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The application of systematic steps for interventions towards meat-reduced diets

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ABSTRACT

Background: Protein transition, i.e. the transition from high levels of traditional meat consumption towards consuming less meat or more plant-based or alternative animal-based proteins, is highly dependent on consumer behaviour. This position paper adds to the literature by integrating the research streams on behavioural sciences and meat reducing strategies, thereby contributing to the use of behavioural science insights in developing meat reducing interventions towards a more plant-based food transition.
Scope and approach: Meat-reducing strategies involve substituting meat with novel proteins, consumption of less meat or consuming meat less often, and becoming a vegetarian or vegan. Based on previous literature four systematic steps for effective interventions towards behaviour change are described in view of the current literature in the specific context of meat reduction. Finally, emergent strands of future research are identified.
Key findings and conclusions: The four described steps compromise: (a) identifying the problem and desired behaviour change, (b) examining the main drivers of behaviour change, (c) select fitting interventions, and (d) impact assessment. Based on the meat-reducing literature the key strands for future interventions in the context of protein transition are identified. Moreover, literature gaps are defined. Resulting in an overview of systematic steps for interventions to support behaviour change in the protein transition.

1. Introduction

Although the need to reduce meat consumption is generally acknowledged to be more medically and environmentally sustainable (de Boer & Aiking, 2019; Godfray et al., 2018; Graça et al., 2019; Springmann et al., 2018), current Western food-consumption patterns are characterised by an excessive intake of animal-based products, that is, an intake of saturated fats and red meats surpassing dietary recommendations (Richi et al., 2015; Sans & Combris, 2015; Stubbs et al., 2018), associated with worrisome environmental (Aiking, 2014; Aiking & de Boer, 2018), health-related (Alexander et al., 2016; Westhoek et al., 2014), and animal welfare issues (Hagmann et al., 2019).

This paper aims to shed light on how behavioural sciences can contribute to behaviour change to support the protein transition. Following previous studies in the field stating that behaviour change is more effective when following systematic steps (Michie et al., 2011; Steg & Vlek, 2009), the current position paper suggests the relevance of following four systematic steps: (a) identifying the behaviour that requires changing, (b) exploring the drivers behind the specified behaviour, (c) selecting fitting interventions, and (d) systematically assessing the impact of these interventions on the specified behaviour and the entire food system (see Fig. 1).

The main aim of the current position paper is to demonstrate how research in behavioural sciences can be used to develop interventions towards meat reduction by using four systematic steps. This manuscript does not include a systematic literature review.[1] I aim to explore the state of the art within each step and highlight topics relevant for future research, thereby contributing to the use of behavioural science in developing meat-reducing interventions towards a more plant-based food transition.

2. Identification of problem behaviour

The identification of the problem behaviour involves a) specifying

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[1] We did use a systematic search to identify the relevant literature reviews (TITLE-ABS-KEY ("meat reduction"OR"reducing meat"OR"less meat"OR"low meat"OR"reduced meat"OR"decrease meat"OR"plant-based"OR"vegetarian"OR"alternative protein"OR"sustainable protein"AND (interventionOR"behav* change"-ANDreduc*ORdecreaseAND review)) resulted in a total of 216 documents, of which the following literature reviews were relevant: Abrahamse, 2020; Harguess et al., 2020; Hartmann & Siegrist, 2017; Kwasny et al., 2022; Mathur et al., 2021; Onwezen, Bouwman, et al., 2021; Sanchez-Sabate & Sabaté, 2019; Taufik et al., 2019.

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the behaviour requiring change (Michie et al., 2014, pp. 1003–1010; Steg & Vlek, 2009), b) assessing baseline behaviour (Steg & Vlek, 2009), and c) specifying target groups (e.g., Sanchez-Sabate & Sabaté, 2019).

2.1. Specify behaviour

First, it is suggested to specify specific problem behaviours and assess which among them has the highest potential to contribute to solving a specific problem (Michie et al., 2014, pp. 1003–1010; Steg & Vlek, 2009). In the case of meat-reducing behaviours, it would be beneficial to include interdisciplinary collaborations, as behavioural consequences relate to various domains (Westhoek et al., 2014), such as nutrition research, health research, environmental research, and behavioural science. The most promising behaviour for dietary change can be selected by considering the feasibility of various types of behaviour changes and their potential impact.

