Reducing Meat Consumption with a Mixed Intervention vs. a Self-Monitoring-Only Intervention

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Abstract

To reduce people's meat consumption the effectiveness of a self-monitoring-only intervention and a mixed intervention was tested. Through a website of the Ministry of Environment Düsseldorf (MoED), meat-eaters who intended to consume less meat were recruited by offering support regarding this goal and randomly assigned to the interventions. In the mixed intervention a packet was sent to participants' homes including an environmentally designed shopping bag, a vegetarian cookbook, tasters, shopping list, informational brochure, and mental contrasting with implementation intentions (MCII)-technique. Meat consumption of 89 participants was measured over 5 weeks (1 baseline-week, 4 intervention-weeks) with a daily questionnaire, that at the same time was the self-monitoring intervention. The self-monitoring-only condition was informed that they receive the packet after trying to reduce meat consumption on their own over 4 weeks. Data of 75 participants who met the exclusion criteria was analyzed. As hypothesized, both interventions significantly reduced meat consumption, while the effect of the mixed intervention was stronger. Implications for institutions, limitations, and suggestions for future research are discussed.

Human's desire of eating meat causes problems for ourselves and the environment. Global meat production contributes to climate change, accounting for about 14,5% of the total CO2 emissions (Herrero et al., 2015). This is more than all cars, trains, ships, and airplanes together (Bailey et al., 2014). High meat consumption also harms human health. It can cause obesity, diabetes, pneumonia, cardiovascular diseases, and cancer (Papier et al., 2012; WHO, 2003). Therefore, reducing people's meat consumption would have benefits for people's health and is seen as an effective strategy to achieve climate protection goals (Davidson, 2012). As we will see next, important reasons why people consume meat are psychological. In order to tackle this problem, we will have a closer look at those psychological factors.

Psychological Factors Influencing Meat Consumption

Intention

An intention is the deliberate will of a person, indicating "how hard people are willing to try, […] in order to perform the behavior" (Ajzen, 1991, p. 181). Following Ajzen's (1991) "Theory of Planned Behavior" (TPB) the intention to perform a behavior is the most proximal determinant of the actual behavior. The TPB is often used to explain food-related behaviors (Bogers et al., 2004; Kim et al., 2003). Also for meat consumption, the intention to eat meat highly correlates with the behavior (Çoker & van der Linden, 2020). This suggests that meat-eating is at least partly a conscious behavior that we can control deliberately. Likewise, an intervention that increased the intention to reduce meat consumption actually led to a lower meat consumption (Carfora et al., 2017a, 2017b). Thus,

people can reduce their meat consumption, if they intend to do so and this intention can be influenced. But what influences the intention?

Attitudes

In the TPB the intention to perform a behavior is influenced by the attitude toward the behavior. An attitude is defined as an evaluation of the believed consequences of the behavior (e.g., I don't like that animals suffer because I eat meat). Accordingly, evidence has shown that the attitude toward meat consumption influences the intention to consume meat as the strongest factor from the TPB (Lentz et al., 2018; Rees et al., 2018). The more positive the attitude is the stronger the intention and the other way around. Attitudes have a cognitive and an affective component (Cantin & Dubé, 1999). The cognitive component is influenced by beliefs and the affective component by emotions, feelings and sensory perceptions.

Beliefs

Before we mentioned that the cognitive component of attitudes is influenced by beliefs someone holds toward the behavior. Therefore, it seems interesting to know what people with a different meat consumption believe about eating meat. Generally, meat-eaters believe that consuming meat is healthy and disagree that it is harmful to the environment and the animals. Vegans, vegetarians and flexitarians (meat-avoiders) on the other hand believe that consuming meat is unhealthy, environmentally harmful and bad for the animals (Cordts et al., 2013; Mullee et al., 2017; Neff et al., 2018; Povey et al., 2001). Thus, meat-eaters hold different beliefs toward meat consumption that seem more positive than non-meat-eaters. Consistently, providing people with information about negative effects of meat consumption on health, environment and animal welfare forms negative beliefs that lead to a more negative attitude toward meat, decreases the intention to consume meat and reduces meat consumption (Loy et al., 2016; Scrimgeour, 2012). Thus, the more negative the three beliefs are the more negative the attitude toward meat consumption becomes and vice versa.

Taste Perception

Besides negative beliefs, also taste perception may be a key factor regarding the attitude towards meat consumption. In the Value-Attitude-Behavior model of Tudoran et al. (2009) someone's taste perception is seen as an affective evaluation that forms a domain specific attitude. In this model, food choice is indirectly influenced by taste perception through attitude and intention. Therefore we can conclude that the better the taste is perceived, the stronger the affective attitude toward that food will be. The same rationale applies to meat consumption. Taste perception of meat is often mentioned as a reason to eat or avoid meat and people who do not eat meat, often state disgust toward meat (Dibb & Fitzpatrick, 2014; Mullee et al., 2017; Piazza et al., 2015; Sanchez-Sabate et al., 2019).

Not only the taste perception of meat affects one's meat consumption, but also the taste perception of meatless meals does. An overarching framework from Graça et al. (2019) who integrated enablers and barriers of meat consumption into the COM-B model (capability, opportunity and motivation influencing behavior) identified positive taste expectations for plant-based meals as important motivational enabler to reduce meat consumption. Likewise, Mullee et al. (2017) found that discovering new tastes is an important motive for reducing meat consumption. Also, the acceptance of meat substitutes is stronger as better the taste of them is perceived (Tucker, 2014). From the Value-Attitude-Behavior model we can conclude that taste perception of meatless meals influences meat consumption in the same way that the taste perception of meat does: by influencing the attitude toward meatless meals.

So far, we discussed psychological factors that influence meat consumption through the intention toward that behavior. Following the COM-B model, these factors that depend on intention are part of a person's reflective motivation. In this model, behavior is additionally influenced by automatic motivation that does not involve intention but for example habits, which also seem to play an important role for meat consumption (Graça et al., 2019).

Habit

In general, many eating behaviors are habitualized (see, e.g., Allom & Mullan, 2012, for fruit and vegetable consumption; de Bruijn et al., 2008, for fat intake; Verhoeven et al., 2012, for snacking). Likewise, meat consumption seems to be a strong habit for many consumers. Rees et al. (2018) found that meat consumption was stronger correlated with habit strength than all other factors of the TPB. Asking meat-eaters about their perception they often mention having the habit to eat meat as a reason to eat meat and as a barrier to reduce meat consumption (Dagevos & Voordouw, 2013; Graça et al., 2015; Lea et al., 2006; Schösler et al., 2014). Even though there is an ongoing debate about how habits should be conceptualized and operationalized (Marien et al., 2019), there is consensus that habits are specific responses (e.g., consuming meat) which are activated by specific cues or contexts (e.g., coming home from a workout) (Robbins & Costa, 2017). They are formed through repetition of the behavior in a stable context (e.g., repeatedly consuming meat after coming home from a workout), which creates a strong and easy accessible context-response link in the procedural memory (Wood & Neal, 2007). After a habit is formed the context triggers the response automatically, without the need of an intention. When a habit conflicts with an intention, the habitual response will be performed when self-control resources are low and can be inhibited when the resources are high. Self-control is a finite, domain-general resource that is depleted when people try effortfully to inhibit behaviors, are stressed or tired (Muraven & Baumeister, 2000). In everyday life when people have low self-control resources because they are stressed, tired or already exerted self-control before, those that eat meat out of habit are likely to

consume meat even though if they intend to not do so. We saw that apart from the intention, habits play an important role for meat consumption. Graça et al. (2019) further identified meal preparation skill as an important capability that influences meat consumption.

