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Short Communication

The taste of change? Free vegan meal boxes do not change meat consumption, self-efficacy, or attitudes toward a plant-based diet among meat eaters



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ABSTRACT

Excessive meat consumption is associated with health and environmental problems. Previous research has shown that the reasons for meat consumption are diverse and often include low self-efficacy beliefs in preparing alternative meals. In an experiment with 71 German participants, we investigated whether the delivery of meal boxes containing ingredients and recipes for three plant-based meals could increase self-efficacy, reduce meat consumption, and improve attitudes toward a vegan diet. No significant differences were found between the control group and the meal box recipients after the intervention. While recipients frequently liked the plant-based meals and could imagine preparing them again, the intervention did not increase their self-efficacy beliefs or affect their meat consumption. These findings indicate that the potential of meal box deliveries to alter dietary patterns may be limited.

1. Introduction

Meat consumption has been linked to health and environmental issues. For instance, high meat intake has been shown to increase the risk of colorectal cancer, cardiovascular diseases, chronic conditions, and weight gain (Lescinsky et al., 2022; Wolk, 2017). At the same time, land and water use and greenhouse gas emissions from meat production contribute to climate change and biodiversity loss (Godfray et al., 2018; Hentschl et al., 2023), and widespread veterinary practices in the meat industry promote the development of antibiotic-resistant pathogens that endanger human health and well-being (Monger et al., 2021; Van Boeckel et al., 2015). While meat intake is declining in high-income countries, it remains high. For instance, in 2023, per-capita meat consumption in Germany was 52 kg (Bundesanstalt für Landwirtschaft und Ernährung, 2024), well above the guidelines of the German Society for Nutrition (Deutsche Gesellschaft für Ernährung, 2024) which recommend eating no more than 300 g per week (i.e., less than 16 kg per year).

Previous research shows that the reasons for eating meat vary. People often know about the negative consequences of meat consumption but fail to change their behavior because they consider eating meat to be necessary, natural, normal, or nice (Piazza et al., 2015). Social norms can also prevent change. For example, the desire to maintain harmony and family cohesion may prevent the reduction of meaty

family meals (Hesselberg et al., 2024). In addition, efficacy beliefs play an important role (Seffen & Dohle, 2023). According to the Theory of Planned Behavior (Ajzen, 1985), behavior change is unlikely if people believe that they are unable to avoid eating meat, even if they are willing to do so. Low efficacy beliefs may be informed by external barriers, such as the availability of affordable meat alternatives (De Oliveira Padilha et al., 2022), but they may also stem from low confidence in one's cooking skills. For instance, a qualitative study of Swedish individuals (Collier et al., 2022) found that a perceived lack of knowledge about how to select, prepare, and serve vegetarian ingredients reduced intentions to omit meat. Similarly, the preparation of plant-based meals is less likely when it is perceived as more time-consuming (O'Keefe et al., 2016). Correcting such perceptions and improving (perceived) cooking skills could help reduce meat consumption. This could be achieved with meal boxes containing plant-based foods and accompanying recipes. A qualitative research study among Belgian parents found that preparing meal boxes can serve as an inspiration for future meals and improve attitudes toward vegetarian food (Vos et al., 2024) and an intervention study from the Netherlands showed that meal boxes can promote the consumption of plant-based meat alternatives (Van Bergen et al., 2024). The positive effects of meal boxes on shifting attitudes and consumption may be explained by mere exposure, as food liking has been shown to increase with repeated consumption, especially for unfamiliar products

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and flavors (Crandall, 1985; Hausner et al., 2012). However, plant-based meal boxes may also alter dietary patterns by improving knowledge and self-efficacy perceptions. Preparing portioned food according to a fixed recipe frees people from the burden of choosing new recipes and shopping for unfamiliar groceries, allowing them to focus on preparing and eating tasty meals, which could increase the appetite for alternative diets and confidence in maintaining them.

2. The present study

To investigate whether the provision of plant-based meal boxes could be a viable intervention for increasing self-efficacy perceptions to omit meat and thereby reducing meat consumption, we conducted a pre-post-intervention study with two groups in Germany. The intervention group, but not the control group, received a meal box containing ingredients and recipes for three vegan dishes. Before and after the intervention, participants' meat consumption intention and behavior, attitude toward vegan diets, and perceived self-efficacy to reduce meat intake were assessed. Based on the above considerations, two hypotheses were pre-registered (<https://aspredicted.org/474h-7nsp.pdf>); we expected that the meal box intervention increases self-efficacy to reduce meat consumption (H1) and, in turn, decreases meat consumption behaviors (H2). While no hypotheses were preregistered for consumption intention and attitude toward vegan diets, we explored if these variables changed accordingly.

