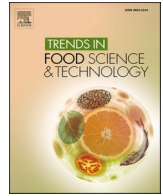




Contents lists available at ScienceDirect

Trends in Food Science & Technology

journal homepage: www.elsevier.com/locate/tifs

#Socialfood: Virtuous or vicious? A systematic review

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ARTICLE INFO

Keywords:

Social media
Consumer
Information
Consumer exposure
Food experience

ABSTRACT

Background: Academic interest in the use of social media data is rapidly increasing. The application of social media analysis in various domains is an emerging trend due to a massive volume of available data, accessibility, and interaction. Food is often a protagonist of the posting activity on social networks; however, the analysis of social media use in relation to food is still limited.

Scope and approach: The dual purpose of this systematic review was, firstly, to provide an overview of the existing literature about the phenomenon of food in social media, in order to identify the role of the consumer, the interlocutors of the message, and the type of content conveyed. Secondly, evaluate the impact of social media use, and understand whether the access to social media content can affect consumer knowledge, awareness of healthy food choices, or drive consumers towards unhealthy food practices.

Key findings and conclusions: Studies can be classified according to two types of communication flow, named *from* (consumer as the sender of a message) and *to* consumers (consumer as a receiver). Content analysis outlined four main categories: user-generated content, information measures and risk communication, digital marketing and exposure. Our results revealed a dual nature of social media use in relation to food: a virtuous one, leading to an increase in consumer knowledge and information, and a bad one, which tends to change individual behaviours in the direction of unhealthy food consumption practices.

1. Introduction

The term ‘social media’ broadly refers to websites and applications that enable users to create and share content online. Despite being a relatively new trend, social media have become a global phenomenon. In 2019, the number of social media users worldwide reached 3.48 billion, and is constantly growing every day (Kemp, 2019).

According to a recent estimate, 2.45 billion of people worldwide actively use Facebook monthly, followed by the Google-owned video site YouTube and Instagram (Kemp, 2019). Eurobarometer data (Special Eurobarometer 487a, 2019) revealed that online social networks have seen the most noticeable increase in recent years: approximately 47% of Europeans use them at least once a week, and almost one-third of Europeans use social networks every day or almost every day.

Social media platforms are becoming increasingly embedded in everyday life, albeit with some age, gender, and socio-economic differences. The spread of social media has been proven to affect several parameters of life both negatively and positively, including politics (Allcott et al., 2020; Garrett, 2019; Lee & Xenos, 2019), social life (O’keefe &

Clarke-Pearson, 2011; Junco, 2012; Oh et al., 2014), news consumption (Kalsnes & Larsson, 2017; Lee et al., 2017; Bergström & Jervelycke Belfrage, 2018), teenage behaviours (Jelenchick et al., 2013; Vanderhoven et al., 2014), parenting (Duggan et al., 2015; Moore & Lantos, 2019), stress levels (Hampton et al., 2014; van der Schuur et al., 2019), and language use (Eisenstein et al., 2014; Grieve et al., 2018).

Food as a subject area is quite relevant on social media. Indeed, population is frequently exposed to food-related posts: for example, the search for the hashtag (a word or phrase preceded by the hash sign ‘#’, used on social media websites to identify messages on a specific topic) #food on Instagram yields 370 million posts, 34.6 million of them for #foodpics and 10.1 million for #Nutella®. The heightened attention to food-related content within social media has led popular mass media to name this phenomenon ‘FoodPorn’. This term denotes all images that portray food in an appetising or aesthetically appealing way (hashtag #foodporn identifies 216 million pictures on Instagram). Even though the use of this term has spread in non-scientific environments and scientific evidence is still limited considering that the phenomenon is quite recent, some researchers have argued that appetising food images may

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Received 21 July 2020; Received in revised form 5 February 2021; Accepted 11 February 2021

Available online 22 February 2021

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have a deleterious impact on certain eating behaviours (Ouweland & Papies, 2010; Robinson & Matheson, 2014).

A clear understanding of the role of social media in the food domain is still lacking. This notion has been underlined by Frewer et al. (2016), who identified a gap in the knowledge related to the application of social media in food-related communication and the need to examine its potential use in addition to traditional approaches. Nonetheless, the fact that social media have the potential to improve food risk and benefit communication (Rutsaert, 2014), though relevant, does not exhaustively describe the relation and interactions of social media with the food domain.

One can argue that the presence of food on social media can reframe the ways people interact with food on multiple levels, and this change can have either positive or negative effects. Meanwhile, many studies have already analysed the role of social media in the health domain (Laranjo et al., 2014; Smailhodzic et al., 2016) and their impact on consumer behaviour. Amongst many, Smailhodzic et al. (2016) identified seven effects of social media use on patients, either beneficial (improved self-management and psychological well-being and enhanced communication between the patient and healthcare professional) and detrimental, like the risk of addiction to social media or the loss of privacy. In addition, Laranjo et al. (2014) explored the effectiveness of social media based health interventions and found that despite the heterogeneity of outcomes, social support and the possibility of the easy spread of health information, can improve the cost-effectiveness of health interventions. On the other hand, other studies suggest that mental health can be adversely affected by the use of social media, especially in the case of children and adolescents (Piteo & Ward, 2020), together with an increasing risk of self-harm and suicide (Picardo et al., 2020).

By contrast, no studies have reviewed the impact of social media in the food domain with a consumer focus. In this context, the aim of this review is twofold: firstly, to provide an overview of the existing literature about the phenomenon of food in social media, to identify the role of the consumer, the interlocutors of the message, the type of content conveyed, and secondly, to evaluate the impact of social media use, or rather to understand, on the basis of the previous classification phase, whether the access to social media content can affect consumer knowledge, awareness of healthy food choices, and healthy food behaviours, or on the contrary may drive consumers towards unhealthy food practices.

The results of the present review can provide insights that could be relevant for future research and applications and for future policy formulation.

