M., & Job, V. (2023). The role of lay beliefs about willpower and daily demands in day-to-day pro-environmental behavior. *Journal of Environmental Psychology*, 88, 102024. <https://doi.org/10.1016/j.jenvp.2023.102024>.
- Job, V., Bernecker, K., Miketta, S., Friese, M. (2015a). Implicit theories about willpower predict the activation of a rest goal following self-control exertion. *Journal of Personality and Social Psychology*, 109(4), 694–706. <https://doi.org/10.1037/pspp0000042>.
- Job, V., Dweck, C. S., Walton, G. M. (2010). Ego depletion—is it all in your head? *Psychological Science*, 21(11), 1686–1693. <https://doi.org/10.1177/0956797610384745>.
- Job, V., Walton, G. M., Bernecker, K., Dweck, C. S. (2015). Implicit theories about willpower predict self-regulation and grades in everyday life. *Journal of Personality and Social Psychology*, 108(4), 637–647. <https://doi.org/10.1037/pspp0000014>.
- Keller, E., Eisen, C., & Hanss, D. (2019). Lessons learned from applications of the stage model of self-regulated behavioral change: A Review. *Frontiers in Psychology*, 10. <https://doi.org/10.3389/fpsyg.2019.01091>.

- Keller, J., Kwasnicka, D., Klaiber, P., Sichert, L., Lally, P., Fleig, L. (2021). Habit formation following routine-based versus time-based cue planning: A randomized controlled trial. *British Journal of Health Psychology*, 26(3), 807–824. <https://doi.org/10.1111/bjhp.12504>.
- Klöckner, C. A. & Verplanken, B. (2018). Yesterday's habits preventing change for tomorrow? about the influence of automaticity on environmental behavior. *Environmental Psychology*, 238–250. <https://doi.org/10.1002/9781119241072.ch24>.
- Klöckner, C. A. (2014). The dynamics of purchasing an electric vehicle – a prospective longitudinal study of the decision-making process. *Transportation Research Part F: Traffic Psychology and Behavior*, 24, 103–116. <https://doi.org/10.1016/j.trf.2014.04.015>.
- Klöckner, C. A., Matthies, E. (2004). How habits interfere with norm-directed behavior: A normative decision-making model for travel mode choice. *Journal of Environmental Psychology*, 24(3), 319–327. <https://doi.org/10.1016/j.jenvp.2004.08.004>.
- Klöckner, C. A., Ofstad, S. P. (2017). Tailored information helps people progress towards reducing their beef consumption. *Journal of Environmental Psychology*, 50, 24–36. <https://doi.org/10.1016/j.jenvp.2017.01.006>.
- Kourouniotis, S., Keast, R., Riddell, L., Lacy, K., Thorpe, M., & Ciccale, S. (2016). The importance of taste on dietary choice, behavior and intake in a group of young adults. *Appetite*, 103, 1-7. <https://doi.org/10.1016/j.appet.2016.03.015>.
- Kurz, T., Gardner, B., Verplanken, B., & Abraham, C. (2015). Habitual behaviors or patterns of practice? Explaining and changing repetitive climate-relevant actions. *Wiley Interdisciplinary Reviews: Climate Change*, 6. <https://doi.org/10.1002/wcc.327>.
- Kuznetsova, A., Brockhoff, P. B., & Christensen, R. H. B. (2017). lmerTest package: Tests in linear mixed effects models. *Journal of Statistical Software*, 82(13), 1-26. <https://doi.org/10.18637/jss.v082.i13>.
- Kyriakopoulou, K., Keppler, J., Goot, A., & Boom, R. (2021). Alternatives to Meat and Dairy. Annual review of food science and technology. <https://doi.org/10.1146/annurev-food-062520-101850>.
- Landis, R. S. (2014). Standardized regression coefficients. *Wiley StatsRef: Statistics Reference Online*. <https://doi.org/10.1002/9781118445112.stat06588>.
- Liu, S., Wen, N., & Su, H. (2022). Influence of High-Protein Food on Physical Function of Athletes. *Journal of Food Quality*. <https://doi.org/10.1155/2022/4447061>.
- Ma, J., Hipel, K. W., Hanson, M. L., Cai, X., Liu, Y. (2018). An analysis of influencing factors on municipal solid waste source-separated collection behavior in Guilin, China by using the theory of planned behavior. *Sustainable Cities and Society*, 37, 336–343. <https://doi.org/10.1016/j.scs.2017.11.037>.

