

# Considering how farm animal welfare concerns may contribute to more sustainable diets

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## ABSTRACT

This paper investigates how consumers can be guided towards healthy diets from sustainable and more animal-friendly food systems, in times when no single food system can be considered the best. In order to provide an alternative, the paper focuses on how farm animal welfare concerns can be translated into potential consumer goals, inspired by the “Three Rs” principles of Replacement, Reduction and Refinement, originally developed to systematically improve the welfare of laboratory animals. After some adaptations, the three goals established are 1) to eat less meat, and/or 2) “less and better” meat, and/or 3) “less worrisome” animal protein, respectively, which imply choices described in the literature on consumer behavior. This literature shows that the goal of eating less meat is relatively straightforward, but needs to be made more prominent, and that the goals of eating “less and better” meat or eating “less worrisome” animal protein need more nuances regarding the specific trade-offs that should be made in terms of species, production types and geographic locations. This may help to better integrate the repercussions of food choices for human health, animal welfare, climate change and biodiversity, the relative importance of which varies between countries and consumer segments. In conclusion, it should be emphasized that Reduction, Replacement and Refinement are not just different parts of the same process to meet human health and animal welfare challenges, but also powerful options to combat the climate, biodiversity and—last but not least—food security challenges of the next few decades.

## 1. Introduction

Farm animal concerns might play a role in the pursuit of efforts to change Western eating practices towards healthy diets from sustainable food systems, as recently recommended by the EAT Lancet Commission on Food, Planet, Health (Willett et al., 2019). Although these concerns are not per se new to the literature on food consumption (Blokhuys, Veissier, Miele, & Jones, 2010; Wilkinson, 2015), they may increasingly gain prominence in catalyzing more comprehensive efforts to transform our diets, which is evidenced by the gradual involvement of animal welfare in a wider set of environmental sustainability discourses (Buller, Blokhuys, Jensen, & Keeling, 2018; Visseren-Hamakers, 2020). These efforts include the development of governance instruments aimed at resolving conflicts between animal welfare and sustainability in animal agriculture, for instance, through the promotion of consuming fewer animal products, reducing food losses and waste, and the development of more animal- or environmentally friendly production systems through “sustainable intensification”, “ecological intensification” or organic agriculture (Visseren-Hamakers, 2020). Currently, however, not

one single food system can be promoted as the best overall (Balmford et al., 2018; Budolfson, 2018). Because these circumstances may seriously complicate the communication with food consumers about these issues, there is room for a new approach.

Recent zoonotic outbreaks, such as the COVID-19 pandemic, have led to an increasing public awareness of the increased risks of infectious diseases linked to animals, but, apart from short-term changes, the literature offers no clear evidence of how this will shape the future of meat consumption (Attwood & Hajat, 2020; Espinosa, Tago, & Treich, 2020). A partly related topic of rising concern is animal welfare in industrialized livestock production, transport, and slaughter methods. Recently, it has been noted that the experiences of the scientific community in trying to systematically improve the welfare of laboratory animals through the ethical principles of the Three Rs may be informative for other uses of animals such as in agriculture and aquaculture (Fenwick, Griffin, & Gauthier, 2009). The so-called “Three Rs” principles for animal welfare should not be confused with other R strategies, such as the 3Rs—Reduce, Reuse, Recycle for efficient use of natural resources (van Heek, Arning, & Zieffle, 2017). The principles of animal

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welfare involve *Reduction* of the number of animals used, *Replacement* of animals with inanimate or non-sentient alternatives, and *Refinement* of procedures to minimize pain and distress experienced by those animals that are used (Russell & Burch, 1959). An additional distinction is made between *Absolute Replacement* (replacing animals with inanimate objects) and *Relative Replacement* (replacing more sentient animals, such as vertebrates, with animals that may have a significantly lower potential for pain perception, such as some invertebrates). The general idea is that a successful application of the principles and their interplay by professionals in the domain of animal testing might be transposed to the domain of animals used for food production in order to develop and promote a common ethic of animal use (Fenwick et al., 2009). Extending this work to the world of non-professionals, the assumption can be made that there are morally better (or less bad) ways of using animals (Singer & Mason, 2007) and that the Three Rs can not only guide researchers towards these (Curzer, Perry, Wallace, & Perry, 2016; Scherer, Tomasik, Rueda, & Pfister, 2018), but also consumers who regularly consume farm animals.

The present paper aims to consider how farm animal concerns may contribute to more sustainable diets by applying the three Rs and their interrelations, after some adaptations, as a general guideline. The paper is based on an empirically-driven review, which started with a brief consideration of the principles for the potential guidance of consumer behavior, followed by a description of the context of consumer behavior and market developments in which the principles need to operate. A point of special attention was the choice of theoretical insights, because the literature on the role of animal welfare in consumer decision-making often refers to a gap between what consumers say and what they do (e.g. Vanhonacker & Verbeke, 2009). The collected insights were used to translate the principles and some potential interactions between them into a number of options for consumers. The options were analyzed in order to interpret their appeal to consumers and their conformity with policy objectives, drawing on literature searches in Google Scholar, using keywords of the options such as “better meat,” combined with forward and backward reference searches. Results were synthesized narratively.

The structure of the paper aligns with this approach. Section 2 presents the context of consumer behavior and market development in which the principles need to operate. Section 3 describes the translation of the principles and their combinations into consumer options. Subsequent sections become more specific about the appeal of the options to consumers and their conformity with policy objectives. Section 4 describes meat reduction, either or not in combination with meat replacement. Section 5 considers the combination of reduction and refinement, which may serve the goal of “less and better” meat. Section 6 focuses on the combination of reduction and relative replacement, which may fit the goal of “less worrisome” animal protein. The discussion and conclusions are presented in Section 7.

