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A systematic review of the definitions and interpretations in scientific literature of 'less but better' meat in high-income settings

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'Less but better' is a pragmatic approach to tackling the sustainability challenges of meat consumption and production. Definitions of 'less' and 'better' lack clarity. Here we explore interpretations of these concepts, finding increasing use of 'less but better' in the literature from Western, high-income settings. Despite discrepancies among interpretations of 'less' meat, existing quantifications indicate that significant reduction is needed to achieve desirable food system outcomes. Interpretations of 'better' meat incorporate the delivery of environmental sustainability, improved animal welfare and better health or nutrition, but lack clear principles and omit many sustainability themes. Practices and outcomes are seldom linked, and diverging narratives on interactions between 'less' and 'better' exist. A shared vision of livestock systems with improved sustainability across multiple indicators is needed to establish principles for 'less but better' in order for decision-making to deliver desired outcomes.

The global food system is the source of many and diverse environmental and social pressures^{1–3}. To respect planetary boundaries while providing adequate and nutritious food for all necessitates production improvements, waste reduction and transformation of dietary patterns^{3–5}. Increasing incomes, urbanization⁶ and Westernization of diets^{7–10} have led to a global increase in annual meat consumption from 23 kg per person in 1961 to 43 kg per person in 2018 (slaughter weight¹¹), but with considerable regional differences. In high-income countries, consumption of meat needs to be drastically reduced^{13,5} and there is extensive literature comparing the environmental impact of meats versus other foods^{2,12–15} and the impact of different diets^{3,4,16–18}. The exact magnitudes of reductions, and how to attain these, is a source of debate within academia^{19–22}, popular media^{23,24} and policy-making circles²⁵.

To eat and produce 'less but better' meat has been suggested by researchers²⁶ and non-governmental organizations^{27–31} as a more politically feasible strategy than calling solely for meat reduction. Previous research has shown that 'less but better' meat is a concept in need of clarity, since how much 'less' is, and what 'better' should deliver depends among other things on the sustainability aspects considered, the local context and the desirable outcomes of the food system³². In this study we systematically review uses, definitions and interpretations of the concept in peer-reviewed scientific literature. We focus specifically on the 'less but better' concept, rather than intending to review all the literature on sustainability issues of livestock, as existing literature is scattered.

Results

Study selection and characteristics. We identified 35 studies for inclusion (Fig. 1) based on the eligibility criteria (see Methods section). 'Less but better' has received greater attention in recent years. Two-thirds ($n=24$) of the articles were published between 2018 and 2021 (Supplementary Table 1), and all (bar one) by authors in Europe, the United States or Australia, demonstrating that this concept is most used in Western, high-income settings—where

overconsumption of meat and dairy is greatest¹¹, and where a shift to more sustainable diets underpinned by sustainable production is most pressing. The majority of selected articles focus on consumption ($n=23$), including consumer acceptance and choice, although a significant number of articles span both production and consumption ($n=11$). Just one article focuses principally on production³³. None of the included articles stated defining 'less but better' as a research aim.

Outcome- and practice-based definitions. Most articles ($n=22$) define 'less but better' in the context of their study, but 13 cite a definition from an alternative source^{26,34}. There was broad agreement that 'less but better' meat should deliver positive outcomes for animal welfare, human health and environmental sustainability. Which farming practices deliver desired outcomes was seldom specified or evidenced (Fig. 2). Selected articles predominantly used definitions of 'better' meat based on outcomes^{33,35–47}. Definitions based on specific farming practices were less frequent^{48–55}.

Linkages and contradictions between these two types of definitions were apparent. Grass-feeding livestock could facilitate increased resource efficiency (that is, environmental sustainability)³³. However, feedlot systems could perform most favourably if the desired outcome is reducing land use per kilogram of meat produced². Practices that improve animal welfare are largely overlooked, except reduced stocking densities^{53,56}. There is a lack of evidence regarding farming practices that improve nutritional quality. One paper for example claims "the nutrients are different" in free-range meat¹⁹, but without evidence to support this.