Meal Preparation Skill

How much meat an individual consumes also depends on the meal preparation skill, meaning to what degree someone can prepare meals he or she likes to eat. The COM-B model of meat reduction by Graça et al. (2019) identified the preparation skill of meatless meals as part of an individual's capability to reduce meat consumption, which influences the actual behavior of consuming less meat. They came to the same result as Mullee et al. (2017), that the difficulty to acquire new cooking skills is an important barrier to reduce meat consumption. If one can rarely prepare meatless meals, the person will not prepare meatless meals very often, because he or she is not capable to do so. When low amounts of meatless meals are prepared the meat consumption should rather be high. Instead, when having the skill to prepare meatless meals, meat consumption should be lower. Indeed, several studies were successful in boosting the meal preparation skill by providing people with meatless recipes and meat alternatives and reduced meat consumption, even 6 months after the intervention (Clark, 2017; Flynn et al., 2013; Holloway et al., 2012).

Model of Psychological Factors Influencing Meat Consumption

We put the psychological factors we described above in a model to visually support its comprehensiveness (Appendix A).

Present Study

Based on the knowledge of how psychological factors influence meat consumption a mixed intervention was developed which was designed to influence the psychological factors mentioned above in order to reduce meat consumption. The effectiveness of this intervention was then tested and compared to a self-monitoring condition that only did the daily measurement of meat consumption. Our first hypothesis is that both interventions will reduce their meat consumption compared to their baseline measurement, because both interventions should influence psychological factors that lead to meat reduction. The working mechanisms of the interventions that support our hypotheses are discussed in the material section. Our second hypothesis is that the mixed intervention we developed will reduce meat consumption stronger than the self-monitoring intervention, because we think the mixed intervention elements will add up their effect size. Self-monitoring combined with other behavior change techniques have shown bigger effects than self-monitoring on its own (Michie et al., 2009).

Method

Participants

97 people signed in to participate and were assigned randomly to one of the two conditions. 89 started to fill out the daily questionnaires and in the end 75 participants (packet condition: *N* = 39, self-monitoring: *N* = 36) met the exclusion criteria and were considered for the analysis. An a priori power analysis for a 2-way mixed ANOVA with two groups and 5 measurements to reach a power of .95, assuming a small effect size (*d* = .25) and an alpha level .05, indicated that 32 participants were needed. The median age of participants was 51 with the youngest being 25 and the oldest 80 years old. 52 participants were female and 23 were male.

The study was conducted in cooperation with the MoED and the target group were inhabitants of Düsseldorf. Participants were recruited through a newsletter of the MoED, their facebook group and a press release which all guided them to a website of the MoED with more information about the study. Here, participants could sign in to participate. Only those who had the intention to reduce their meat consumption and ate at least once a week meat could participate, because the MoED did not want to target people with a very low meat consumption.

Material and Measurements

Website

On the website from the MoED of the environment of Düsseldorf information in text and video was given about the consequences of meat consumption on the environment, health and animals (Appendix B). As we mentioned before, providing people with information about the negative consequences of meat consumption for the environment, animals and health can reduce meat consumption through forming negative beliefs that decrease the attitude toward meat consumption and intention to eat meat (Loy et al., 2016; Scrimgeour, 2012). In the end people were motivated to reduce their meat consumption and offered to get supported regarding this goal with a support packet that included meatless recipes, tasters and a motivational technique. Additionally, they were informed that to participate they needed to fill in daily a short questionnaire over a month. They could click on a link that led them to a sign in form to participate.

Sign-in Form

After giving an informed consent participants were asked if they want to reduce their meat consumption and whether they agree to daily fill in a two-minutes questionnaire for a month. If one of their responses were no, they directly got to the end and could not participate, because otherwise chances would have been high that the materials would not be used and the questionnaires not filled in. Next, they were asked how often they eat meat on a six-point scale from “never” to “daily”. If the response was “never” or “less than once a week” again participants could not participate, because they did not belong to the target group. Those who passed the “knock-out” questions were then asked to give their name and address in order to send them the intervention. In the end they were

asked for their e-mail address in order to send them the following instructions and the questionnaires.

Daily Questionnaire

We were interested in the total amount of meat (in grams) participants ate that day, but to make it easier the questionnaire first asked how many times they ate meat that day and then how many grams at each meal. Internal validity was increased by helping to estimate the amount of grams of their meal (Kim & Holowaty, 2003). Therefore, a table with weight estimations for common meat products was given (Appendix C). To minimize the probability that participants would lie about their meat consumption, at the beginning they were requested to report the truth and explained that filling in the questionnaire makes only sense if it is true.

The measurement of participants meat consumption also served as a monitoring technique. Daily reporting the own food consumption is a self-monitoring strategy that can change the reported eating behavior by helping to identify differences between current and intended levels of food consumption (Burke et al., 2011; Fishbach et al., 2012; Helsel et al., 2007; Myrseth & Fishbach, 2009). This effect is based on an increased self-awareness, simplifying memory and self-confrontation (Bailey & Sowder, 1970; Kanfer, 1970; Schoutrop et al., 2002). Thus, participants should become more aware of their meat consumption and monitor better whether their behavior actually was in line with their intention to eat less meat, and thereby be better able to act on their intention and reduce meat consumption. Two studies found that daily reporting meat consumption + SMS-reminders to monitor their consumption and to not exceed the recommended consumption reduced meat consumption (Carfora et al., 2017a, 2017b). Following the self-monitoring literature we discussed, only questionnaires without a reminder should also reduce meat consumption.

Shopping Bag

We designed a shopping bag made out of environmentally friendly material with the print office “Jute statt Plastik”. The logo on it was a shopping cart with a globe inside printed in green (Appendix D). The logo should activate associations about the effects (meat) shopping has on our planet. The organic material of the bag and the green globe should activate associations with the environment and sustainability. Organic material and the color green are effective to promote sustainability and activate environmental values (DeLong & Goncu-Berk, 2012). We chose to use the color green with a globe symbol, because we believe that associations with the environment will be even stronger in combination with a globe, which is often used as symbol for environment, sustainability or climate change. Environmental values can influence environmental beliefs, attitude and behavior (Steg & De Groot, 2012). The shopping cart should link the activated environmental value to the shopping activity so that participants buy less meat. Ideally this process would be activated close in time to the shopping behavior, where the decision of buying meat takes place,

when they are about to go shopping and pick up the bag. Buying less meat is assumed to go in hand with a consumption reduction of meat.