## 2. The context of consumer behavior and market developments

This section describes the context of consumer behavior and market developments in which the principles of Reduction, Replacement and Refinement need to operate. It also briefly presents the theoretical insights chosen to bridge the gap between what consumers say and what they do. Both social psychological and sociological concepts are mentioned in this connection, including *values*, *attitudes*, *goals* and decisions to engage in or to avoid certain actions or adapt a practice. *Values* are guiding principles in people's lives (Schwartz, 1992, p. 21), which affect concerns and attitudes. The words “concern” and “attitude” are often used interchangeably, although the second is conceptually more accurate. An *attitude* is “a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor” (Eagly & Chaiken, 1993, p. 1). Importantly, concerns about issues or attitudes toward objects are insufficient in and of themselves to incite action, as behavior is driven by *goals*, i.e. desirable and attainable

outcomes of one's actions (Kruglanski et al., 2015). Goals can vary in importance for an individual and can be positively or negatively associated with other goals. Hence, it is important to examine whether meat-eating consumers may be responsive to the goal of improving farm animal welfare and whether boosting this goal can, either or not together with other goals, contribute to a diet change. Voluntary decisions to change something of some importance, such as a repertoire of habitual meat eating, can follow different psychological paths (T. W. Lee, Hom, Eberly, Li, & Mitchell, 2017). The paths may originate from a growing negative evaluation of one or more aspects of meat eating, or the availability of an easy alternative, or the discovery of new meals. These paths will be reiterated below.

### 2.1. Consumer concerns with farm animal welfare

Consumer concerns with farm animal welfare can be studied from different points of view, which are to a greater or lesser extent critical of Western industrialized livestock production systems (Boogaard, Bock, Oosting, Wiskerke, & van der Zijpp, 2011; Vanhonacker & Verbeke, 2014). Deemer and Lobao (2011) mention three examples of how consumer concerns in Western countries can be conceptualized. The *first* concept is a derivative of attitudes toward valuing natural life, which may capture all organisms with natural adaptations and capabilities. *Secondly*, the concept can involve concerns with human inequalities extended to the welfare of non-human animals (e.g. “the underdogs”). *Thirdly*, it can be seen as one of the concerns about food-systems that belongs to the same category as ethical consumption by organic and/or local purchasing. In these ways consumer concerns will differ from other evaluations of animal life, based on the more practical views of livestock farmers (Blokhuys et al., 2010) or on formal ethical and scientific considerations (Mellor, 2016).

Importantly, the degree to which consumers are exposed to animal welfare issues may vary significantly, because food producers and retailers have stimulated two contrasting tendencies in the marketing of animal products. On the one hand, there is an ongoing process to de-animalize animal products by hiding their origin, because many consumers do not like to be reminded of the slaughter process (Elias, 1978; Vialles, 1994). On the other hand, but on a much smaller scale, there are initiatives to re-animalize animal food products by highlighting (pastoral) animal life, not as an isolated feature, but in conjunction with a number of related environmental, health and territorial advantages used to create a composite construction of product quality (Buller & Cesar, 2007; Oejo, 2014).

The responses of consumers to animal welfare issues will not necessarily be consistent with ethical principles; most people seem to have relatively low moral ambitions, aiming to be about as morally good as their peers—not explicitly better, not explicitly worse (Schwitzgebel, 2019). The phenomenon of “do-gooder derogation” reveals how individuals tend to react negatively to those whom they perceive as promoting exemplary moral behavior, which, for instance, has been shown to seriously hamper the communication between omnivores and vegetarians (Greenebaum, 2012; Minson & Monin, 2012). In the words of Francione (2012), the dominant position on the matter of animal ethics in most Western countries is that although animals have some moral value, they have less moral value than do humans, and, therefore, it is acceptable to use animals for our purposes as long as we treat them “humanely” and do not inflict “unnecessary” suffering on them. From a very early age, children can form judgments of the act of killing, taking into account mitigating circumstances that mirror Western normative ethical standards, i.e. killing an animal is bad, but killing an animal for food is less bad, unless it is due to greed for food (Pnevmatikos, 2018). Moreover, as a result of the tendencies to de-animalize animal products, the principles have to be applied by groups of consumers who eat animal protein, but have no direct contact with the farm animals themselves and may also lack involvement in the true nature of meat production (Gangnat et al., 2018; Schröder & McEachern, 2004).

## 2.2. The goal of farm animal welfare improvement

In terms of consumer behavior a key question is whether they are at least somewhat responsive to the goal of farm animal welfare improvement. Although many studies have been done on consumer values and attitudes related to farm animal welfare (Cornish, Raubenheimer, & McGreevy, 2016; Vanhonacker, Verbeke, Van Poucke, & Tuytens, 2007), much less attention has been given to the question whether the notion of improving farm animal welfare can become a goal for an individual in a given situation. Nevertheless, the logic of this process might be described as follows. Starting with the concept of values and moving to the choice of a particular action, several factors play a role. Having particular values, such as universalistic values (reflecting motivation to contribute to the welfare of the wider society, including nature), makes it more likely to develop, through experience and learning, animal-friendly attitudes (Cembalo et al., 2016; de Boer, Hoogland, & Boersema, 2007). These attitudes have to be transformed into desirable and attainable goals that are worth pursuing by engaging in appropriate behaviors (Kruglanski et al., 2015). In other words, goals combine a value component (desirable) and an expectancy component (attainable). In case of ethical consumer behavior, the latter can take the form of a general belief that the efforts of an individual can make a difference in the solution to a problem (also called perceived consumer effectiveness, see Ellen, Wiener, & Cobb-Walgren, 1991; Kinnear, Taylor, & Ahmed, 1974). Next, the goals need to be activated and to become dominant in the given situation rather than being overridden by alternative objectives (Kruglanski et al., 2015). Also, for a given action to be carried out in specific circumstances it would need to be chosen as the preferred means to the dominant goal out of the set of currently accessible means to that end (Kruglanski et al., 2015).

The logic of goal-directed behavior brings with it that the likelihood of a particular action depends on several person-related and situation-related factors, which are part of wider social and cultural processes. The actions are often what sociologists call “social practices” (Bourdieu, 1984; Reckwitz, 2002), involving people who actively integrate (1) particular materials, (2) cultural meanings of materials and processes, and (3) forms of competence as ingredients of a practice, such as barbecuing (Dummitt, 1998; Shove & Pantzar, 2005). Hence, sets of desirable and attainable goals may already be part of a given practice. Helping to improve farm animal welfare might be the focal goal of certain specific actions, such as donating money to animal welfare movements (Dietz, Allen, & McCright, 2017). It may also become one of the background goals in the case of actions aimed at other goals. A background goal is a goal of secondary importance which may also influence choices, such as time saving and food security. Although, it is not the focal goal of food consumption practices to improve farm animal welfare, such practices have socially recognized repercussions for animal life and reducing these may become a background goal.