2. Methods

A systematic literature review on the effects of social media use on food-related issues was conducted to identify and assess appropriate papers for inclusion in the review. A systematic review involves an explicit, rigorous, and transparent methodology for identifying, selecting, and coding papers (Greenhalgh et al., 2005). Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009) were followed in the conduct and reporting of this review. We employed a search strategy consisting of two strings connected by the 'AND' operator, as follows:

- a) 'social media' or 'social network' or 'Facebook' or 'Twitter' or 'Instagram' or 'porn'
- b) 'eating' or 'eat' or 'food' or 'healthy food' or 'unhealthy food' or 'overweight' or 'underweight' or 'obesity' or 'anorexia'.

The keywords were selected for the specific purpose to answer the research question proposed in the aim section, and more specifically, to compile a set of general keywords, that can enable the identification of all the papers covering the issue of food and social media (social media,

social network, Facebook, Twitter, Instagram, food, eating, eat and porn) and a set of more specific keywords focusing on the potential effects of food-related posts on consumer eating behaviour (unhealthy food, healthy food, overweight, obesity, underweight and anorexia). This combination of keywords was employed to search in the online databases Web of Science, SCOPUS and Pubmed, from 2010 to 2020. For pragmatic reasons, the language of publications was limited to English, and the results were filtered for research articles and reviews only, excluding conference proceedings and book chapters. The results of the two searches were compared and then merged to eliminate double counting. The searches were performed in December 2020 and yielded 5216 unique references after removing the duplicates.

The first step of the selection process involved the evaluation of titles by two researchers independently, and their coding outcomes were compared via inter-coder agreement, which ensures the validity of research results. In our study, inter-coder agreement (Cohen's kappa) was 98.2%, and the remaining differences were resolved through personal consultation between the two coders. The evaluation caused the exclusion of 2979 articles (because they were not relevant to the food domain) leaving 2237 papers for the next phase of the review.

For the next step, the abstracts were coded independently by the same two coders (Cohen's kappa = 97.4) using a set of inclusion criteria to better align the results with the scope of the review. For example, in a large proportion of the literature, the term 'social network' has been used to indicate a subject's social sphere composed of family and friends, which is not relevant to the aim of the present work. Additionally, papers strictly related to health implications of food behaviours (e. g., the development of chronic diseases) were discarded. This phase excluded 1996 papers (Fig. 1).

At the final step, full-text articles of all 241 abstracts were collected using the libraries accessible to the authors through their institutional affiliations and then were coded and categorised according to four levels of classification:

2.1. Descriptive analysis of the dataset

The first level is represented by the identification of the key features of each work:

- Title, author/s, year, and journal
- Geographical scope of the study (country)
- The type of data used (i.e., textual/written or image-based/visual or both textual/image-based)
- Social media being analysed (e.g. Facebook, Twitter or Instagram)
- Content classification based on Web of Science, SCOPUS and Pubmed categories.

Because this field of research is very young and seminal, the inclusion of all types of papers dealing with both qualitative and quantitative research, was considered the best strategy in line with the aim of the work.

2.2. The role of the consumer

The second level of classification was implemented by analysing the structure of information flows. To this end, the present authors started from the assumption that social media communication is naturally interactive and makes it possible to consider each user both a message sender and recipient, in connection with a wide variety of other users. Thus, with the objective of finding a coding scheme that can clarify information structure and flows, the present authors decided to focus on the role of social media users by placing consumers at the centre, as message sender and receivers. Moreover, the type of interlocutors involved in food communication on social media was identified and classified.