How much is 'less'? All papers referenced the need for reduced consumption (Supplementary Table 2), but only eight quantified this. Quantifications were primarily relative, used different units (for example, grams of food versus protein) and definitions (animal-sourced foods versus animal protein versus meat). Recommendations on limiting consumption ranged from 9 to 105 g

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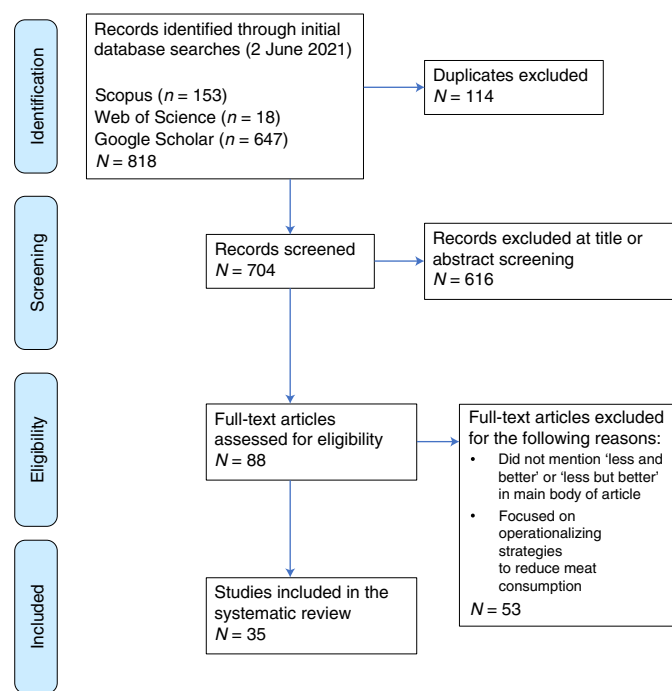


Fig. 1 | PRISMA workflow. PRISMA workflow diagram outlining the systematic review process. The left-hand panels show the four phases of the review and the centre and right-hand boxes show the number of articles for each step.

per capita per day (Fig. 3)^{38,41,44,45,57,58}. One study provides an absolute quantification, suggesting that livestock on ecological leftovers could globally provide 9–23 g per capita per day of animal-sourced protein (including milk and eggs), covering 16–42% of average daily protein requirements³³. Studies seldom stated which meat types were included or whether figures referred to slaughter or cooked weight, despite these factors having an influence on sustainability impacts.

What is 'better'? Interpretations of 'better' were varied with regard to sustainability (Fig. 4, Supplementary Table 3). Climate (lower carbon footprint)^{22,33,35–37,44,52,58–62}, land use (grass-fed meat minimizing feed–food competition) and animal welfare^{22,26,33,35,36,42,45,50–52,54,57,60,63} were mentioned frequently. Eight studies discussed eating quality^{37,38,46,47,54,58,59,64}, two of them linking it to animal welfare^{46,54}. Discussion on sustainability and quality trade-offs was noted, for example, swapping beef for chicken to lower emissions^{22,52,62}, which could result in increased feed–food competition, animal welfare issues, displaced nutrient losses and deteriorating eating quality from mass production^{45,50,52,60}. Grass-fed beef and dairy is more emissions-intensive when assessed by product weight, but has benefits for other sustainability areas^{22,35,44,61}.

Many other sustainability aspects were underdiscussed. Biodiversity was mentioned frequently, but rarely as a criterion for 'better', including grazing for promoting biodiversity^{22,36}. Health or nutrition were referenced frequently concerning 'less' meat. In relation to 'better', fat content^{40,58,59} and public health issues such as air quality associated with intensive production were cited^{22,42}. Other aspects, such as digestibility, iron and vitamin B12 were absent. Freshwater use^{26,35,54} and nutrient balance or eutrophication^{33,50,51} each appeared in three papers. Views on hormones, antimicrobials and genetically modified organisms ranged from negative for public health⁴² to positive for efficiency³⁵. Social and economic sustainability aspects were largely missing. No articles dealt with matters of well-being, working conditions or governance. Maintenance

Table 1 | Production systems mentioned in the context of 'better' meat in included articles