Shopping List

We also designed a shopping list in form of a pad with 25 pages that could be teared off, which participants should use when they buy meat (Appendix E). A shopping list helps to make more rational decisions rather than impulsive ones, hence strengthening the link between intention and behavior (Block & Morwitz, 1999). When participants use the shopping list to buy meat, they are more likely to write down the amount of meat that is in line with their intention to reduce meat and will buy less meat when they use the list while shopping. On the bottom of the list were symbols for the environment, animals and health with a speech bubble that says "Thanks!" During the study participants got information about the negative consequences of meat consumption for the environment, animals and health, thus the corresponding symbols should remind people about the information and their intention to reduce meat consumption in a way that is not bothering but rather "sweet". Other reminders (text-message) to reduce meat consumption have shown to be effective (Carfora et al., 2017a, 2017b). We decided to use symbols as reminder on a shopping list and not to send text-messages, first because we already sent daily questionnaires and did not want to bother participants too much and second because the shopping list is used during the decision process of buying meat at home and later again at the market. The reminder thus can activate the goal and intention to reduce meat consumption in a relevant situation for decision making of buying meat.

Cookbook and Tasters

More than 40 recipes were provided in form of the vegetarian cookbook "Leicht & Schnell Vegetarisch" by TS-Team (Appendix F). It contained a variety of different meatless meals that were not difficult to prepare and did not cost much time. Participants also got four different tasters that were soy meat suited for vegetarian lasagna or bolognese, plant-based burger, vegetable spread to eat on bread instead of sausage and tortellini as a quick and tasty meal without meat. The recipes and tasters should motivate participants to try them and discover new tastes, as this is frequently named as a motivation to eat more meatless food (Graça et al., 2019; Mullee et al., 2017). It is also possible that the taste perception of meatless meals increases if participants find the tasters and recipes tasty and did not know them before. When participants try the tasters and recipes and prepare a meal, they practice their preparation skill of meatless meals and can improve this skill (Graça et al., 2019). Providing people with meatless recipes and tasters has shown to reduce meat consumption (Clark, 2017; Flynn et al., 2013; Holloway et al., 2012).

Informational Brochure

The informational brochure from "BUND" consisted of visually attractive information about consequences of meat consumption for environment, health and animals (BUND, n.d.). We chose to

give participants information again, so that they had easy accessible information physically at hand and did not need to make the effort to search information when they wanted to know more or refresh their knowledge. This seemed especially useful for the long term, because people forget information the more time passes by and the brochure was an easy way to refresh that knowledge.

MCII Technique

When a habit conflicts with an intention, the habitual response can be inhibited with effortful self-control, in case enough regulatory capacity is available (Wood & Neal, 2007). Self-regulatory techniques, like implementation intentions and mental contrasting, can weaken the undesired effect of the meat habit while boosting the intention to reduce meat and lead people to consume less meat (Loy et al., 2016; Rees et al., 2018). Loy et al. (2016) used both combined, mental contrasting with implementation intentions (MCII). Here one identifies a wish or a goal regarding the desired behavior (e.g., eating meat X times per week) and then identifies and imagines the most positive future outcome if one reaches the goal (e.g., animals would be prevented from suffering). Finally, the main personal obstacles are identified and strategies to prevent and overcome the obstacles are formulated in terms of an implementation intention. An implementation intention has the structure of an if-then plan, linking a situation or a cue to the desired behavior (e.g., if I come home from a workout, then I will eat tofu instead of meat). In the present study participants got the MCII technique in form of an instruction on paper (Appendix G). We orientated the instruction on the study of Loy et al. (2016), but also on general literature about MCII (Oettingen & Schwörer, 2013; Stadler el al., 2010). First it stated that in order to be effective the reader should take a calm moment when doing this technique. It also said that they could use this technique for different goals they have. In the beginning participants should write down their most important reasons to reduce meat consumption and imagine them vividly. We added this step to the technique so that participants had reasons present in mind to better identify their personal goal regarding meat reduction, which was the next step. Additionally, they were told that goal attainment is greater when goals are realistic but still challenging and verifiable (Krott et al., 2019). Next, they should imagine the best possible future outcomes and how they would feel when they reach their goal. Then they should identify their obstacles of attaining their goal and mark their two biggest ones. For these obstacles they should think about strategies to prevent and overcome them and formulate the strategies in form of implementation intentions. For this purpose examples were given. Finally, they were asked to also make an implementation intention to use the shopping list effectively and a possibility was given to make more implementation intentions regarding meat reduction.

Procedure

On March 25th the website was published and people could sign in. After signing in participants were randomly assigned to a condition and got an e-mail, explaining how the study will

go on. Both groups were told that the study starts on June 1st and in the first week they should eat meat like before and not try to reduce the amount, so that we could compare if their meat consumption will change. Meanwhile they would daily get a questionnaire of how much meat they ate that day. The packet group was told next that after this baseline week they will receive the support packet and should continue with the daily questionnaires for four weeks. The self-monitoring group was told that before they receive the support packet, we were interested to know if they will reduce their meat consumption on their own. Therefore, they should try to reduce meat consumption the next four weeks without the packet and fill in the daily questionnaires. After four weeks they would receive the support packet and did not need to continue with the questionnaires.

Starting on June 1st, all participants daily received the questionnaires at 7 pm via e-mail. They were told to fill in the questionnaire after their last meal of the day. If they did not fill in the questionnaire until 8 am in the next morning, they got a reminder to catch up on the questionnaire.

After the first week the self-monitoring group was reminded that from now on, they should try to reduce meat consumption on their own. The intervention packet was sent to the packet group on June 7th and included the shopping bag, shopping list, cookbook, tasters, informational brochure, MCII technique and an instruction explaining all the materials (Appendix H). They were told that their packet was sent and that they should continue to fill in the questionnaires when the packet has arrived and not before. It is possible that participants did fill in the questionnaires already before the packet arrived. Unfortunately, we did not have an option that ensured participants filled in the questionnaires again after the packet arrived. Following the dates when the packet group continued to fill in the questionnaires again, packets arrived between June 8th and 12th. Corresponding to the date participants of the packet group filled in again the questionnaires, they received the questionnaires four weeks more, so that every participant had one week baseline data and four weeks intervention data.

The packet was also sent to the self-monitoring group after five weeks. They were informed that the packet is on the way and all participants were told after their fifth week of responding the questionnaires that the study has finished and were thanked for their participation.

Data-Analysis

To test our hypotheses a 2-way mixed ANOVA with meat consumption (grams) as dependent variable, time (week 1-5) as within-subject factor and intervention (packet, self-monitoring) as between-subject factor was conducted. For analyzing food consumption 7-day periods are advised (Wolper et al., 1995). Therefore, daily meat scores from the daily questionnaires were transformed into weekly mean scores. Mean scores instead of sum scores were chosen to account for missing scores. Mean scores were only calculated when participants filled in the questionnaire at least four times a week, because less times a week would be less than half of the week which seemed too

vague for us to calculate weekly scores. Participants that ate less than 200 grams at baseline (week 1) were excluded from the analysis, because the MoED was interested in the effect of the intervention for people who consume more than this amount and the intervention was not designed for people who eat very low amounts of meat.