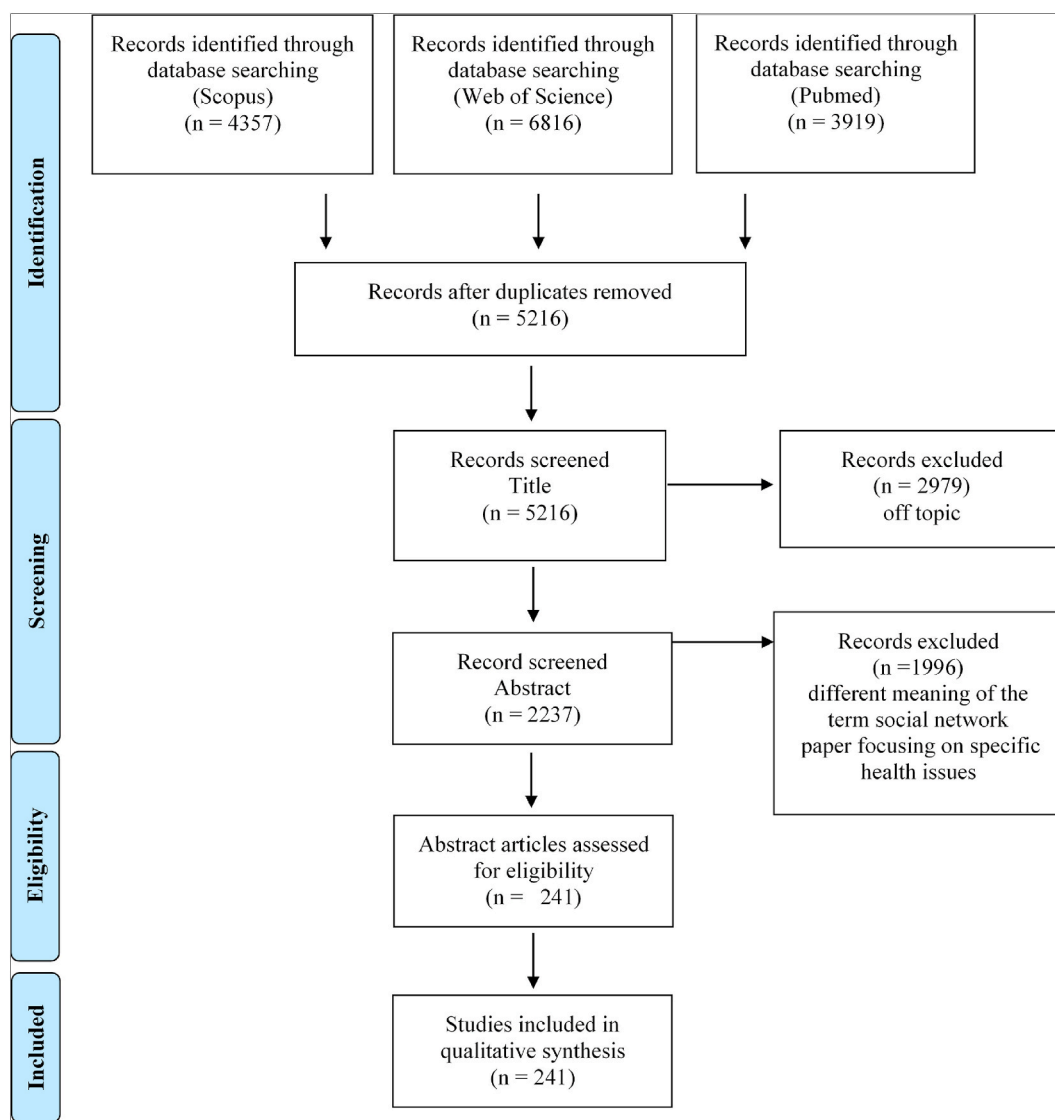


Fig. 1. PRISMA Flow Diagram for the selection process.

2.3. Content analysis

The third level of classification focused on content categorisation, with the aim to understand – for both the roles of the consumer and each interlocutor considered – what the main topics involved in food-related communication on social media are.

2.4. Impact analysis

The fourth level of the coding procedure dealt with the impact of social media as the main effect found by authors with reference to each paper category identified at classification steps 2 and 3. The categories considered were as follows: a positive effect for the papers which showed that a specific use of social media in the food domain can lead to an improvement in consumer knowledge, awareness of healthy food choices, or healthy food behaviours; and a negative effect whenever papers indicated that social media may help to spread incorrect food-related information or promote unhealthy food practices. Finally, the papers where investigators did not claim any specific effect (or outline both pros and cons) were classified as mixed.

3. Results

3.1. Descriptive analysis of the dataset

The results in Table 1 show that, with few exceptions, it was not until 2013 that the relation between food and social media truly started to receive academic attention. Research peaked in 2018, with 50 articles being published that year. Specific social media platforms were investigated in 130 articles (58%), whereas the remaining papers offered more general investigation into the use of social media in the food domain. Twitter and Facebook are the most important platforms for researchers (13.9% and 13.4% of studies, respectively) far ahead of Instagram (8.2%), YouTube (6.5%) and Pinterest (1.3%), but the 12.1% of papers have dealt with two or more social media platforms.

When analysed by country, a strong focus of American research on the topic of social media and food was found because almost 18% of the papers include analysis performed in that area, followed by Europe (13.4%), Australia (7.4%), and China (4.3%). Nevertheless, nearly half of the studies covered by the review do not refer to a specific country of analysis.

As for the type of data used, text posts are the most common tool for the analysis of the contents related to food in social media (e.g. Twitter

Table 1
Key findings of descriptive analysis.

Items	Percentage of studies (%)
Year of Publication	2010–2012 (3.5%), 2013–2015 (22.5%), 2016–2018 (49.8%), 2019–2020 (24.2%).
Social media	Twitter (13.9%), Facebook, (13.4%), Instagram (8.2%), You Tube (6.5%), Pinterest (1.3%), Others (2.6%), More than one social (12.1%), Not specified (42%).
Country of data Collection	United States (17.7%), Europe (13.4%), Australia (7.4%), China (4.3%), other (10%), not Country specific (47.2%).
Content analysis	Text analysis (16.9%), Image analysis (10%) Both (23.8%), No text/Image analysis (49.4%).
WOS/Scopus Categories	NUTRITION AND HEALTH (nutrition and dietetics, healthcare science, pediatrics, neurosciences) (15.5%), SCIENCE AND TECHNOLOGY (multidisciplinary sciences, food science and technology, Biotechnology & Applied Microbiology, Green & Sustainable Science & Technology) (13.8%), BEHAVIOURAL SCIENCES (behavioural sciences, psychology, psychiatry, social) (21.1%), BUSINESS (business, ethics, Planning and development, Agricultural Economics, Management) (13.8%), POLICIES (Health Policy & Services, Public, Environmental & Occupational Health, Communication, education) (27.6%), OTHER SCIENTIFIC DISCIPLINES (Engineering, Computer Science, Cybernetics, Ergonomics, Information Science & Library Science, Medical informatics, Artificial Intelligence, Geography, Developmental) (8.2%).

posts, or exploration of the use of hashtags on Instagram). On the contrary, visual communication alone is much less investigated, given that only 10% of the papers include image analysis in the research, while a considerable proportion of studies (23.8%) have combined text and image analysis and their interaction on social media platforms. The extreme complexity and diversification of research activity in this field is revealed by the distribution of the WOS/Scopus/Pubmed categories to which the papers have been attributed. Although Nutrition and Health and Policies are the most represented classes, several studies have addressed the technological, behavioural, and business issues related to food content in social media. In a few additional papers, the main field of research is investigated from different points of view, e.g. computer science and geography.

3.2. The role of the consumer

The second step of the analysis was aimed at identifying the direction of the information flow on social media and different types of consumer involvement, separating those papers that deal with an active function of consumers (a sender, i.e., personal posting activity) from those that investigate more passive involvement (a receiver, i.e., when consumers are exposed to somebody else's messages). Thus, papers were classified based on the role of the consumer in the communication process and flow.

The analysis revealed that, owing to the intrinsic nature of social media, consumers can play both roles: thus, the first group of the studies has analysed the consumer as the sender of a message and accordingly was classified as *from consumers* (71 papers). The second group of studies deals with the consumer as a receiver and was classified as *to consumers* (170 papers).

In any case, the consumer is at the centre of this structure, playing either an active or passive role, such that social media becomes an ambivalent tool for the diffusion of food-related contents.

3.3. Content analysis

Table 2 outlines the third level of classification, by representing the type of content generated for each of the two above-mentioned consumer's roles and its main interlocutors.