The above means that a growing negative evaluation of one or more aspects of meat eating is one of the paths to a decision to change something. The likelihood of the change depends on the “embeddedness” of the practices in a person’s life, together with the attitudes towards other aspects of meat eating and the perceived alternatives (adapted from T. W. Lee et al., 2017). In the case of meat eating, the decision may focus on just one meat ingredient or on more than that, such as the person’s repertoire of potential meals. In addition, the preferred means to the goal can be chosen by either selecting “the best” or eliminating “the worst” options from a choice set (Higgins, 2012), which may result in a choice for “better” meat or for meat that is “less worrisome” than other meats.

## 2.3. Improving the role of background goals

Overall, the factors mentioned above can explain why animal-friendly attitudes do not necessarily lead to particular actions, such as purchasing food products with higher animal welfare standards, as they

will often take the form of a background goal when shopping. Importantly, the literature on goal-theory suggests that there are several ways to facilitate the influence of a background goal on consumer decisions, some of which may easily backfire, however (Aspara, Chakravarti, & Hoffmann, 2015). The *first* way is that the person is subtly reminded of the particular goal (e.g. eating in an animal-friendly way) that might be satisfied by choosing one of the available alternatives. Some food-related (Hoogland, de Boer, & Boersema, 2005) and non-food-related experiments (Aspara et al., 2015) show that this approach can work if the reminders are subtle enough. However, explicit reminders of the background goal (the *second* way) are likely to trigger a backlash, because they can make the person think about missing the focal goal (e.g. food that is tasty) (Aspara et al., 2015). Such a backlash effect may also be based on the belief that a product that is explicitly promoted as better for ethical reasons may be inferior on other attributes. The *third* way is that the influence of a background goal on consumer decisions is facilitated by a food environment in which popular focal goals (e.g. getting healthy and tasty food) are already likely to be achieved. In that case, a background goal (e.g. food that is also animal-friendly) may gain more importance (Fishbach & Dhar, 2005; Unsworth, Dmitrieva, & Adriasola, 2013).

A different way to facilitate the influence of a background goal on consumer decisions is by creating conditions to couple different background goals that may contribute either to a growing negative evaluation of the status quo or to the benefit of one alternative choice option that can serve multiple goals (i.e. “two birds with one stone” or multifinality) (Kruglanski et al., 2002). Highlighting the combination of higher product quality and improved animal welfare is an example of this strategy, which may avoid the risk of backlash effects and can appeal to particular consumer segments (Vanhonacker & Verbeke, 2009). In sum, this means that there are several conditions that can increase the role of animal welfare concerns in consumer decision making.

## 2.4. Differences between markets

Voluntary decisions to reduce the consumption of one or more types of meat may also originate from the availability of an easy alternative or the discovery of new meals. The opportunities that consumers have to respond to the three Rs principles depend on the protein choices and replacement or refinement options provided by the market and thus differs per country or region. In Europe, for example, there is a split in the meat market for consumers, dividing countries with high incomes and high meat price levels, such as Germany and Denmark, from countries with medium or low incomes and low meat price levels (GfK, 2012). Higher prices are, to a certain extent, correlated with more quality cues, including those that may signal higher animal welfare standards (Buller & Cesar, 2007). Similar country differences are revealed by the fast growing markets for plant-based meat and dairy substitutes in Northwestern Europe, thanks to increased consumer demand and a wave of new products, even without cell-based meat yet (ING Research, 2020). These national differences, which cannot be elaborated here, have to be kept in mind when considering the principles.

## 3. Translation of the three Rs into potential consumer goals

This section gives an overview of how “reduction”, “replacement”, “refinement” and their interrelations can be translated into practical consumer goals that may contribute to more sustainable diets. As emphasized by some experts, it is important to carefully consider the potential implications of the principles; when applied in concrete situations, one of them may have a positive or negative effect on one or both of the other Rs (de Boo, Rennie, Buchanan-Smith, & Hendricksen, 2005). Moreover, the position of animal welfare issues in relation to current understandings of food and sustainability issues (Buller et al., 2018; Visseren-Hamakers, 2020) may require some adaptations. From a

sustainability perspective, the total amount of protein consumed (or wasted) from animal-based and plant-based sources should be reduced, together with a shift from mainly animal to mainly plant protein (Willett et al., 2019). Although there are synergies between these reductions and animal welfare improvements, a reduction in the amount of animal protein eaten does not always correspond with an equal reduction in the number of animals used, as would be required by a reduction in the sense of the three Rs (Scherer et al., 2018). This potential conflict with the original intention of the three Rs is, in particular, clear when it comes to choices and circumstances that call for trade-offs between animal protein sources that have very different sizes, such as cattle, poultry and insects. The same applies to trade-offs between animal protein sources that are kept in different production systems, for example, when it appears that greenhouse gas emissions are lower per animal in intensive and specialized production systems than in extensive, often more animal-friendly systems (Visseren-Hamakers, 2020).

A closely related issue is the relationship between the principles. If minimizing harm done to laboratory animals is the main objective, the Three Rs can be interpreted in a hierarchical way with Replacement of all animals put first (Curzer et al., 2016; Scherer et al., 2018), as it can totally eliminate harm (but see de Boo et al., 2005). From a sustainability perspective, there is no hierarchy implied with animals intended for consumption. Reduction can be more interesting than Replacement, particularly when it is not only linked to “less animals used,” but also to “less protein used or wasted” and “less environmental damage caused”, although the three reductions will not go together under all circumstances. In the case of protein, Reduction can occur without Replacement, but Replacement without any Reduction would be less productive. Absolute Replacement reduces industrial animal farming, its inefficiencies and its damage to the environment, but these gains may be counteracted if animal protein is replaced with highly processed meat alternatives. Relative Replacement within the category of animal protein sources may lead to choices of more efficient and less damaging, but less animal-friendly products.

Fig. 1 depicts the three principles and some potential interactions. A potential positive interaction of Reduction and Refinement is that households which generate some weekly cost savings because they buy less animal protein (but still want to remain meat eaters) may increase

their budget for meat with higher animal welfare standards. Among other households, however, the idea that they already consume less animal protein per week may reduce the perceived urgency of buying better meat. Similarly, a potential negative interaction with Refinement is that choosing meat with higher animal welfare standards may reduce the perceived urgency of Absolute Replacement.

