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Review

Circular Food Behaviors: A Literature Review

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Abstract: Consumer behavior is crucial in the transition towards circular food systems. Studies so far investigate isolated circular food behaviors, but it is still unclear how the literature comprehensively addresses these behaviors. This paper provides an overview of the literature on circular food behaviors. Following a semi-systematic literature review, we analyze 46 papers related to circular food behaviors. We summarize their main features, categorize the behaviors, and propose a future research agenda. Results show the novelty and quick popularity of the topic, a dispersion across sustainability and agri-food journals, the manuscripts' goals related to consumption, a predominance of empirical data collection in Europe, a focus on behaviors related to protein alternatives, food waste, and upcycled foods, and the importance of communication and consumers' education. We categorize and characterize three types of circular food behaviors: linear, transitioning, and circular behaviors. Circular behaviors (i) are part of a systemic circular economy view, (ii) define consumers as "doers" or "prosumers", (iii) pursue long-term sustainability goals, (iv) show a high engagement of skilled consumers, and (v) are supported by technologies. Future research should consider the social dimension of sustainability and pursue a systemic view of circular food behaviors. We suggest that a circular food-related lifestyle may incorporate the recommended directions.

Keywords: circular economy; consumer behavior; food sector; circular food behavior; semi-systematic review

Citation: do Canto, N.R.; Grunert, K.G.; De Barcellos, M.D. Circular Food Behaviors: A Literature Review. *Sustainability* **2021**, *13*, 1872. https://doi.org/10.3390/su13041872

Academic Editor: Massimiliano Borrello
Received: 31 December 2020
Accepted: 4 February 2021
Published: 9 February 2021

1. Introduction

The food sector impacts nature and society in several negative ways [1]. It accounts for around 30 percent of the world's total energy consumption and around 22 percent of greenhouse gas emissions [2]. Each year about 14 percent of the world's food is lost before even reaching the market, and food loss is valued at $400 billion annually [3]. The United Nations (UN) [4] calls for an urgent need to rethink food systems and combat their inefficiencies such as food loss and waste. Several of its Sustainable Development Goals [5]—such as Goal 2 on Zero Hunger, Goal 3 on Good Health and Wellbeing, and Goal 12 on Responsible Production and Consumption [6]—relate to the food sector and strongly interrelate.

A goal particularly linked to the food sector is Goal 12, which aims to ensure sustainable consumption and production patterns. Consumers have a meaningful impact on the planet by regularly purchasing products, but current and projected material consumption rates are simply not sustainable. The impact of rising consumption coupled with the middle class's projected growth in developing countries will require even more resources [6,7]. With the world's population predicted to reach 9.1 billion people in 2050 [8], the equivalent of almost three planets could be required to provide the natural resources needed to sustain current lifestyles [2]. Food demand specifically is predicted to increase by 70% by 2050 [9], which will likely also have implications in terms of food loss and waste.

Conscious, rational, and systemic management of the food supply chain can meaningfully reduce food losses [10]. Goal 12, in particular, is very consistent with the idea of

sustainable supply chain management since it is based on many practices commonly used in supply chains such as eco-design, use of recycling, stakeholder education, but also less frequently applied in projects that fit into the broadly understood idea of a closed-circuit economy [11].

A recent UN report shows that many food-related issues—such as hunger, undernutrition, family farmers, and sustainable agriculture—still fall short of the sustainability goals [12]. A possible solution may lie in the transition towards circular food systems, i.e., food systems that implement the circular economy's principles [13]. The circular economy refers to "an industrial system that is restorative or regenerative by intention and design" [14] (p. 7). This system pursues sustainable development by replacing "the 'end-of-life' concept with reducing, alternatively reusing, recycling, and recovering materials in production/distribution and consumption processes" [15] (p. 229).

Principato et al. [16] investigate food loss and waste valorization from a circular economy perspective in the pasta supply chain in Italy. Results show that food loss from this chain can be effectively reused for other purposes. However, the main issue remains at the consumption level—where only 25% of food wasted is reused with difficulty and ends up in landfills or, at best, being composted.

Therefore, in the transition towards sustainable food systems, consumption is crucial [17–19]. The transition towards a circular economy asks for a change in consumer behavior, increasing conscious consumption practices and green products' demand. For instance, during the COVID-19 lockdown, people who started implementing good food management practices (as shopping lists and meal planning) reduced the amount of food wasted [20] and prepared healthier food [21], showing that it is possible to transform habits and behaviors when there is control and awareness. A more substantial community involvement, public education, and proper media coverage are also critical to support circular economy initiatives [22]. Food consumption impacts human health, the environment, the economy, and society [1]. However, the literature on consumption towards circular food systems—what we refer to as *circular food behaviors*—is still scarce and fragmented.

Studies on circular behaviors (e.g., [23,24]) mostly consider products made of long-lived, durable materials that are unsuitable for the environment (like metals and most plastics), also referred to as the "technical cycle" of the circular economy [14]. The literature focuses on behaviors involving Product-Service-Systems (when consumers purchase services instead of products). Some of the most popular categories of circular behaviors in the literature involve consumer electronics and car-sharing [23]. In the circular economy, consumers use, rent, and lease these products [14,25], prefer refurbished [26] or remanufactured products [27], and repair or return them after their use [23].

Many of these studies on circular behavior fail to address the food sector [23]. Food products are mainly made of biodegradable materials that can safely return to the environment (also referred to as the "biological cycle" [14]). These products are not easily subject to "servitization" [28]: Food cannot be rented, leased, refurbished, repaired, upgraded, or reused in the same way as durable goods such as mobile phones [29] or automobiles [30]. It is necessary to understand which options of circular food behaviors exist and how the consumers perceive them. Although some studies investigate isolated circular food behaviors, it is unclear how the literature comprehensively addresses these behaviors. Therefore, this paper aims *to provide an overview of the literature on circular food behaviors*. In a semi-systematic literature review, we summarize and discuss insights from 46 articles, categorizing the circular food behaviors and proposing a future research agenda. Our findings can help researchers refine their knowledge in this field, develop new research ideas, and provide critical skills in synthesizing existing literature.

We ultimately contribute by showing from the analysis of the papers that circular food behaviors can be categorized according to three types (or levels of development) as linear, transitioning, and circular. For each type, we identified consumers' role, sustainability goals, engagement, and technology, offering a framework to better understand the changes towards more sustainable behaviors. This research represents a valuable tool, especially

considering the Sustainable Development Goal 12 (Responsible Production and Consumption), by showing a possible transition towards more circular behaviors, anchored in a broader understanding of consumers' roles and choices, and built up with the support of different stakeholders and technologies.

2. Materials and Methods

Semi-systematic reviews are useful for understanding complex areas and covering broad topics and different types of studies; they generate results as themes in literature, research agendas, and theoretical models [31]. To provide a transparent research process [31], we followed the guidelines by Tranfield et al. [32], dividing procedures into three stages: planning the review, conducting the review, and reporting and dissemination.

2.1. Stage I: Planning the Review

We planned the review according to the review protocol in Table 1. The protocol followed a flexible approach, making the research intentions explicit a priori but being open for changes through the study [32].

Table 1. Review protocol.

Step	Description
Research question	How does the literature approach circular food behaviors?
Population targeted	Papers related to circular food behaviors in marketing, management, and related areas
Search strategy	Databases: Science Direct, EBSCO Business Source, Web of Science, and Scopus Search terms [a]: 'circular,' 'food,' and 'consum *' in the title, abstract, and keywords
Inclusion criteria	Peer-reviewed journals Language: English, Portuguese, Spanish, German Areas: marketing, management, and related areas
Exclusion criteria	Repeated papers (found in more than one database) Papers failing to address at least one of the topics of interest (circular economy, consumer behavior, and food sector) Papers in unrelated areas
Data tabulation	Coding categories: title, journal, year, keywords, abstract, authors, goal, theory/approach, type of study (conceptual, empirical, review), methodological procedures, geographical scope of the analysis, sample, concept of circular economy, consumption practices/behaviors investigated, determinants of behaviors, circular products, conflicting goals/tradeoffs/barriers, main findings, practical implications, limitations, future studies
Data analysis	Descriptive analysis Content analysis
Expected results	Overview of the literature on circular food behaviors: Summary of papers Categorization of behaviors Future research agenda

[a] The asterisk (*) used in the search terms refers to a multi-character wildcard, meaning that the search engine matches any words that fit the pattern. Based on Tranfield, Denyer, and Smart [32].