The set of studies involving the analysis classified as *from consumers*, indicates that users can interact with institutions, food producers, and other consumers (71 papers). In this category the types of content were classified as Nutrition/Health (i.e. the analysis of dietary behaviour and reasons for eating healthy/unhealthy foods, 34 papers), Food experience (i.e. reviews of restaurants, 18 papers), Marketing (i.e. a personal response to a digital campaign on social media, 9 papers), Environment (i.e. the analysis of food waste behaviours, 5 papers), and Food safety (5 papers). The most represented sub-category concerns the analysis of users' posts regarding nutritional/health-related parameters of personal dietary habits, for instance, a paper about the analysis of tweeting activity on obesity (Ghosh & Guha, 2013).

Nonetheless, the interactive nature of social media could reverse information flow, meaning that content developed by some users could be read and seen by others as passive information. The category *to consumers* (Table 2) includes the set of papers that regards the consumer as a receiver (170 papers). The type of content is classified as *Information Measures & Risk Communication* (92 papers), *Digital Marketing* (43 papers) and *Exposure* (35 papers).

The most representative sub-category is *Information Measures & Risk Communication*, where the main players are public institutions: the main purpose of this group of studies is to evaluate the effectiveness of informational and educational programmes conducted via social media. Our content analysis revealed that social media platforms have been utilised to spread information on specific food issues, addressing educational and informational programmes or campaigns on nutritional contents of food (nutrition/health, 53 papers), risk/food safety issues (28 papers), and environmental topics related to food consumption (e.g. like the use of social media to shift consumers' attitude towards sustainable behaviours, such as a food waste reduction, 6 papers). A few studies have covered other food issues (5 papers), e.g., the role of social media in promoting local cuisine, improving the effectiveness of the food-chain governance, or supporting the evolution of urban food systems.

The second important sub-category of the *to consumers* group of studies is related to the use of social media for food advertising (*Digital Marketing*, 43 papers), which includes those papers that address the use of a social media platforms by the food industry as the most innovative way to engage consumers and stimulate the purchase of food products.

The last sub-category in the *to consumers* class includes studies that have analysed exposure to food-related content generated by other users (*Exposure*, 35 papers). This sub-category includes the investigation of the 'food-porn' phenomenon, meaning the propensity to emphasise the aesthetic appeal of a meal by sharing it on social media before or during its consumption, a phenomenon that leads to the situation where social platforms are increasingly becoming a showcase for beautiful and appetising dishes to which other users are exposed unintentionally. Moreover, the analysis of the role of specific content created by popular users (i.e. 'influencers') is also the focus in several studies, which investigate the relation between exposure to social media posts and food choices.

3.4. Impact analysis

3.4.1. The from consumers category: the main effects of what consumer posts

In the sub-category related to *Self-generated Content*, the group of studies on Nutrition/health (34 papers) is the majority, and the main topic is obesity, approached through the analysis of what people like to share about obesity (So et al., 2016) or communication about childhood obesity on Twitter (Harris, Mansour, et al., 2014). For this analysis, authors collected and coded tweets containing hashtag #childhoodobesity. This type of study is aimed at identifying the prevalent

Table 2

The third level of classification: content analysis.

Role of consumer	Interlocutors	Type of content	N.o of papers	Sub-Topics	N.o of papers	
FROM CONSUMERS (71)	Institutions, Food producers, Consumer	Self -Generated Content	71	Nutrition/Health	34	
				Food experience	18	
				Marketing	9	
				Environment	5	
				Food Safety	5	
TO CONSUMERS (170)	Institutions	Information Measures & Risk Communication	92	Nutrition/Health	53	
				Risk/Food safety	28	
				Environment	6	
	Food Producers Consumers	Digital Marketing Exposure	43	Food	5	
				35		

beliefs and attitudes about obesity and suggests that social media can be a good environment to promote healthy messages. Only two studies have focused on the risks related to a potential relation between eating disorders and social media content related to fitness (Holland & Tigge-mann, 2015) and body image (Rounsefell et al., 2019). Thus, social media content promoting a healthier lifestyle may have unintended negative consequences in terms of risks of eating disorders and compulsive exercise.

Another group of studies is focused on the description of food experience and its potential value in academic research (Table 3, Self-generated Content on food experience, 18 papers). The enormous quantity of data potentially available on social media platforms about consumer preferences, perceptions, and behaviours towards food is highly attractive from a research perspective. For example, Ariyasri-watana and Quiroga (2016) performed an analysis of the consumers' natural expression of consumers linked to the deliciousness of meals.

In the same line of research, Vidal et al. (2015) used Twitter data to analyse what people say about different eating situations, thus exploring the reasons for specific food choices. This sub-category of studies was coded as having a positive impact, in that they depict social media as an effective source of consumer data for researchers. In parallel, some other studies related to food experience analysis have yielded relatively mixed results. Coary and Poor (2016), who investigated consumer-generated

food images and the influence of such images on the consumer creating them, argue that posting activity leads to a delay in food consumption, which can increase the savouring of indulgent foods, and, only in some cases, of healthy foods as well. Similarly, a study exploring how adolescents communicate food images on social media suggests that it could be challenging to monitor the use of these tools in the marketing of unhealthy foods (Holmberg et al., 2016).

An additional sub-category of studies included in this class is Self-Generated Content on Marketing (9 papers), where the focus is on the application of social media by the food industry as an innovative tool for collecting large amounts of qualitative data at low cost. The players in the food industry can apply social media data to discover new trends, evaluate the success of marketing campaigns or monitor product performance, with several benefits including a cost reduction for product development (Carr et al., 2015). The effects shown in this sub-category are globally positive or mixed, with only one study indicating negative effects: Liu and Lopez (2016) stated that consumers' conversations about brands and nutritional characteristics of carbonated soft drinks can act as a driver of purchasing behaviour, with implications for consumer diets. In contrast, Pilař et al. (2018) demonstrated positive implications of hashtags for the promotion of new sales channels, such as farmers' markets.

Few other studies have addressed the value of social media data for

Table 3

A summary of results of the impact analysis: classification 'from consumers'.