Second, it is suggested to be specific in the selection of a behavioural strategy (Steg & Vlek, 2009). A myriad of possible meat-reducing strategies are included in current literature: meat avoidance (vegetarianism or veganism), reduction of meat portions or curtailment (Verain et al., 2015), consuming less meat of better quality (Grunert, 2006), or adoption of flexitarian diets advocating less frequent meat consumption (Dagevos & Voordouw, 2013; Schösler et al., 2012). All of these strategies lead to reduced meat consumption; however, it is relevant to be specific, as different consumer segments with varying meat-reducing strategies relate to different drivers of behaviour (e.g., Onwezen & van der Weele, 2016; Verain et al., 2015).

Third, studies indicate that acceptance levels differ substantially across categories of proteins, such as insects, seaweed, and cultured meat (Birch et al., 2019; de Boer et al., 2013; Grasso et al., 2019; Onwezen et al., 2019). Moreover, Onwezen et al. (2019) revealed different acceptance levels, and underlying acceptance mechanisms, across different insect-based products. I, therefore, suggest to be specific in terms of category and product-level when specifying target behaviour (Michie et al., 2014, pp. 1003–1010; Steg & Vlek, 2009).

2.2. Measure current baseline behaviour

Measuring current behaviour can help to assess the status quo, along with identifying occurring problems (Steg & Vlek, 2009), to specify target groups, or current behaviour can function as a baseline to evaluate interventions (Michie et al., 2014, pp. 1003–1010).

Consumer behaviour in the context of meat-reducing strategies can refer to a variety of possible measurements to assess behaviour, for example, the consumption of meat and plants or the willingness to accept or purchase alternative proteins. Many studies in the context of nutrition (Ocké et al., 1997; Thompson & Subar, 2008) and alternative proteins have focused on questionnaire-based self-reports and intentions (e.g., Baker et al., 2016; Bryant et al., 2019; Gere et al., 2017; La Barbera et al., 2018; Menozzi et al., 2017; Onwezen et al., 2019), whereas previous studies have indicated that intentions explain only parts of the variance of actual behaviour (i.e., Hassan et al., 2016; Stubbs et al., 2018). It is, therefore, suggested that future studies also find ways to measure behaviour or develop and collect valid and reliable self-report methods (Schoeller et al., 2013), for example, using 2-h (instead of 24-h) recall apps to decrease the recall bias (van den Puttelaar et al., 2016) or photographs to complement self-reported behaviour with objective data (Swanson, 2008).

2.3. Identifying target groups

Most studies on alternative plant- or animal-based proteins have focused on representative or convenience samples, whilst a range of studies exploring differences across consumers have highlighted the relevance of differentiating across groups (Hoek et al., 2011; Onwezen & van der Weele, 2016; Verain et al., 2015).

Specifically, segmentation criteria are, for example, demographic groups such as the elderly (Grasso et al., 2019) or for distinguishing between groups based on gender (Gómez-Luciano et al., 2019; Love & Sulikowski, 2018; Sanchez-Sabate & Sabaté, 2019; Siegrist & Hartmann, 2019), or lifestyle by, for instance, looking at sportspersons, vegetarians, and food enthusiasts (Moons et al., 2018). Previous studies have generally indicated the relevance of prior experience by exploring the differences between experienced and inexperienced users (Hoek et al., 2011; Lucas et al., 2019; Schäufele et al., 2019; Warne et al., 2019) or stages of behavioural change (Sanchez-Sabate et al., 2019). It is, therefore, suggested to identify relevant target groups that differ in behaviour and drivers of behaviour.