2.2. Stage II: Conducting the Review

This stage aimed for a comprehensive, unbiased search, resulting in a full listing of documents for the review [32]. The selection of studies started with the search of documents in January 2021 in four databases. We defined three main strings, based on the research question and population targeted (Table 1): (1) *circular*, to account for studies in the context of the circular economy; (2) *food*, since our focus was on the food sector; and (3) *consum**, to include studies on consumer behavior. We aimed to search simultaneously in the title, abstract, and keywords. However, we had to adapt filters and criteria in each database

(see Appendix A for details) because they offered different search options. We favored peer-reviewed sources to guarantee that the papers were carefully assessed.

After the search, we refined the data (Figure 1), according to Snyder's [31] third strategy. First, we removed papers duplicated across the databases; then, two independent researchers screened the titles and abstracts of the papers and checked the inclusion and exclusion criteria. The researchers individually reviewed the papers with disagreements a second time. When no consensus was reached, the researchers discussed each paper until they decided on it. This phase resulted in 53 papers. Next, we downloaded the selected papers. Two full papers could not be found (even when we contacted their authors), so they were removed from the sample. The remaining papers were fully read and mapped according to the pre-defined categories in Table 1. In this process, we discarded five papers that failed to fulfill the inclusion and exclusion criteria, resulting in a final sample of 46 papers.

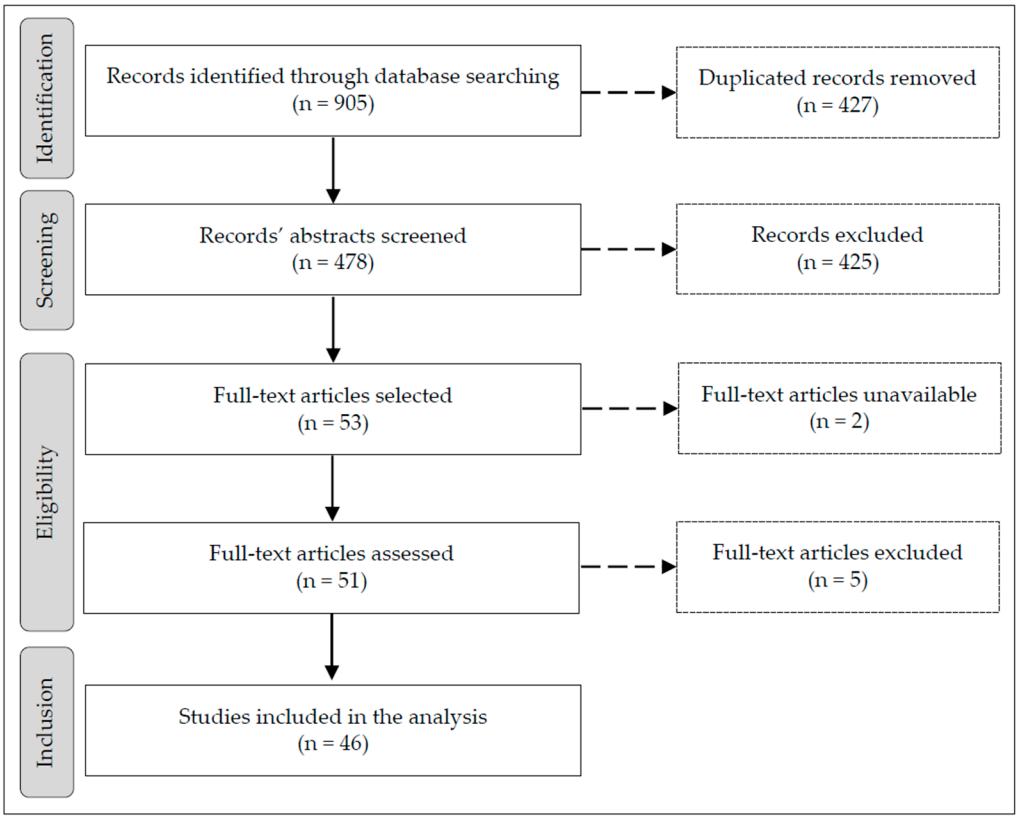

Figure 1. Methodological steps for the choice of relevant papers for the semi-systematic review. Based on PRISMA [33].

2.3. Stage III: Reporting and Dissemination of Results

This stage synthesized the selected information sources, simplifying the content [32]. We analyzed the content of the papers, starting with a descriptive analysis of the coded categories (Section 3.1). Next, we discussed findings according to a thematic analysis, which aggregated and summarized the studies. This stage focused on identifying and categorizing circular food behaviors (Section 3.2) and presenting a future research agenda (Section 3.3).

3. Findings

3.1. Summary of Papers

Year of publication. The papers were published from 2016 to 2020 (Figure 2). The number of papers increased through the years, with the great majority published in the last two years. This publication trend reflects the novelty and quick popularity of the topic.

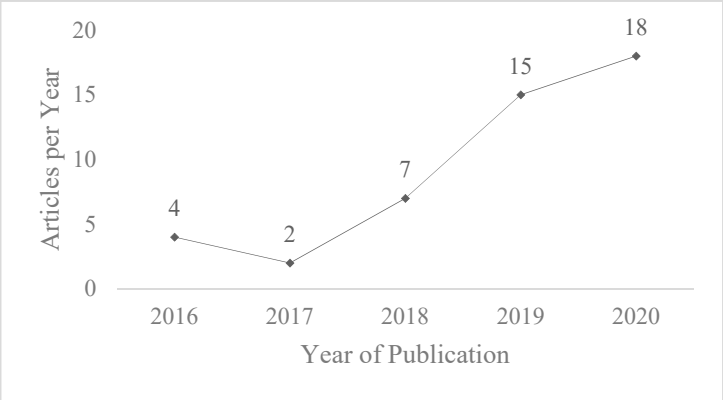

Figure 2. Circular food behaviors: article publication trends (data collected in January 2021).

Outlet. The papers were published in 29 academic journals (Table 2), demonstrating a dispersion across sources. The Journal of Cleaner Production published more papers on circular food behaviors, closely followed by Sustainability. Three other journals published more than one paper. Most journals focus on sustainability or agri-food.

Goals. The papers investigated three main types of goals: related to consumers or consumption (most frequent); unrelated to consumers, but in the circular economy context; and unrelated to consumers and circular economy, but in a related context (least frequent). Appendix B details each paper's goal.

Table 2. Journals disseminating circular food behaviors.

Source	Papers
Journal of Cleaner Production	8
Sustainability	7
Food Quality and Preference	3
Journal of Insects as Food and Feed	2
Trends in Food Science & Technology	2
Agronomy	1
AIMS Agriculture and Food	1
Bioresource Technology	1
Current Opinion in Clinical Nutrition & Metabolic Care	1
Current Opinion in Green and Sustainable Chemistry	1
Environmental Innovation and Societal Transitions	1
Frontiers in Environmental Science	1
Frontiers in Sustainable Food Systems	1
Geoforum	1
Global Change Biology	1
International Journal of Food Science and Technology	1
Journal of Business Ethics	1
Journal of Consumer Culture	1
Organic Agriculture	1
Packaging Technology and Science	1
PLoS ONE	1
Quality—Access to Success	1
Recent Patents on Food, Nutrition and Agriculture	1
Resources	1
Resources, Conservation and Recycling	1
Rural Society	1
Sociologia del Lavoro	1
Supply Chain Management: An International Journal	1
Sustainable Production and Consumption	1
Total	**46**

Research methods. Most papers (32) collected empirical data, with fewer review and conceptual papers (8 and 6 each, respectively). The majority of empirical papers adopted quantitative methodologies, with surveys and experiments as the most employed research methods (Figure 3).

Geographical scope of analysis. The papers mostly targeted European countries, with Italy and the United Kingdom as the most frequently investigated countries (Table 3). Four studies investigated two or more countries, also mainly in Europe. In fourteen studies (mostly reviews and conceptual papers), the geographical scope was not described.

Behaviors explored. The papers most frequently explored behaviors related to protein alternatives (e.g., plant-based, insects as feed), food waste, and upcycled foods. Other behaviors were related to alternative food networks, food provisioning, and packaging. Fewer papers mentioned consumers' use of wild plants in nutrition, responsibility for nutrients, reduced consumption, general dietary changes, among others. Some papers explored behaviors fitting in more than one category, but most papers investigated isolated behaviors, lacking a comprehensive perspective. Appendix B lists the behaviors each paper explores.