Taken together, the various possibilities depicted in Fig. 1 indicate that the three Rs provide several options for meat-eating consumers who are responsive to the goal of animal welfare improvement. In line with the theoretical insights presented in Section 2, it can be said that consumers' reactions may primarily depend on the way they interpret the options and the relative importance of the various goals they have in mind in addition to the animal welfare goal. For a consumer with an animal welfare goal, the least complicated option might be to opt for a meal with simply less animal protein (Reduction and Absolute Replacement). If the goal is not strong enough and conflicts with other goals, then the alternative might be to opt for a meal with “less but better” meat (Reduction and Refinement). If that also conflicts with other goals, the alternative might be to opt for a meal with “less worrisome” meat (Relative Replacement and Refinement). Hence, with some adaptations, the Rs can be translated into goals to eat less meat, or “less and better” meat, or “less worrisome” meat, which can be extended in terms of “less worrisome” animal protein. The goals imply choices that are described in the literature on consumer behavior. The next sections become more specific about their appeal to consumers and their conformity with policy objectives.

#### 4. Steps towards meat reduction

This section focuses on some conditions that may further guide consumers' evaluation of meat eating or trigger a change of action, either or not in combination with Absolute Replacement. Given the high levels of protein intake in many Western countries, Reduction without Replacement can be an adequate first step (Aiking & de Boer, 2020). However, the literature on decision-making shows that there are many situations in which people accept a growing negative evaluation of certain aspects of their behavior and, subsequently, have to be triggered or prompted to change, due to the embeddedness of the behavior in their

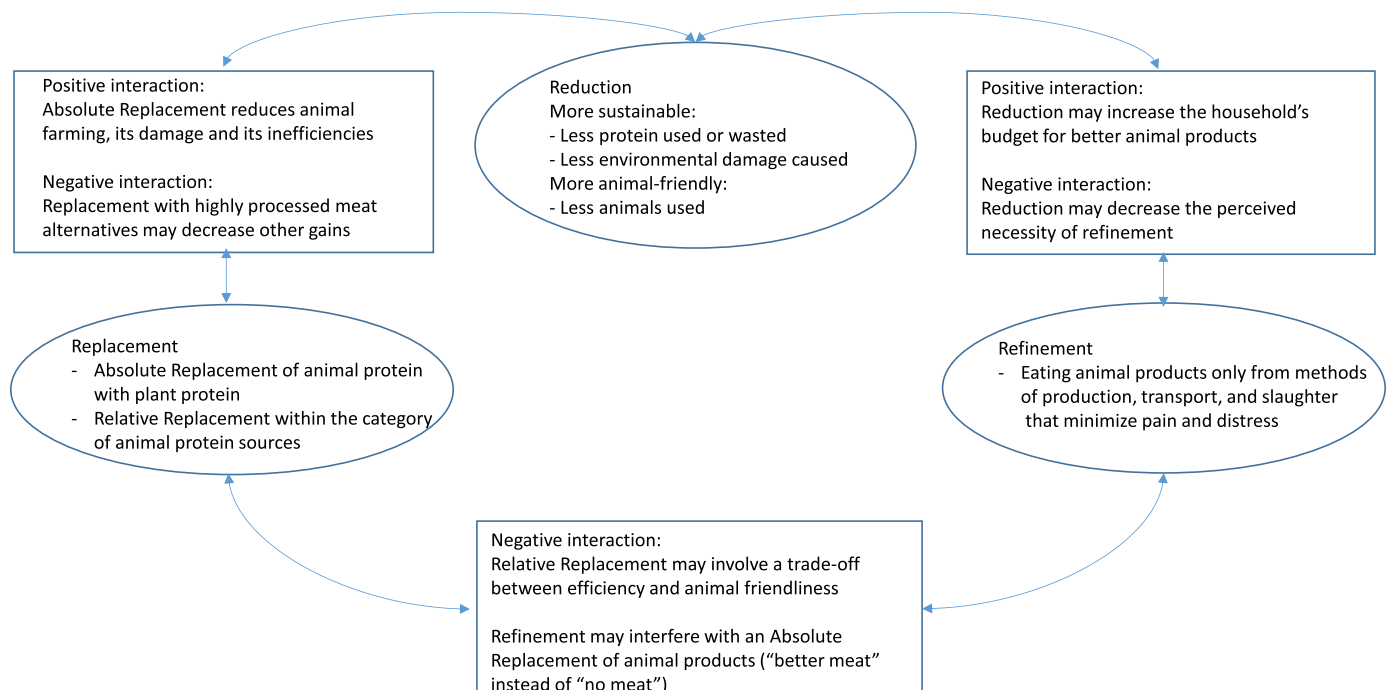


Fig. 1. Overview of the three Rs and their potential interactions (adapted from de Boo et al., 2005).



life (T. W. Lee et al., 2017). In the case of meat eating, reduction seems to have been hampered by various “paradoxes” that surround this behavior. One of the paradoxes is that people may simultaneously dislike hurting animals and like eating meat (Loughnan, Haslam, & Bastian, 2010). It also appears that consumers are more sensitive to animal reminders in a Western country where they are rarely exposed to unprocessed meat than in a country (i.e., Ecuador) where such exposure is common (Kupsala, 2018). The former are eating meat in a setting far-removed from the lives and deaths of animals, which leaves much room for psychological (Bastian & Loughnan, 2017; Graça, Calheiros, & Oliveira, 2016; Hartmann & Siegrist, 2020) and sociocultural (Oleschuk, Johnston, & Baumann, 2019) mechanisms to solve or dissolve a paradox, without a change in consumption patterns. However, a new perspective is that there are now also health-related (Willett et al., 2019), climate-related, and biodiversity-related reasons to reduce meat eating (Machovina, Feeley, & Ripple, 2015) and more alternatives (He, Evans, Liu, & Shao, 2020).

