

BMJ Open Perspectives of individuals on reducing meat consumption to mitigate climate change: protocol for a scoping review

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ABSTRACT

Introduction High consumption of red and processed meat increases the risk of several chronic diseases. Many people, especially in high-income countries, eat more meat than recommended by nutritional and health agencies. Meat production also has negative impacts on the environment and contributes to climate change. Therefore, climate protection, besides health or animal welfare, could motivate individuals to eat less meat. Willingness to reduce meat consumption and motives to do so are not yet fully understood.

Methods and analysis Based on the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) extended guidelines, a scoping review of peer-reviewed original studies will be conducted to address three questions: What is the evidence regarding (1) the willingness of individuals to reduce meat consumption to mitigate climate change, (2) the awareness of individuals about the link between their meat consumption and the potential to mitigate climate change and (3) individuals having reduced meat consumption for the reason of climate protection? We will search the databases Medline (via PubMed), Scopus, Embase, Greenfile (via Ebsco) and PsynDex/CurrentContent/Agris (via Livivo) using a systematic search string. Studies from 2015 onwards, published in English, German, Danish or Dutch, will be included. We will include observational studies, qualitative studies, intervention studies (if they include surveys) and reviews. Data will be summarised in a narrative synthesis, comprising methods, population characteristics, meat type under study, indicators measured and limitations. Key findings will be grouped according to the research questions. This scoping review will help clarify the role of climate protection in individual reduction of meat consumption and identify research gaps in this field.

Ethics and dissemination Formal ethical approval is not required, as primary data will not be collected in this study. Findings of this scoping review will be presented at scientific conferences and published in a peer-reviewed journal.

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INTRODUCTION

Climate change is one of the greatest public health threats of the 21st century.¹ The

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ We will use the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) tool to ensure a systematic approach to searching, screening and reporting.
- ⇒ We take into account that both climate change and meat consumption are investigated in different disciplines, so the databases to be searched cover health, medical, environmental and social sciences.
- ⇒ The scoping review will include recent studies (as of 2015) and consider studies in four languages (English, German, Danish and Dutch).
- ⇒ We will not include grey literature, for example, national polls or market research among consumers not published in peer-reviewed journals, although these data may hint at meat eating habits and behaviour change intentions of populations.

consequences of climate change directly influence our health, well-being and safety. The frequency of life-threatening weather events, such as droughts and heat waves, will continue to increase, leading to a higher heat-related mortality and a higher incidence of accidents and trauma, among others. The rise in mean temperature has already started to affect ecosystems, with implications for the prevalence of certain infectious diseases and allergies. We therefore need to proactively reduce our greenhouse gas emissions and thereby mitigate climate change. In the Paris Agreement of 2015, many nations made the commitment to limit global warming to an increase of preferably 1.5°C compared with pre-industrial levels.² Currently, the transformational shifts needed in all sectors to achieve this goal seem to be happening too slowly.³

The food system is responsible for 19%–29% of global greenhouse gas emissions, 80%–86% of which is based on agricultural production.⁴ Within agricultural production, the production of meat is responsible for 72%–78% of

greenhouse gas emissions,⁵ and beef production emits considerably higher amounts of greenhouse gases per unit of mass, per grams of protein and per serving compared with pork and chicken.^{6,7} Given the further increase in global population and wealth, the demand for meat will continue to increase, as will the negative environmental impact associated with meat production.⁵

A diet consisting of a higher consumption of meat, especially red and processed meat, is also associated with several chronic non-communicable diseases, such as coronary heart disease, cancer and type 2 diabetes, compared with diets with lower meat consumption.^{7–10} In a meta-analysis, processed meat consumption was associated with a 42% higher risk of coronary heart disease and a 19% higher risk of diabetes.⁸ Comparing meat eaters with vegetarians, the EPIC-Oxford study found that vegetarians have a 10% lower risk of total cancer than meat-eaters.¹¹