	TYPE	IMPACT	SAMPLE STUDIES
FROM CONSUMERS (71)	Self-Generated Content on Nutrition/Health (34)	Positive	Ghosh and Guha (2013); Hingle et al. (2013); Chen and Yang (2014); Chou et al. (2014); Harris, Mansour, et al. (2014); Widener and Li (2014); Gore et al. (2015); Shan et al. (2015); Nguyen et al. (2016); So et al. (2016); Chung et al. (2017); Zhang et al. (2017); Inan-Eroglu and Buyuktuncer (2018); Ozhan Dedeoglu and Kabasakal (2019); Santarossa et al. (2019)
		Mixed	Chancellor et al. (2016); Branley and Covey (2017); Carrotte et al. (2017); Smith and Carpenter (2018); Cavazos-Rehg et al. (2019); Holmberg et al. (2019); Hawkins et al. (2020); Laguna et al. (2020); Saura et al. (2020); Steils and Obaidalahe (2020); Walsh and Baker (2020)
		Negative	Teufel et al. (2013); Tigge-mann and Slater (2013); Ghaznavi and Taylor (2015); Holland and Tigge-mann (2015); Santarossa and Woodruff (2017); Rounsefell et al. (2019); Bertolazzi et al. (2020); Wilksch et al. (2020)
	Self-Generated Content on Food Experience (18)	Positive	Lynch (2010); Ariyasri-watana and Quiroga (2016); Doub, Small, Levin, et al. (2016); Meza and Park (2016); Vidal et al. (2016); Mhlanga and Tichaawa (2017); Middha (2018); Arellano-Covarrubias et al. (2019); Oliveira and Casais (2019); Yu and Sun (2019); Zhu et al. (2019); Lim et al. (2020)
		Mixed	Vidal et al. (2015); Coary and Poor (2016); Holmberg et al. (2016); Wessel et al. (2016); Lewis (2018); Taylor and Keating (2018)
		Negative	–
	Self-Generated Content on Marketing (9)	Positive	Feher et al. (2014); Carr et al. (2015); Dabija et al. (2018); Pilař et al. (2018); Samoggia et al. (2019)
		Mixed	Austin and Gaither (2016)
		Negative	Liu and Lopez (2016); Alruwaily et al. (2020); Rummo et al. (2020)
	Self-Generated Content on Environment (5)	Positive	Lazell (2016); Wang et al. (2017); D'Ambrosi (2018); Ruggeri and Samoggia (2018); Young et al. (2018)
		Mixed	–
		Negative	–
	Self-Generated Content on Food Safety (5)	Positive	Gaspar et al. (2014); Sadilek et al. (2017); Rizvi et al. (2019)
		Mixed	Kang et al. (2017); Vargas Meza and Yamanaka (2020)
		Negative	–

environmental issues (Self-Generated Content on Environment, 5 papers). Wang et al. (2017) proposed an Environmental Quality Index developed by means of people's feelings about pollution posted on social media and found that this method can be an effective pollution evaluation model. Another important topic explored in this sub-category is food waste. Lazell (2016) tried to understand the hidden practices that lead to wastage on campus and encouraged food sharing to mitigate this problem. The last sub-category (Self-Generated Content on Food Safety, 5 papers) refers to data-mining activity on social media platforms to prevent or monitor foodborne illnesses. Sadilek et al. (2017) employed a web interface that generated a list of food venues ranked by the number of tweeted self-reports of illness.

Overall, the *from consumers* group of studies showed positive outcomes in 56% of the studies. The main outcome can be identified as the possibility that personal posting activity can represent an innovative source of data for the analysis of consumer's preferences and behaviour, considered useful for multiple purposes. Academic research can benefit from social media data in the form of a deeper understanding of how consumers shape personal food habits, as in the study by Laguna et al. (2020) where the impact of the COVID-19 lockdown on food priorities was evaluated via a social media survey. Moreover, institutions can

utilise such data to develop more target-focused information campaigns, and the food industry can profile consumers more effectively.

3.4.2. The 'to consumers' category: the main effects of what consumer receives

The set of studies that fell into the *to consumers* category deal with a passive role of users that receive the message in relation to four main topics: information measures, risk communication, social media marketing, and exposure (Table 4). The most positive contribution of academics to social media is their power to deliver healthcare programmes and services, education, and interventions (Information Measures, 92 papers): social media are considered a tool for assisting consumers with positive lifestyle changes, because interventions have largely been effective in promoting physical activity and healthy diets. Participation in a social media programme has been associated with greater weight loss, possibly due to social support (Pappa et al., 2017) in the achievement of health-related goals, a virtual community for encouragement, sharing of success stories, and thus motivating other users (De la Peña & Quintanilla, 2015). As for the sub-category Risk Communication, most of these studies indicate that communication works effectively in increasing user knowledge about a particular issue (Mayer & Harrison,

Table 4
Summary of the results of the impact analysis: 'to consumers' classification.