3. Drivers of behaviour

The effectiveness of interventions is stated to increase when there is a

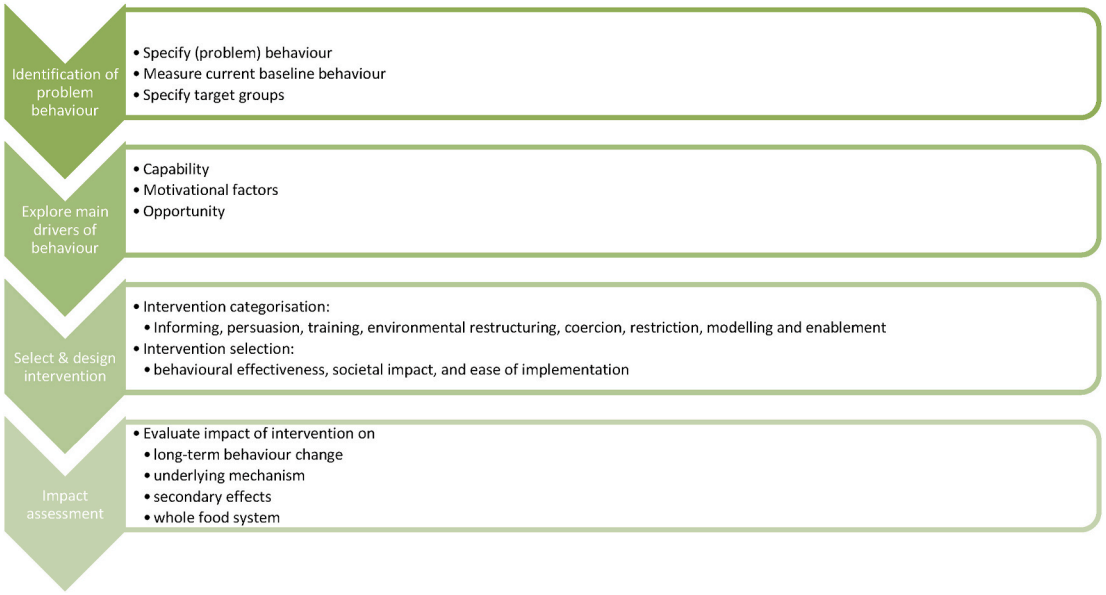

Fig. 1. Systematic steps for stimulating behaviour change towards protein transition (based on Michie et al., 2014, pp. 1003–1010; Steg & Vlek, 2009).

fit with underlying drivers of behaviour (Michie et al., 2011, 2014, pp. 1003–1010; Steg & Vlek, 2009). Therefore, it is suggested to distinguish which factors promote meat-reducing strategies. Based on previous studies (Michie et al., 2011), three categories of drivers – motivational factors, capability, and opportunity (3.1–3.4) – are described and then directions for future research are provided (3.5).

3.1. Motivational factors

Motivational factors refer to psychological factors that vary across consumers (Michie et al., 2011). Although these motivational factors might vary in terms of context-specificity, they all refer to psychological drivers of consumer behaviour. I highlight three relevant examples of motivational factors. However, several more drivers, such as attitudes that consistently show to be relevant for meat consumption (Sanchez-Sabate & Sabaté, 2019) and the acceptance of plant-based or alternative animal-based proteins (Onwezen, Bouwman, et al., 2021), can be found in the literature.

Environmental engagement is generally quite low, as there is, for example, low awareness regarding the major environmental impact of meat (Hartmann & Siegrist, 2017) or the environmental advantages of, for example, insects (Myers & Pettigrew, 2018). Environmental concerns seem mainly relevant to a minority of the consumers who adopt various meat-reducing strategies (see for a review, Sanchez-Sabate & Sabaté, 2019): Vegans and meat limiters are, for instance, more influenced by environmental reasons than vegetarians are (Sanchez-Sabate et al., 2019; Sanchez-Sabate & Sabaté, 2019).

Food neophobia and disgust are relevant for the acceptance of plant-based proteins or alternative animal-based proteins. Food neophobia, the aversion to trying novel foods (Pliner & Hobden, 1992), is, for example, an important barrier to the consumption of plant-based meat alternatives (Bryant et al., 2019; Hartmann & Siegrist, 2020, pp. 315–332; Hoek et al., 2011), insects (Barton et al., 2020; Orkusz et al., 2020), and seaweed (Birch et al., 2019; Moons et al., 2018). High levels of disgust correspond to less willingness to try alternative proteins, such as plant-based meat alternatives (Bryant et al., 2019; Siegrist & Hartmann, 2019), insects (Barton et al., 2020; Kornher et al., 2019; Sogari et al., 2019), and cultured meat (Birch et al., 2019; Wilks et al., 2019).

Food motives refer to various motives of consumers, such as health, price, and ethics (Steptoe et al., 1995), when choosing specific foods. The results generally indicate that consumers highly value both taste and health when choosing specific alternative plant- and animal-based proteins (Moons et al., 2018; Vázquez-Araújo et al., 2012) and when choosing to become vegetarian or flexitarian (De Backer & Hudders, 2014; Rosenfeld & Tomiyama, 2020). Prioritising various motives varies across consumer segments, such as vegetarians and vegans, throughout different phases of behaviour change (Sanchez-Sabate et al., 2019). A related stream of literature refers to the attributes consumers attach to traditional meat, for example, perceiving high amounts of meat as a necessary part of ones' diet (Van Wezemael et al., 2014) and enjoying meat (Kemper, 2020; Van Wezemael et al., 2014), whereas eating less meat was perceived as moral but less masculine (Ruby & Heine, 2011), difficult, less enjoyable and expensive (Bryant, 2019). These attributes can be strong and might form a barrier to meat reduction.