Production system	Articles
Organic	McGregor and Houston ⁵² , Apostolidis and McLeay ^{58,59} , de Boer et al. ²⁶ , Guzek et al. ⁴⁰ , Capper ^{35,36} , Jurgilevich et al. ⁵⁰ , Laestadius et al. ²² , Sahakian et al. ⁴⁶ , Pais et al. ⁴⁵ , Klosse ⁵¹ , Schösler and de Boer ⁵⁴ , Trewern et al. ⁵⁷
Pasture/grass-fed	McGregor and Houston ⁵² , Morris et al. ⁶³ , de Boer et al. ²⁶ , van Zanten et al. ³³ , Capper ³⁵ , Jurgilevich et al. ⁵⁰ , Laestadius et al. ^{22,61} , Neff et al. ⁴⁴
Extensive	McGregor and Houston ⁵² , de Boer et al. ²⁶ , Hyland et al. ⁶⁰ , Capper ³⁵ , Jurgilevich et al. ⁵⁰ , Laestadius et al. ⁶¹ , Santini et al. ⁵³ , Shimokawa ⁶⁵ , Schösler and de Boer ⁵⁴
Small-scale	McGregor and Houston ⁵² , Apostolidis and McLeay ^{58,59} , Jurgilevich et al. ⁵⁰ , Laestadius et al. ²² , Sahakian et al. ⁴⁶ , Shimokawa ⁶⁵ , Schösler and de Boer ⁵⁴
Free-range	Morris et al. ⁶³ , de Boer et al. ²⁶ , Jurgilevich et al. ⁵⁰ , Caraher ⁴⁹ , Trewern et al. ⁵⁷
Agroecological	Broad ⁴⁸ , Treich ⁵⁵
Intensification	Capper ³⁵ , Hyland et al. ⁶⁰
Regenerative	Klosse ⁵¹

of rural landscapes was mentioned twice^{36,52}. One paper called for "socially acceptable" production⁴¹ while another pointed to the importance of ensuring that meat reduction strategies do not negatively impact farmers⁶³. Financial risks of intensive systems appeared once⁵³. The most frequently discussed socioeconomic aspect was the importance of close relationships between consumers and producers^{46,47,50,51}, including consumers perceiving meat bought at a local butcher as 'better'^{46,54,58}. High- and low-quality meat was often referred to but not defined. One paper reported that Chinese consumers prefer industrially produced meat which they associate with quality and safety⁶⁵.

Most articles ($n = 24$) on 'less but better' mentioned a specific farming system (Table 1). This reveals a dominant narrative in the literature that 'better' meat comes from extensive, mixed, local systems that use few, if any, external inputs such as feeds and chemicals. Whether these forms of production constitute more sustainable farming has been studied by many^{66–71}, but was also criticized as a "rose-tinted view(s) of traditional food production" because of the higher emission intensities, land use and water use of extensive beef and pork³⁵. This dispute between organic/nature-based solutions or intensification^{72,73} as 'better' is commonly referred to as 'land sharing' and 'land sparing'^{74,75}, and sustainability impacts are widely debated. Both approaches would, however, require a shift in diets, that is 'less' meat^{46,68,71,76}.

Organic could be considered to deliver 'better' because organic labels are the most recognized cues available to consumers. For example: "As Dutch consumers had no shopping-aid to distinguish grass-fed meat ... 'better' meat was defined as 'organic or free range meat'"²⁶. This indicates that fully grass-fed meat is considered 'better' than organic, although few articles presented it as such (Table 1). Consumers opting for organic are found to adhere more to other sustainability-promoting behaviours such as eating less meat^{26,54,77}, although the underlying drivers of this relationship are unclear.

A systems perspective on 'better' meat. Most papers focused on single actors or scales, or interactions between two actors (for example, producer–consumer relations). Only two studies addressed

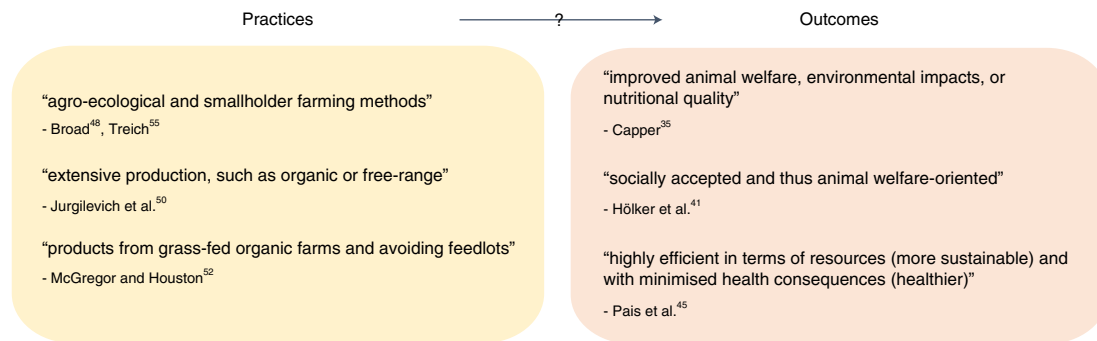


Fig. 2 | Selected descriptions of 'better' meat. Outcome- and practice-based descriptions of 'better' meat found in selected articles.