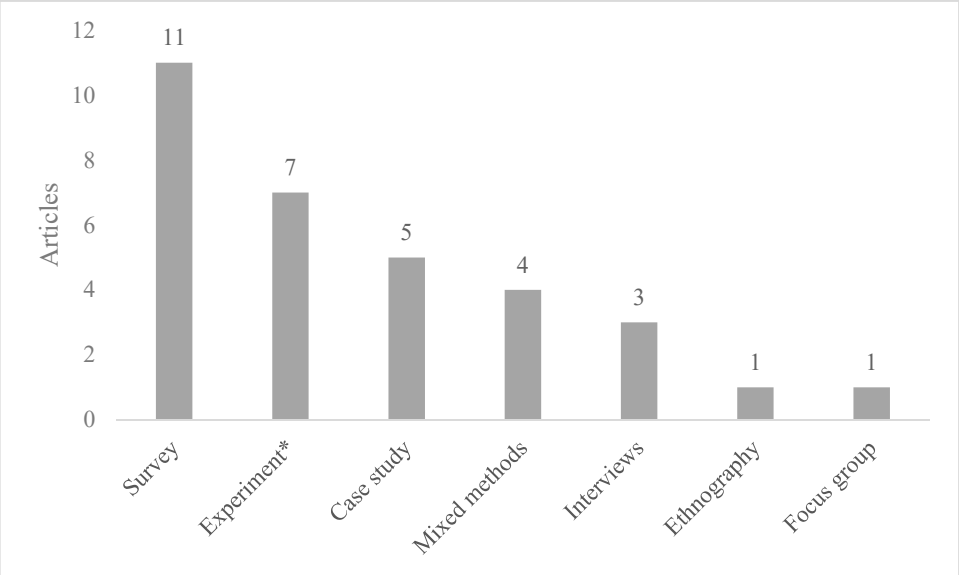

Figure 3. Research methods in the empirical papers. * Including surveys with experimental design.

Table 3. Geographical scope of analysis.

Investigated Country	Papers
Italy	6
United Kingdom	5
The Netherlands	4
Finland	3
Denmark	2
Australia	1
Belgium	1
Bulgaria	1
China	1
Hungary	1
Luxembourg	1
Norway	1
Spain	1
Multiple (two or more)	4
Total	**32**

Main results. Appendix B summarizes the results of each paper. Some studies identified how different variables influenced consumers' behaviors, highlighting the importance of education and communication. Other studies emphasized consumers' role in promoting circular food systems, relevant practices and products, main barriers, and the need for collaboration between stakeholders.

Some studies provided encouraging results. Cattaneo et al. [34] found a positive attitude towards the uses of food by-products (new food products with high added-value compounds recovered from food production). Russo et al. [35] found that British consumers are willing to participate in circular economy initiatives incorporating products from regenerated bio-waste. In Aschemann-Witzel and Peschel [36], communicating that a food ingredient was previously "waste" did not seem to influence consumers negatively. In another study, Peschel and Aschemann-Witzel [37] (p. 9) found that "upcycling in products can be popular among consumers". In Coderoni and Perito [38], 56% of respondents stated to be willing to buy waste-to-value food. In Grasso and Asioli [39] (p. 5), 85% of respondents said they "would consider buying foods with upcycled ingredients". Borrello et al. [19,28] found that many consumers would be willing to participate in innovative circular food loops. In Steenis et al. [40], packaging with a circular design was perceived as more sustainable than the one with a linear design and generated the most positive attitudes. Biological solutions were considered more sustainable than technical solutions [40]. Van Huis [41,42] stressed that insect-based foods are a sustainable protein alternative and present a high nutritional value and health benefits. In Sijtsema et al. [43], participants presented several motives or advantages for circular food behaviors, such as preventing food and plastic waste, economic advantages, a more social food production system, and positive feelings of helping others.

Studies also highlighted challenges. Sijtsema et al. [43] raised several objections and disadvantages consumers perceive in circular food behaviors, such as products' lack of functionality, lack of interest in participating in production systems, economic disadvantages, and risks. In Peschel and Aschemann-Witzel [37], consumers seemed unwilling to pay more for upcycled plant-based alternatives (unless there was transparency about the costs involved, but then the choice likelihood also decreased). Further challenges towards circular food behaviors related to consumers' education [44,45] and lack of knowledge and awareness [18,43,46]. Consumers seemed unaware of food sustainability challenges, failing to include these in their food purchase goals [47]. The lack of information—for example, on the sustainability of different packaging [48] and upcycled food ingredients [39]—showed a need to communicate better with consumers [44]. Further consumption-related barriers found were food neophobia [41,42] and food technology neophobia [17,38] (although food neophobia was not relevant in all cases, e.g., [39]); lack of acceptance of insect as a food source [42,47,49,50] and food produced with upcycled ingredients [18,39]; globalized diets leading to inattention towards diversified, local and seasonal foods [17]; the change of shopping habits [44] and dietary choices [13]; lack of convenience [1,28,44]; adaptation to new technologies [46]; perception of risk in new food technologies [34]; lack of planning in food purchases [51]; the perceived tradeoff between sustainability and taste [36]; unfamiliarity with the "circular economy" term [43]; and the negative influence of the media [44,52].

In short, the selected papers show the novelty and quick popularity of the topic, a dispersion across sustainability or agri-food journals, goals mostly related to consumption, a predominance of empirical data collection in Europe, a focus on behaviors related to protein alternatives, food waste, and upcycled foods, the importance of consumers' education and communication, and mixed results in terms of circular food behaviors.

3.2. Categorization of Circular Food Behaviors

From the analysis of the papers, we offer a framework to better understand the changes towards more sustainable behaviors (Figure 4). We categorize circular food behaviors according to three types, or levels of development: linear, transitioning, and

circular behaviors. Next, we describe the behavior types and characterize them in terms of consumers' role, sustainability goals, engagement, and technology.

	Linear behaviors	Transitioning behaviors	Circular behaviors
Definition	Follow a linear logic	Go beyond the linear logic but lack a systemic view	Integrate into a systemic view
Consumers' role	'Purchasers,' 'users,' 'wasters'	'Learners'	'Doers,' prosumers
Sustainability goals	Short-term economic goals, with secondary environmental or social benefits	Medium-term goals, involving two sustainability dimensions	Long-term economic, social, and environmental goals
Engagement	Low engagement. Consumers believe other actors are responsible for the impact of their behaviors	Medium engagement. Consumers inform about the impact of their behaviors	High engagement. Consumers are skilled and take responsibility for their behaviors
Technology	Traditional technologies. Low complexity	New technologies, connecting niches and informing consumers. Medium complexity	Support consumers' education and connection. High complexity

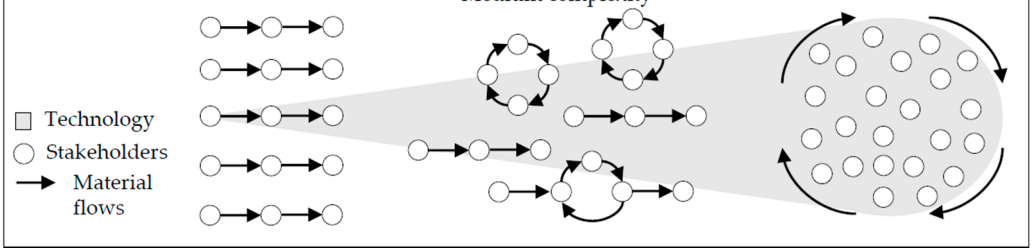

Figure 4. Transition towards circular food behaviors: three types of behaviors and their characteristics.

3.2.1. Linear, Transitioning, and Circular Behaviors

We distinguish three types of circular food behaviors: linear, transitioning, and circular behaviors. In this section, we define these behaviors and give some examples. The categorization is a general guide, and the examples are illustrative. A clear-cut categorization would require a more precise assessment, such as approaches combining life cycle assessment (LCA) and behavioral sciences [53] or social practice theory [54]. For instance, Di Sorrentino et al. [53] propose that LCA can integrate with behavioral science (BS) and help measuring behavior and assessing potential and means for changing behavior. This combination of LCA and BS is meaningful in terms of behavior-driven ecodesign since, in the environmental impact assessment of a product, behavioral aspects are crucial in the choice between different alternative products, the subsequent behavior of using the product, and—at the end of the use phase—in the decision how to dispose of the product. To assess sustainable consumer behavior, the authors review cognitive aspects underlying human decision making that can suggest concrete intervention for behavior change in the context of sustainable product design and policy interventions.