Familiarity refers to a tendency to opt for familiar products (e.g., Pelchat & Pliner, 1995; Tuorila et al., 1998). Specifically, for acceptance of meat-reducing strategies, familiarity with a product, ease of how to use a product, and a fit with accustomed meal patterns are relevant (Schösler et al., 2014). Familiarity is also relevant in understanding the acceptance of, for example, pulses (e.g., Akaichi et al., 2012; Florkowski & Park, 2001), insects (Schlup & Brunner, 2018; Verbeke, 2015; Woolf et al., 2019), and cultured meat (Hoek et al., 2011).

3.2. Capability

Capability refers to an individual's psychological and physical capacity to behave in a specific way, including having the necessary knowledge and skills (Michie et al., 2011). A lack of skills might act as a barrier (Kwasny, Dobernig, & Riefler, 2021).

Consumers who are willing to adopt meat-reducing strategies may not always be aware of the number of alternative options and ways to prepare specific meat alternatives or plant-based dishes. A substantial body of research concedes that preparation difficulties, including difficulties in preparing vegetarian meals (Schösler et al., 2014) and plant-based diets (Haverstock & Forgays, 2012), are perceived as barriers to consuming pulses, algae, insects, cultured meat, and plant-based meat alternatives (e.g., Balzan et al., 2016; Figueira et al., 2019; Lea et al., 2005; Lensvelt & Steenbekkers, 2014).

3.3. Opportunity: Physical and social environment

Opportunity refers to physical and social support to conduct a specific behaviour (Michie et al., 2011).

Physical environment. Studies that include the physical environment, such as product placement and supermarket design, are rare (Kwasny et al., 2021). However, there are indications that the physical environment may contribute to meat-reducing strategies. Studies have shown that supermarkets allocate significantly more shelf space to animal-based products than to plant-based protein products (Gravely & Fraser, 2018) and that this trend varies across locations and countries (de Boer & Aiking, 2018). Moreover, studies have suggested that adaptions in the environment, for example, changing the default (Abrahamse, 2020; Gravert & Kurz, 2019) or changing the proportions such that consumers receive more vegetables and less meat (Reinders et al., 2020), may lead to reduced meat consumption.

Social environment. Social norms refer to perceived socially approved behaviour (Cialdini et al., 1991, pp. 201–234). Social norms also seem to be relevant for meat-avoidance behaviour (Abrahamse, 202; Schenk et al., 2018) and the acceptance of insects (Hartmann et al., 2015; Onwezen et al., 2019; Sogari, 2015; Sogari et al., 2016), legumes, pulses (Lemken et al., 2017), seaweed, and cultured meat (Onwezen et al., 2019).

The strong influence of the social environment also works contrariwise if traditional meat consumption seems to be the norm, which inhibits the transition towards meat-reducing strategies. For example, anticipated stigmas of the social environment are mentioned as an important barrier for becoming vegetarian (Ruby, 2012) or vegan (Markowski & Roxburgh, 2019). Furthermore, changing traditional meat-consumption behaviour seems harsh because meat consumption is associated with high levels of status (Schösler et al., 2012; Vanhonacker & Verbeke, 2014), and positive messages from social media, for example, link meat to a healthy lifestyle (Bogueva et al., 2017).

3.4. Literature gaps: Directions for future research

Based on psychological insights from related streams of research (e.g., Siegrist & Hartmann, 2020), promising yet underexplored drivers in various meat-reducing strategies within the research are stated.

Few studies have looked at *emotions or other affective drivers* in the context of meat-reducing strategies (Hartmann & Siegrist, 2017), and the results look promising (Kwasny et al., 2021; Onwezen, Bouwman, et al., 2021; Onwezen et al., 2021). Future research should include more diverse affective variables, such as positive and negative emotions, or a broader range of specific emotions (Laros & Steenkamp, 2005).

Social identification seems under-researched in the context of meat-reducing strategies, whereas moral identity is stated as highly influential for meat-reducing strategies (Rosenfeld et al., 2020). Future research might explore whether activating identities might be relevant to close the gap between aversion to animal harm and the desire to eat meat ('meat paradox', Loughnan et al., 2014; Onwezen & van der Weele, 2016).