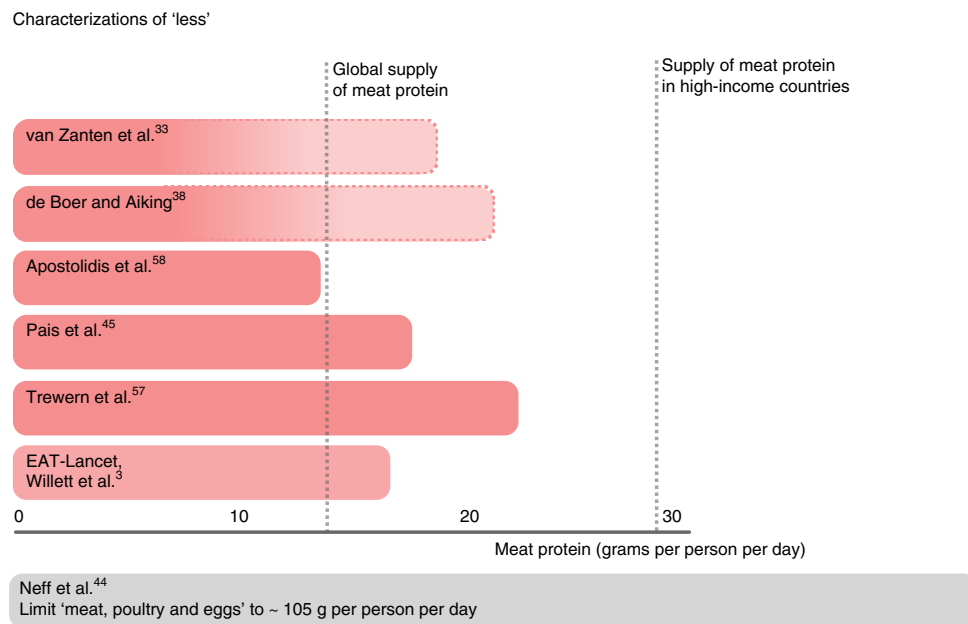


Fig. 3 | Standardization of (explicit and implicit) descriptions of 'less' among included articles. All values have been recalculated to grams of meat protein per person per day using a 20% protein content in meat (see Supplementary Information for data) except the figure in Neff et al.⁴⁴, which includes eggs and refers to a daily recommended intake limit (grey bar). The shaded bars for van Zanten et al.³³ and de Boer and Aiking³⁸ indicate that these articles describe 'less' as ranges.

system-level aspects, for example, that beef from dairy rather than suckler herds can be a 'better' option, both considering the climate impact of the meat and the resource efficiency of the food system⁵³. The structural dynamics of the current, highly globalized meat production system also has implications for 'better'⁵⁰. Industrialization has, among other factors, caused concentration of livestock in certain regions, resulting in eutrophication, pollution, overgrazing and land abandonment, and a more localized, circular production system could therefore be a 'better' option⁵⁰.

Interactions between 'less' and 'better'. A strength of 'less but better' is its consideration of both production and consumption, supporting the identification of trade-offs and win-win outcomes. We found several interactions between 'less' and 'better' with implications for dissonance or coherence between scales (Fig. 5).

'Less' was sometimes seen as a prerequisite for 'better'—for example, "the significant reduction of farm animal production ... in order to improve the production standards for the remaining animals"⁴¹. 'Less for better' at local scale could address localized impacts of livestock production, but unless national consumption is

reduced, this strategy risks offshoring food production impacts and increasing reliance on imported goods.

Another interpretation was that the 'better' option is to eat 'less' meat ('less as better'), with improvements to production as a secondary goal. There are commercial challenges in promoting 'less' without 'better' and a concerted societal effort including policy interventions would be needed to enable this^{26,57}. This view also neglects that food's environmental impacts primarily occur at the production stage². Food is often heralded as holding the potential to deliver multiple Sustainable Development Goals, including addressing climate change and biodiversity loss⁷⁸. Without a focus on production, it is difficult to see how this could be realized, and 'less and worse' can hardly be desirable.