Linear behaviors follow a linear logic of taking-making-disposing materials [14] but contribute to the circular economy by having secondary environmental or social impacts. Examples are purchasing products that use resources more efficiently (e.g., through eco-efficiency) [40] and separating waste.

Transitioning behaviors go beyond the linear logic but lack a systemic view. The transition phase involves a mix of linear behaviors and new, circular behaviors that develop in niches. Examples are: purchasing innovative products, such as insect-based foods, upcycled food products [19,37], and foods with edible coatings [55]; purchasing less appreciated products, such as food with a non-standard aesthetics [46] or surplus food [56]; purchasing local and seasonal foods [57]; participating in alternative food networks, as packaging-free grocery shops, community-supported agriculture [57], short food chains [46,58], online groceries shopping [51], food box schemes [51,57], and digital platforms fighting food

waste [45]; returning food waste to be upcycled [19,59] in "food-product-as-a-service" approaches [28]; finding new strategies towards circularity, such as food sharing and repurposing [60]; and more radical practices, like dumpster diving [13,61]. The niche experiments that succeed in the transition phase become mainstream in the circular phase—not necessarily by upscaling these experiments since small cases might be multiplied in local communities [57].

In circular food systems, products follow a cyclical loop—for example, with packaging made of renewable material [51], or with consumers' food waste serving as insect feed, which later becomes feed for animals that re-enter the food consumption [19]. To this end, production cycles need to be redesigned and incorporate consumers [51]. In this way, what differentiates *circular behaviors* is that they integrate into a systemic view [51], in which broad, systemic, and economic changes are the goal. We agree with Holmes [62] and Jurgilevich [13] in that many practices to the circular economy are not novel and are already in use or recognized. To Jurgilevich et al. [13] (p. 12), the difference is that the "circular economy provides a framework in which society can create cross-sectoral policy to support varied initiatives in different 'parts of the circle' for the ultimate goal of breaking away from the linear and extractive model to a more sustainable mode of production and consumption".

Circular behaviors go beyond the individual products' choices: they are part of consumers' lifestyle [17], with consumers actively involving in initiatives that promote the circular economy. Borrello et al. [28] find that lifestyle measures (coping with risks of food provisioning, managing dependencies in food provisioning, convenience, and social pressure towards recycling) can be relevant drivers of consumers' willingness to participate in innovative circular food loops [28]. We propose that circular food behaviors imply adopting a *circular food-related lifestyle*, in which food consumption is part of systemic thinking. Consumers' choices are interconnected and consider a combination of factors, with the complete management of the food provisioning and diets primarily based on sustainable decisions.

3.2.2. Consumers' Role

The investigated papers emphasize the role of consumers in the transition towards circular food systems: "The transition to a circular economy [. . .] requires first and foremost a change in the situation of consumers and not just that of isolated entrepreneurs" [46] (p. 129). Consumers can support circular food systems through their choices [51] in terms of lifestyle and dietary eating patterns [17]; and by accepting novel products, such as upcycled foods [37,38] and new packaging solutions [44]. Consumers may have different roles in circular food behaviors: classic customers, prosumers with flexible commitment, and compulsory volunteers [57]. We propose that these roles differ in each type of behavior.

In *linear behaviors*, consumers are customers [57] and owners [59] of products or services. Food consumption is centralized in supermarkets [46], with a passive purchase, use, and discard of products, and a lack of awareness about the food chain [13,19]. Consumers are "considered mere intermediaries between retailers and waste collection" [59] (p. 40).

We propose that in *transitioning behaviors*, consumers become "learners": they educate, learn, inform, and develop new abilities, knowledge, and competencies [13,60] to support the transition towards circular food behaviors. Consumers' education seems essential in adopting new food technologies and has been associated with lower food technology neophobia [34]. By learning more about the circular economy and how to make it concrete, consumers also increase their involvement [43]. Consumers can learn about the "complexity of food consumption" and the "sustainability and health gains of sustainable diets" [63] (p. 16); they can start to "change their habits regarding the end-life of products" [59] (p. 43) and learn "what can be composted, replanted, or what is suitable for wildlife to eat" [60] (p. 10). They can learn how to interact with food products designed for circularity and change their perception of what "waste" is [56]. This learning can happen through formal education in schools, promotion campaigns in the media [59,64,65], educa-

tion policies promoted by governments [66], or even through companies' educational and engagement efforts [56]. It can also occur in niche experiments that educate consumers [57] and develop their skills and knowledge through the exchange between people [62].

In *circular behaviors*, consumers are "doers" of everyday activities, who incorporate food in their daily activities [60]; they become prosumers [57], which means the division between consumption and production is less clear [67]. Prosumption can imply different activities, such as volunteering to work in food initiatives and accepting the limitations of the work in the field [57].

3.2.3. Sustainability Goals

The circular economy aims to achieve sustainable development [15], i.e., a development that meets "the needs and aspirations of the present generation without compromising the ability of future generations to meet their needs" [68] (p. 292), implying a long-term perspective. Sustainability is also commonly divided into three dimensions: economic, environmental, and social. We propose that consumers' goals in circular food behaviors vary in terms of the time-frame and sustainability dimensions targeted.

In *linear behaviors*, the main focus is on short-term economic goals, which might have secondary benefits for the environment or society. People might reduce food waste, which positively impacts the environment—but their primary motivation is economic. *Transitioning behaviors* broaden consumers' concerns [46], who then motivate by the economic and at least one more sustainability dimension (usually the environmental). They focus on medium-term goals. We propose that *circular behaviors* target broad and holistic sustainability goals—simultaneously considering long-term economic, social, and environmental aspects. So far, studies mostly neglect the social dimension, although it might enable sharing and circulating food in different ways [62]. Mylan et al. [60] (p. 11) recommend, "a move beyond the current focus on economic value and environmental costs produced by material flows, to also consider the social value generated through processes of 'consumption'". Circular food behaviors may involve social benefits such as the "provision of care, enjoyment, maintenance of traditions and connections with personal histories" [60] (p. 11) and create a community and social support [57,62]. In addition, the social aspect (such as caring for farmers' welfare) may be critical to motivate consumers to participate in circular systems [65].

3.2.4. Engagement

In the linear economy, consumers mostly act isolated; the circular economy presupposes their engagement. We propose that consumers' engagement gradually increases from linear to circular behaviors.

In *linear behaviors*, consumers have no responsibility toward products (apart from domestic recycling) [59] and believe that other actors (as companies and governments) are responsible for the environment and society [43]. Therefore, consumers adopt the options available in the market and act according to their private interests. In *transitioning behaviors*, consumers start to engage in niche experiments and develop, test, and disseminate them. This engagement may happen in a more flexible or binding way [57]. In niche experiments, consumers get informed about their behaviors' impact, develop skills relevant to circular food behaviors [60], and promote these experiments so that they can be upscaled [13]. In *circular behaviors*, consumers actively and voluntarily engage in circular practices and long-term relationships [56]. They assume responsibility for their behaviors [18,57] and for the design, use, and disposal of products [52,59] and have a set of skills that support circular food behaviors. Some niche experiments become mainstream, some remain a niche, and others disappear [13].

These different engagement levels presuppose that not only consumers get involved. Multiple stakeholders—such as industries, the government, social research, media, retailers, consumer organizations, the food and packaging design industry, and circular economy groups [13,46,47,49,51,52,57,59,69]—should focus "on the collective efforts that

are necessary to build a more resilient food system" [57] (p. 174). The behavioral changes towards circular food systems have to occur in a broad, systemic [51], economic, social [60], political [57], and cultural [1,57] level. Collaboration is the keyword, and consumers are part of it.

3.2.5. Technology

Technology may support circular food behaviors through innovation, connection, and education. As in the previous point, we propose that the support and complexity of technology increase from linear to circular behaviors.

Linear behaviors use traditional technologies, such as recycling and composting [19,35]. Innovations are incremental, e.g., based on reducing resources used in the production stage and end-of-pipe approaches. Consumers use technology to reproduce the linear logic—for example, to make online purchases and compare prices.

In *transitioning behaviors*, consumers experiment and adopt new technologies that support the circular economy. This experimentation may involve radical innovations, as insects as animal feed [19,59], refrigerators and freezers with "integrated storage solutions and tools for measuring shelf life" [51] (p. 1440) or technologies in food packaging [44], such as QR codes that interact with bins and aid consumers in the disposal process [52]. Innovations are consumer-oriented and may be developed in collaborative approaches, such as co-creation [43], co-innovation, or co-design [70].