Food choices largely depend on *habitual behaviour* (van't Riet et al.,

2011). In the context of meat-reducing strategies, a limited body of research reveals that habits play a prominent role (Kwasny et al., 2021; Siegrist & Hartmann, 2019; Stubbs et al., 2018). Future research on the role of habits at life-changing moments such as moving or becoming a parent is needed, as these moments ask for deliberate choices through which new habits can be formed (Schäfer et al., 2012).

Meat consumption is strongly embedded in *cultural values and traditions* (Elzerman et al., 2011; Hayley et al., 2015). However, there is mixed evidence, as some question (Hartmann & Siegrist, 2020, pp. 315–332) and others highlight (Kwasny et al., 2021) the relevance of cultural values. There is only a limited number of studies that include cultural values such as cultural familiarity (Gallen et al., 2019; Hartmann et al., 2015). Therefore, further research is needed to explore the role and potential of cultural values in meat-reducing strategies.

Although research including the *physical or social environment* is limited (see 3.4), the results look promising (e.g., adapting the environmental context Campbell-Arvai et al., 2014; Kwasny et al., 2021; Vecchio & Cavallo, 2019). Given the attention to nudging and the call for nudging policies, future studies are suggested to focus on the relevant aspects of environmental context for behaviour change.

4. Select effective interventions

Based on previous literature (e.g., Michie et al., 2011; Steg & Vlek, 2009), it is suggested to rate possible interventions together with experts on three criteria: (a) intervention selection based on fit with underlying drivers, (b) expected societal impact, and (c) ease of implementation.

4.1. Intervention selection based on fit with underlying drivers

A meta-analysis on the effectiveness of interventions showed in general positive effects of interventions in the context of meat consumption, although there were some backfiring effects (Mathur et al., 2021). As for the latter, meat consumption and, therefore, emissions increased instead of decreasing (Klöckner & Ofstad, 2017; Friis et al., 2017; Wynes et al., 2018). Previous literature has postulated that it is relevant to select an intervention strategy that fits the problem behaviour and the underlying drivers that explain that specific behaviour (e.g., Michie et al., 2011; Michie et al., 2014, pp. 1003–1010). Section 4.4 applies relevant categories of interventions (Michie et al., 2011) to the specific context of meat-reducing strategies. Table 1 shows (based on Michie et al., 2011) how these different interventions are associated with underlying drivers (Chapter 3).

4.2. Expected societal impact

The effectiveness of an intervention depends not only on its effect on consumer behaviour but also on the possible societal health and environmental impact (Westhoek et al., 2014). Some behavioural changes might be more impactful than others. For example, if all consumers were to stop eating red meat, the environmental and health impact would be higher than if 5% of the consumers were to stop eating meat altogether. Moreover, the sustainability impact across various meat alternatives, such as processed and unprocessed plant-based alternatives, varies (van der Weele et al., 2019).

4.3. Ease of implementation

Additionally, some interventions are easy to execute, whereas others are more difficult to implement (Bos et al., 2013; Waterlander et al., 2018). For example, it is easier to provide information on a website than to make insect burgers widely available. Moreover, label systems can be designed perfectly but only when the labels are voluntarily adopted by the industry. Their effectiveness might be reduced because the meat industry is still reluctant to follow labelling trends (Röös et al., 2014; Röös & Tjärnemo, 2011). To support a successful implementation, it is relevant to consider the APEASE criteria: Affordability, Practicality, Effectiveness and cost-effectiveness, Acceptability, Side-effects and safety, and Equity (Michie et al., 2014, pp. 1003–1010) (Table 1).

Table 1
Summary of intervention strategies (Section 4) and link with drivers (Section 3) based on the Behavioural Change Wheel (Michie et al., 2011).