Due to the detrimental effects that a high level of meat consumption can have on both health and climate, many international associations and expert commissions have highlighted the need to decrease the amount of meat consumed. The EAT-Lancet Commission, for example, describes food as the ‘single strongest lever to optimise human health and environmental sustainability on Earth’,¹² and recommends a substantial reduction in meat consumption, especially in high-income countries. Likewise, the Food and Agriculture Organization of the United Nations and the WHO support reducing the consumption of meat as an important step towards a more sustainable and healthy diet.¹³

Research has identified barriers for meat reduction, including habits, taste preferences, or emotional and social attachment to meat.^{14,15} Less is known about the willingness of individuals to reduce meat consumption and the role of climate change mitigation as a motivation for doing so. Health is a very common motive for individual reductions in meat consumption.^{16–19} In addition to health motives, animal welfare has also been shown to be important for individuals to limit or cease meat consumption, as can be seen in studies among vegetarians.^{20,21} Other motives could be related to the high cost of meat, food scandals and social pressure from peers or family. In addition, greater availability of meatless meals and plant-based products could result in lower meat consumption.

It is important to disentangle which of these factors are most relevant for behaviour change. Uncertainties about the impact of climate protection as a motive remain because several studies have either asked individuals about multiple motives (eg, climate protection plus health plus animal welfare) or they considered willingness or intentions, which are no guarantee for behavioural changes. Some people may also be unaware of or underestimate the climate impact of meat production and hence not willing to change their behaviour.

A better understanding of individuals’ awareness, willingness and motives to reduce meat consumption, and whether climate protection plays a role in this context,

is important for identifying key motives, that could, for example, be used in health promotion campaigns. Our scoping review will aggregate the evidence on individuals’ perspectives on reducing their own meat consumption to mitigate climate change.

The aim of the scoping review is to describe the existing evidence on individuals’ perspectives on reducing meat consumption. The scoping review will classify the evidence on this topic according to the following three research questions:

- What is the current evidence regarding the willingness of individuals to reduce meat consumption to mitigate climate change?
- What do we know about the awareness of individuals about the link between their own meat consumption and the potential to mitigate climate change?
- What is the current evidence regarding individuals having reduced their meat consumption for the reason of climate change mitigation?

METHODS AND ANALYSIS

Our scoping review follows the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)²² and was registered at Open Science Framework (<https://doi.org/10.17605/OSF.IO/MWB85>).

Search strategy

The databases to be searched are Medline (via PubMed), Scopus, Embase, Greenfile (via Ebsco) and PsynDex/CurrentContent/Agris (via Livivo). With those databases, we intend to cover public health, medical, environmental and social sciences.

The search strategy was conducted with English search terms (table 1). The search strings for the databases Greenfile and PsynDex/CurrentContent/Agris consist of two search components, namely one for meat and one for climate change. For the databases Medline, Embase and Scopus, a third search component is added covering the desired study types. Within the components, search terms are connected with the Boolean operator ‘OR’, while the components themselves are connected with the Boolean operator ‘AND’.

Inclusion criteria

For the scoping review, we will only include peer-reviewed, original articles that report on any of the following study designs:

- observational studies (longitudinal and cross-sectional studies),
- qualitative studies,
- intervention studies (if they include surveys among participants, for example, experiments with motivational messages on the different benefits of meat reduction) and
- reviews.

We will also include mixed-methods studies, but we will only extract data from study parts that meet the inclusion criteria.

Table 1 Search terms for the databases Medline, Embase, Scopus, Greenfile and PsynDex/CurrentContent/Agris