Technologies can support in new ways old modes of provision [62] or engage consumers in innovative experiments [57]. Both in transitioning and circular behaviors, technologies connect, inform, and educate consumers and have the potential to bridge the "circularity holes" in food chains [45]. They can educate about a product's benefits, indicate how and where to dispose of products [44,52], guide consumers towards healthier and more sustainable food choices [13], and increase transparency in the food chain [63]. Digital means and online communities—such as information and communications technologies, apps, digital platforms, and social networks—disseminate established practices and simplify and amplify the connections between different actors [45].

A circular economy "takes a step beyond the pursuit of waste prevention and reduction to inspire technological, organizational, and social innovation across supply chains" [35] (p. 966). Therefore, *circular behaviors* involve changing infrastructures and technologies that support consumption [52,60]. In the circular economy, the technologies from the transitioning phase become established and widely adopted. Innovations occur at a systemic level [18], and niche experiments become mainstream.

In sum, the main takeaway of this section is that the transition to circular food systems aims to achieve *circular behaviors*, which (i) are part of a systemic circular economy view, (ii) define consumers as doers or prosumers, (iii) pursue long-term sustainability goals, (iv) show a high engagement of skilled consumers, and (v) receive the support of technologies for education and connection.

3.3. Future Research

In the promotion of circular food behaviors, engaging consumers may be one of the greatest challenges [43]. Behaviors may involve different tradeoffs, such as investing more time and effort to behave more sustainably. Future studies should investigate ways of making circular food behaviors more familiar and attractive to consumers [43]. This greater engagement can support a systemic view of circular behaviors, which mostly lacks in the current literature.

Although we present some examples of foods and behaviors that could fit each category, the literature needs an understanding and consensus on what sustainable food is [18]. Future studies should clarify differences between circular behaviors so that consumers can have confidence in what they should do. The linear, transitioning, and circular behaviors (Figure 4) could also be explored in different ways. These behaviors' characteristics (their definition, consumers' role, engagement, and technology) could be refined—for example,

by understanding users' willingness to adopt circular food-related technologies and the existing drivers and barriers [45]. Future studies could also check whether the proposed framework applies to other contexts than the food sector.

In terms of scope of analysis, future studies could collect data in other regions than Europe and compare results. Studies could also expand knowledge to product categories not yet investigated—for example, other upcycled and innovative food products [36,37,39] or bio-based products [35]. In addition, most of the selected studies investigate isolated behaviors or products. We call future studies to address multiple behaviors, aiming to achieve a systemic view of circular food behaviors. Future studies could also use real products and realistic designs (such as field experiments) to reduce hypothetical- and social desirability biases [39]. Aschemann-Witzel et al. [17] and Grasso and Asioli [39] also recommend studies to do sensory tests so that the taste is taken into account.

Many current studies investigate the consumption of recent, hypothetical, or not-yet-in-the-market innovations. Examples are waste-to-value/upcycled food products or novel ingredients in food [34,36,37,39]; a bio-fiber beer bottle [48]; a new biodegradable material based on food waste [35]; and hypothetical food waste recycling initiatives [19,28]. This shows that there is still much to understand in terms of consumers' reactions to these innovations and reinforces Kirchherr et al.'s [71] (p. 269) argument that the circular economy is a "difficult-to-implement concept"—also in terms of food consumption. Future studies should explore the feasibility of these initiatives. For example, is it technically possible to develop the innovations considered? If yes, would this be a sensible financial investment for companies? Are the other actors involved in the initiatives willing to invest the time, effort, and financial resources necessary? Does the legislation allow and support the development of these hypothetical innovations [70]? These and other factors should also be examined for each initiative before they are considered applicable (for an overview of possible challenges for the circular economy in the food sector, see [59]).

The investigated studies mostly disregard the social dimension of sustainability, a gap also found in previous reviews on the circular economy [72]. Future studies should take a better account of this dimension. Social outcomes, such as consumers' health and healthcare costs [73], could be further explored. In addition, considering that the ongoing pandemic situation has changed food consumption habits [66], studies could investigate changes in food-related lifestyle behaviors in the "post-COVID" world.

Finally, future studies should focus on behaviors with the greatest sustainability potential. The ranked lists proposed by Aiking and de Boer [1,47] (with potential improvements in the food system and current Western consumption patterns, respectively) could guide it. Although reducing consumption is considered one of the most critical strategies, few studies in our sample have investigated it. The behaviors investigated focus more on reducing food waste or the consumption of animal-based products (and substituting these with other protein alternatives [56])—but not so much on overconsumption.

4. Discussion

Previous reviews on circular economy called for more research on motivating consumers to participate in circular solutions [74], showed that consumers have been neglected in initial circular economy definitions [15], and suggested that circular food consumption was rarely investigated [23]. This trend seems to be reverting: our results show a growing number of studies in recent years on the topic, indicating that interest in circular food behaviors is increasing.

As in previous reviews on circular consumption [23] and circular economy in general [72], the Journal of Cleaner Production is the outlet publishing more papers. Sustainability is also among the most important journals. Differently from previous reviews, in our study, outlets related to agri-food have greater importance. This result reflects the focus on food-related behaviors. However, it also indicates that researchers on circular food consumption could direct their efforts not only for sustainability-related outlets but also towards niche-journals from different areas.

Despite the growth in publications, room exists for expanding the knowledge in the area. Most empirical studies reviewed collect data from Europe, with few articles exploring other regions, especially emerging economies. The same issue appears in previous reviews on consumption in the circular economy [23] and circular economy in general [72,74]. China and Asia have the largest number of articles on the circular economy in the reviews by Ghisellini et al. [74] and Merli et al. [72], respectively. However, only one study in our sample targets the country, and Camacho-Otero et al. [23] also found fewer studies on circular consumption in the region. This imbalance indicates that research on circular production is not always accompanied by research on circular consumption in the same geography.

Our main contribution is to propose and characterize three types of circular food behaviors (linear, transition, and circular). All types contribute to the transition towards the circular economy, but the third one is the "ideal" to achieve. A linear logic can gain efficiency, but it also leads to "low food prices [...], a lack of a connection between consumers and the food they eat, and a lack of appreciation of food as a vital source of life by consumers or food supply chain actors" [75] (p. 6471). Therefore, only a systemic logic, with changes in diets and purchase habits, may achieve a resilient, regenerative food system [73].

A systemic view of consumption may imply a lifestyle change; in the food sector, this means a new food-related lifestyle and responsible multi-stakeholder engagement. Recent studies have related the food-related lifestyle to edible insects [76] and food waste [77]. We suggest that future research expands this view to circular food behaviors by developing a circular food-related lifestyle concept.

In circular food-related lifestyles, consumers will avoid or reduce the consumption of foods with a negative environmental impact [78]. The behaviors mostly studied in the selected papers relate to protein substitution. This focus aligns with studies recommending reducing red meat production and consumption to diminish the environmental impacts of food systems and help the transition towards more sustainable food consumption patterns [79–81].

Our results support that sustainable behaviors may involve tradeoffs for consumers [82]. Usually, acting in favor of the environment is more costly in terms of time and money [83] or considered less pleasurable or convenient [82]. For example, although consumers want to avoid food waste, this usually is not prioritized when there are tradeoffs concerning taste, convenience, or health [75]. Therefore, it is essential to find ways of helping consumers to behave more sustainably, without giving up other priorities.

We also concur with the importance of educating consumers on a more practical level. People may lack the skills or knowledge to perform more sustainable behaviors in a way that just being aware of an environmental issue may not necessarily translate into behavioral changes [83]. For example, consumers present a lack of knowledge about environmentally friendly packaging, and the characteristics that make a packaging be considered "sustainable" can differ across cultures [84]. The awareness of consumers in various European countries about meat production's environmental impact is also surprisingly low [80]. Finding out the appropriate educational tools for different contexts is essential in the promotion of circular food behaviors.

5. Conclusions

The circular economy is a framework that can help to integrate sustainability in food systems [13,63]. Promoting circularity in food systems is more relevant than ever, considering that the ongoing pandemics "has highlighted the importance of sustainable food management by revealing the food system as a pivotal aspect of the sustainable supply chain" [66] (p. 9). In this sense, the literature lacked an integration of what has been studied so far in terms of circular food behaviors. This paper contributes to that by providing an overview of the literature on circular food behaviors. It summarizes the insights of 46 studies, categorizes the circular food behaviors, and proposes an agenda for

future studies. This overview of current studies helps to understand the state-of-the-art of research and direct future efforts towards unexplored areas.