Strategy	Definition	Example	Underlying drivers
Information strategies	Information strategies refer to strategies to communicate various sorts of information to increase knowledge or understanding.	Communicating the environmental benefits of reducing meat consumption.	Information strategies assist individuals in overcoming gaps regarding lack of (reflective) motivation or physical skills (capability).
Persuasion strategies	Persuasion strategies increase acceptance of a meatless diet by using framing to increase positive associations.	Using the framing of communication messages via marketing, positive framing, or highlighting future consequences.	Persuasion strategies are particularly suited to increase motivation.
Training	Training involves developing skills such that individuals become more capable to use, and familiar with, specific novel products.	Developing cooking and preparation skills for example by providing recipes or public free tasting sessions.	Training is particularly suited to increase capability.
Environmental restructuring	Strategies in which the physical or social context is adapted to guide the desired behaviour.	Nudges that change the default in the menu to involve vegetarian options as the standard.	These strategies are fitting drivers related to automatic motivation and opportunity.
Coercion	Coercion refers to creating the expectation of punishment or cost.	Using taxation or true pricing, resulting in higher prices for meat.	Coercion strategies are particularly suited to increase motivation.
Restriction	Restriction involves using rules to restrict opportunities to engage in the target behaviour.	Prohibiting meat consumption or forcing supermarkets or canteens towards a specific ratio of meat versus meat alternatives.	Restriction strategies are particularly suited to increase opportunity.
Modelling	Modelling involves using an example for people to mimic or aspire.	Using social norms or famous individuals to highlight example behaviour.	Modelling fits drivers of automatic motivation.
Enablement	Enablement refers to increasing means and reducing barriers to make the target behaviour easier to perform (increase capability or opportunity).	Using labelling systems or behavioural support.	Enablement fits a range of drivers, including capability, automatic motivation, and opportunity.

4.4. Categorisation of interventions

Based on previous studies (Michie et al., 2011; 2014, pp. 1003–1010), I provide examples of each of the nine intervention categories specifically for meat-reducing strategies (Table 1).

Education strategies refer to strategies aimed at providing information (Michie et al., 2011). Mixed findings can be found regarding the specific effects of information interventions. On the one hand, some types of information have proven to be effective. For example, a body of research has shown that information on health or the environment (or both; Verain et al., 2017) positively affects the acceptance of alternative proteins (pulses [Warne et al., 2019], insects [Cavallo & Materia, 2018], and meat alternatives [Bryant & Barnett, 2018]). On the other hand, providing information can also backfire. For example, an intervention in which participants were provided with all available (rather than tailored or simplified) information (Klöckner & Ofstad, 2017) and information on cultured meat (Siegrist et al., 2018) backfired and resulted in self-reported heightened meat consumption.

Therefore, information alone may not always lead to behaviour change (Gadema & Oglethorpe, 2011; Grunert et al., 2014; Onwezen & van der Weele, 2016). It is relevant to specify which types of information are effective for the specific target behaviour and target group (Klöckner & Ofstad, 2017). Persuasion strategies to frame information can be an efficient way to increase effectiveness.

Training strategies are aimed at developing skills such that individuals become more capable to perform a specific behaviour (Michie et al., 2014, pp. 1003–1010). These, for example, might involve training preparation or cooking skills. The number of studies that focus specifically on enhancing skills is scarce (see for reviews, Harguess et al., 2020; Kwasny et al., 2021). There is a focus on familiarising strategies. For example, disguising techniques to fit with known products and dishes increases acceptance of algae (Balzan et al., 2016) and willingness to eat insects (Baker et al., 2016; Cavallo & Materia, 2018; Schlup & Brunner, 2018). Similarly, studies have revealed higher acceptance for processed insects compared to unprocessed insects (Hartmann et al., 2015), for insects as feed compared to insects as food (Laureati et al., 2016), and for vague menu descriptions as opposed to explicit menu descriptions (Baker et al., 2016). Strategies that involve making alternative proteins fit with known diets and products might help consumers to become more familiar with these novel plant- or animal-based proteins or diets, as they can have a normalising function.

Persuasion refers to manipulating different forms of information. In the context of meat reduction, framing information may increase consumer acceptance (Kwasny et al., 2021). For example, highlighting societal benefits (more so than individual benefits) increased the acceptance of insects (Verneau et al., 2016), and describing cultured meat in a nontechnical way that focuses on the final product increased acceptance of cultured meat (Siegrist et al., 2018).

Similar to informational strategies, not all framing effects are effective (Harguess et al., 2020), for example, showing no effects (e.g., product-related information, physiological information, social norm information or no information; Lensvelt & Steenbekkers, 2014) or negative effects by increasing acceptance of traditional meat compared to cultured meat (e.g., 'high-tech' framing [Bryant & Dillard, 2019] and communicating e-numbers or possible negative health effects [Siegrist & Sütterlin, 2017]).

Persuasion strategies can also be used in combination with other intervention strategies. For example, pairing information with prompts (Abrahamse, 2020; Carfora et al., 2017a) or a self-regulation technique of imagining a future goal (Loy et al., 2016) reduced red meat consumption more than standalone information, indicating the relevance of bundling intervention strategies.