Results

A factorial mixed ANOVA between intervention (between-subject factor: packet, self-monitoring) and time (within-subject factor with 5 levels) revealed a significant main effect of intervention, $F(1,73) = 5.07$, $p = .027$, $\eta_p^2 = .065$, with a lower meat consumption over the five weeks in the packet condition ($M = 65.8$, $SE = 6.5$) than in the self-monitoring condition ($M = 86.8$, $SE = 6.7$).

There was also a significant main effect of time $F(3.13,73) = 32.41$, $p < .001$, $\eta_p^2 = .31$. Planned contrast revealed that overall meat consumption reduced from week 1 ($M = 113.9$, $SE = 6.2$) to week 2 ($M = 66.4$, $SE = 5.6$; $p < .001$) and increased from week 3 ($M = 61.4$, $SE = 5.7$) to week 4 ($M = 73.5$, $SE = 5.9$; $p = .001$).

Furthermore the analysis revealed a significant 2-way interaction between group and time, $F(3.13,73) = 2.62$, $p = .049$, $\eta_p^2 = .035$. Tests for within-subject contrasts and the respective means showed that meat consumption decreased more in the intervention condition than in the self-monitoring condition from week 1 to week 4 ($p = .04$), suggesting that the intervention reduces meat consumption more than self-monitoring in the third week post-intervention. A pairwise comparison of the changes in meat consumption over the 5 weeks in each condition revealed a reduction of meat consumption in the intervention condition from week to week 2 ($p < .001$), week 1 to week 3 ($p < .001$), week 1 to week 4 ($p < .001$) and week 1 to week 5 ($p < .001$), and also from week 2 to week 3 ($p = .02$), indicating that the intervention decreased meat consumption already in the first week and even more after the second week where it keeps stable until the end of the measurement. For the self-monitoring condition a pairwise comparison also revealed a reduction of meat consumption from week 1 to week 2 ($p < .001$), week 1 to week 3 ($p < .001$), week 1 to week 4 ($p = .003$) and week 1 to week 5 ($p < .001$), and from week 4 to week 5 ($p = .041$), but an increase from week 2 to week 4 ($p = .005$) and from week 3 to week 4 ($p = .004$), indicating that self-monitoring reduces meat consumption already in the first week, but then the effect weakens in the third week and finally again reduces meat consumption in the fifth week. Figure 1 and table 1 show the meat consumption for each condition and each week.

The assumption of homogeneity was violated, as indicated by Mauchly's Test of Sphericity and Leven's Test of Equality of Error Variances. Also, the assumption of normality was violated, indicated by the Kolmogorov-Smirnov test and the Shapiro-Wilk test. Therefore, the results of the 2-

Figure 1

Graphical representation of meat consumption means for each condition over five weeks

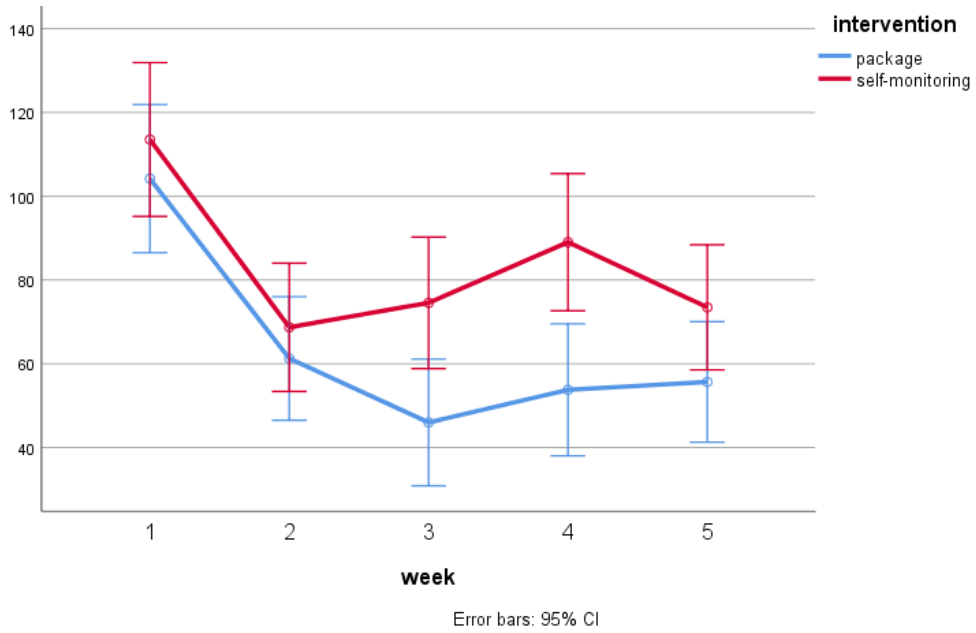

Table 1

Meat consumption means and standard errors for each condition at each week

Intervention Condition	Week	M	SE
Packet	1	108.9	8.6
	2	62.2	7.7
	3	46.3	7.6
	4	55.4	8.2
	5	56.2	7.4
Self-Monitoring	1	118.9	9
	2	70.7	8
	3	76.5	8.2
	4	91.5	8.5
	5	76.6	7.7

way mixed ANOVA may not be completely reliable. Additionally, non-parametric tests were conducted that are more robust against violations of assumptions.

To test if there is a difference between the two conditions, a Mann-Whitney test with group (intervention, self-monitoring) as between-subject factor and the five weekly meat consumption means as dependent variable was conducted. Participants that missed a weekly score were excluded so that the analysis was done with the same participants as in the factorial mixed ANOVA before.

Meat consumption was lower in the intervention condition (mean rank = 31.9) than in the self-monitoring condition (mean rank = 44.6) at week 3 (U = 938.5, z = 2.51, p = .012, r = 0.27), and at week 4 (U = 943.5, z = 2.56, p = .010, r = 0.29), intervention condition (mean rank = 31.8), self-monitoring condition (mean rank = 44.7). These results support the main effect of group found in the first analysis, specifically in week 3 and week 4.

To test if the meat consumption changes over time in each condition, two Friedman's ANOVA's were conducted. The first was conducted only with participants of the packet condition with meat consumption as dependent variable and time (week1 to week5) as within-subject factor. Meat consumption reduced significantly over time, $X^2(4) = 56.4$, $p < .001$. Pairwise comparisons revealed that meat consumption reduced from week 1 to week 2 (T = 1.56, p = .001, r = 0.73), week 1 to week 3 (T = 2.53, $p < .001$, r = 1.18), week 1 to week 4 (T = 1.67, $p < .001$, r = 0.78) and week 1 to week 5 (T = 1.99, $p < .001$, r = 0.93), indicating that the intervention packet reduced meat consumption over the measured period of time.