Although circular economy literature clearly emphasizes systems thinking, we see a predominance of incremental changes at consumers' and users' level. It is hard to change the existing paradigm, as some structures are highly rooted [18]. We propose that the path towards circular food behaviors could start with small changes within the current practices that support this evolution (*linear behaviors*), going through slightly more transformative practices (*transitioning behaviors*) until reaching circular practices (*circular behaviors*). We propose that, by understanding different behaviors that can be encouraged, it could be easier to transition towards circular food systems. The expectation of rapidly moving from linear directly to circular behaviors is probably exaggerated and unrealistic, but a smooth transition may have better chances of being welcomed and long-lasting.

We acknowledge that this paper is limited by a small sample of papers and illustrative examples of behaviors fitting in each category, without an empirical analysis that identifies which practices are the most sustainable. However, to the best of our knowledge, this is the first review addressing circular food behaviors and provides a set of future research possibilities. Future reviews could develop the theme further, for example, by applying meta-analytical designs that provide statistical analysis of the outcomes of studies.

Author Contributions: Conceptualization, K.G.G., M.D.D.B., and N.R.d.C.; methodology, N.R.d.C.; formal analysis, N.R.d.C.; investigation, N.R.d.C.; data curation, N.R.d.C.; writing—original draft preparation, N.R.d.C.; writing—review and editing, K.G.G., M.D.D.B. and N.R.d.C.; visualization, N.R.d.C.; supervision, K.G.G. and M.D.D.B.; project administration, K.G.G. and M.D.D.B.; funding acquisition, K.G.G., M.D.D.B. and N.R.d.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Aarhus University; The Brazilian National Council for Scientific and Technological Development (Conselho Nacional de Desenvolvimento Científico e Tecnológico) (CNPq), Call GM/GD, process 141414/2017-0 and Call PQ/2016, process. 306279/2016-9; and the Danish Agency for Science and Higher Education (Danish Government Scholarship 2018/2019).

Acknowledgments: We would like to thank Rafaela Trizotto and Cynthia Faviero for assisting in the selection of papers.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Data collection in the databases.

	EBSCO Business Source	Web of Science	Science Direct	Scopus
Initial search [a]	• Strings: circular AND food AND consum * • Field searched: Abstract • Results' limits: Full Text, Scholarly (Peer Reviewed) Journal	• Strings: circular AND food AND consum * • Fields searched: Topic (Title, Abstract, Author Keywords and KeyWords Plus [b])	• Strings: circular AND food AND (consumer OR consumption OR consume [c]) • Fields searched: Title, abstract or author-specified keywords	• Strings: circular AND food AND consum * • Fields searched: Article title, Abstract, Keywords
Partial result	378 papers	420 papers	184 papers	487 papers
Inclusion criteria	• Language: English (n = 376)	• Research Areas: Agriculture (42), Behavioral Sciences (1), Business Economics (16), Communication (1), Cultural Studies (1), Development Studies (2), Education Educational Research (3), Environmental Sciences Ecology (147), Food Science Technology (67), International Relations (1), Operations Research Management Science (3), Psychology (1), Public Administration (3), Science Technology Other Topics (113), Social Sciences Other Topics (1), Sociology (2), Urban Studies (4) • Document types: Article (186), Editorial Material (5), Early Access (3), Review (29)	Article type: Discussion (2), Research articles (124), Review articles (37), Short communications (5)	• Source type: Journal (432) • Language: English (472), Spanish (3), German (1), Portuguese (1) • Subject areas: Agricultural and Biological Sciences (167), Arts and Humanities (5), Business, Management and Accounting (63), Decision Sciences (5), Earth and Planetary Sciences (11), Economics, Econometrics and Finance (19), Environmental Science (176), Multidisciplinary (11), Neuroscience (5), Psychology (2), Social Sciences (52) • Document type: Article (283), Review (41), Note (3), Editorial (1), Short Survey (1)

Table A1. *Cont.*

	EBSCO Business Source	Web of Science	Science Direct	Scopus
Exclusion criteria	• Language: Lithuanian (1) and Turkish (1) • Exact duplicates (180)	• Research areas: Allergy (1), Anthropology (1), Asian Studies (1), Biochemistry Molecular Biology (11), Biodiversity Conservation (2), Biophysics (2), Biotechnology Applied Microbiology (11), Cell Biology (1), Chemistry (39), Computer Science (3), Construction Building Technology (1), Electrochemistry (1), Endocrinology Metabolism (2), Energy Fuels (25), Engineering (87), Entomology (4), Evolutionary Biology (2), Fisheries (14), Forestry (1), Gastroenterology Hepatology (2), General Internal Medicine (1), Genetics Heredity (3), Geography (2), Geology (2), Government Law (2), Health Care Sciences Services (3), Immunology (2), Infectious Diseases (1), Instruments Instrumentation (1), Life Sciences Biomedicine Other Topics (1), Literature (1), Marine Freshwater Biology (15), Materials Science (5), Mechanics (1), Metallurgy Metallurgical Engineering (1), Microbiology (7), Nutrition Dietetics (20), Oceanography (2), Parasitology (1), Pharmacology Pharmacy (3), Physics (4), Physiology (2), Plant Sciences (10), Polymer Science (1), Psychiatry (1), Public Environmental Occupational Health (10), Remote Sensing (1), Robotics (1), Sport Sciences (1), Thermodynamics (2), Toxicology (2), Tropical Medicine (1), Veterinary Sciences (8), Virology (1), Water Resources (2), Zoology (2) • Document types: Proceedings Paper (20)	Article type: Book chapters (10), Conference abstracts (4), Encyclopedia (1), Other (1)	• Source type: Conference Proceeding (22), Book (22), Book Series (11), Trade Journal (2) • Language: Chinese (6), French (3), Russian (1) • Subject areas: Biochemistry, Genetics and Molecular Biology (69), Chemical Engineering (44), Chemistry (41), Computer Science (5), Energy (88), Engineering (92), Health Professions (3), Immunology and Microbiology (26), Materials Science (14), Mathematics (8), Medicine (44), Nursing (24), Pharmacology, Toxicology and Pharmaceutics (14), Physics and Astronomy (5), Veterinary (9) • Document type: Conference Paper (2)
Sample collected	**188 papers**	**220 papers**	**168 papers**	**329 papers**

[a] The asterisk (*) used in the search terms refers to a multi-character wildcard, meaning that the search engine matches any words that fit the pattern. [b] KeyWords Plus are index terms automatically generated from the titles of cited articles [85]. [c] Science Direct did not support wildcard characters at the time of the search.

Appendix B

Table A2. Goals, primary behaviors explored and main results of the selected papers.

Source	Goal(s)	Primary Behavior(s) Explored	Main Results
Aiking and de Boer [1]	To sketch why a transition from diets based primarily on animal proteins towards diets based primarily on plant proteins products is urgent for both food security and sustainability.	Adopting a diet based primarily on plant proteins products	A dietary transition from primarily animal towards plant protein products is required. New dietary guidelines are taking sustainability into account, and the contours of a diet transition are slowly emerging.
Aiking and de Boer [47]	To outline the role and potential contribution of insects towards food security and sustainability from a multidisciplinary perspective.	Accepting edible insects	In light of the circular economy, insects are useful for food, feed, and other purposes. Health may be key to entice consumers to progress towards a diet transition. An integrated, multidisciplinary approach, including all stakeholders, remains a prerequisite.
Aschemann-Witzel and Peschel [36]	To explore how Danish consumers of cocoa drinks react to the use of potato and grass protein in a mock-up plant-based cocoa drink in terms of attitude towards the product and expected quality.	Attitude and expected quality towards a plant-based cocoa drink	Results show a main effect of gender and brand and an interaction of ingredients with both brand and communication, respectively. For both grass and potato proteins, the unknown brand is relatively preferred and better liked by males. Communication improves attitude towards potato drink. Brand- and product design-related differences play a role in determining attitude to products with such new ingredients.
Aschemann-Witzel et al. [17]	To outline how sensory consumer science can contribute to the further sustainable development of food production and consumption.	Changing food choices and diets, accepting new food and food-related behaviors	Six transformations to which sensory consumer science can contribute: (1) promotion of a dietary shift towards more sustainable foods and diets, (2) increase of food diversity, (3) food waste reduction, (4) enhancement of the circularity of the food system, (5) heightening and prioritizing food-related well-being, and (6) coping with the effects of climate change.
Bocken et al. [56]	To explore business innovation for sufficiency as a means to encourage sustainable consumption.	Slow consumption; moderate consumption; sustainable consumption.	Creation of a conceptual framework, including a range of sufficiency strategies for food. Although sufficiency implies consumption moderation, it is suggested that when a company substitutes the consumption of a less sustainable option, growth could be desirable.
Boesen et al. [48]	To investigate how consumers living in Denmark perceive the environmental sustainability of liquid food packaging and how much they know about eco-labels; to compare the perceived environmental sustainability with LCA.	Perception of the environmental sustainability of food packaging; knowledge about eco-labels	There is a gap between Danish consumers' perception of the environmental sustainability of packaging and LCA results. Consumers have limited knowledge of sustainability-related eco-labels.