3. Methods

3.1. Participants and design

The study was advertised via social media and university postings (see online supplement). Participants had to (a) eat meat and (b) live with a partner but not with children (as the meal boxes contained dishes for two adults). A total of $N = 71$ individuals completed two surveys in April and June 2024. The study employed a one-factorial experimental design, with participants assigned to one of two groups: those who received a vegan meal box (meal box group; $n = 39$) and those who did not (control group; $n = 32$). All participants were offered a 10 euro gift card upon completion of both surveys.

3.2. Meal boxes

Meal boxes were prepackaged by a commercial provider and sent by mail. They contained ingredients and recipes for three dishes to be prepared on consecutive days in the following order: (1) courgette pasta with cream sauce and Jerusalem artichokes, (2) Asian coconut stir-fry, and (3) oriental salad with chickpeas. The delivery was announced by telephone and participants were instructed to prepare the dishes themselves or with their partner.

3.3. Measures

The following measures were rated by all participants in both the April and June surveys. Two weeks passed between the delivery of the meal boxes and the second survey.

Self-efficacy. Participants were asked how easy it was to omit meat and meat products when preparing their own meals. Responses were recorded on a 7-point scale ranging from "very difficult" to "very easy".

Attitude toward the vegan diet. Participants were asked to rate the vegan diet on eight 7-point semantic differential scales (bad–good, harmful–beneficial, unpleasant–pleasant, inedible–enjoyable, negative–positive, repulsive–appealing, boring–exciting, and awkward–comfortable), a measure that had been used in previous studies of attitudes toward veganism (Scholz & Lenhart, 2023). The responses were averaged (Cronbach's alpha ≥ 0.86 for both time points).

Meat consumption intention and behavior. Participants were asked

how many days in the previous week they had consumed meat. Frequencies (ranging from 0 to 7 days) were assessed for breakfast, lunch, dinner, and snacks between meals. Responses were summed and divided by 28, resulting in an overall proportion of meals containing meat. Participants were also asked how much they intended to reduce their meat consumption over the next six months, and responses were recorded on a 7-point scale ranging from "not at all" to "very much".

In addition to these measures, participants in the meal box group were asked if their meal box contained spoiled ingredients. This allowed us to limit analyses to individuals in the meal box group who were able to prepare and consume the meals delivered. Meal box participants were also asked how much they liked each of the three meals (on a 7-point scale ranging from "not at all" to "very much") and if they could imagine preparing one or more of the meals again (on a 7-point scale ranging from "not at all" to "very much").

3.4. Ethics and consent

The study was conducted according to the guidelines of the German Psychological Association. Ethical clearance was obtained from the University of Bamberg's institutional review board (#2024–03/13, dated 15/04/2024), and all participants provided informed consent to use and share their data for scientific purposes without disclosing their identities.

4. Results

Fifteen participants in the meal box group reported receiving spoiled ingredients. Upon closer investigation, we found that their boxes had been delivered several days late. Because these participants were unable to prepare the meals as planned, they were removed from the analyses. While we aimed for 80 participants in the preregistration, calculations in G*Power 3.1 (Faul et al., 2009) indicated that the remaining sample ($n = 56$) was large enough to detect meaningful changes in perceptions and behaviors when conducting repeated-measures ANOVAs comparing the two groups ($f = 0.4$, $\alpha = 0.05$, $1 - \beta = 0.80$, correlation between repeated measures $r = 0.90$). Participants in this sample were aged 21–64 ($M = 34.02$, $SD = 13.35$), and 77 % identified as female (23 % as male). Age, gender, education and subjective socioeconomic status did not differ significantly between the two experimental groups ($p > .245$; see online supplement for details).

Repeated measures ANOVAs were conducted to examine the effects of the experimental group, survey time point, and their interaction on participants' self-efficacy, meat consumption behavior and intention, and attitudes toward a vegan diet (see Table 1). Contrary to our expectations, self-efficacy to abstain from meat did not show a significant improvement in the meal box group (Fig. 1A). Similarly, self-reported meat consumption did not decrease after the intervention when looking at the overall proportion of meals containing meat (Fig. 1B) but also when comparing meat consumption for breakfast, lunch, dinner, and snacks separately (see online supplement for details). Notably, both groups found it relatively easy to omit meat from their diets, and, on average, only about one-third of their meals contained meat products.