A conflicting narrative defined 'better' as meat with lower emissions intensity per unit of output (sustainable intensification), which would allow for unchanged consumption, that is, 'better' without 'less'⁶⁰. This, however, ignores the need to reduce high-income meat consumption, for example, to meet the 1.5 °C climate goal^{3,79,80} and metrics per kilogram of product or protein seldom account for sustainability trade-offs and complexity. 'Better' without 'less' could

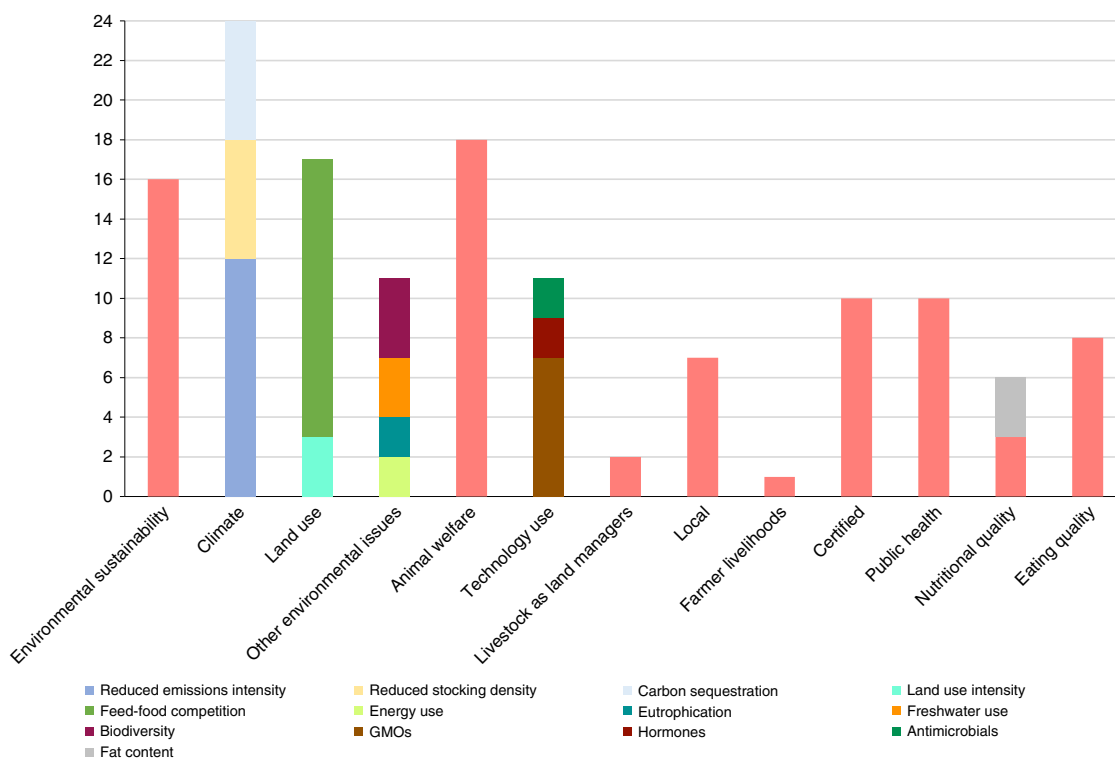


Fig. 4 | Sustainability themes referenced in selected articles as identified through abductive thematic analysis. The figure shows the number of articles in which sustainability themes were mentioned. Note that articles appear more than once if they reference multiple themes.

thus become a cover-up for business-as-usual and an attempt at greenwashing.

Discussion

One criticism of ‘less but better’ is that it puts responsibility on consumers to make sustainable, ethical or ‘better’ choices rather than recognizing issues caused by capitalist agrifood systems (refs. 81–84 in ref. 64), thus depoliticizing the issue. Without clear definitions of ‘less’ or ‘better’, the concept cannot place responsibility where responsibility is due. Among the included articles, very few address how value-chain actors beyond producers and consumers ought to facilitate ‘less and better’ (except⁵⁷). Some interpret ‘less but better’ as more radical, going hand-in-hand with “food sovereignty’s anti-capitalist orientation” requiring “agro-ecological and small-holder farming methods” and “redistributive land reform”⁴⁸.