#### 4.1. The role of values

Concern for the environment and concern for animals are often seen as related concerns (Kendall, Lobao, & Sharp, 2006). They may both have their roots in universalistic values, which, in the approach of Schwartz et al. (2012), are linked to environmental protection, nature conservation, social concern, social justice and social tolerance. In environmental research, the nature- and environment-related value-items have been converted into a “biospheric value orientation” (Van der Werff, Steg, & Keizer, 2014). However, given the fact that there may be differences between concern for animals as such and concern for animals at the species level as an integral part of an ecosystem, various authors (Dietz et al., 2017; J. A. Lee et al., 2019; Suchyta, 2021) have proposed to add a distinct “animals value” to the set. This addition appears to fit well into the adjacent nature-related values (J. A. Lee et al., 2019), but it has not become standard practice. The differences between “animal,” “environment” and “nature” become clearer going from broad values to more specific attitudes. Regarding the attitudes expressed by social movements, it has been noted that animal rights movements have sometimes been more radical than environmental movements (Rootes, 2004), which reveals that animal-related issues can evoke stronger emotional and moral responses. Research into the attitudes of individuals shows differences between attitudes toward environmental protection, which often require self-sacrifices, and attitudes toward nature preservation, which may be grounded in enjoyable experiences involving natural settings and features of the natural world (Kaiser, Hartig, Brügger, & Duvier, 2013). Therefore, to the extent that farm animal welfare concern is derived from an attitude toward valuing natural life (Deemer & Lobao, 2011), it is also related to and distinct from an attitude toward environmental protection, and both the animal-related and the environment-related attitude can be relevant for meat reduction (de Boer & Aiking, 2021). In sum, there are subtle, but important differences between various interpretations of these variables, which have not been fully investigated yet.

Correlational studies in samples of the general population show that universalistic values and animal-friendly attitudes are simultaneously associated with lower levels of meat consumption and a preference for more animal-friendly produced meat (Clonan, Wilson, Swift, Leibovici, & Holdsworth, 2015; de Boer et al., 2007). The latter is the topic of the next section. Focusing on reduction, small but theoretically meaningful correlations of universalistic values have been found with lower levels of meat consumption (Graham & Abrahamse, 2017; Hayley, Zinkiewicz, & Hardiman, 2015; Lea & Worsley, 2001) or closely related variables such as a less positive red meat attitude (Allen, Ng, & Hung, 2003) and an intention to reduce red/processed meat consumption (Carfora, Conner, Caso, & Catellani, 2020; Van der Werff et al., 2014). In particular, the single subset of nature- and environment-related universalistic values correlates with a higher preference of plant protein over animal protein

(de Boer & Aiking, 2011). These correlations appear to be typical for red meat and for European, American or Australian samples; for instance, they were not found in India, where vegetarians abstain from meat eating because they regard the eating of meat as pollution (Ruby, Heine, Kamble, Cheng, & Waddar, 2013).

#### 4.2. Interventions to reduce meat consumption

Recent experimental studies have investigated potential interventions to reduce meat consumption by specifically appealing to animal welfare. A review of these studies, conducted by Mathur et al. (2021), shows that the interventions vary in several ways and include displaying photographs of meat dishes alongside photographs of the animals from which they came, providing graphic verbal or visual depictions of welfare conditions in factory farms, providing information about the animal-friendly norms and behaviors of other people, or providing information that gives concrete implementation suggestions for reducing meat consumption. Hence, they may in different ways affect decisions about meat consumption. Based on a meta-analysis, Mathur et al. (2021) conclude that the interventions appear effective in typically short-term studies of primarily self-reported changes in behavior or behavioral intentions, but that the studies have many shortcomings and problems in the control of social desirability effects. One of the weaknesses of current work is also that it does not consider the role of the context in which a particular intervention can fruitfully work, without generating backlash effects. This makes it difficult to judge the likelihood of real-world steps towards meat reduction.

One of the few well-documented experiments that gives an estimate of real-world changes is an education-based intervention in a North American college canteen setting, which enabled the use of purchase data. During twenty weeks after a lecture about meat, health and climate change (i.e. not specifically about animal welfare), the meat-based meal purchases fell by 8% and plant-based meal purchases increased by 20%, relative to control conditions (Jalil, Tasoff, & Bustamante, 2020). According to the authors, two key features facilitated the observed dietary changes in their setting: 1) a receptive audience that views climate change as a policy priority; and 2) a canteen food environment with affordable and readily available plant-based options. Although acknowledging that much larger movements away from meat and toward plants are necessary, the authors note that this type of soft, “awareness-raising” interventions is likely a necessary first step in the sphere of public policy (Jalil et al., 2020).

#### 4.3. Recent developments

Apart from the potential impacts of concerns about climate change and biodiversity, another relevant recent development is that the market for plant-based replacement is becoming more mature (He et al., 2020). There is now a wide range of convenience products, based on novel functional protein ingredients (plant-based or cell-based), and consumer products with a high profile in the market (burgers). Yet market analysts see much room for improvement by reducing the price gap with animal-based products, improving the user experience (through better taste and nutritional profile), and increasing distribution and availability (ING Research, 2020). In addition to the availability of alternatives, decisions to change may also be affected by the discovery of new meals, such as spicy, plant-based meals that use authentic plant protein sources (nuts, chickpeas and lentils), often inspired by ethnic cuisine (Melendrez-Ruiz, Buatois, Chambaron, Monneray-Patris, & Arvisenet, 2019; Schösler, de Boer, & Boersema, 2012; Spencer, Cienfuegos, & Guinard, 2018). However, such discoveries are less likely for consumers who lack an adventurous taste and are regular meat eaters (Schösler et al., 2012).

In sum, the goal of meat reduction has some appeal to certain consumers but the likelihood of real-world steps towards meat reduction is small. Given the embeddedness of meat eating in a person's life, the

reduction goal needs to be made more prominent, for instance, by better integration with other goals. The goal's degree of conformity with policy objectives can be high, but depends on the benefits of the alternatives, which are not all transparent at the moment.

## 5. Opting for a meal with less but better meat

This section is devoted to the combination of Reduction and Refinement. For those consumers who want to continue to eat some meat, while acknowledging the importance of animal welfare, it is an option to choose a product that might be considered "better" meat. This may not easily become a common practice, however, as many consumers seem to be accustomed to highly standardized and de-animalised meat products, commonly sold in supermarkets (Vialles and Underwood, 1994). As a result, it may be necessary to remind consumers of the animal and the importance of animal welfare when shopping. An experiment in which ordinary supermarket customers in the Netherlands were subtly reminded of links between meat and animals, which were embedded in a quiz, revealed that the answers to subsequent questions on meat choice criteria were more in favor of the animal welfare criterion after the manipulation than in the control group, but only among those who endorsed universalistic values (Hoogland et al., 2005).