Search component 'meat'	Search component 'climate change'	Search component 'study type'
Search terms for Medline (via PubMed)		
'Animal Proteins, Dietary'[Mesh]	'Greenhouse Effect/ prevention and control'[Mesh]	'Cross-Sectional Studies'[Mesh]
'Meat Products'[Mesh]	'Climate Change'[Mesh]	'Longitudinal Studies'[Mesh]
'Diet/adverse effects'[Mesh]	'Global Warming/prevention and control'[Mesh]	'Surveys and Questionnaires'[Mesh]
'Meat'[Mesh]	'Greenhouse Gases'[Mesh]	'Qualitative Research'[Mesh]
'Red Meat'[Mesh]	'Carbon Footprint'[Mesh]	'Epidemiologic Studies'[Mesh]
meat consum*	climate change	'Focus Groups'[Mesh]
'meat attachment'	'climate protection'	'Diet Surveys'[Mesh]
'meat reduction'	'environmental impact**'	'Nutrition Surveys'[Mesh]
meat [Title/Abstract]	'carbon footprint'	survey*
'meat product**'	'global warming'	focus group*
'meat intake**'	'pro-environmental behavior**'	'quantitative stud**'
reduc* meat	'greenhouse gas emission'	'qualitative stud**'
'animal protein**'	'greenhouse effect'	questionnaire*
	'ecological footprint'	'cross-sectional stud**'
	mitigat*	'epidemiologic stud**'
		'diet survey**'
		'nutrition survey**'
		'evaluation stud**'
		'intervention stud**'
		'comparative stud**'
Search terms for Embase		
'meat'/mj	'greenhouse effect'/de	'cross-sectional stud**'
'meat'/de	'climate change'/de	'quantitative stud**'
'red meat'/de	'climate change'	'qualitative stud**'
'red meat'	'climate change mitigation'/de	'focus group**'
'meat consum**'	'global warming'	'epidemiologic stud**'
'meat consumption'/de	'global warming'/de	'questionnaire'
'meat attachment'	'greenhouse gas emission'/de	'survey**'
'meat reduction'	'carbon footprint'/de	'original research'
'meat product**'	'climate protection'	'evaluation stud**'
'meat intake**'	'climate warming'/de	'intervention stud**'
'reduc* meat'	'environmental impact'/de	'comparative stud**'
'animal protein**'	'environmental impact**'	
	'pro-environmental behavior'/de	
	'pro-environmental behavior'	
	'ecological footprint'/de	
	'ecological footprint'	
	'mitigation'/de	
Search terms for Scopus		
TITLE-ABS-KEY (meat)	TITLE-ABS-KEY ('climate change')	ALL ('qualitative stud**')
KEY ('meat consum**')	ALL ('pro-environmental behavior')	ALL ('quantitative stud**')
ALL ('meat consum**')	KEY ('global warming')	ALL ('original research')
ALL ('meat attachment')	KEY ('greenhouse gas emission')	

Continued

Table 1 Continued

Search component 'meat'	Search component 'climate change'	Search component 'study type'
KEY ('meat attachment')	KEY ('carbon footprint')	
KEY ('meat reduc**')	ALL ('climate protection')	
ALL ('meat reduc**')	KEY ('climate warming')	
ALL ('meat product')	KEY ('environmental impact')	
KEY ('meat product')	ALL ('climate change mitigation')	
	KEY ('ecological footprint')	
	KEY (mitigation)	
Search terms for Greenfile (via Ebsco)		
SU meat	SU climate change	
TI meat	TX global warming	
AB meat	TX greenhouse effect	
TX meat product*	TX greenhouse gas emission	
TX red meat	TX greenhouse gases	
TX meat consum*	TX carbon footprint	
TX meat reduction	TX climate protection	
TX reduc* meat	TX climate change mitigation	
TX animal protein	TX environmental impact*	
	TX pro-environmental behavior	
	TX ecological footprint	
	TX mitigat*	
Search terms for PsynDex/CurrentContent/Agris (via Livivo)		
FS=('meat consumption')	KW=(climate change)	
KW=('meat consumption')	FS=('climate protection')	
KW=(meat)	FS=('pro-environmental behavior')	
KW=(meat reduction)	FS=('environmental impact')	
FS=('meat reduction')		
KW=('meat products')		
FS=('meat products')		

In terms of population, studies among meat eaters, among so called 'flexitarians', as well as among vegetarians and vegans will be included. We will consider studies in any age group.

We will consider the content of:

- ▶ Studies that address individuals' willingness to reduce meat consumption.
- ▶ Studies that investigate the awareness of individuals about the association between their meat consumption and climate change mitigation.
- ▶ Studies that investigate climate change mitigation as a motive for individuals already having reduced their meat consumption.

