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Review

Consumer perception and behaviour regarding sustainable protein consumption: A systematic review



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ABSTRACT

Background: Our daily food choices have a huge impact on the **environment**. Production of **meat** has a much larger impact compared with the production of vegetable-based proteins. In order to create a food production and supply system that is more **sustainable** and environmentally friendly, food consumption behaviour needs to change. A reduction of meat intake is necessary. The introduction of alternative protein sources (e.g., insects or cultured meat) might be one possibility to replace meat.

Scope and approach: The present systematic review identified 38 articles to answer the following three research questions: 1) Are **consumers** aware that meat consumption has a large environmental impact? 2) Are consumers willing to reduce meat consumption or substitute meat with an alternative? 3) Are consumers willing to accept **meat substitutes** and alternative proteins, such as **insects** or cultured meat?

Key findings and conclusion: Consumer awareness of the environmental impact of meat production is surprisingly low. This is true for consumers in various European countries. Likewise, willingness to change meat consumption behaviour in terms of reducing or substituting meat (e.g., by eating insects or meat substitutes) is low as well. How people can be motivated to decrease their meat consumption behaviour has been underexplored. In particular, experimental studies are lacking and further investigations should focus on strategies (e.g., nudging interventions) that might help to motivate pro-environmentally friendly meat consumption behaviour. Moreover, population-based studies are scarce, and we need more in-depth studies on the factors that increase people's willingness to reduce or to substitute meat consumption.

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Although consumers may not be aware, their daily food choices have a huge impact on the environment and on climate change. It has been estimated that between 20% and 30% of the total environmental impact caused by humans is related to food production (Tukker & Jansen, 2006). New food technologies and new food products may help reduce the environmental impact of people's food behaviour (Bonny, Gardner, Pethick, & Hocquettez, 2015; Smetana, Mathys, Knoch, & Heinz, 2015). Consumers' food preferences are important, however, because the environmental impact related to nutrition varies considerably depending on the foods selected. There are large differences in greenhouse gas emissions, for example, across meals (Visschers & Siegrist, 2015). A behavioural change by consumers in the more affluent countries is

needed, however, in order to substantially reduce the environmental damage caused by the foods consumed. This implies a reduction in the consumption of animal proteins, because they have a much larger environmental impact compared with vegetable-based proteins (Aiking, 2011; Lamb et al., 2016; Leip et al., 2015). The goal of the present review is, therefore, to better understand the challenges and the opportunities related to moving consumers towards more sustainable protein consumption.

A transition from animal-based to plant-based proteins would be beneficial for biodiversity, land use, water use, climate, human health and animal welfare (Aiking, 2011; Leip et al., 2015). A reduction in the consumption of meat and dairy products is, therefore, crucial for more sustainable food production (Aiking, 2014; Lamb et al., 2016). It is important to change agricultural practices, improve technologies and change consumer behaviour in order to reduce greenhouse gas emissions. It seems, however, that technological approaches may not be sufficient (Garnett, 2011). The importance of reducing meat consumption in order to reduce

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greenhouse gas emissions was shown in a study conducted in the UK (Scarborough et al., 2014). Results of this study suggest that greenhouse gas emissions for meat-eaters are roughly two times as high compared with vegans. A 50% reduction in meat, dairy products and eggs in the European Union would result in a 25%–40% reduction in greenhouse gas emissions associated with food production (Westhoek et al., 2014). There is broad consensus that reduction of meat consumption will be crucial for a transition towards more sustainable food consumption.

Not all animal proteins are equally problematic from an environmental point of view. Greenhouse gas emissions and the grain needed for production of animal protein vary by animal type (Sabate & Soret, 2014; de Vries & de Boer, 2010). The production of pork is much more efficient compared with beef, and chicken is much more efficient compared with pork. Even for one animal type, however, different livestock systems differ considerably in their environmental impacts (Herrero et al., 2015). Therefore, the environmental burden caused by the consumption of meat could be reduced by replacing meat that needs many resources for its production by meat that can be produced more efficiently. An extreme approach would be to replace beef or pork by edible insects in order to reduce the climate impact of animal food production (Premalatha, Abbasi, Abbasi, & Abbasi, 2011).