### 5.1. Segments of consumers

Less and better meat appeal to certain segments of consumers. Correlational studies show that universalistic values and related animal friendly attitudes are associated with choices for animal friendly meat (Clonan et al., 2015; de Boer, Schöslér, & Aiking, 2014; Toma, McVittie, Hubbard, & Stott, 2011; Vanhonacker, Van Loo, Gellynck, & Verbeke, 2013; Vanhonacker & Verbeke, 2009) and fish (Zander & Feucht, 2018). Animal friendly attitudes are also associated with a preference for smaller meat portions (de Boer et al., 2014) or a lower meat consumption frequency (Malek, Umberger, & Goddard, 2019; Piazza et al., 2015; Sonntag et al., 2019; Vanhonacker et al., 2007). In addition, it might be that the combination "less and better" appeals to consumers for various reasons, for example, to hedonistically compensate for the fact that they reduce the amount of meat they eat (Sahlin, Rööös, & Gordon, 2020), or to justify that they eat more meat than they feel they should (Schröder & McEachern, 2004), but this has not been established systematically.

The importance of animal welfare attitudes in decision-making is always relative to one's evaluation of the current state of farm animal welfare. Consumers who tend to buy animal-friendly products may not be different from the others because they positively evaluate animal-friendly produced meat, which is a rather socially desirable opinion, but because they consider conventional products unacceptable (de Boer, Boersema, & Aiking, 2009; Vanhonacker et al., 2007). A choice experiment in Germany shows that certain consumers (often customers of organic retailers) were more likely to choose the no-buy option than the cheap conventional meat option, if they had no other choice (Risius & Hamm, 2018). A special segment might be called "conscientious omnivores" as they aim to eat meat or fish only when it satisfies certain ethical standards (Rothgerber, 2015). One of the options for larger segments of consumers is to buy organic meat, but the main reason to buy organic meat used to be the belief that it has fewer residues (pesticides, hormones, antibiotics), is safer, and healthier (Van Loo et al., 2010). Some experiments have shown that consumers do not fully understand that organic meat products should also meet higher animal welfare standards (Cornish et al., 2020; Hoogland, de Boer, & Boersema, 2007). In these cases, the provision of additional information may significantly increase the intention to purchase higher than conventional welfare products. A recent German study based on household panel data reports that animal welfare was the most important determinant for organic meat purchases, i.e. more than the combination of healthiness and naturalness, or environmental protection (Schäufele & Janssen,

2021). A study among European fish consumers found that whether it is "higher animal welfare standards," or "according to organic standards," or "sustainably", that appeals most to consumers varies between countries (Zander & Feucht, 2018).

### 5.2. Recent developments

In considering the appeal to consumers and the conformity with policy objectives, it should be noted that the production and marketing of "better meat" are not unproblematic. One of the polarizing issues is the relative importance given to minimizing animal health issues and promoting natural behaviors (Blokhuis et al., 2010; Sonntag et al., 2019; Vigers, Ewing, & Lawrence, 2021). There is also a tension between producers' paradigms of animal welfare in intensive animal production and concepts of naturalness as the latter are used in animal product marketing, based on the expectation that these concepts conform to what consumers want (but see the more nuanced picture provided by Vigers et al., 2021). A Swedish study demonstrates how specific marketing instruments are being used to display a green, eco-, climate-, and animal friendly production in order to sell animal products that, in fact, conform to the paradigms of animal welfare in intensive animal production (Borkfelt, Kondrup, Röcklinsberg, Björkdahl, & Gjerris, 2015).

Highlighting the better meat products may require that more attention is given to the farm animal than is common in conventional supermarkets. That involves a re-animalization of meat products in combination with higher quality cues (Buller & Cesar, 2007; Ocejo, 2014). This development is in particular attractive to special consumer segments, such as gourmets who regard the presence of the animal in meat as important for its quality (Kupsala, 2018; Schöslér & de Boer, 2018). These gourmets may not necessarily also prefer to moderate their meat consumption, but they tend to like types of meat and offal (nose to tail) that ordinary consumers dislike (Ocejo, 2014). Re-animalization and quality improvement may also be attractive to other stakeholders in the food chain, such as retailers and farmers. However, that does not apply to encouraging and assisting consumption reduction. A recent study among the retail sector in the United Kingdom into their marketing activities to promote "less and better" meat and dairy as a core component of sustainable diets indicates that, while marketing strategies related to "better" meat and dairy are being adopted, no retailer is implementing interventions focused on reducing purchasing of meat products (Trewern, Chenoweth, Christie, Keller, & Halevy, 2021). Yet, reduction may fit well into more innovative business models that are also more transparent about animal welfare (see below).

In sum, the goal of "less and better" can appeal to several segments of consumers, but it needs more transparency regarding the specific species, production types and geographic locations that might be considered "better". Increasing transparency is a major responsibility of professionals in the field. Moreover, the notion of "less" should not be neglected.

## 6. Opting for a meal with less worrisome sources of animal protein

This section addresses the combination of Reduction and Relative Replacement, i.e. within the category of animal protein sources. From the perspective of consumers, the goal might be to choose less worrisome sources of animal protein. In a Western country, a preference for white over red meat may correlate with meat avoiding attitudes (de Boer & Aiking, 2011). More generally, there is a long-term trend in meat consumption that involves the relative shift from red meat (beef and pork), away from animal fat, to poultry (Cederberg, Hedenus, Wirsenius, & Sonesson, 2013; Daniel, Cross, Koebnick, & Sinha, 2011). Poultry is acceptable to a wide diversity of cultures, traditions and religions (Mottet & Tempio, 2017). A large European survey shows that many consumers (74%) say they are willing to replace beef or pork with poultry or fish for environmental reasons (European Commission,

2013). Additionally, some experiments demonstrate that providing meat eating consumers with specific examples of environment-friendly meal replacements can stimulate small changes, which often include replacements with poultry (Lacroix & Gifford, 2020; Morren, Mol, Blasch, & Malek, 2021). Hence, there is an important potential of consumers who can be triggered more by this type of meal examples.

### 6.1. Specific trade-offs

In terms of conformity with policy objectives, however, it should be noted that trade-offs at the level of beef versus poultry or fish are much too general and need to take better account of the specifics of species, production types and geographic location. Beef has the largest impact on climate change (Cederberg et al., 2013), but pasture based or extensive cattle husbandry with suckler cow rearing has benefits for animal welfare and nature conservation (Risius & Hamm, 2018; Sahlin et al., 2020). The current trend in the market is closely related to the industrialization of poultry production processes enabled by specific technological changes (e.g. advances in breeding poultry to increase animal size), which made poultry one of the fastest growing agricultural subsectors of the past decennia (Mottet & Tempio, 2017). In comparison with beef and pork its environmental impacts may be much smaller (Cederberg et al., 2013), which can make it less worrisome. Despite its benefits to food security and nutrition, however, industrially produced poultry represent a threat to human health, especially as a vector of infectious diseases and because of its role in antimicrobial resistance (Mottet & Tempio, 2017).