Environmental restructuring refers to a wide range of possibilities to change the environment to stimulate unconscious behaviour change, for example, nudging (Hansen & Jespersen, 2013). Although studies revealed that nudging was effective in decreasing meat consumption (Brunner et al., 2018; Friis et al., 2017), the number of studies on nudging is limited in te meat-reducing context (Harguess et al., 2020. Three types of nudging are a) making vegetarian food more visible, (b) changing the portion sizes of meals and, (c) setting vegetarian meals as the default (Kwasny et al., 2021).

The findings in this field are promising, although nudging appears to be most successful in controlled, easily adaptable environments such as schools or canteens (Abrahamse, 2020; Friis et al., 2017; Lehner et al., 2016). Nudges are not effective for all specific target groups, for example, motivated consumers who fail to put behaviour to practice (Cadario & Chandon, 2019; Friis et al., 2017), and nudging may be more effective when preceded by information and education interventions (Hansen & Jespersen, 2013).

Incentivisation has a focus on creating expectations of reward (Michie et al., 2011), for example, by using price promotions to increase the attractiveness of plant-based meat alternatives. Recent reviews have indicated that only a few studies include incentivisation interventions for meat reduction (Harguess et al., 2020; Kwasny et al., 2021; Onwezen, Bouwman, et al., 2021). The creation of expected rewards may support animal-friendly purchase behaviours (Cornish et al., 2019). Generally, rewards are found to be more effective than sanctioning behaviour, specifically in the context of pro-environmental behaviour (Geller, 2002). However, some studies have indicated that rewards may inhibit intrinsic motivation and, therefore, inhibit long-term behaviour change (Lepper et al., 1973).

Coercion refers to ways to alternate costs of the specific target behaviour, all of which aim to punish 'bad' behaviour (Michie et al., 2011), for example, using true costs or tax regulations. The true cost of meat is different from the current price of meat, as it includes negative environmental externalities such as loss of biodiversity and greenhouse gas emissions (Stevenson, 2018). However, research is scarce on the true cost of meat.

Currently, no European tax regulations regarding meat have been implemented (Bonnet et al., 2020). The literature reveals mixed effects (e.g., Nordgren, 2012; Säll & Gren, 2015). For example, the junk food tax in Hungary was effective in reducing junk food consumption (Bíró, 2015), and the sugar tax in the UK shows promise in decreasing obesity (Briggs et al., 2013). The fat tax in Denmark (Jensen & Smed, 2013), on the contrary, was abolished two years after its implementation due to a poor design (Bødker et al., 2015). Coercion strategies are effective when specific behaviour is costly or difficult to perform because of external barriers (Rothschild, 1999; Ölander & Thøgersen, 2014).

Restriction strategies refer to regulations (Michie et al., 2011) on meat consumption by, for example, making meat less or fully unavailable in canteens or supermarkets. Violations of regulations are met with some type of penalty, such as fines, to make meat less attractive (Lombardini & Lankoski, 2013). Simultaneously, various alternative protein sources, such as insects and seaweed, would become more easily available. Currently, no national studies are available, and the number of studies on restriction strategies is limited (Kwasny et al., 2021).

Specific case studies have been conducted, such as that in Scandinavian schools, where a forced vegetarian lunch menu day led to students leaving school for lunch and higher plate waste for those who stayed in school. It is, therefore, suggested to use nudging instead of regulatory tools, especially for cases in which strong opposing motivations might clash with coercing strategies (Lombardini & Lankoski, 2013).

Modelling strategies refer to the use of inspiring individuals consumers may relate to such that they follow their example (Michie et al., 2011), for example, celebrities or context-related famous individuals, such as chef Jamie Oliver (Cornish et al., 2019). Previous studies have demonstrated that consumers mimic the behaviours of direct role models, such as family, friends, and colleagues, more compared to indirect role models, such as television and movie stars (Ruvio et al., 2013). Providing information on social norms was indicated to be successful in supporting meat-reducing behaviour (Amiot et al., 2018). Social norms

are challenging in the context of meat reduction, as the overall majority consumes meat. Research on dynamic norms shows that consumers who are starting to eat less meat can inspire people to follow, for example, by choosing vegetarian options more often (Sparkman et al., 2020).

Enablement refers to increasing means or reducing barriers to increase capability or opportunity (Michie et al., 2011). Examples mentioned in medicine, for example, are prostheses and surgery to reduce obesity. This type of intervention seems more difficult to apply in the context of meat reduction. One example is labelling systems (Cornish et al., 2019). Labelling systems might enable consumers to buy higher welfare products or less albeit higher quality meat (Cornish et al., 2019). A recent experimental study showed that mandatory front-of-pack food labels with simplified information on environmental characteristics may lead consumers to switch to food baskets with better environmental quality (Muller et al., 2019).