- Markus, C., Verschoor, E., Firk, C., Kloek, J., & Gerhardt, C. (2010). Effect of tryptophan-rich egg protein hydrolysate on brain tryptophan availability, stress and performance. *Clinical nutrition*, 29 5, 610-6 . <https://doi.org/10.1016/j.clnu.2010.01.003>.
- Masur, P. (2018, May 23). *How to center in multilevel models – Philipp K. Masur*. <https://philippmasur.de/2018/05/23/how-to-center-in-multilevel-models/#:~:text=In%20this%20case%2C%20we%20could,from%20each%20person's%20individual%20value>.
- Miller, E. M., Walton, G. M., Dweck, C. S., Job, V., Trzesniewski, K. H., McClure, S. M. (2012). Theories of willpower affect sustained learning. *PLoS ONE*, 7(6). <https://doi.org/10.1371/journal.pone.0038680>.
- Modlińska, K., Adamczyk, D., Maison, D., & Pisula, W. (2020). Gender Differences in Attitudes to Vegans/Vegetarians and Their Food Preferences, and Their Implications for Promoting Sustainable Dietary Patterns—A Systematic Review. *Sustainability*. <https://doi.org/10.3390/su12166292>.
- Mullan, B., Allom, V., & Mergelsberg, E. (2016). Forming a habit in a novel behavior: the role of cues to action and self-monitoring. *The European health psychologist*, 18, 686.
- Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin*, 126(2), 247–259. <https://doi.org/10.1037/0033-2909.126.2.247>.
- Neal, D. T., Wood, W. & Drolet, A. (2013). How do people adhere to goals when Willpower is low? the profits (and pitfalls) of strong habits. *Journal of Personality and Social Psychology*, 104(6), 959–975. <https://doi.org/10.1037/a0032626>.
- Nielsen, K. S. (2017). From prediction to process: A self-regulation account of environmental behavior change. *Journal of Environmental Psychology*, 51, 189–198. <https://doi.org/10.1016/j.jenvp.2017.04.002>.
- OpenAI. (2024). *ChatGPT* (January 13 version) [Large language model]. Retrieved from <https://chat.openai.com/>
- Päivärinta, E., Itkonen, S., Pellinen, T., Lehtovirta, M., Erkkola, M., & Pajari, A. (2020). Replacing Animal-Based Proteins with Plant-Based Proteins Changes the Composition of a Whole Nordic Diet—A Randomised Clinical Trial in Healthy Finnish Adults. *Nutrients*, 12. <https://doi.org/10.3390/nu12040943>.
- Pinho, M., Mackenbach, J., Charreire, H., Oppert, J., Bárdos, H., Glonti, K., Rutter, H., Compernelle, S., De Bourdeaudhuij, I., Beulens, J., Brug, J., & Lakerveld, J. (2017). Exploring the relationship between perceived barriers to healthy eating and dietary behaviours in European adults. *European Journal of Nutrition*, 57, 1761 - 1770. <https://doi.org/10.1007/s00394-017-1458-3>.