Again, the same test was conducted for participants of the self-monitoring condition. Here as well meat consumption significantly reduced over time, $X^2(4) = 31.22$, $p < .001$. Pairwise comparisons revealed that meat consumption reduced from week 1 to week 2 (T = 1.82, $p < .001$, r = 0.72), week 1 to week 3 (T = 1.68, $p < .001$, r = 0.75), week 1 to week 4 (T = 1.21, p = .012, r = 0.54), and week 1 to week 5 (T = 1.54, p = .001, r = 0.69), indicating that the self-monitoring reduced meat consumption over the measured period of time.

Discussion

The purpose of this study was to test the effectiveness of two interventions, a mixed intervention and a self-monitoring-only intervention, on meat reduction and to compare both effects to each other. The first hypothesis that both interventions significantly reduce meat consumption was confirmed. Also the second hypothesis, that the mixed intervention reduces meat consumption stronger than the self-monitoring intervention, was supported, but only for the third week post-intervention.

The results of parametric and non-parametric tests indicate both that the two interventions significantly reduced meat consumption at all four weeks post-intervention. These findings support our first hypothesis, indicating that the material combination from the mixed intervention, as well as daily questionnaires about one's meat consumption alone are both effective to reduce meat consumption.

The reduced meat consumption we found in the self-monitoring condition is in line with previous literature, suggesting that self-monitoring strategies are effective to change eating behaviors by helping to identify differences between current and recommended levels of food

consumption (Fishbach et al., 2012; Myrseth & Fishbach, 2009). Self-monitoring was effective to reduce meat consumption in combination with a daily SMS-reminder to monitor meat consumption and to not exceed recommended meat amounts (Carfora et al., 2017a, 2017b). A meat-analysis of interventions targeting conscious determinants to reduce meat consumption from 2018 (Bianchi et al.) could not find interventions that used self-monitoring alone. To our knowledge this study is the first that tested the effect of self-monitoring alone on meat consumption and the results suggest that only providing people daily with meat consumption questionnaires is enough to reduce meat consumption. Self-monitoring by recording the behavior effects the behavior through an increased self-awareness, simplifying memory and self-confrontation (Bailey & Sowder, 1970; Kanfer, 1970; Schoutrop et al., 2002). Therefore, it seems that daily filling in how much meat participants ate, increased the awareness of the current meat consumption and confronted this amount with the intended amount of their meat consumption goal. If the amount is higher as intended people become more aware of that and are more likely to reduce the amount of meat.

That the intervention packet reduced meat consumption is also in line with previous literature which found that daily meat consumption questionnaires, shopping list, reminders, meatless recipes and tasters, MCII, and written information about consequences of meat consumption for health, environment and animals, reduced meat consumption (Block & Morwitz, 1999; Carfora et al., 2017a, 2017b; Clark, 2017; Flynn et al., 2013; Holloway et al., 2012; Loy et al., 2016; Scrimgeour, 2012). The previous studies have not combined all these materials together, but only some of them like meat diary + information + recipes + tasters (Holloway et al., 2012). In general, self-monitoring seems to be more effective in combination with other behavior change techniques (Michie et al., 2009). To our knowledge this is the first study combining all these materials in one intervention and the results indicate that this combination is effective to reduce meat consumption.

Comparing both interventions to each other the results indicate that the packet intervention reduced meat consumption significantly stronger than the self-monitoring intervention in the third week post intervention. That the packet intervention reduced meat consumption stronger than self-monitoring alone is in line with previous literature that found self-monitoring in combination with other behavior change techniques to be more effective than self-monitoring alone (Michie et al., 2009). Unlike the self-monitoring intervention which only enhanced the intention-behavior link, the packet intervention should also affect meat consumption through enhancing the meal preparation skill (Graça et al., 2019). Therefore, meat consumption should be affected stronger because the packet intervention involves an additional way of influence. However, we would have expected that the effect difference between the interventions is more persistent than only at one of the four weeks.

An alternative explication of our results is that participants did not reduce meat consumption because of the interventions, but rather because they already had the intention to eat less meat before and thus would have reduced meat consumption even without participating. Participants were only selected if they indicated that they intend to reduce their meat consumption, thus all participants had the intention to eat less meat already before the intervention. However, we think that it is more likely that participants would not have reduced their meat consumption as strong as with the interventions. Often only having the intention to change eating behavior is not enough for a successful behavior change (Godinho et al., 2014). Behavior change techniques we used, like self-monitoring and MCII can strengthen the intention-behavior link, making it more likely to act on one's intentions (Carfora et al., 2017a; Loy et al., 2016). Probably the interventions helped participants to narrow the gap between their intention to eat less meat and actual meat reduction.

Limitations

There are at least three limitations of the study we want to address. First, the target group for which the interventions were designed were meat-eater that had the intention to reduce meat consumption and regularly ate meat (at least one time a week and at least 200g per week). All participants belonged to the target group, so the results are only generalizable to this group. First, people who do not intend to reduce meat would probably not participate in the interventions because they do not have a reason to do so. Even if they would participate, for example because they get paid, we would not expect that the intervention materials influence their meat consumption. Self-monitoring only effects the target behavior if it is in line with one's goals and intentions (Kanfer & Goldstein, 1991). If participants do not intend to reduce meat, monitoring how much meat they eat will not reduce their consumption, because they have no intended goal to compare their consumption with. Other elements of the intervention packet, like MCII and the shopping list, boost the intention, but if the intention to reduce meat is not there, meat consumption will not be influenced (Block & Morwitz, 1999; Loy et al., 2016). Eventually the cookbook and tasters might lead to a meat reduction also for meat-eaters who do not intend to reduce meat, if they like some of the recipes and/or tasters and prepare them instead of meat meals. But for those who show a strong attachment to meat it is unlikely that they will try or like them (Graça et al., 2015). Future studies could investigate if the cookbook and tasters also reduces meat consumption for people who do not have the intention to reduce meat and if this depends on meat attachment.

Another limitation of the study is that the long-term effects of the interventions are unknown. Participant's meat consumption was measured over four weeks post-intervention, thus conclusions about the studies' effectiveness can only be drawn for this time period. However, we will discuss the expectations deriving from the theory. The self-monitoring effects of the questionnaires should disappear after the intervention. We think, that most people will not continue to daily write

down their meat consumption, considering the discipline it takes. In this case, the self-monitoring effect, that influences behavior through comparing current behavior with the goal, disappears (Burke et al., 2011). Though it is possible that the reduced meat reduction became a habit, meaning that meat consumption would reduce in the long-term. How long it takes to form a habit varies a lot, but Lally et al. (2010) found that for automatizing new eating behaviors the median was 34 days. Since our interventions lasts 28 days, it is possible that eating less meat got automatized for some participants. For the packet intervention long-term effects are expected, because the packet intervention design has a long-term boost approach, meaning that it teaches competences that can be performed at will and across situations (Hertwig & Grüne-Yanoff, 2017). The cookbook should teach preparation skill of meatless meals. One can deliberately choose to prepare a meatless meal and this can be done in various situations, like at home or at a friend's house. This suggests that the packet intervention might have a long-term effect on meat consumption. Nevertheless, follow-up studies over longer time periods are necessary to investigate long-term effects of the interventions.