	TYPE	IMPACT	SAMPLE STUDIES
TO CONSUMERS (170)	Information Measures on Nutrition/Health (53)	Positive	Lohse (2013); Leak et al. (2014); Muller et al. (2014); Tobey and Manore (2014); Dagan et al. (2015); De la Peña and Quintanilla (2015); Ashton et al. (2016); Doub, Small, Birch, et al. (2016); Endres (2016); Gruver et al. (2016); Park et al. (2016); Taiminen (2016); Pappa et al. (2017); Park et al. (2017); Chau et al. (2018); Klassen et al. (2018b); Ling et al. (2018); Loh et al. (2018); Zhou, Liu, and Zhou (2018); Dessart and Duclou (2019); Duplaga (2020); Hockin-Boyers et al. (2020); Januraga et al. (2020); Jefrydin et al. (2020)
		Mixed	Oksanen et al. (2015); Helm and Jones (2016); Meitz et al. (2016); Wilkinson et al. (2016); May et al. (2017); Turner and Lefevre (2017); Hsu et al. (2018); Kite et al. (2018); Klassen et al. (2018a); Raggatt et al. (2018); Reddy et al. (2018); Tan et al. (2018); Timmins et al. (2018); Ambwani et al. (2019); Riesmeyer et al. (2019); Wilson et al. (2019); Chatzopoulou et al. (2020); Moorman et al. (2020)
		Negative	Simpson and Mazzeo (2017); Tiggemann and Slater (2017); Koball et al. (2018); Saunders and Eaton (2018); Butkowski et al. (2019); Coates et al. (2019); Sharps et al. (2019); Sukamto et al. (2019); Dedrick et al. (2020); Foster et al. (2020); Yao et al. (2020)
	Information Measures on risk/ food safety (28)	Positive	Rhoades and Ellis (2010); Mayer and Harrison (2012); Chapman et al. (2014); Harris, Mansour, et al. (2014); Kuttischreuter et al. (2014); Mou and Lin (2014); Wu (2015); Regan et al. (2016); Yang et al. (2016); Marvin et al. (2017); Harris et al. (2018); Renner et al. (2018); Tao et al. (2019); Ying, Yingying, Sha, and Jingjing (2016); Soon (2020)
		Mixed	Freberg et al. (2013); Rutsaert et al. (2013a); Rutsaert et al. (2013b); Rutsaert et al. (2014); Shan et al. (2014); Burke et al. (2016); Desmarchelier and Fang (2016); Henderson et al. (2017); Hilverda et al. (2017); Alvarez-Perea et al. (2018); Hamshaw et al. (2018); Hilverda and Kuttischreuter (2018); Basch et al. (2019)
		Negative	–
	Information Measures on environment (6)	Positive	Young et al. (2017); Narvanen et al. (2018); Singh et al. (2018)
		Mixed	Hynes and Wilson (2016); Mishra and Singh (2018)
		Negative	Simeone and Scarpato (2020);
	Information Measures on food (5)	Positive	Cho and Park (2012); Hearn et al. (2014); Panagiotopoulos et al. (2015); Kamarulzaman et al. (2016); Ming and Chua (2016)
		Mixed	–
		Negative	–
Digital Marketing (43)	Positive	House et al. (2015); Kang et al. (2015); Mostafa (2018); Stevens et al. (2018); Trude et al. (2018); Pilgrim and Bohnet-Joschko (2019); Almousa et al. (2020); Folkvord et al. (2020); Jaffery et al. (2020); You et al. (2020); Olstad and Lee (2020)	
	Mixed	Minton et al. (2012); Lee et al. (2013); De Vries et al. (2018); Vandevijvere, Molloy, et al. (2018); Cuesta-Valiño et al. (2020); Lutfaeli et al. (2020)	
	Negative	Dietz (2013); Freeman et al. (2014); Guidry et al. (2015); Boelsen-Robinson et al. (2016); Dunlop et al. (2016); Freeman et al. (2016); Thaichon and Quach (2016); Buchanan et al. (2017); Folkvord et al. (2017); Baldwin et al. (2018); Brownbill et al. (2018); Buchanan, Kelly, et al. (2018); Buchanan, Yeatman, et al. (2018); Gupta et al. (2018); Horta et al. (2018); Vandevijvere, Molloy, et al. (2018); Jaichuen et al. (2019); Potvin Kent et al. (2019); Qutteina et al. (2019); Bragg et al. (2020); Coates and Boyland (2020); Folkvord and de Bruijne (2020); Kidd et al. (2020); Murphy et al. (2020); Sacks and Looi (2020); Smit et al. (2020)	
Exposure (35)	Positive	Pagoto et al. (2014); Vaterlaus et al. (2015); Kinard (2016); Reed and Keech (2018); Swaney-Stueve et al. (2018); Xu et al. (2018); Krishnan and Zhou (2019); Mete et al. (2019)	
	Mixed	Vandewater and Denis (2011); Staiano and Calvert (2012); Puccio et al. (2015); Calefato et al. (2016); Zhou, Liu, and Zhou (2018); Coates et al. (2019); Nelson and Fleming (2019); Strand and Gustafsson (2020)	
	Negative	Mabe et al. (2014); Carrotte et al. (2015); Murray et al. (2015); Sampasa-Kanyinga et al. (2015); Tiggemann and Zaccardo (2015); Walker et al. (2015); Eckler et al. (2016); Lydecker et al. (2016); Sidani et al. (2016); Spence et al. (2016); Tan et al. (2016); Pila et al. (2017); Tang and Koh (2017); Jin (2018); Pennell (2018); Saul and Rodgers (2018); Declercq et al. (2019); Versace et al. (2019); Lynn et al. (2020)	

2012), thereby improving food safety attitudes and practices. Some other papers have uncovered a mixed effect of social media on food risk communication. Rutsaert et al. (2014) stated that even if speed, accessibility, and interactions make social media a promising tool for crisis communication, the lack of filters and the risk of information overload need to be taken into consideration.

Desmarchelier and Fang (2016) added that the emergence of food scares can potentially give rise to social panic, and Riesmeyer et al. (2019) pointed out the risk of untrustworthy information on Instagram. Informational campaigns on social media can also help to drive pro-environmental behaviours: Narvanen et al. (2018) found that food waste is strongly perceived as something disrespectful, which evokes a sense of guilt, because food represents a link between humans and nature. Social media provide the opportunity to showcase virtuous actions and behaviour, such as careful food choices, consumption, and practices. Indeed, not only do consumers feel some sense of responsibility towards the time and money spent on food, but also they feel that wasting may be perceived as unethical and therefore influences how others judge them.

Several campaigns have been launched to raise the awareness of food waste using different social media platforms, while creativity, aesthetics, and ethics play a major role in conveying these kinds of messages, and social networks may amplify this effect.

Hynes and Wilson (2016) analysed which norms and values underlie consumers' food choices. Although social media are a great tool for spreading environmental awareness, only 10% of consumers actually act on their pro-environmental attitudes. The easy, fast, and high-volume sharing of pictures and personal information on social media has amplified this phenomenon. For certain issues such as environmental awareness and food waste, a social comparison may be prominent, and social media can affect individual behaviours (Hynes & Wilson, 2016).