While relevant in high-income settings, ‘less but better’ is not suitable for regions where diets are nutritionally inadequate. In these areas, ‘more and better’ meat may be more relevant^{79,80,85}. To stay within planetary boundaries globally, however, a focus on ‘less’ in overconsuming areas is needed to make room for ‘better’ in regions where consumption of animal-sourced foods needs to increase. In the FAO’s ‘Towards Sustainability’⁸⁵ scenario, for example, animal herd sizes in high-income countries would decrease by 2030 and further by 2050 while the opposite development would occur in low-income regions. The scenario also postulates that highly productive livestock-rearing practices would have to be abandoned and most regions would have less intensive livestock systems, including a rewilding of 3–4% of arable land in Europe. In-depth analysis of the implications of such transitions for producers was missing in the literature. To enable ‘better’ at scale, incentives and policy mechanisms such as product labelling, price premiums and fair payment for delivery of public goods are necessary, as is diversification of farm incomes to maintain viable farm businesses when meat production is reduced^{70,71}.

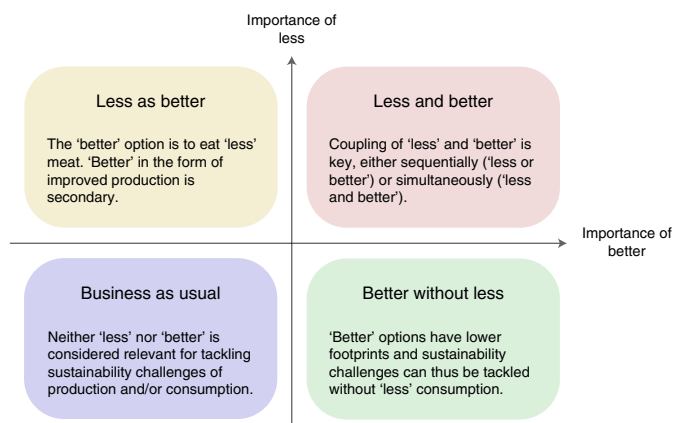


Fig. 5 | Interactions between ‘less’ and ‘better’. Illustrations of interlinks between ‘less’ and ‘better’ based on importance of the two.

‘Empowered consumers’ willing to reduce their meat consumption are often highly educated, women and/or from high-income households^{44,58,59}, and are a minority of the population^{26,58,59}. They tend to be less price sensitive than ‘average’ consumers^{47,59}, giving “these more conscious forms of food consumption ... a distinctive middle-class appeal”⁵². Speaking in favour of the potential of ‘less and better’ is the combination of reducing consumption and eating meat of higher quality as consumers could maintain current spending while improving sustainability^{22,39,43}. This makes ‘less but better’ a more acceptable message than ‘eat no meat’^{22,61}. Whether higher prices would drive sufficient meat reduction is, however, unclear⁶⁴—high-income consumers can probably afford to maintain consumption anyway^{44,54}, and meat-loving consumers are often driven by taste and eating quality^{47,58}. A strong personal interest is

required from the consumer to adopt a 'less and better' diet. Policy interventions and commitment from businesses to reduce meat intake and make 'better' options accessible to a broader spectrum of consumers are key to realize the full potential of 'less but better'.

Concluding remarks. The 'less but better' meat concept is increasingly used in the English-language scientific literature, especially in Western, high-income settings. There is, however, a lack of consensus on how much 'less' is, as most studies provide no quantification despite often evaluating the efficacy of meat reduction strategies. Based on existing quantifications ($n = 8$), 'less' involves a significant reduction from current consumption. The use of different scopes and measures could inhibit progress, and probably creates confusion. Future studies should provide more clarity and transparency around recommendations on 'less'. Ideally, these should encompass all animal-sourced foods, not just meat, given the sustainability impacts of all livestock production.

There is a similar lack of coherence in definitions and interpretations of 'better'. The idea that 'better' meat should deliver 'environmental sustainability', improved animal welfare and better health outcomes is not accompanied by clear principles, and many key sustainability themes, including social and economic aspects, are absent from discussions. There is a lack of clarity on desirable outcomes from human–livestock interactions and what practices would deliver these at different scales. This missing link between practices and outcomes results in a lack of clarity on 'less but better', preventing the concept from bridging bodies of literature on meat and sustainability. If the concept is to be used to guide food systems decision-making in policy and industry environments, there is a need to develop principles or best-practice guidelines to ensure alignment and progress toward desired outcomes. More work needs to be done to establish a vision of future livestock production systems that have improved outcomes across sustainability themes and can be agreed on by a wide range of stakeholders.

Methods

We conducted a systematic review of the literature published in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines⁶⁶ (Fig. 1).