While consumption patterns did not change, intentions to reduce meat consumption in the future did. Participants in the meal box group reported lower reduction intentions in the first survey ($M = 3.17$, $SD = 1.61$), and these increased significantly after the intervention ($M = 4.00$, $SD = 1.67$), Welch's $t(45.93) = 1.76$, $p = .042$, $d = 0.51$ (Fig. 1C). A similar pattern was observed for participants' attitude toward the vegan diet, which improved considerably in the meal box group (April survey: $M = 3.73$, $SD = 1.13$; June survey: $M = 4.38$, $SD = 1.05$), Welch's $t(45.72) = 2.04$, $p = .024$, $d = 0.59$ (Fig. 1D). However, when comparing post-intervention meat reduction intentions and vegan attitudes between the control and the meal box groups, no significant differences were found, Welch's $|t| < 1$ (see online supplement for details).

Further analyses showed that meal box recipients tended to like the

Table 1
Meal box effects.

Predictor	Self-efficacy to omit meat			Meat consumption behavior			Meat consumption intentions			Attitude toward the vegan diet		
	<i>F</i>	<i>p</i>	η^2	<i>F</i>	<i>p</i>	η^2	<i>F</i>	<i>p</i>	η^2	<i>F</i>	<i>p</i>	η^2
Constant	444.64	<0.001	0.85	121.16	<0.001	0.64	489.59	<0.001	0.87	635.53	<0.001	0.90
Group	0.36	0.550	0.00	0.05	0.827	0.00	4.51	0.038	0.06	1.03	0.315	0.01
Time	1.22	0.274	0.01	1.29	0.261	0.01	0.63	0.432	0.00	0.23	0.635	0.00
Interaction	0.02	0.879	0.00	0.09	0.766	0.00	10.02	0.025	0.05	4.07	0.049	0.02

Note: Results of repeated measures ANOVAs with an experimental group (meal box vs. control), survey time point (June vs. April), and their interaction predicting self-efficacy, meat consumption behavior and intention, and attitude toward the vegan diet. η^2 refers to generalized eta squared. Predictors in bold are significant ($p < .05$).

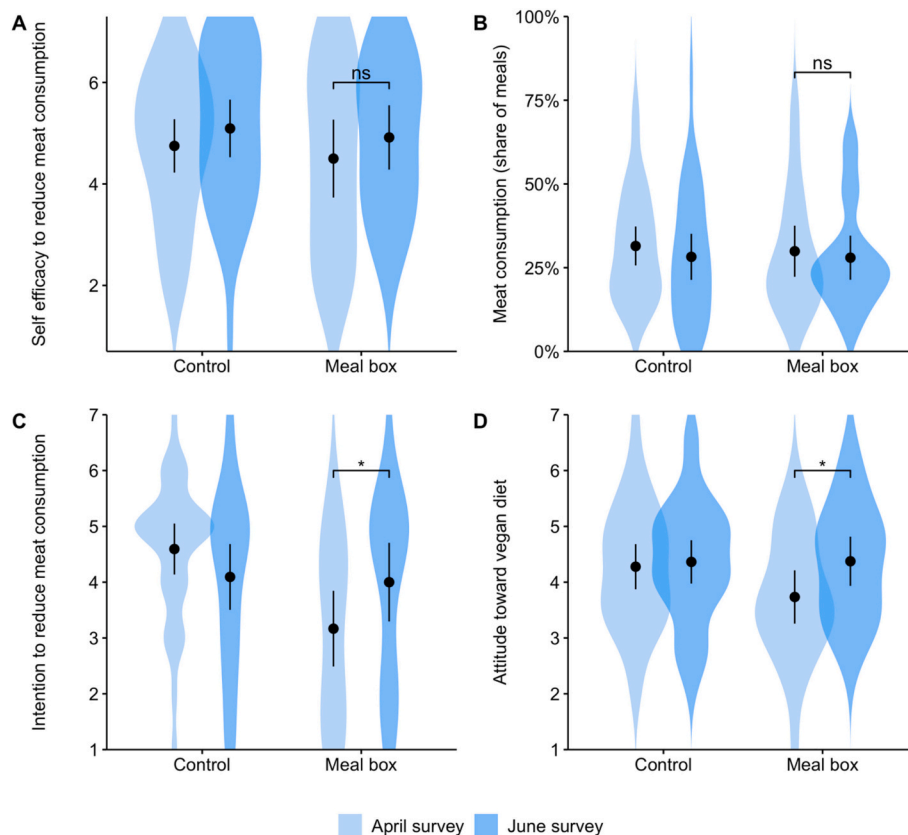


Fig. 1. Development of key variables.