Table A2. *Cont.*

Source	Goal(s)	Primary Behavior(s) Explored	Main Results
Borrello et al. [59]	To illustrate an alternative to the traditional supply chain of bread based on the principles of a circular economy; to highlight the major barriers to achieving a smooth transition into a bio-based economy in the agri-food sector.	Returning bread leftovers and used packaging to retailers; household recycling/reuse of materials	Presentation of a framework for the bread chain with two technologies (insects as feed and degradable packaging); Seven macro-categories that summarize the main challenges which actual implementation of the model would face: regulatory limitations; reverse cycle logistics management; geographic dispersion of enterprises; system boundaries and leakages of matter; acceptance among consumers; technology development and diffusion; uncertainty of investments and incentives.
Borrello et al. [19]	To assess consumers' willingness to participate in strategies to reduce food waste inspired by the circular economy.	Returning food waste, purchasing circular food products	Portrait of the potential participation of consumers to closed loops inspired by the principles of the circular economy. The willingness to participate did not depend significantly on the level of innovativeness of the technology.
Borrello et al. [28]	To analyze consumers' willingness to participate in an innovative food provisioning mechanism with retailers.	Willingness to participate in an innovative food provisioning mechanism with retailers	The expected participant is an individual already engaged in tasks to cope with risk in food provisioning and having already developed a long-lasting relation with a retailer. The study reveals the opposite effect of concerns about tasks related to take-back system, such as food waste handling, and social desirability of recycling.
Cattaneo et al. [34]	To investigate how food technology neophobia level, socio-economic variables, and information affect consumers' attitude towards uses of food by-products in relation to positive effects on the environment and consumers' health.	Attitude towards uses of food by-products	Education and food technology neophobia and information can be critical in facilitating the adoption of new food technologies. Positive attitudes towards food by-products were found, even in people with a greater food neophobia and lower education level.
Christis et al. [86]	To measure to which extent circular economy strategies in Brussels Capital Region can enable climate change mitigation and understand their effect on the material footprint.	Consumption adapted to needs, improved diets, no excessive consumption	With circular economy-strategies on consumption or production of food, mobility, and housing, Brussels could mitigate 25% of its carbon footprint and 26% of its material footprint, 18% of its carbon footprint and 26% of its material footprint, and 7% of its carbon footprint and 10% of its material footprint, respectively.
Ciulli et al. [45]	To investigate the 'circularity broker', uniting network research and circular supply chain research.	Food waste recovery	The paper uncovers how platform organizations foster the recovery of waste by bridging circularity holes. It identifies and explicates six brokerage roles (connecting, informing, protecting, mobilizing, integrating, and measuring), and discusses them in relation to extant literature, highlighting novelties compared to earlier studies.

Table A2. *Cont.*

Source	Goal(s)	Primary Behavior(s) Explored	Main Results
Clark et al. [44]	To understand the views of stakeholders from the UK food packaging supply chain towards a move to the circular economy.	Perception of food packaging, changing shopping habits, reducing food and packaging waste	Possible solutions towards the circular economy have different benefits and limitations. Transformative technologies could enable these solutions; in selecting the best solution for packaging, a decision-maker must consider supply chain constraints and consumers' behaviors.
Clark et al. [52]	To understand how packaging development stakeholders can apply consumer behavior research methods within the packaging development process to aid the UK's food-to-go supply chain in the transition to a circular economy.	Consumer engagement in the food-to-go packaging development process; disposal of food-to-go packaging	Although all stakeholders identified strengths in incorporating behavior studies into the supply chain packaging development process, providing essential knowledge feedback loops, barriers to their application include the cost and time to implement, plus the existing inconsistent UK waste infrastructure.
Coderoni and Perito [38]	To evaluate factors that favor consumer engagement in the circular economy by purchasing waste-to-value (WTV) food.	Purchasing waste-to-value food	Food neophobia and food technology neophobia negatively influenced the probability of positive purchase intentions. Consumers who give importance to reading food labels and think that food could have environmental or health benefits are more likely to be willing to buy WTV food.
de Boer et al. [87]	To explore the relative importance of 'Reward' and 'Reflection' in food orientations.	Consuming meat versus plant-based food	Giving relatively low importance to both Reward and Reflection ('routine taste') is not favorable for healthier and more sustainable diets; giving importance to Reward but not Reflection ('hedonic taste') is not better; giving relatively high importance to both Reward and Reflection ('reflective taste') can be a favorable, complementary combination.
Farooque et al. [64]	To identify and systematically analyze the causal-effect relationships among barriers to circular food supply chains in China.	End-of-life management of leftovers; of unwanted, expired, or wasted food; and of packaging materials	Two key cause-barriers to circular food supply chains in China are weak environmental regulations and enforcement and lack of market preference/pressure. Lack of collaboration/support from supply chain actors is the most prominent barrier.
Fogarassy et al. [88]	To explore the circular characteristics of consumers' attitude towards food purchasing in Hungary.	Consumers' attitude towards food purchasing	Highly educated young people, who are conscious consumers and live on good incomes, may be the target group for circular innovation.
Grasso and Asioli [39]	To understand the most preferred attribute composition for upcycled foods using the attributes price, type of flour, protein content and Carbon Trust label.	Consumers' preferences for novel food products made with upcycled ingredients	Consumers preferred biscuits made with wheat flour and tended to reject biscuits made with upcycled sunflower flour. Three consumers' groups were identified: (1) price sensitive consumers with the strongest preferences for low price biscuits, (2) traditionalist consumers and strongest rejection for upcycled sunflower-flour, (3) environmentalist consumers with the strongest preference for biscuits with the Carbon Trust label. Most consumers had not heard of upcycled ingredients before, but they would consider buying foods with upcycled ingredients.

Table A2. *Cont.*

Source	Goal(s)	Primary Behavior(s) Explored	Main Results
Hebrok and Heidenstrøm [51]	To identify decisive moments and contexts within everyday practices where food waste could be prevented.	Food waste-related practices (acquiring, storing, assessing, valuing, and eating)	Five practices emerged as significant to food waste generation: acquiring, storing, assessing, valuing, and eating. Discussion of the role of the material structures within these practices and the possible interventions.
Holmes [62]	To explore how alternative modes of provisioning employ ordinary practices of sharing and circularity.	Participating in an alternative food provisioning group	Studying materiality is one way to illuminate new and emerging spaces of provisioning; this material focus illustrates how provisioning practices are not new but organized in original and novel ways; the materials of provisioning can be both beneficial and troublesome to provisioning organizations' practices of circulating and sharing and the extent to which they tackle social and sustainable issues.
Jurgilevich et al. [13]	To shed light on the concept of circular economy in the context of a circular food system.	Avoiding food waste and surplus, reusing food, utilizing by-products and food waste, changing the diet, political activity	Challenges and potential solutions. Circular economy as a framework to create policies supporting sustainable initiatives in different 'parts of the circle.'
Kiss et al. [58]	To cast light on the short supply chains' role in circular economy and sustainability.	Consuming in short food supply chains	Short supply chains connect to circularity and sustainability through environmental issues, health, food quality, consumers' behavior, producer-consumer relationships, and the local economy. These factors cannot be generalized across all short chains. Their circular economic and sustainability features depend on their location, type, and individual attitudes of the involved consumers and producers.
Kuokkanen et al. [18]	To understand what hampers the transition to a circular nutrient economy in Finland from the stakeholders' perspective.	Consuming food produced with recycled nutrients; taking responsibility for nutrients	The policy-governance interface lacks directionality and coordination; the enterprise-market interface creates inadequate demand articulation. The resilience of deep-rooted structures is critical.
Lakemond et al. [49]	Does not apply (editorial)	Consuming edible insect	The circular economy is a perfect vehicle to plug in edible insects, but their embedding in the whole process should be further worked out.
Lehtokunnas et al. [61]	To examine the everyday practices of food waste reduction in households as ethical work.	Household food waste practices	Results suggest that in order to understand the circular economy as a moral economy, it is crucial to note the moral complexity of everyday life that results from partly contradictory ethical sensitivities and practices.
Mak et al. [89]	To elucidate how circular bioeconomy can be achieved through sustainable food waste management, review the existing food waste management literature, and suggest research directions and limitations.	Food waste-related behavior	Future developments on food waste management are expected to explore the multi-functionality of products, boundary and allocation in a circular system, and the tradeoff between food waste and resources.
McCarthy et al. [65]	To assess consumers' willingness to buy food derived from underutilized biomass.	Willingness-to-buy value-added foods	Half of the sample was willing to buy value-added food. Helping Australian farmers was the top-ranking factor driving demand. Awareness of the food waste problem distinguished consumers willing to buy value-added food.