Protocol and registration. We did not submit a review protocol to PROSPERO (or similar) because this review does not evaluate the effectiveness of an intervention, test the accuracy of a diagnostic or similar, or aim to synthesize the current state of knowledge regarding the prevalence or incidence of a phenomenon.

Eligibility criteria. After defining the scope and aim of the study, we identified search terms and eligibility criteria (Table 2). At this stage we sought input from three external independent experts to refine our search strategy.

Information sources. On 2 June 2021 we performed searches on Scopus, Web of Science and Google Scholar to identify relevant scientific literature (step 1, Fig. 1).

Search. We used the terms 'meat' AND 'less but better' OR 'less and better' and limited the search to peer-reviewed studies published in English since year 2000, which were available as full-text options online.

Study selection. The search yielded 818 entries. We screened titles and abstracts and excluded papers not dealing with meat consumption and reduction, or meat production and livestock (step 2, Fig. 1). We screened the full texts for mention and definition of 'less but better', 'less and better' or 'less-but-better' (step 3, Fig. 1). To reduce bias, both authors screened independently, and discrepancies during cross-checks were resolved through discussion. A final 36 articles (six correspondence or viewpoints) were included. Resare Sahlin et al.³² was used as basis for the thematic coding because it is the first paper focusing on defining the concept, thus leaving 35 articles included in the study.

Data collection. We manually coded in Microsoft Excel and Microsoft Word⁸⁷ using 37 initial codes based on ref. ³² and 24 codes inductively identified from individual coding of four randomly selected articles. Subsequent comparison and discussion refined the coding framework, based on which we then coded all 35 papers.

Table 2 | Eligibility criteria for inclusion and exclusion of articles

Inclusion	Exclusion
Focused on meat consumption or livestock production	Focused on sustainable diets more generally, or specific production processes of meat alternatives, but no explicit focus on meat consumption or production
Includes 'less but better' or 'less and better' in title, abstract or main body of text	Does not include these terms
Includes a definition of 'less but better' or 'less and better', either explicitly or implicitly (for example, consumer preference of attributes related to better meat and dairy)	Focused on operationalizing strategies related to reducing meat consumption, but does not seek to define, or refer to a definition of, 'less but better' or 'less and better'
Published in 2000 or later	Published before 2000
Published in English	Published in a language other than English
Articles published in peer-reviewed academic journals, including original research, opinion and correspondence articles.	Patents and quotes (Google Scholar), theses (bachelor's, master's)
Full-text available online	Full-text not available online (for example, books)

Analysis and synthesis of results. Coded text was transferred to a Word document and grouped thematically to allow for analysis of definitions and interpretations⁸⁷. To reduce bias, both authors independently reviewed thematic clusters and looked for emerging narratives. These were then compared and discussed before key results were documented. Quantifications of 'less' were normalized (Supplementary Table 5). We created tables of concept definitions (Supplementary Table 4) and sustainability themes and production systems in the context of 'better' (Table 1 and Supplementary Table 3). Rounds of inductive analysis elicited narratives of interlinkages of 'less' and 'better'.

Risk of bias. Since this study does not assess the applicability or accuracy of any scientific finding or conducted study, or seek to make any recommendation based on these, but instead seeks to report on existing narratives, the importance of the risk of bias in the included article is not relevant to the findings. To reduce internal biases within the research theme, which risk impacting the exploratory, qualitative approach, we conducted coding and analysis independently and discussed throughout, and moreover took a deductive–inductive approach to ensure results were not restricted by the a priori coding framework. Expanding the search to other languages would probably have yielded more relevant materials; however, in the regions where the concept is most relevant (Western, high-income countries), English is the key language for scientific publication and this limitation is thus justified.

Reporting summary. Further information on research design is available in the Nature Research Reporting Summary linked to this article.

Data availability

Data used in this study, including a list of papers reviewed, can be found in the Supplementary Information.

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Study description	Systematic review with qualitative thematic analysis of results
Research sample	Peer-reviewed academic literature on 'less and better' meat
Sampling strategy	Search of main databases: Scopus, Web of Science, Google Scholar
Data collection	Computer
Timing	All data were collected in a search performed June 2, 2021
Data exclusions	Article exclusion criteria: Published before 2000, published in a language other than English, full-text not available online, not focused on livestock production or meat consumption, did not mention 'less and better' or 'less but better' in main body of article, focused on operationalising strategies to reduce meat consumption.
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