- R Core Team (2023). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. <https://www.R-project.org/>.
- Revelle, W. (2023). *_psych: Procedures for Psychological, Psychometric, and Personality Research_*. Northwestern University, Evanston, Illinois. R package version 2.3.12, <https://CRAN.R-project.org/package=psych>.
- Rosenfeld, D., & Tomiyama, A. (2021). Gender differences in meat consumption and openness to vegetarianism. *Appetite*, 166. <https://doi.org/10.1016/j.appet.2021.105475>.
- Schwartz S.H., & Howard J.A. (1981). A normative decision-making model of altruism. J.P. Rushton, R.M. Sorrentino (Eds.), *Altruism and helping behavior*, Erlbaum, Hillsdale, NJ (1981), 189-211.
- Schwarzer, R. (2008). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology*, 57(1), 1–29. <https://doi.org/10.1111/j.1464-0597.2007.00325.x>.
- Tangney, J. P., Baumeister, R. F., Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality*, 72(2), 271–324. <https://doi.org/10.1111/j.0022-3506.2004.00263.x>
- Tepper, B., & Barbarossa, I. (2020). Taste, Nutrition, and Health. *Nutrients*, 12. <https://doi.org/10.3390/nu12010155>.
- Thurn, J. (2014). *(In)aktiv aus Gewohnheit? Theoretische und Empirische Fundierung des Konstrukts Gewohnheit und Validierung des Deutschsprachigen Self Report Habit Index für Körperliche Aktivität* (Dissertation). Universität Stuttgart. <http://dx.doi.org/10.18419/opus-5646>
- Tukker, A., & Jansen, B. (2006). Environmental Impacts of Products: A Detailed Review of Studies. *Journal of Industrial Ecology*, 10. <https://doi.org/10.1162/jiec.2006.10.3.159>.
- Verplanken, B., Orbell, S. (2003). Reflections on past behavior: A self-report measure of habit strength. *PsycEXTRA Dataset*. <https://doi.org/10.1037/e536932011-097>
- Verplanken, B., Roy, D. (2016). Empowering interventions to promote sustainable lifestyles: Testing the habit discontinuity hypothesis in a field experiment. *Journal of Environmental Psychology*, 45, 127–134. <https://doi.org/10.1016/j.jenvp.2015.11.008>
- Vestergren, S., Uysal, M. S. (2022). Beyond the choice of what you put in your mouth: A systematic mapping review of veganism and vegan identity. *Frontiers in Psychology*, 13. <https://doi.org/10.3389/fpsyg.2022.848434>.
- Wan, C., Shen, G. Q., Choi, S. (2017). Experiential and instrumental attitudes: Interaction effect of attitude and subjective norm on recycling intention. *Journal of Environmental Psychology*, 50, 69–79. <https://doi.org/10.1016/j.jenvp.2017.02.006>.

- Wehbe, L., Banas, K., & Papies, E. (2022). It's Easy to Maintain When the Changes Are Small: Exploring Environmentally Motivated Dietary Changes From a Self-control Perspective. *Collabra: Psychology*. <https://doi.org/10.1525/collabra.38823>.
- Weiden, A., Benjamins, J., Gillebaart, M., Ybema, J., & Ridder, D. (2020). How to Form Good Habits? A Longitudinal Field Study on the Role of Self-Control in Habit Formation. *Frontiers in Psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.00560>.
- Wood, W. (2017). Habit in personality and social psychology. *Personality and Social Psychology Review*, 21(4), 389–403. <https://doi.org/10.1177/1088868317720362>.
- Wyss, A. M., Knoch, D., Berger, S. (2022). When and how pro-environmental attitudes turn into behavior: The role of costs, benefits, and self-control. *Journal of Environmental Psychology*, 79, 101748. <https://doi.org/10.1016/j.jenvp.2021.101748>.
- Zhang, K., & Cai, Y. (2022). The effect of stress on individuals' wasting behavior: The mediating role of impaired self-control. *Sustainability*, 14(3), 1176. <https://doi.org/10.3390/su14031176>.