Table A2. *Cont.*

Source	Goal(s)	Primary Behavior(s) Explored	Main Results
Mylan et al. [60]	To illustrate an alternative account of 'consumption' through the application of a 'sociotechnical' perspective to understanding what shapes patterns of resource use in everyday life.	Domestic food provision practices	A suggestion of conceptualizing consumers as 'doers' of everyday activities, instead of 'users' of products or services; and of taking account of the social value of consumption in the principle of eco-effectiveness.
Núñez-Cacho et al. [90]	To analyze what consumer's characteristics influence a sustainable purchase decision.	Sustainable purchase decision	Consumers' purchase decision on the food industry is conditioned by factors such as age, sustainable behavior, knowledge of the circular economy and the perception of usefulness of plastic.
Pashova et al. [55]	To examine consumer attitudes towards the use of edible coatings in various sectors of the food industry.	Purchasing products with edible coatings	Most consumers are not familiar with edible coatings, so they would not consume foods with them. There is a need to raise consumer awareness of the benefits of edible coatings.
Pereira et al. [46]	To estimate the environmental benefits of milk sold through vending machines compared to milk sold in supermarkets, and to assess it from a socio-economic point of view.	Purchasing from a milk short supply chain based on vending machines	A short supply chain can bring environmental and socio-economic benefits, but the entrepreneurship may not suffice—the transformation towards a circular food system requires political and societal commitment.
Peschel andAschemann-Witzel [37]	To investigate different degrees of transparency in communicating sustainable production practices, especially upcycling, on consumers' perceived benefit (preference) as well as companies' potential cost and benefits (sales volume and prices charged).	The likelihood of choosing plant- based foods with upcycled ingredients	A higher degree of transparency in communicating sustainability efforts increases product choice only to a minor degree or even affects it negatively. Fair price perception increases for upcycled alternatives, but only when cost transparency, a specific type of transparency, is disclosed. This leads to a tradeoff consisting of selling either more of the product but for lower price, or less product but at a higher value, that is, more for less or less for more.
Principato et al. [16]	To quantify the main food loss and waste and their causes along the food supply chain of the pasta production; to understand if this food loss and waste could be reused according to the circular economy approach.	Reusing and minimizing food loss and waste (FLW)	The pasta supply chain is a good example of a circular economy as little is lost. Food losses in the field are minimal, while the straw obtained during the harvest is typically used as animal feed and litter. The losses in the grinding of the wheat and pasta production amounted to approximately 2%. Most FLW occurs during the cultivation and consumption.
Reckinger [57]	To analyze four case studies of the circular and collaborative economy-type fruit and vegetable production as well as unpackaged and/or socially responsible food retail.	Participating in alternative food networks (AFNs)	AFNs carve out a protected space for themselves on a small scale, allowing them to experiment and develop know-how, building networks to ground their knowledge claims onto agricultural practices and community backing. They hope to set a precedent for informed policy-making. AFNs need prosumers to make their knowledge claim strong and legitimate.
Rumpold and Langen [50]	To give an overview on potential strategies for the promotion of edible insects as food; to portray challenges regarding consumer acceptance of edible insects in an organic-based bioeconomy; to highlight the role of the consumer for the success of an organic-based bioeconomy.	Consumer acceptance of edible insects	Trust, willingness to eat, and overcoming disgust and neophobic reactions are central aspects to attain consumer acceptance of edible insects. Other key factors seem to be taste and other sensory aspects.

Table A2. *Cont.*

Source	Goal(s)	Primary Behavior(s) Explored	Main Results
Russo et al. [35]	To understand consumers' intentions to purchase, pay for, and switch to products made from regenerated bio-waste.	Intention to purchase, pay for, and switch to products made from regenerated bio-waste	Findings reveal no effects for product involvement and gender on the dependent variables, but for green self-identity, attitude towards bio-based products, age and past purchase experience of eco-friendly products.
Saviolidis et al. [63]	To explore and analyze stakeholders' proposed solutions for creating sustainable agri-food systems.	Sustainable food consumption behavior	Most of the identified solutions were located in the strategic tools category, reflecting shared recognition of the need to integrate food policy to achieve long-term goals. Emerging solutions—those which were most commonly identified among the different national contexts—were used to derive empirically-grounded and more universally applicable recommendations for the advancement of sustainable food consumption policies.
Sijtsema et al. [43]	To find the starting points for consumer involvement in activities that promote a circular economy.	Perception of circular economy and of food-related practice cases of a circular nature.	Most consumers did not have a clear understanding of the term 'circular economy'; Perceptions, attitudes, motives and barriers in terms of advantages and disadvantages varied and were related to (1) the functionalities of the products, (2) the production system, (3) economic aspects and (4) emotions such as concern about risks. The authors identified four key messages: targeting with regard to behaviors, attitudes and product functionalities; aligning with emotions; linking to practical cases; and applying multidimensional circular economy-related behavior in everyday life and involving consumers in its innovation.
Sijtsema et al. [70]	To introduce circular food design model and present some applications.	Participation in circular food design	The added value of circular food design model is; first, the model stimulates a citizen participation approach in a creative way; second, the model supports communication and collaboration among all involved disciplines. The newly developed circular food design model visualizes an iterative approach meant to be a flexible and creative tool to structure the new food development in the different phases to support value creation in the food system in order to support its transition.
Steenis et al. [40]	To assess to what extent (combinations of) sustainable design strategies affect consumers' purchase intentions.	Consuming packaging redesigned following circular economy strategies	Consumers respond favorably to more sustainable packaging redesigns, particularly biological circular improvements and less so to linear ones. Such effects are mainly driven by higher perceived sustainability, associated with greater perceived naturalness and moral satisfaction. The combinations of sustainable design strategies in packaging design follow the principle of diminishing returns.
van Huis [41]	To elucidate the effect of insects as feed and food on nutrition and health of humans and animals.	Consumption of insects as food	The academic interest in insects as food and feed is growing exponentially. In addition to their high nutritional values, there are also health benefits, such as prebiotic effects of insect products, and antioxidant properties. The main strategies related to consumer issues are disguising the insects in familiar products and making them tasty.

Table A2. *Cont.*

Source	Goal(s)	Primary Behavior(s) Explored	Main Results
van Huis [42]	[To clarify] prospects of insects as food and feed.	Consumption of insects as food	People in western countries are not used to eating insects, and therefore, strategies to 'convince' consumers of their hygienic safety, environmental sustainability, and tastiness are necessary. The insect sector is maturing fast, but still faces many challenges, which can only be met when all stakeholders cooperate closely.
van Zanten et al. [69]	To assess the potential contribution of livestock—fed with low-opportunity cost feedstuff—to the food supply, while reducing arable land use.	Consuming livestock raised under the circular economy concept	Livestock—by recycling biomass unsuited for direct human consumption back into the food system—can potentially play a key role in feeding the future population.
Vilariño et al. [91]	To review global food loss and waste (FLW) and the related environmental, social, and economic impacts.	In-home practices to reduce food loss and waste	The literature lacks information and evaluation of the socio-economic impact of measures and policies to reduce FLW. Lack of reliable and consistent data and inconsistences in definitions and measurement frameworks of FLW need to be addressed.
Zarbà et al. [92]	To evaluate potential changes in habitual and occasional consumers in the use of wild plants in human nutrition.	Using wild plants in human nutrition	Wild leafy 'vegetables' are included among new food lifestyles and are valued mainly due to health, popular tradition, and sustainability aspects.

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