We will only consider articles published in the languages English, German, Danish and Dutch. We will include studies published as of 1 January 2015. In recent years, attention on this topic has increased, accompanied by the Paris Agreement, a legally binding international treaty on climate change,² which was issued and signed by many

countries in December 2015. Awareness and attitudes may have changed considerably over the last years, therefore we will focus on recent findings.

Exclusion criteria

We will exclude predictions, scenarios and models; clinical studies; ethnographic observations; and editorials. Grey literature will also not be included.

In terms of study content, we will exclude the following types of articles:

- ▶ Studies on sustainable aquaculture or exclusively on fish (but not meat) consumption.
- ▶ Studies that do not address reduction of an individual's own meat consumption, but
 1. reduction of meat offered to others (eg, studies focusing on canteen owners decreasing the amount of meat dishes in their canteen/cafeteria menus), or

2. increased consumption of (healthier) food items, such as meat alternatives.

Studies that are not available in English, German, Dutch or Danish or were published before 2015 will also be excluded.

Study selection

Study selection will be managed using the software EndNote 20 and Rayyan. Two researchers (RM, JW) will independently perform the screening process, which includes both abstract and full-text screening. Twenty abstracts will be screened by the researchers together to generate a common sense of the inclusion and exclusion criteria. The remaining abstracts will be screened independently. An article will be considered for full-text screening if at least one researcher suggests an inclusion. Afterwards, the full-text of five articles will be screened by the two researchers together. The remaining articles selected for full-text screening will again be screened independently. Discrepancies during full-text screening will be discussed with and resolved by a third person (AR) from the review team.

Appropriate studies will be hand-searched for other relevant references (reference tracking). If the research identifies highly relevant authors for this research field (the author is involved in more than three of the included studies), their publications will be hand-searched according to the inclusion and exclusion criteria above.

In the case of reviews, we will not include the review as such, but will screen the cited original articles and include them if they meet the inclusion criteria.

Duplicates will be excluded.

Data extraction

Articles meeting all inclusion criteria above will be extracted for details on study characteristics (authors, title, publication year, study design, country, study period); study methods (research question(s), sample size, sampling method); population characteristics (target population under study, percentage female, percentage vegetarians); measurements (of awareness, willingness, (change in) behaviour, meat type under study); key findings (of awareness, willingness, (change in) behaviour) and author-reported limitations. Two researchers (RM, JW) will pilot test the data extraction instrument with three articles that will be included in the scoping review, before one person (RM) will extract the data from all included studies. Data will be stored in Microsoft Excel. A second person (JW) will check the data extraction. If several publications of one study are available, those publications will be summarised as one study. This might underestimate the number of total publications on this topic, but analysing the research field in general is more relevant for the appraisal of the conducted research and identifying research gaps. Double counting the same study would result in an overestimation of, for example, the populations studied. Studies with multiple assessment time points (eg, panel studies) will only be considered

separately if the study populations are independent of each other.

Data analysis

To answer the three research questions, the data from the included studies will be summarised in the form of a narrative and descriptive synthesis of evidence. We will present overviews of the number of studies (1) using certain methods and study designs (eg, qualitative or quantitative design), (2) including certain populations (eg, in terms of age, country or living environments), (3) addressing certain meat types and (4) measuring certain indicators. We will also report the main study limitations mentioned by the authors. Key findings will be summarised in narrative form and grouped according to the three research questions. We also intend to document potential changes over time. Results will primarily be presented in text and tables.

In alignment with the PRISMA-ScR extensions for scoping reviews, we will not perform a risk of bias assessment for each included study. An assessment of risk of bias is applicable to systematic reviews of interventions, where scoping reviews are 'generally conducted to provide an overview of the existing evidence regardless of methodological quality or risk of bias'.²² Since we will include a variety of study types, it would not be feasible to use a unified tool for risk of bias assessment. We will however conduct a non-standardised critical appraisal of the studies.

Patient and public involvement

None.

ETHICS AND DISSEMINATION

Formal ethical approval is not required, as primary data will not be collected in this study.