Moreover, it has to be acknowledged that eating poultry is related to several animal welfare and ethical issues. Relative Replacement is based on differences in sentience, but there are also differences in holding systems. The welfare issues depend on the latter and can be mitigated by initiatives to produce and market animal products with animal welfare advantages (del Bosque, Busch, Spiller, & Risius, 2020; Vanhonacker & Verbeke, 2014) or “compromise products” with small increases in animal welfare level and associated costs (de Jonge, van der Lans, & van Trijp, 2015). However, an additional ethical issue is that the number of animals being factory farmed and killed goes up dramatically when people choose to eat poultry meat (Scherer et al., 2018). An Australian consumer experiment had in one of its four experimental conditions a number of participants who agreed to eliminate during one week poultry from their diets, based on the argument that it takes more than 200 birds to provide the same number of meals as one cow (Dakin et al., 2021). Engaging consumers with this issue has been a unique experiment so far, however.

The experiment conducted by Dakin et al. (2021) was based on three-hundred participants recruited from a “paid research” pool run by the university. The researchers presented the participants with the rationale for one of four specific meat reduction diets, asked them to commit to the diet for a seven-day period, and measured their meat consumption and attitudes before, during, and two weeks after this period. One diet was related to climate change and involved eliminating red meat, three were related to ethical reasons and involved either eliminating poultry, or reducing the amount of meat, or eliminating all meat and fish. The results revealed that each diet assignment had some impact on participants’ meat consumption and attitudes afterwards without differences between the groups. Dakin et al. (2021) concluded that the diets were equally effective “foot in the door” methods for making participants reconsider their meat-eating behavior and attitudes, although the vegetarian diet was rated as the most difficult of the four and was not completely adhered to. Notably, the design does not allow for general conclusions on the relative effectiveness of replacement and reduction strategies, or strategies that appeal to either the environment or animal welfare.

### 6.2. Specific replacements

Some specific replacements within meals and recipes have been investigated in correlational and modelling studies. This work emphasizes the importance of accounting for individual food habits (i.e. to eat beef or to eat take away food) when issuing nutritional recommendations, because the participants’ willingness to change portion sizes or to adopt new protein sources varies depending on the food groups concerned (de Gavelle et al., 2019). Other studies underline the relevance for replacement of the distinction between meat-centered and mixed dishes. Experiments with existing recipes of meals where meat is not the center of the dish show that 50% of the protein of animal origin can be replaced with well-chosen plant-based proteins and spices, without a significant loss of sensory appeal (Spencer et al., 2018). Hence, the distinction between Absolute and Relative Replacement can be nuanced by differences in quantity per meal and/or frequency of food intake per week.

In this connection, some remarks should be made on replacement with fish or insects. Fish has several benefits that make it a desirable part of a healthy diet (Thilsted et al., 2016) and it causes less environmental pressure than other animals that are fit for human consumption (Reynolds, Horgan, Whybrow, & Macdiarmid, 2019). However, much more integrated research is necessary to assess how both capture fisheries and aquaculture can sustainably meet increasing global demands for fish. Hence, public health institutes have reasons to consider the optimum number of fish servings per week, beyond which there are no additional health gains, but only sustainability losses due to overfishing (Kromhout, Spaaij, de Goede, & Weggemans, 2016). Moreover, fish consumption is also related to animal welfare and ethical issues. Being vertebrates, fish have many traits in common with the more familiar intensively farmed animals, such as pigs and poultry; they also differ from terrestrial animals in other ways that are important when it comes to welfare (Huntingford & Kadri, 2014).

Farmed insects are currently not popular as meat replacers, but questions on welfare and ethical aspects are gaining more attention. Whether insects should be treated as “sentient beings,” is under discussion (Van Huis, 2019), but this is not the only issue. As noted by Van Huis (2019), scholars who consider the large number of farmed insects needed for food or feed may propose to discourage the consumption of insects and favor plant-based diets (e.g. Scherer et al., 2018), but in order to produce plants for food, billions of insects have to be killed by insecticides (Fischer, 2016). Taking also their history on our planet into account, Van Huis (2019) concludes that insects should be treated with respect.

Overall, the literature demonstrates that Relative Replacement may appeal to consumers and that it might become increasingly important. However, its conformity with policy objectives depends on the specifics of species, production types and geographic location, which need much more attention from professionals in the first place.

## 7. Discussion and conclusion

The previous sections have shown that the three Rs may succinctly capture the core message of a diet transition and, with some adaptations, can be translated into potential consumer goals. The goals aim to eat less meat, or “less and better” meat, or “less worrisome” animal protein, which imply choices that are described in the literature on consumer behavior. The literature shows that the goal of eating less meat is relatively straightforward, but needs to be made more prominent, for instance, by better integration with other goals. A different point is that the goals of eating “less and better” meat or eating “less worrisome” animal protein need more nuances regarding the specific trade-offs that should be made in terms of species, production types and geographic locations. In this way, farm animal concerns have much potential to engage both professionals and consumers in a common process of thinking and acting in line with the challenges of more responsible diet



choices, while avoiding the presumption that a single food system is the best (Budolfson, 2018). The principles may help to better integrate the repercussions of food choices for human health, animal welfare, climate change and biodiversity, the relative importance of which varies between countries and consumer segments. A case in point is the recently developed, more integrated guide on Swedish meat, which appears to provide consumers with an understanding that any food product chosen comes with trade-offs (Spendrup, Rööös, & Schütt, 2019).