A third limitation of the study is that the daily meat consumption questionnaire may threaten internal validity. 24 hours recall periods for food intake can be biased and can produce inaccurate results because of a distortion of memory (Larkin et al., 1991; Myers et al., 1988). However, in these studies recall bias for food intake was studied for recalling multiple food items of various categories. The present study only accessed meat, thus we argue that the recall bias is rather little for this single category, but probably is still there. Future studies could improve the measurement of meat consumption while still being a self-monitoring tool, in form of a meat diary. Participants have always access to the diary and should directly write down meat consumption after the meal, which reduces the recall bias, because the time delay between consumption and recall is very short (De Castro, 1994). We did not use this diary in the present study because requesting participants to use a diary after every meal seemed too demanding for the present study.

Despite these limitations, the present study indicates that the self-monitoring-only intervention and the packet intervention both successfully reduce meat consumptions for individuals that intend to eat less meat, while this effect is even stronger for the packet intervention. This study showed for the first time that a daily meat consumption questionnaire alone and the combination of the packet materials are both successful to reduce meat consumption. These results have potential intervention implications. Institutions who have an interest to reduce meat consumption like the MoED could offer the interventions. Daily questionnaires can be divided on a low-budget and if resources are higher the intervention packet can be used to reduce meat consumption even stronger.

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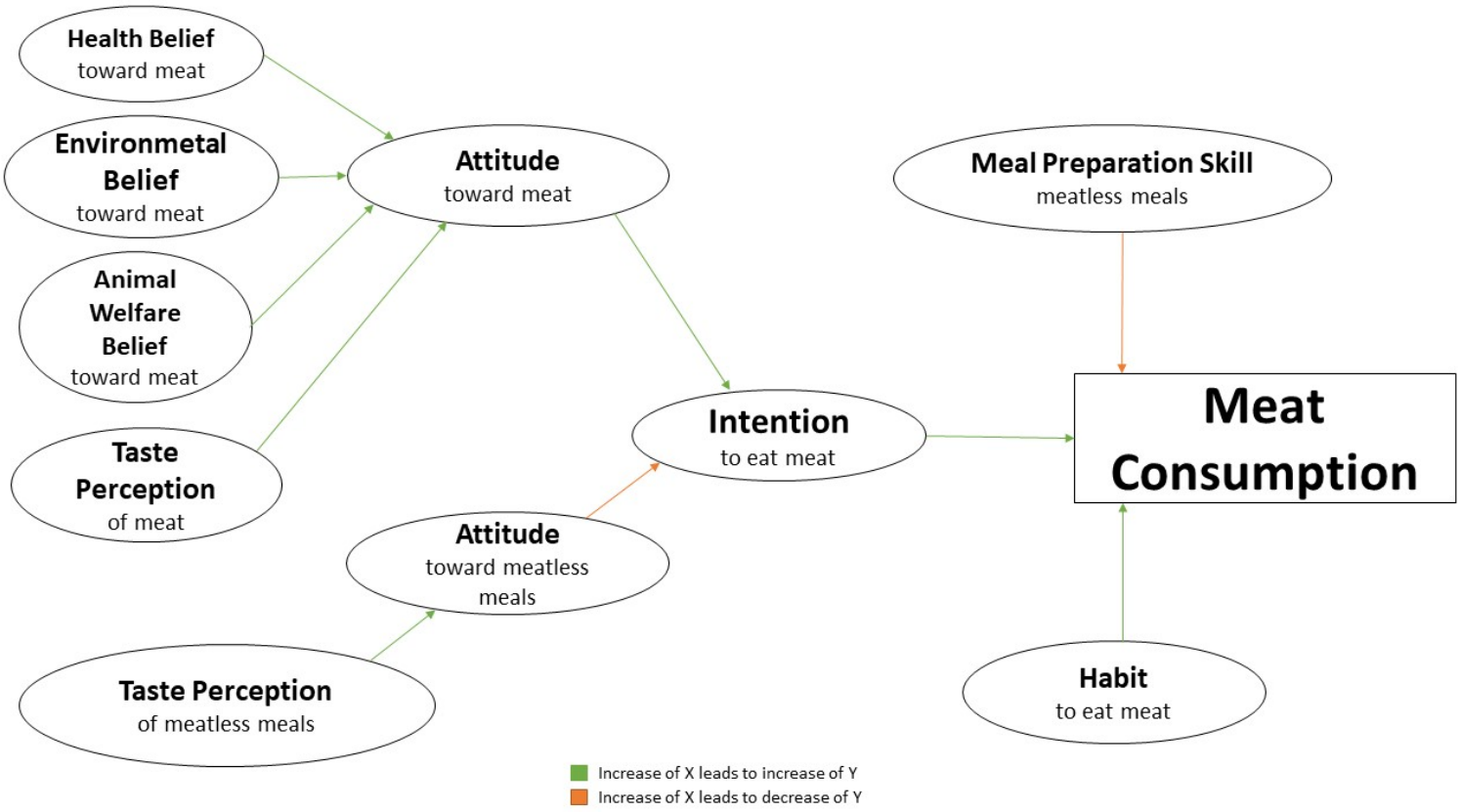
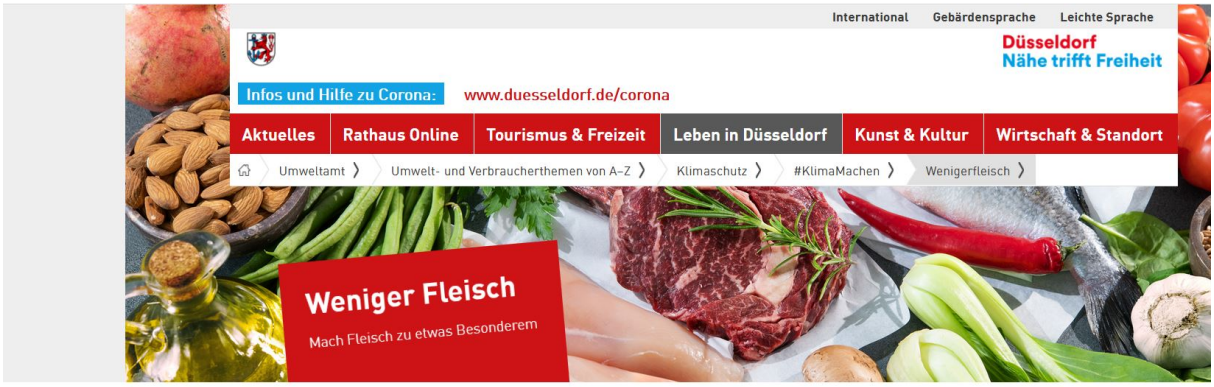
Appendix A

Psychological factors influencing meat consumption



Appendix B

Website



Teilnehmen an einer Studie zur Verringerung des Fleischkonsums

Das Amt für Umwelt- und Verbraucherschutz sucht 50 Menschen, die ihren Fleischkonsum reduzieren möchten. Interessentinnen und Interessenten können sich **bis spätestens Montag, 31. Mai 2021,** hier anmelden:

Zur Teilnahme

Weitere Informationen lassen sich unten im Abschnitt "Und jetzt?" nachlesen und Fragen beantworten gerne:

Wenn, dann Fleisch bewusst konsumieren

Bewusster Fleischkonsum

Tatsache ist, dass Fleisch einfach wahnsinnig gut schmeckt und bei guter Qualität in Maßen genossen auch gesund ist. Doch da wir es inzwischen gewohnt sind, Fleisch nicht mehr als Sonntagsbraten wertzuschätzen, sondern als billiges Alltags-Lebensmittel anzusehen, muss es in Massen "produziert" werden, mit einer Flut an Problemen für deine Gesundheit, die Umwelt und das Klima und nicht zuletzt für die Tiere, welche zum Großteil unter unwürdigen Bedingungen gehalten werden.