Note: Participants received a vegan meal box or not (control). Before (April 2024) and after the intervention (June 2024), they were asked about (A) their perceived self-efficacy to avoid meat, (B) their meat consumption, (C) their intention to reduce meat intake, and (D) their attitude toward the vegan diet. Dots denote means, and bars represent 95 % confidence intervals. For the meal box group, pre–post-intervention differences are asterisked if significant ($p < .05$) and ns if not.

delivered meals ($M = 5.13$, $SD = 1.49$ for the courgette pasta; $M = 4.96$, $SD = 1.46$ for the Asian stir-fry; $M = 4.74$, $SD = 1.48$ for the oriental salad) and could imagine preparing them again ($M = 5.21$, $SD = 1.48$).

5. Discussion

Excessive meat consumption is associated with health and environmental concerns (Godfray et al., 2018). Previous research suggests that the reasons are varied but often include low self-efficacy beliefs (Collier et al., 2022; O’Keefe et al., 2016). If people do not know what to eat instead of meat or how to prepare alternatives, it is unlikely that their diets will change. Here, we investigated whether providing meat eaters with meal boxes containing vegan ingredients and recipes could be a viable strategy to increase self-efficacy and reduce meat consumption. Contrary to our expectations, no such effects were observed. Although participants often liked the plant-based meals and could imagine preparing them again, the intervention did not improve their self-efficacy or change their meat consumption. Interestingly, the vegan meal boxes

improved intentions to reduce meat consumption and attitudes toward a vegan diet. However, this effect was explained by lower intentions and attitudes in the meal box group (compared to the control group) before the intervention, as no differences were found between the two groups after the intervention. This may be due to imperfect randomization, which often occurs when working with small samples (Nguyen et al., 2017; Saint-Mont, 2015). Since post-intervention self-efficacy beliefs, attitudes toward vegan meals, meat consumption intentions, and behaviors did not differ between the two groups, it appears that mere exposure to plant-based foods is not sufficient to change dietary behaviors. There may be several reasons for this. First, the meal boxes may have simply not contained enough meals to shift attitudes and self-efficacy beliefs. Providing more meals may be more effective, as previous interventions that successfully improved the liking of new foods often relied on 10 or more exposures (Lakkakula et al., 2010; Pliner, 1982). Second, it cannot be ruled out that participants altered the recipes and added meat to the plant-based dishes. Future studies may benefit from assessing the meal preparation process. Third, the sample

appeared to be quite open to dietary changes before the intervention. For example, average self-efficacy, intentions to reduce meat consumption, and attitudes toward a vegan diet were all above the scales' midpoints. However, this may also be due to social desirability bias (Cerri et al., 2019). Future research should investigate whether the meal box intervention is more effective with meat eaters who are more reluctant to eat vegan dishes and have little intention to change their diet. However, in line with the Theory of Planned Behavior (Ajzen, 1985), a potential increase in self-efficacy from vegan meal boxes is unlikely to change meat consumption if people continue to hold positive attitudes toward meat consumption (e.g., if they consider it nice, natural, normal, or necessary; Piazza et al., 2015) and resent plant-based alternatives.

Overall, the results are consistent with other research indicating that meal boxes alone are unlikely to disrupt dietary patterns (Van Bergen et al., 2024). However, future research should investigate whether they could be a useful element in combined interventions. For instance, combining educational efforts (i.e., communicating the positive health, environmental, and animal welfare benefits of reduced meat consumption) with multiple meal box deliveries might be more effective in promoting meat reduction.

CRedit authorship contribution statement

Philipp Sprengholz: Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Lina Hammer:** Writing – review & editing, Methodology, Investigation, Conceptualization. **Linda Scheelje:** Writing – review & editing, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.foodqual.2025.105471>.

Data availability

Materials, data, and the data analysis script are available at <https://doi.org/10.17605/OSF.IO/C7BEX>

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