However, this conclusion will apply only to informed consumers who are relatively highly involved with food. Given the complexities of the trade-offs, it has to be acknowledged that most consumers are not capable of determining which behavior changes are desirable and attainable and, therefore, worth doing (Thøgersen, 2021). To involve more consumers, it may be necessary to conceptualize diet change as a social process rather than as an individual-based phenomenon. Market shifts that reflect a shift in ethical beliefs may require a triggering or catalyzing change in cultural meanings, such as the distinction made in the recent past between eggs from “caged” and from “free” birds, which impacted producers, distributors, retailers, food manufacturers and consumers, but had to be stimulated by social activist groups who built coalitions—first with other activist groups, then with retailers and producers—to act in a coordinated and sustained way to bring about market change (Ruiz, Baker, Mason, & Tierney, 2020). The new distinction in the market may require some degree of moral struggles, which can be higher (Balsiger, 2016; Ruiz et al., 2020) or lower (Saatkamp, Vissers, van Horne, & de Jong, 2019). Although the importance of social processes cannot be elaborated here, the literature suggests several themes that may stimulate such a change, including the re-animalization of food products, the development of more innovative business models, and the further promotion of the cultural significance of “better” food choices.

### 7.1. Stimulating themes

From a societal perspective, re-animalization is important to better communicate about alternative production systems that may be economically less profitable than the current ones, but can generate other benefits. An example is the use of traditional dual-purpose breeds, providing both meat and milk or meat and eggs, which may increase the genetic diversity in animal breeding. To give consumers easily understandable information about breeds and make the product more personal, it is considered helpful to present pictures of animals on meat packages, but research shows that such pictures are currently only accepted by a smaller segment of consumers who are more involved with animal welfare (del Bosque et al., 2020). From an economic perspective, it has been calculated that in high-income countries a win-win scenario might be created, where consumer preferences for diets with less red meat are accompanied by a transition in livestock production systems towards higher average quality of beef (Soler & Thomas, 2020). For instance, whereas intensive cattle production is one of the primary causes of biodiversity loss, pasture-based animal husbandry has the potential to enhance biodiversity and offers a “public-good” with high-quality meat (Butler, Ali, Oladokun, Wang, & Davis, 2021; Stampa, Schipmann-Schwarze, & Hamm, 2020). More generally, there may be societal benefits associated with improving the quality of animal welfare and human-animal interactions that extend beyond production gains, including benefits to the animal, positive effects on the workforce, competitive advantage for businesses, mitigation of animal and human health risks, and positive social consequences (Fernandes, Hemsworth, Coleman, & Tilbrook, 2021).

In addition, the social image of plant-based meals has to be improved, for instance, by better preparation methods and meal concepts, possibly inspired by creative meals that are meat-free and provide a new taste or texture experience, as offered in the luxury gastronomic industry (Batat, 2020). Many food trends and innovations “trickle down” from fine dining to other restaurant segments; however, there is

also the potential “trickle up” or learning effect for other foodservice segments from systematic innovation processes in the quick-service restaurant chains to address the growing “foodie” culture (Ottenbacher & Harrington, 2009). These social processes may benefit from the positive association between social status, ethical consumption and certain new food practices in urban centers, which has been recently described in the literature (Carfagna et al., 2014; Hanser & Hyde, 2014). In the urban context, “food has become an important avenue through which key social values are expressed and furthered; and is associated with beauty, authenticity, cultural diversity, environmental consciousness, a connection with nature and with community, a commitment to social justice, or the honest, hard work associated with small-scale farmers and craft producers” (Hanser & Hyde, 2014, p. 46). This growing cultural significance of food is an important development, but it should be noted that elitist tendencies in relation to food might become counter-productive for public policy purposes (Bourdieu, 1984; Dubuisson-Quellier & Gojard, 2016). Hence, further steps have to be taken to make the principles fit for different segments of consumers.

### 7.2. Limitations

A limitation of this paper is that it was not possible to present the various aspects of the principles in a way that is fully underpinned by relevant empirical studies. This is due the novelty of applying the three Rs principle to farm animals. Another point is the focus on consumers who are at least somewhat responsive to the goal of farm animal welfare improvement. Clearly, this is inherent to the topic of farm animal welfare concerns. According to the literature presented above, these concerns are mainly associated with the endorsement of universalistic values. The literature also shows the opposite values of groups who explicitly legitimize their animal eating practices. Several studies indicate that the latter groups have a social dominance orientation that includes a hierarchical view of society and human superiority over animals (Dhont & Hodson, 2014; Monteiro, Pfeiler, Patterson, & Milburn, 2017). Some authors suggest that this view can be made compatible with farm animal welfare improvement, for instance, by highlighting those moral intuitions (Haidt, Graham, & Joseph, 2009) that might be distinctly related to meat consumption attitudes among groups with a high social dominance orientation (Grünhage & Reuter, 2021).

### 7.3. Further research

The new application of the three Rs, in line with Fenwick et al. (2009), should stimulate more research as well as societal discussion about the welfare of farm animals. An interesting example is how Scherer et al. (2018) used the three Rs in combination with a newly developed framework for integrating animal welfare into life cycle sustainability assessment. The previous sections mentioned many other issues that require more research. At the individual level, more research should be done to specify the conditions that improve the role of animal welfare goals in consumer decision making. At the level of society, more insight is required into the societal benefits and costs of a transition to a more animal-friendly and sustainable system of food production and consumption.

Considering the near future, several studies foresee that dramatic changes in the contribution of animal protein might be necessary, as reductions of (on average) more than 50% are proposed for the coming decades (Kesse-Guyot et al., 2021; Päivärinta et al., 2020; Willett et al., 2019). A recent Finnish feasibility study examined a 12-week randomized clinical intervention with three different diets, varying in the consumption ratios of animal protein to plant protein (Päivärinta et al., 2020). The ratios in the three conditions were 70:30 (an average Finnish diet), 50:50 and 30:70 (a potential Finnish reference diet). According to the authors, a substantial increase in legume consumption and a decrease in red meat consumption is feasible in a Nordic dietary setting,



but the 50:50 diet can be reached much more easily than the 30:70 diet, which will require appropriate measures to promote the change (Päiväranta et al., 2020). A French diet modelling study also concludes that meeting both nutrient reference value and environmental objectives requires the reduction of animal foods together with important substitutions between animal food groups, and that further research is required to explore alignment with long-term health value and conflict with social acceptability, in particular for greater reductions of food-related greenhouse gas emissions (Kesse-Guyot et al., 2021). In view of the urgency of these matters, it should be emphasized that Reduction, Replacement and Refinement are not just different parts of the same process to meet human health and animal welfare challenges, but also powerful options to combat the climate, biodiversity and—last but not least—food security challenges of the next few decades.

## Author contributions

JdB and HA conceived and designed the article. JdB wrote the first draft. HA revised it critically. JdB and HA approved the final article.

## Ethical statement

The paper does not involve new human participants.

## Declaration of competing interest

None.

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