Appendix A

Full Set of All Variables

T0	
Current nutrition status	1 item assessing current nutrition status in self-description (omnivore, flexitarian, vegetarian, vegan); single choice
Dietary aim	1 item assessing participants' dietary aim: reducing only meat products or reducing meat, egg and dairy products; single choice
Motives for diet change	1 item assessing participants' motives for diet change (environmental concerns, animal welfare, health, saving money, open category); multiple choice
Current consumption of animal products	Adapted version of the Food Frequency Questionnaire (Haftenberger et al., 2010)
Intended amount of reduction of animal products	1 item assessing the amount to which people aim to reduce their meat and/or dairy and egg consumption (slider – percentage)
Habit strength	Self-Report Habit Index (Verplanken & Orbell, 2003); Adapted German version (cf. Thurn, 2014)
Meat and dairy liking	Adapted visual analogue scale (Becker & Lawrence, 2021)
Info material	Information on the impact of nutrition on the environment and guidance how to reduce the consumption of animal products
Goal commitment and goal attainability	Goal commitment & attainability subscales (Brunstein et al., 1998)
Lay beliefs about willpower	Lay beliefs about willpower scale (Bernecker & Job, 2015)
Trait self-control	Self-Control Scale (short form; Tangney et al., 2004); German version (Bertrams & Dickhäuser, 2009)
Demographics	Age, gender, education status, job status, income, residence, political attitude

MAP-stage	Filter question to assess current stage of behavioral change (pre-decision stage, pre-action stage, action stage, post-action stage); single choice
Self-exclusion	Participants indicate if they deem their data unusable (e.g., due to distraction)

T1-T7 (Monday–Friday)

Daily demands	Adapted from the NASA-TLX (Hart & Staveland, 1988)
Consumption of meat and dairy products	Adapted version of the Food Frequency Questionnaire (Haftenberger et al., 2010)
Self-exclusion	Participants indicate if they deem their data unusable (e.g., due to distraction)

One-Month Follow-Up (4 Weeks after T1)

Habit strength	Self-Report Habit Index (Verplanken & Orbell, 2003); Adapted German version (cf. Thurn, 2014)
Meat and dairy liking	Adapted visual analogue scale (Becker & Lawrence, 2021)
Personal benefits	Items assessing health benefits, financial benefits and other (open format) benefits, people derived from diet change
Significant life-events	Item assessing significant life events during study period (e.g., new relationship, break-up, moving, distressing life events)

Two-Month Follow-Up (8 Weeks after T1)

Habit strength	Self-Report Habit Index (Verplanken & Orbell, 2003); Adapted German version (cf. Thurn, 2014)
Meat and dairy liking	Adapted visual analogue scale (Becker & Lawrence, 2021)
Personal benefits	Items assessing health benefits, financial benefits and other (open format) benefits, people derived from diet change

Significant life-events	Item assessing significant life events during study period (e.g., new relationship, break-up, moving, distressing life events)
Use of additional tools	Participants are asked whether they used other aids, such as apps or guidebooks to help them change their diet
Lay beliefs about willpower	Lay beliefs about willpower scale (Bernecker & Job, 2015)
Trait self-control	Self-Control Scale (short form; Tangney et al., 2004); German version (Bertrams & Dickhäuser, 2009)

Appendix B

Grand Correlation Table

Means, Standard Deviations, and Correlations with Confidence Intervals

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Willpower belief at T0	3.30	0.71															
2. Willpower belief at T9	3.32	0.68	.61** [.54, .68]														
3. Consumption of meat and dairy products at T0	359.78	502.57	-.04 [-.13, .06]	-.12 [-.23, .00]													
4. Average consumption of meat and dairy products T1-T7	227.81	198.99	.10 [-.01, .21]	.04 [-.08, .15]	.67** [.60, .73]												
5. Average demands T1-T7	2.60	0.47	-.04 [-.15, .07]	-.06 [-.17, .06]	.15** [.04, .26]	.06 [-.05, .18]											
6. Meat and dairy liking at T0	57.88	20.40	.01 [-.09, .10]	-.04 [-.16, .08]	.10* [.00, .19]	.10 [-.01, .21]	-.01 [-.12, .11]										
7. Meat and dairy liking at T8	48.85	20.96	-.02 [-.13, .10]	-.09 [-.21, .03]	.06 [-.06, .17]	.11 [-.01, .23]	-.05 [-.17, .07]	.79** [.75, .83]									
8. Meat and dairy liking at T9	45.03	21.69	.01 [-.11, .13]	-.08 [-.20, .04]	.08 [-.04, .19]	.13* [.01, .24]	-.05 [-.16, .07]	.76** [.70, .80]	.89** [.86, .91]								
9. Habit strength at T0	2.83	0.88	.06 [-.03, .16]	.05 [-.07, .17]	-.20** [-.29, .10]	-.20** [-.31, -.09]	-.02 [-.13, .10]	-.35** [-.43, -.26]	-.29** [-.40, -.18]	-.32** [-.42, -.21]							