4.5. Literature gaps and directions for future research

Based on a range of systematic literature reviews and my overview, the following research gaps can be defined. Improvement in sampling (not only student sampling), geographical spreading, including real consumption behaviour, and more in-depth insights into underlying mechanisms can be assessed (Kwasny et al., 2021). Furthermore, most studies seem to focus on educational, framing, or environmental restructuring strategies (Harguess et al., 2020; Kwasny et al., 2021). Therefore, it remains difficult to build an understanding of the relative importance of different interventions in the context of meat reduction. More research on, for example, incentivisation and modelling are suggested for future research to further build the overall picture. Moreover, because there is no one solution, multifaceted approaches and combinations of intervention measures are suggested to reduce meat-consumption levels. Targeting policy measures to specific consumer groups according to socio-demographic characteristics, motivations, or prior beliefs will make them more powerful (Kwasny et al., 2021). Future research on these interlinkages of bundling relative importance across interventions and effectiveness for various consumer groups would be worthwhile.

5. Impact assessment: Evaluate the effectiveness

So far, policy measures or interventions have not always been evaluated. Understanding why and under which conditions interventions are effective increases the possibility to improve future interventions (e.g., Steg & Vlek, 2009). The following steps are therefore recommended:

First, by using solid experimental research designs, the effectiveness of single as well as combinations of interventions can be explored. Moreover, including a control group allows exploring the effects of interventions without the 'noise' of external influences (Steg & Vlek, 2009; Taufik et al., 2019).

Second, until now, most studies have examined intentions to reflect upon behavioural changes (Hartmann & Siegrist, 2017). Actual long-term behavioural changes, measuring which is ultimately the ambition of many interventions, have received hardly any attention. It is, therefore, suggested to also study behaviour and its long-term effects (Taufik et al., 2019).

Third, it is highly relevant to understand and monitor why interventions are showing effects. Monitoring behavioural determinants and their changes can shed light on the reasons behind the success of intervention programmes or the lack thereof (Steg & Vlek, 2009). This knowledge might be used to build future interventions.

Fourth, interventions often affect not only the targeted behaviour and segment but also other areas, and one should ascertain that these effects move in the desired direction. Secondary effects such as spillover effects or moral licensing (Blanken et al., 2015) might be considered together with the effects an intervention has on related individuals such as families and peers (Carrico et al., 2018).

Finally, behavioural change includes not only individual factors but also food system factors (van Berkum et al., 2018), for example, producers, value chain actors, consumers, and governmental actors. It is of relevance to acknowledge the complex interrelations and find ways to include multiple actors, for example, by co-creation, reversed design, and living labs (e.g., Conrad & Hilchey, 2011; Wolfert et al., 2010).

6. General discussion

This position paper made the first attempt to use available literature on meat-reduction strategies to describe systematic steps towards behaviour change interventions. Based on previous literature (Michie et al., 2011; Steg & Vlek, 2009), four key steps for interventions towards behaviour change were described: (a) identifying problem behaviour, (b) assessing the main drivers of the specified behaviour, (c) selecting a fitting intervention to change the relevant behaviour(s), and (d) assessing impact.

More specifically, it suggested that it is relevant to understand the problem behaviour and target group. Understanding the underlying drivers of behaviour is relevant to designing and selecting fitting interventions. In some cases, environmental restructuring (e.g., availability of plant-based alternatives), may be effective, whereas, in others, training or coercion (e.g., tax) may be more effective. Generally, combinations of multiple interventions will be most effective, as there is often more than one barrier to decreasing meat consumption or increasing acceptance of plant-based and alternative animal-based proteins (de Bakker & Dagevos, 2012; Graça, 2016; Hartmann & Siegrist, 2017; Nederkoorn et al., 2011; Tiffin & Arnoult, 2011). I suggest also including possible impact and ease of implementation, in addition to a fit with drivers, as criteria to select an intervention. Although doing this might be difficult in practice, many different groups may have different reasons for their behaviour (e.g., Onwezen & van der Weele, 2016). Therefore, interventions may best be tailored to the motivations, opportunities, and abilities of different target groups. Finally, assessing the effectiveness of an intervention in a structured, solid, and broad sense allows exploring why an intervention is effective and for whom (Steg & Vlek, 2009). The current position paper can be used to develop, understand, and test interventions in the future to further support behaviour change in the protein transition.

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