The findings of this scoping review will be disseminated through conference presentations and a publication in a scientific, peer-reviewed journal.

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Contributors All authors have made substantial contributions to the development of this scoping review protocol. RM, GBMM, KM, AR and JL were involved in defining the research questions and eligibility criteria. RM and KH were responsible for developing the search strings. JW was involved in writing the introduction part of the protocol. All authors critically revised and commented on the manuscript and approved the final version.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

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REFERENCES

- Costello A, Abbas M, Allen A, *et al.* Managing the health effects of climate change: Lancet and University College London Institute for Global Health Commission. *Lancet* 2009;373:1693–733.
- Paris Agreement. *United Nations framework convention on climate change*. 2015.
- Cléménçon R. “Zweckoptimismus” and the paris process will not save the world from climate catastrophe. *Integr Environ Assess Manag* 2018;14:198–201.
- Vermeulen SJ, Campbell BM, Ingram JSI. Climate change and food systems. *Annu Rev Environ Resour* 2012;37:195–222.
- Springmann M, Clark M, Mason-D'Croz D, *et al.* Options for keeping the food system within environmental limits. *Nature* 2018;562:519–25.
- Sachverständigenrat für Umweltfragen (Hrsg. *Umweltgutachten 2012. Verantwortung in einer begrenzten Welt*. 2012.
- Tilman D, Clark M. Global diets link environmental sustainability and human health. *Nature* 2014;515:518–22.
- Micha R, Wallace SK, Mozaffarian D. Red and processed meat consumption and risk of incident coronary heart disease, stroke, and diabetes mellitus: a systematic review and meta-analysis. *Circulation* 2010;121:2271–83.
- Boada LD, Henríquez-Hernández LA, Luzardo OP. The impact of red and processed meat consumption on cancer and other health outcomes: epidemiological evidences. *Food Chem Toxicol* 2016;92:236–44.
- IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. *Red meat and processed meat*. Lyon, France: International Agency for Research on Cancer, World Health Organization, 2018.
- Key TJ, Papier K, Tong TYN. Plant-based diets and long-term health: findings from the EPIC-oxford study. *Proc Nutr Soc* 2022;81:190–8.
- EAT-Lancet Commission. *Healthy diets from sustainable food systems*. Food Planet Health, 2019.
- Food and Agriculture Organization of the United Nations (FAO), World Health Organization (WHO). *Sustainable healthy diets – guiding principles*. 2019.
- Stoll-Kleemann S, Schmidt UJ. Reducing meat consumption in developed and transition countries to counter climate change and biodiversity loss: a review of influence factors. *Reg Environ Change* 2017;17:1261–77.
- Kwasny T, Dobernig K, Riefler P. Towards reduced meat consumption: a systematic literature review of intervention effectiveness, 2001–2019. *Appetite* 2022;168:105739.
- Collier ES, Oberrauter L-M, Normann A, *et al.* Identifying barriers to decreasing meat consumption and increasing acceptance of meat substitutes among swedish consumers. *Appetite* 2021;167:105643.
- Fresán U, Errendal S, Craig WJ. Influence of the socio-cultural environment and external factors in following plant-based diets. *Sustainability* 2020;12:9093.
- Henn K, Bøye Olsen S, Goddyn H, *et al.* Willingness to replace animal-based products with pulses among consumers in different european countries. *Food Res Int* 2022;157:111403.
- Kemper JA. Motivations, barriers, and strategies for meat reduction at different family lifecycle stages. *Appetite* 2020;150:104644.
- de Boer J, Schösler H, Aiking H. Towards a reduced meat diet: mindset and motivation of young vegetarians, low, medium and high meat-eaters. *Appetite* 2017;113:387–97.
- Fox N, Ward K. Health, ethics and environment: a qualitative study of vegetarian motivations. *Appetite* 2008;50:422–9.
- Tricco AC, Lillie E, Zarin W, *et al.* PRISMA extension for scoping reviews (PRISMA-scr): checklist and explanation. *Ann Intern Med* 2018;169:467–73.