10. Habit strength at T8	3.26	0.84	.06 [-.06, .18]	.09 [-.03, .20]	-.14* [-.25, -.02]	-.15* [-.26, -.03]	.05 [-.07, .17]	-.42** [-.52, -.32]	-.46** [-.55, -.36]	-.49** [-.58, -.40]	.66** [.59, .73]						
11. Habit strength at T9	3.39	0.88	-.00 [-.12, .12]	.06 [-.06, .17]	-.14* [-.25, -.02]	-.14* [-.26, -.03]	.01 [-.11, .13]	-.44** [-.53, -.33]	-.44** [-.53, -.34]	-.51** [-.59, -.42]	.64** [.57, .71]	.82** [.78, .86]					
12. Self-control at T0	3.06	0.67	.40** [.32, .48]	.32** [.21, .42]	.01 [-.08, .11]	.00 [-.11, .12]	-.02 [-.13, .10]	-.08 [-.18, .01]	-.10 [-.21, .02]	-.09 [-.21, .02]	.07 [-.02, .17]	.16** [.04, .27]	.11 [-.01, .22]				
13. Self-control at T9	3.14	0.65	.31** [.20, .42]	.37** [.26, .47]	-.10 [-.22, .02]	-.03 [-.15, .09]	.02 [-.10, .14]	-.02 [-.14, .10]	-.06 [-.18, .06]	-.11 [-.23, .01]	.07 [-.05, .19]	.15* [.04, .27]	.15* [.03, .26]	.82** [.77, .85]			
14. Goal commitment at T0	3.64	0.58	.10* [.01, .19]	.07 [-.05, .18]	.01 [-.09, .10]	-.03 [-.14, .08]	.06 [-.06, .17]	-.06 [-.15, .04]	-.13* [-.24, -.01]	-.17** [-.28, -.05]	.28** [.19, .37]	.20** [.09, .31]	.26** [.15, .37]	.17** [.08, .26]	.10 [-.02, .21]		
15. Age	32.77	11.88	.11* [.02, .20]	.12 [-.00, .23]	.04 [-.06, .13]	.03 [-.08, .14]	-.08 [-.19, .04]	.12* [.02, .21]	.14* [.03, .26]	.13* [.01, .25]	-.02 [-.12, .08]	-.04 [-.16, .08]	-.11 [-.23, .01]	.18** [.09, .27]	.19** [.08, .31]	-.01 [-.11, .09]	
16. Political attitude	2.74	1.28	.02 [-.08, .12]	-.01 [-.13, .11]	.10* [.00, .19]	.05 [-.07, .16]	-.03 [-.14, .09]	.16** [.07, .26]	.22** [.11, .33]	.21** [.10, .33]	-.11* [-.21, -.02]	-.15* [-.26, -.03]	-.24** [-.35, -.12]	.05 [-.05, .15]	.01 [-.11, .13]	-.16** [-.25, -.06]	.07 [-.03, .16]

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). Higher values in willpower belief indicate a stronger nonlimited willpower belief; the consumption of animal products is measured and indicated in grams; lower values in political attitude refer to left-wing views and higher values to right-wing views respectively.

* indicates $p < .05$. ** indicates $p < .01$.

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