In short, few studies have detected a negative impact of the use of social media for informational purposes, implying that despite some shortcomings, social media can be considered an effective tool for spreading positive information among the public.

The second group of studies classified as 'to consumers' refers to the application of social media as an innovative tool for advertising or communication of the food industry with the public (Table 4, *Digital Marketing*, 43 papers). However, many studies have uncovered a negative impact of social media marketing on consumers, particularly on adolescents (Boelsen-Robinson et al., 2015; Dietz, 2013; Montgomery & Chester, 2009; Thaichon & Quach, 2016). By using strong definitions such as 'digital junk', the authors suggest that the food industry, especially larger organisations, are purposefully exploiting the special relationship that teenagers have with the new media, by means of online marketing campaigns that increase consumer interaction and engagement to promote unhealthy foods and beverages (Montgomery & Chester, 2009). Freeman et al. (2014) assessed the role of Facebook in food marketing, showing that ad-hoc content, online shopping pages, apps, and interactive games may make young adults and adolescents increasingly receptive towards food products. Coates et al. (2019) demonstrated that young children are highly influenced by YouTube content and that unhealthy foods are featured more in the videos than healthy foods, thereby leading to high consumption of junk food and sugary drinks. Many studies also underscored the function of YouTube 'Influencers', by showing that they have a potential role in determining children's choices in terms of food.

Nevertheless, the vast majority of studies in this field are limited to a mere recognition of the existence of a relation between exposure to unhealthy food contents and food consumption habits: they simply stated the problem, failing to propose concrete solutions to limit or at least control negative effects. An exception is the work by Kidd et al. (2020) in which a specific tool (a browser extension) is proposed to monitor adolescent's exposure to unhealthy food advertisements, with promising future applications.

The third group of papers that belong to the *to consumers* classification has analysed the impact of social media content developed neither

for informational purposes nor for advertising by the food industry but posted by single users and then spread by the social media community (Table 4, *Exposure*, 35 papers). The main issues discussed in this set of papers are the exposure of users to social content and the influence of time spent on social media itself, with most of the studies highlighting a potential negative (or mixed) effect on consumers. Mabe et al. (2014) identified cross-sectional and temporal associations between Facebook use and disordered eating. Similarly, other studies point to a link between social media use (e.g. the amount of time spent on Facebook, the number of Facebook friends, and integration of Facebook into day-to-day life) and eating disorders and unhealthy eating behaviours, including skipping of meals and consumption of sugar-sweetened beverages (Eckler et al., 2016; Sampasa-Kanyinga et al., 2015; Sidani et al., 2016; Tang & Koh, 2017; Walker et al., 2015). The main explanation of this phenomenon is based on the sedentary lifestyle of adolescents who have adopted digital media for daily activities. In addition, screen-based media viewing has been proven to encourage indiscriminate eating and high caloric intake.

As for the case of the recent phenomenon called 'foodporn', its consequences are more negative than positive: several authors have identified the creation of an obesogenic environment exacerbated by pictures of calorie-dense foods. Harrar et al. (2011) employed a set of stimuli to demonstrate that high-fat food images motivate human behaviour more effectively than low-fat food images. Spence et al. (2016) describing the neurophysiological changes seen in response to food images, stated that exposure to beautifully presented images of food can have detrimental consequences, stimulating one of the brain's its most ancestral functions (foraging and feeding) and thus exacerbating what they call 'visual hunger', with the consequent risk of unhealthy food consumption, overweight, or obesity.

On the other side, also the risk of underweight and anorexia is exacerbated by the exposure to social media contents related to fitness and healthy food promotion: experimental studies (Chatzopoulou et al., 2020; Holland & Tiggemann, 2015; Tiggemann & Zaccardo, 2015) demonstrated effects as body dissatisfaction, anxiety, disordered eating and compulsive exercise. Moreover, Lydecker et al. (2016) regard Twitter as potential source of content related to fat shaming, which can promote disordered eating. They compared exposure to tweets with other forms of fat-related talk or cyber-bullying and with similar consequences, such as lowered self-esteem, disordered eating, and distorted perceptions of the body image.

However, a few studies suggest that exposure, intended as the level of social engagement, can also have positive effects in the case of social media content related to healthy eating habits (Krishnan & Zhou, 2019), thus implying that social support among users can be helpful in combination with health-related programmes or interventions (Mete et al., 2019).

A summary of the main outcomes is presented in Fig. 2, which is a conceptual map of the patterns, flow, and effects of social media communication regarding food.

4. Discussion and conclusions

Modern society is increasingly embedded in the online environment, and social media platforms represent the most innovative and appealing tools for obtaining and sharing information, especially on food-related issues. The present study provides an overview of this extremely complex phenomenon and offers a classification of social media contents, players, and streams of information within the food domain.

The analysis of social media data on food-related topics is a new and promising research area which has acquired increasing importance over recent years. This field of investigation is particularly productive in the United States, where researchers seem to pay special attention to the assessment of the influence of social media use on human activities including food consumption behaviours. The papers analysed in the present study show a variety of approaches to dealing with the *social*