Meat substitutes made entirely of vegetable components (e.g., tofu) are available on the market. The production of these substitutes is efficient, but their taste, texture and smell are different to those of meat. Therefore, the market share of such meat substitutes is limited to consumers who are willing to consume plant-based proteins that are quite different from meat. In order to create a meat substitute that exactly mimics meat, research focuses on culturing meat based on stem cell technology (Post, 2012). There is still a long way to go before cultured meat is economically feasible and mimics real meat (Post, 2012). The technology hurdles are one obstacle; consumer acceptance will be another.

If plant proteins substituted animal proteins, environmental pollution could be reduced and fewer resources would be needed (Westhoek et al., 2014). From a sustainability standpoint, a reduction of livestock products is important. However, there is little political effort to reduce consumers' meat and dairy consumption. It has been suggested, therefore, that consumer awareness of the environmental costs of animal protein should be raised, because consumers need to change their nutrition behaviour (Aiking, 2014). Furthermore, it has been emphasized that consumers need to be involved in realizing new ways to consume protein (de Bakker & Dagevos, 2012). A change in consumers' food behaviour will not be easy, because it is related to taste preferences, social norms and culinary traditions (Sabate & Soret, 2014).

What do we know about consumers' perceptions of the environmental impact of meat and the willingness to reduce meat consumption? In a literature review, we searched for articles to help us identify important factors for moving society towards more sustainable food consumption behaviour. The aim of the present review was to summarize the literature that examined the barriers and chances for motivating or nudging consumers to change their protein consumption behaviour. More specifically, the review addressed three questions as follows: 1) Are consumers aware that meat consumption has a large environmental impact? 2) Are consumers willing to reduce meat consumption or substitute meat with an alternative? and 3) Are consumers willing to accept meat substitutes and alternative proteins, such as insects or cultured meat? Results of this review are important for those who are interested in moving society towards more sustainable protein consumption, for the industry interested in developing alternative proteins and for researchers interested in identifying knowledge gaps regarding meat consumption for sustainability reasons.

1. Method

1.1. Selection of relevant studies

A literature search of Web of Science (Core Collection) was conducted in January 2016. The following search string was used: (((“meat substitute” or “alternative protein” or “cultured meat”) or (sustainab* and (meat or milk* or cheese* or egg*)) and (consum* or behav* or food choice)). The search was restricted to English-language research articles.

A flow chart summarizing the study selection process is depicted in Fig. 1; inclusion and exclusion criteria are summarized in Table 1. The literature search resulted in 929 records. Eligibility assessment of the records was performed independently by the two authors. The retrieved records were screened by title and abstract; when indicated, the full text publication was reviewed. Inter-rater agreement was generally high and disagreement between the authors was resolved by consensus (e.g., discussing the study design). Overall, 870 articles were excluded because they did not meet the inclusion criteria as described in Table 1. In particular, those articles were not related to consumer behaviour (e.g., life cycle analysis modelling, meat production systems), did not report primary quantitative results (e.g., review articles or qualitative studies), focused on wild animals (e.g., hunting, eating wild animals) or focused on the physiological aspects of meat consumption. This resulted in 59 articles that were full text screened. Using the same criteria described for the screening of the titles and abstracts, 34 articles were excluded because they did not meet the inclusion criteria. This resulted in a set of 25 articles that were included in the systematic review. An additional eight articles were identified that met the inclusion criteria by checking the references lists of studies that have cited these papers. Five articles that were published during the review process of the present article were included as well. In total, 38 articles met the inclusion criteria and were included in the review.

1.2. Data collection process

One review author extracted the data from the included articles and the second author checked the extracted data. Disagreement was resolved by discussion. Information was extracted from each study on 1) study design and year of data collection, 2) characteristics of the study sample, including country of residence, sample size and gender, 3) the main research question of the article, 4) the outcome measure (including questionnaire questions or the conducted interventions as well as main findings) and 5) influential covariates. Furthermore, it is indicated when participants received information about the topic under investigation. The summary information of the articles is shown in Tables 2–4.

2. Results

2.1. Consumer awareness of the environmental impact of meat production and consumption

In Table 2, the findings are summarized from 10 articles (nine different study samples) that examined consumer awareness of the environmental sustainability of meat production and consumption. The majority of the studies suggest that consumers are not aware that production and consumption of meat has a huge impact on the environment. This observation holds true for consumers in various Western countries, including the US, Germany, Netherlands, Portugal and Australia. Based on the results of four studies, between 18% and 38% only of the study participants agreed on statements about the negative impact of meat consumption and

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