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Review

Using dietary quality scores to assess sustainability of food products and human diets: A systematic review

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ABSTRACT

The increased recognition of inter-relationships between the environmental and health effects of food has resulted in a new fast-growing research area. Development of methods for integrated analysis of environmental and nutritional impacts is essential to facilitate policy decisions and actions for sustainable food systems. Dietary quality scores is one of the methods suggested to combine environmental and nutritional assessments of foods, meals and diets. This systematic review provides an overview of how dietary quality scores are used in environmental sustainability studies of food products and diets. The review includes 24 articles applying 20 different types of dietary quality scores. We describe current approaches used to combine environmental and nutritional assessments, discuss methodological choices of importance and their impact on results, and identify research gaps that require further efforts to push the current frontier of knowledge. Based on our analysis we identify two different categories of dietary quality scores and four approaches used to integrate environmental and nutritional assessments. There is a large number of methods available to quantify a dietary quality score: which one is chosen as well as how they are combined with environmental assessments can affect the results, and hence also the conclusions of which foods that are more sustainable to eat. This is critical to understand for the set-up of studies and for the interpretation of results and drawing conclusions. Our categorization of existing methods used, how they differ, what applications they are suited for, and which methodological challenges they involve increases the understanding of what analyzes are possible today and point out areas where methods are lacking and where more research is required. Continued efforts are needed to bring about a transition to sustainable food systems that do not exceed the planets ecological limits and promote healthy populations. This systematic review provides guidance for future use and development of methods within the field of sustainable nutrition.

1. Introduction

Environment and nutrition has traditionally been treated as separate fields of research. However, as awareness of the environmental impact of different food products and diets has increased, the fields have gradually been more integrated in research, society and policy (Nemecek et al., 2016; Sabaté et al., 2016). The increased recognition of inter-relationships between the environmental and health effects has resulted in a new fast-growing research area in need of new and developed methods that can incorporate the two fields (Heller et al., 2013; Johnston et al., 2014; Mertens et al., 2017; Schneider and Hoffmann, 2011).

Dietary quality scores are used to categorize foods according to their nutritional composition to facilitate identification of nutritious food that can improve dietary quality (Drewnowski, 2005). Dietary quality scores have been used for educational purposes to guide consumers via front-of-pack logos at supermarket and portable apps, and for regulatory applications to set standards and criteria for nutrition and health claims, marketing and taxation of food products (Drewnowski, 2017). In recent years, dietary quality scores have become one of the methods used to combine nutritional and environmental analyzes of foods, meals and diets (Mertens et al., 2017). Although considerable amount of research has been made to create and evaluate dietary quality scores within the area of nutrition (Fulgoni et al., 2009; Scarborough et al., 2007), the knowledge of how dietary quality scores can be used within the environmental field is still limited (Saarinen et al., 2017). Since there are many dietary quality scores to choose from, it is essential to understand how the scores are designed, what distinguishes them, and how this affects the results of the analysis.

The overall aim of this paper is to provide a summary of how dietary quality scores are used in environmental sustainability studies of food. More specifically the objectives are to analyze:

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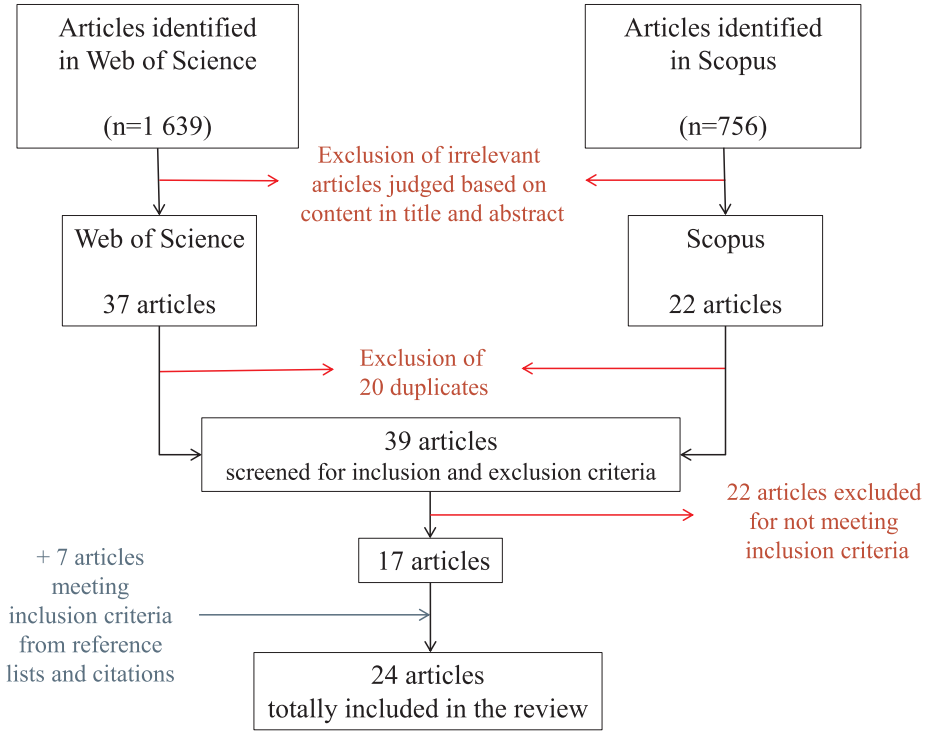

Fig. 1. Literature search and selection of articles in the review.

(i) Methodological differences in dietary quality scores and their consequences for results and applications
(ii) Methods to combine dietary quality scores and environmental impact assessment

Initial research questions that we hope to shed light on are; how does choice of method affect the results in different dietary quality scores? Are some dietary quality scores more or less suitable for different purposes? What methods are used to combine nutritional and environmental assessments, and how does the choice of method affect conclusions? In an emerging research field an overview of research gaps is valuable, and we aim to identify such gaps as a guidance and overview for future use and further development of dietary quality scores within the field of sustainable nutrition.

2. Method

2.1. Literature search

The study design and analysis of this systematic review follows the PRISMA Statement protocol (Moher et al., 2009). The search was made in Web of Science (ISI) and Scopus in March 2017 using the following search strategy:

("nutrition score" OR "nutrient density" OR "NDI" OR "diet* quality" OR "health score" OR "nutrient profil*") AND (diet* OR food) AND ("sustain*" OR LCA OR "life cycle assessment" OR "life cycle analysis" OR climate OR "greenhouse gas*" OR land OR resource OR environment*)

The literature search was limited to journal articles and reviews. Title, abstract and keywords were searched in Scopus and topics in Web of Science. In addition, reference lists and citations of relevant located articles were searched using Google Scholar. Articles reviewed were limited to English-language articles published in peer-reviewed scientific journals between 2001 and Feb 2017. Articles included in the review were further limited to those using the following methodology:

(i) Quantitative assessment of the environmental impact of foods, meals or diets.
(ii) Quantitative assessment of the food and/or nutrient intake of foods, meals or diets.
(iii) Assessment of the dietary quality of food, meals and diets based on dietary quality scores

Determination of articles that met these inclusion criteria was made based on information available in titles and abstracts of the publications. To locate a large number of original articles, also review articles were included in the literature search, these were however not included in the systematic review which only included original articles. A more detailed description of the literature search is found in supplementary materials.

2.2. Synthesis of results

The assessment of reviewed articles was made from a methodological and research focus perspective. The methodology used in the reviewed articles was analyzed based on choice of dietary quality assessment (3.2), environmental impact assessment (3.3) and identified research gaps (3.4).

More specifically, for the dietary quality assessment we analyzed:

- Design of mathematical algorithm used in dietary quality scores
- Methodological choices, e.g. dietary quality indicators, use of capping, diversity factor, reference amount, weighting, reference intake levels and dietary focus

For the assessment of environmental impact assessment we analyzed:

- Choice of environmental impact categories
- Method to combine environmental and nutritional assessment