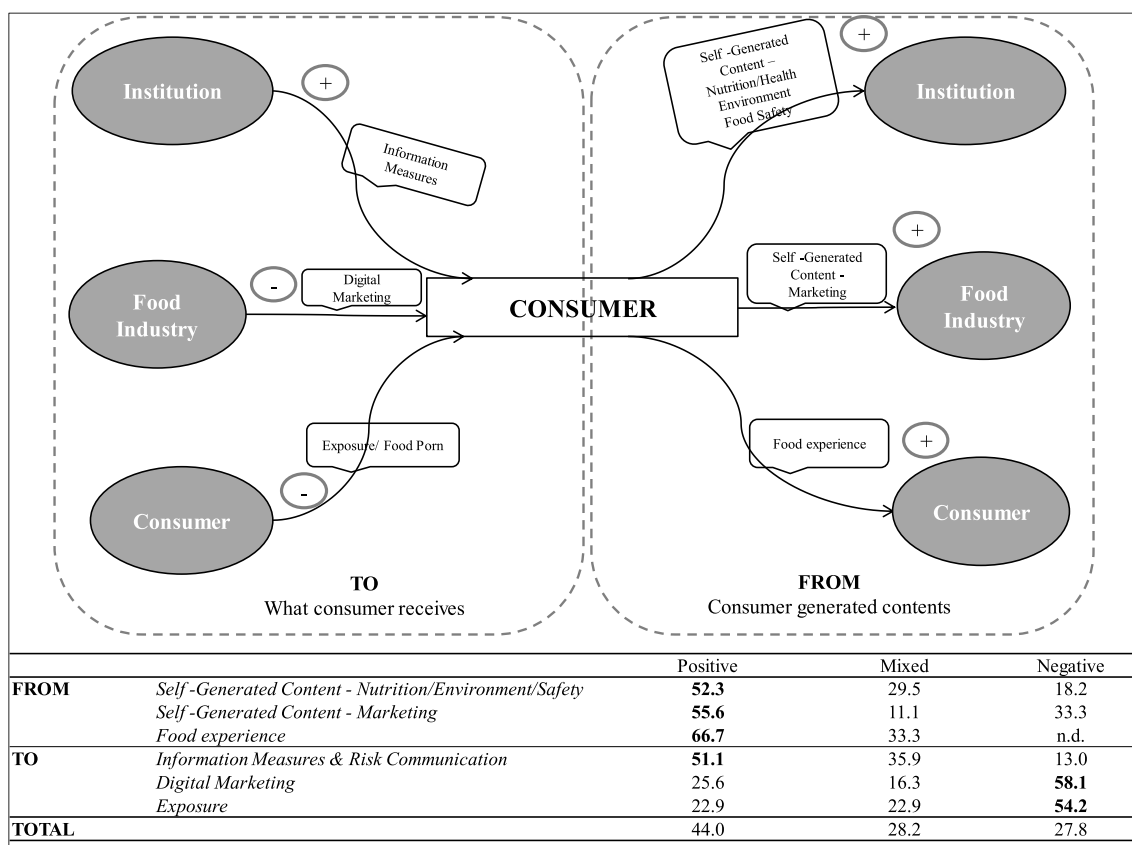


Fig. 2. Social media and food: main outcomes.

food issue. Nutrition has been the predominant theme in all these papers, indicating an interest in understanding the potential presence of a relation between food-related content on social media and evolving modern food consumption models.

Furthermore, this research implies that the scientific literature can be divided into two main categories according to the direction of the information flow, indicated by the *from/to consumers* terms. The two categories were not equally represented, because the number of articles was more than two-fold higher in the *to consumers* category than that in the *from consumers* category, indicating that most research regard the consumer as a passive element subject to external content. It seems that the recent literature is devoted to the social environment such as traditional media, where the information flow proceeds in only one direction, thus, missing the opportunity to assess the interactive power of new communication platforms. Further research is needed to cover a broader scenario, which includes the nature and impact of the content generated by users.

The present study also summarises the literature on potential effects of the huge presence of food content on social media platforms, thereby providing a basis for further research in this field.

As for impact analysis, our investigation revealed that the generation of content *from consumers* rarely has adverse effects: most of the papers considered indicate positive or at least mixed effects. It seems that single users tend to post social media contents simply for the purpose of sharing their food experience, without a pre-determined positive or negative connotation. On the other hand, consumer-generated content can be a useful source of information for research, institutions, and the food industry, which can exploit the huge amount of available information for multiple purposes.

The *to consumers* group of studies includes two sub-categories that mostly contributed to the negative impact assessment, namely, digital marketing and exposure to digital contents developed by other users.

The impact includes users' being easily influenced by the food industry, owing to the power of digital marketing, which can drive high-calorie product consumption. The overwhelmingly large number of food-related images on social media platforms can encourage consumption, consequently increasing caloric intake, whereas long screen time can promote careless and irrational eating patterns.

On the other hand, studies in the sub-category related to information measures and risk communication have uncovered a positive influence for educational and informative activities, enabling easy collection of information on food issues, generating improved responses to educational campaigns, and facilitating social support for achieving specific food-related goals (weight loss, physical activity, healthy eating, recycling, and a reduction in food waste).

In summary, the *to consumers* group of studies indicates a dual nature of social media use. On the one hand, it creates an opportunity to improve knowledge translation, owing to its facilitated interactive communication with the public, speed of spreading a message, and the size of the audience. Such virtuous use of social media content may effectively support public and private interventions intended for healthier and more sustainable food consumption patterns, the implementation of policies aimed at fostering and promoting social media use in this regard is to be considered a strategic goal.

On the other hand, abuse of social media can result in increased exposure to unhealthy food-related content, which could influence children and adolescents negatively. Indeed, according to a Pew Research Center survey in 2018, an estimated 63% of teenagers say they use social media every day, while 45% say they are on the Internet almost constantly, implying that the negative effects outlined in the present study can be crucial in this age group. This group is characterised by a lack of complete knowledge, making them susceptible to misinformation. Nonetheless, the massive use of social media can be potentially exploited as a vehicle of innovative information tools

tailored for teenagers to improve the awareness of their food choices.

However, even if the debate on the tools such as novel software, or apps able to facilitate the control of food and brand marketing to children on digital media is recently acquiring increasing consideration (Olstad & Lee, 2020), no discussion exists about the protection of other vulnerable target groups of populations, different from children, and the control of diverse food advertising that cannot be really considered digital marketing, though presenting comparable features and impacts.

In other words, brands frequently used popular ‘influencers’ to disseminate their marketing messages. Users tend to consider them (influencers or vloggers on platforms such as YouTube) as authentic, and trust their recommendations more than overt advertising by the brands. These kinds of advertising can have in the same way a negative impact on the food choices and on the human health, and few studies succeeded in proposing concrete and feasible solutions or developing innovative tools to support policy interventions. Thus, the present study calls for additional research to find policy measures intended to regulate or control the quality of social media content or to encourage the development of new technologies for decreasing user exposure. Moreover, a more comprehensive framework must be considered to support global policy implication, in order to protect users from different kinds of advertising, including the hidden ones.

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