Es gibt also gute Gründe für einen bewussteren Fleischkonsum!

Gesundheit

Fleisch enthält viele wichtige, gut verwertbare Nährstoffe, die allerdings bei einer vollwertigen vegetarischen Ernährung ebenfalls in ausreichender Menge aufgenommen werden. Gleichzeitig begünstiget rotes Fleisch, zum Beispiel von Rind und Schwein, die Entstehung von Darmkrebs, und ein generell hoher Fleischkonsum erhöht nachweislich dein Risiko, an Herz-Kreislauf-Krankheiten und an Diabetes zu erkranken. Auch der hohe Verbrauch von Antibiotika in der Massentierhaltung sowie wiederholte Fleischskandale stellen den gesundheitlichen Nutzen dieses Lebensmittels in Frage.
Die Deutsche Gesellschaft für Ernährung empfiehlt übrigens, den wöchentlichen Verbrauch auf maximal 300 bis 600 g Fleisch und Wurst pro Woche im Durchschnitt zu halbieren.

Weitere Informationen

Umwelt und Klima

Etwa 15 Prozent des globalen Treibhausgasausstoßes werden von der Nutztierhaltung verursacht. Das ist mehr als der gesamte Sektor Transport mit allen LKW, PKW, Schiffen und Flugzeugen zusammen erzeugt! Verantwortlich ist neben der Tierhaltung selber die Futtermittelproduktion – überwiegend Soja aus den USA, Brasilien und Argentinien - einschließlich der Transportwege und die Brandrodung von Regenwäldern für Weideflächen und Sojaanbau. Der Sojaanbau wiederum geht einher

Regenwäldern für Weideflächen und Sojaanbau. Der Sojaanbau wiederum geht einher mit einem hohen Einsatz an Pestiziden, von denen einige in der EU bereits verboten sind.

Gleichzeitig beansprucht die Fleisch- und Futtermittelproduktion 70 Prozent der weltweiten Agrarflächen und 29 Prozent des landwirtschaftlich genutzten Süßwassers. Dafür belasten jährlich 200 Millionen Kubikmeter Gülle aus der Massentierhaltung unser Grundwasser mit Nitrat.

Download DIW-Studie

Tierleid

Das Leben für die Tiere in der Massentierhaltung ist einfach nicht schön zu reden: Hühnern werden die Schnäbel und Krallen gekürzt und männliche Küken werden direkt nach der Geburt geschreddert. Auch Schweinen kürzt man die Schwänze und die Zähne und hält sie in so engen Buchten, dass sie sich nicht einmal drehen können. Männliche Ferkel werden ohne Betäubung kastriert. Jungtiere werden kurz nach der Geburt von ihren Müttern getrennt, was wie bei uns Menschen zu sichtbarem Leid führt. Lebewesen werden zur Ware, die möglichst schnell und gewinnbringend verarbeitet werden soll.

Jeder, der Fleisch isst, sollte mindestens einmal gesehen haben, unter welchen Bedingungen die meisten Tiere gehalten werden. Die Bilder sind schrecklich, aber real.

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Infos und Hilfe zu Corona: www.duesseldorf.de/corona

Aktuelles | Rathaus Online | Tourismus & Freizeit | Leben in Düsseldorf | Kunst & Kultur | Wirtschaft & Standort

Umweltamt › Umwelt- und Verbraucherthemen von A–Z › Klimaschutz › #KlimaMachen › Wenigerfleisch ›

Und jetzt?

Wenn du auch denkst, dass es gute Gründe gibt weniger Fleisch zu essen, dann wollen wir dich motivieren, es einmal auszuprobieren. Keine Sorge, du musst nicht gleich Vegetarier werden, um einen Einfluss zu haben. Jede Portion weniger macht einen Unterschied. Wie stark du deinen Fleischkonsum reduzieren möchtest, entscheidest du selber.

Du bekommst von uns kostenlos Unterstützung in Form von leckeren Rezepten und Kostproben sowie Strategien gegen das Schwachwerden. Ein entsprechendes Paket haben wir zusammen mit einem Psychologen im Rahmen seiner Masterarbeit geschnürt. Um teilzunehmen, musst du dich lediglich dazu bereit erklären, dir bei Ankunft des Pakets einen kurzen Augenblick für den Inhalt zu nehmen und einen Monat lang weniger als 2 Minuten pro Tag einen kurzen Fragebogen zu deinem Fleischkonsum ausfüllen. Zum einen hilft dir das deinen Konsum besser im Auge zu behalten und zum anderen können wir mit den Ergebnissen die Effektivität der Unterstützung besser nachvollziehen und verbessern. Somit hilfst du, neue Erkenntnisse zu gewinnen und gleichzeitig bekommst du ein mit Liebe und Fleiß gemachtes Unterstützungspaket.

50 Unterstützungspakete stehen bereit. Wer zuerst kommt, malt zuerst.

Downloads und Links

Downloads und Links

- Teilnahmeformular zur Studie für weniger Fleischkonsum
- Empfehlungen der Deutschen Gesellschaft für Ernährung DGE
- Helmholtz-Forschungsgemeinschaft über Fleischkonsum
- Fleischatlas 2021
- DIW-Studie "Warum essen wir so viel Fleisch?"
- Nährstofftabelle der Verbraucherzentrale

Appendix C

Weight estimations for common meat products

Gewicht: (ohne Knochen)	
Steak/Schnitzel:	ca. 150-200g
Geflügel:	ca. 120-150g
Hackfleisch/Gulasch:	ca. 100-120g
Würstchen:	ca. 50-100g
Wurst:	ca. 10-25g

Appendix D

Shopping bag

Appendix E

Shopping list

Appendix F

Cookbook

Appendix G

MCII technique

Durchhalte-Methode

Wir wollen dich gerne durch eine Methode führen, die dir dabei hilft dein Ziel - weniger Fleisch zu essen – besser umzusetzen. Die Methode wirkt natürlich nur, wenn du dich ernsthaft mit den Fragen auseinandersetzt und dafür einen Augenblick der Ruhe einplanst. Das Prinzip dieser Methode kannst du auch für andere Ziele anwenden.
(Falls dich die Theorie dahinter interessiert, kannst du mehr unter den Begriffen „WOOP-Methode“ und „Wenn-Dann Pläne“ erfahren)

Los geht’s:

1. Was sind deine wichtigsten Gründe weniger Fleisch zu essen? Welche Dinge gefallen dir überhaupt nicht und wie sieht deine Wunschvorstellung aus?
   Versuche dir diese Dinge lebhaft vorzustellen und schreibe sie auf.

2. Wie stark möchtest du deinen Fleischkonsum verringern? Überlege dir, was dein persönliches Ziel ist.
   Ziele werden besser umgesetzt, wenn sie herausfordernd, aber dennoch realistisch sind. Um zu verhindern, dass du dich selber austrickst, sollte das Ziel deutlich und überprüfbar sein (z.B. anstatt „weniger" besser „X mal pro Woche").

3. Stelle dir nun die Dinge vor, die du verbessern würdest, wenn du dein Ziel erreichst und deine Wunschvorstellung, für die du dich einsetzt. Stelle dir auch vor, wie du dich fühlen würdest, wenn du dein Ziel erreichst.
   Umso intensiver du dir die positive Veränderung vorstellst und die Gefühle, die du damit verbindest, desto stärker wird deine Motivation sein. Nimm dir am besten ein paar Minuten Zeit, um tiefer in deine Vorstellungen einzutauchen.

4. Jetzt wo du dein Ziel klar vor Augen hast, überlege welche Hindernisse dich von deinem Ziel abhalten könnten und wann und wo diese meistens auftauchen.
   (z.B. das Verlangen nach einem großen Steak, nach einem anstrengenden Tag auf der Arbeit).

5. Markiere deine 2 größten Hindernisse.

6. Überlege dir nun Strategien, um deine 2 größten (oder mehr) Hindernisse zu überwinden bzw. zu vermeiden.
   Formuliere die Strategien als „Wenn-Dann Pläne“ (Wenn Hindernis X, dann Verhalten Y. z.B. Wenn ich nach einem anstrengenden Tag auf der Arbeit Verlangen nach einem Steak habe, dann gönne ich mir stattdessen mein vegetarisches Lieblingsgericht). Die Strategien sollten eine Alternative beinhalten, die dich motiviert.

Strategien, um meine Hindernisse zu überwinden:

Strategien, um meine Hindernisse zu vermeiden:

7. Formuliere selbst einen Wenn-Dann Plan, um die Einkaufsliste effektiv zu nutzen.
(z.B. Bevor ich Einkaufen gehe, schreibe ich die Menge an Fleisch, die ich einkaufen möchte, auf die Liste und halte mich beim Einkaufen an die Liste)

8. Wenn du möchtest, kannst du auch noch weitere Wenn-Dann Pläne machen, von Situationen, in denen du anstatt Fleisch etwas anderes essen möchtest.
(z.B. Wenn ich beim Frühstück Wurst aufs Brot tun möchte, dann nehme ich stattdessen einen Gemüseaufstrich)

Appendix H

Instruction of packet materials

HURRA, dein Paket ist da!

Wir freuen uns dir dieses Paket überreichen zu können und dass du offen für Neues bist.

Viel Spaß mit dem Inhalt 😊

In dem Paket findest du folgende Dinge:

- Kostproben
- Kochbuch
- Einkaufsliste
- Einkaufsbeutel
- Durchhalte-Methode

Kostproben

Sojagranulat kann für viele Gerichte anstelle von Hackfleisch benutzt werden und schmeckt hervorragend zusammen mit Soßen, wie in Spaghetti Bolognese oder Lasagne. Eingeweicht mit Gemüsebrühe oder Kräutern kannst du den Geschmack nochmal zusätzlich abrunden. Da Soja sehr proteinhaltig ist, braucht man keine Sorge zu haben nicht satt zu werden.

Die Bratling-Mischung eignet sich ideal für leckere Burger oder als Beilage zu Reis- oder Kartoffelgerichten. Bratlinge gibt es mittlerweile in allen möglichen Geschmacksrichtungen, sodass für jedermann etwas dabei ist.

Wer zum Frühstück hauptsächlich sein Brot mit Wurst belegt, der hat mit dem Gemüseaufstrich eine super Frühstücksalternative. Obendrauf noch frische Tomate oder Gurke und das Ganze schmeckt noch köstlicher. Auch die Gemüseaufstriche gibt es in jedem Supermarkt in vielen Geschmacksrichtungen.

Tortellinis, der Klassiker. Hiermit kann man nie etwas falsch machen. Einfach mit einer Soße ergänzen und bei Bedarf mit ein paar frischen Zutaten und schon hat man eine schnelle und leckere Mahlzeit ohne Fleisch.

Kochbuch

Wir hoffen, dass du in dem Kochbuch neue leckere Gerichte kennenlernst. Lass dich einfach inspirieren und probiere Rezepte aus, die dich anlächeln. Wenn du noch einen Schub Motivation

brauchst, dann such dir schon mal 3 Rezepte aus und plane, wann du das erste Rezept ausprobieren willst.

Einkaufsliste

Wie viel Fleisch du isst, hängt natürlich stark mit deinem Einkauf zusammen. Die Einkaufsliste soll dir dabei helfen wohl überlegte Entscheidungen, die deinem Ziel entsprechen, zu treffen, anstatt sich von der Gewohnheit oder der Lust leiten zu lassen.
Schreibe auf die Liste nur so viel Fleisch, wie es deinem Ziel entspricht und versuche nur die Menge an Fleisch auf deiner Liste einzukaufen und Spontankäufe zu vermeiden. Wenn du die Liste gut sichtbar aufhängst (z.B. am Kühlschrank) wird es noch wahrscheinlicher, dass du sie auch benutzt.

Einkaufsbeutel

Der Beutel, in dem sich die Sachen befinden, eignet sich hervorragend zum Einkaufen. Wir haben ein schönes Logo rausgesucht, dass zum Thema passt und überlassen dir ein wenig Interpretationsspielraum bei der Deutung. Wenn du den Beutel auch gut findest, dann versuche ihn diesen Monat zum Einkaufen zu benutzen.

Durchhalte-Methode

Um dein Ziel zu festigen und dich gegen Versuchungen zu stärken, führen wir dich durch eine Übung aus der Motivationspsychologie. Folge dazu einfach den Schritten auf der nächsten Seite. Um die Übung vernünftig zu machen, solltest du dir etwa eine halbe Stunde in Ruhe Zeit nehmen.

Täglicher Fragebogen

Täglich aufzuschreiben wie viel Fleisch du gegessen hast ermöglicht einerseits, dass wir eine Auswertung durchführen können, aber andererseits hilft es auch dir selbst. Dadurch, dass du deinen Fleischkonsum jeden Tag aufschreibst, wirst du dir täglich darüber bewusst und es bleibt kein reiner Automatismus mehr. Somit kannst du besser kontrollieren, ob du dich auf deiner Zielgeraden befindest oder davon abgekommen bist. Wer es übersichtlicher haben möchte, kann sich einfach die Angaben im Fragebogen auf einem Blatt notieren.

Viel Erfolg bei deinem Ziel, weniger Fleisch zu essen!