Accepted manuscript

https://doi.org/10.1016/j.tifs.2023.104290

Trends in Food Science and Technology

Published online 10 December 2023

Social media and food consumer behavior: A systematic review

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Abstract

Background:

Social media (SM) have become an integral part of consumers' daily life, prompting multidisciplinary research on its link with human behaviors, including food attitude and consumption. However, the precise role of SM in shaping food consumer behavior remains partially explored.

Scope and Approach:

This review adopts a systematic literature approach, focusing on the methodological and outcome characteristics. Applying PRISMA guidelines, 377 studies were identified and categorized into three SM functions: Tool, Determinant, and Source. Tool studies involved active SM use for research, while Determinant studies measured SM-related variables' impact on outcomes, and Source studies involved data extraction and analysis from SM. This review traces the growth of studies over time, highlighting the study characteristics focusing on the methodology, and the scope of the findings per function.

Key Findings and Conclusion:

Data collection methods differed across functions: Source studies relying on user-generated content (UGC) via data mining, other functions mostly employed surveys targeted to participants. Notable platforms include Facebook (Tool) and Twitter (Source), with cross-sectional designs being prevalent. Tool and Determinant studies linked SM with food intention and behavior, Source studies delved into categorization and exploration of UGC and consumers' sentiments related to food. In both the Tool and Determinant functions, most studies demonstrated the influence of SM on outcome measures. As each function has its own distinct characteristics, knowledge from all functions should be considered to gain comprehensive perspective regarding the relationship between SM and food consumer behavior.

Keywords: social media, consumer behavior, food behavior, food attitude, systematic review.

1. Introduction

Nowadays, social media (SM) empower consumer voice by facilitating low-cost communication and enabling consumers to express their opinions and share their experiences with millions of people (Olsen & Christensen, 2015). SM have become an essential part of daily life, where consumers integrate and rely on it for many activities, such as obtaining information, communicating, entertainment, and more (Kapoor et al., 2017). Conceptually, SM are defined as applications and websites that provide users with a digital environment in which they can interact with each other by sending or receiving digital content (Appel et al., 2020). Currently, there are a variety of SM platforms, including social networks/SNSs (e.g., Facebook, Instagram, TikTok), blogs, microblogs (e.g., Twitter), and forums. Globally, the number of users of SM will exceed 4.5 billion in 2022, accounting for over 55% of the total population of 7.91 billion people (Kemp, 2022). In addition, the daily time spent using SM is also increasing over the years, from an average of 97 minutes in 2013 to 147 minutes in 2021 (Kemp, 2022).

SM play a role in the rapid dissemination of information and trends, such as the well-known 'viral' phenomenon, which indicates that the content of SM reaches a large audience, supported by the sharing of content by users of SM (Han et al., 2020). Accordingly, SM are the way for brand marketing via influencers. Using celebrities as influencers is costly, hence the emergence of the phenomenon of "micro-influencers". This type of influencer is less well-known to the public but can convey warmer and more relatable messages to their followers, which are often more targeted and reach a significant number of followers (Chang et al., 2019). Therefore, the potential of SM in marketing has prompted companies to integrate it into their strategies (Appel et al., 2020; Saxena & Khanna, 2013).

Meanwhile, food consumer behavior is a captivating topic because it revolves around food, which is a fundamental part of human life. Food not only helps to satisfy hunger, but also influences health and well-being (Nordstrom et al., 2013), as well as the sacred, moral, social, and esthetic aspects of life (Arbit et al., 2017). With the advance of technologies from SM, consumers have gained more information for food-related purposes, such as searching for instructions or recipes for cooking, comparing food products, or

58 evaluating a restaurant, which ultimately leads to decision making, such as selecting, purchasing, and/or
59 eating certain foods or dishes. The marketing potential of SM is also being exploited in the food sector.
60 Some examples include viral food content after celebrity internet chefs post food content to their followers
61 on their platform SM, such as food tips or food or restaurant reviews, or food and beverage promotion by
62 influencers on SM (Coates et al., 2019a; Folkvord & de Bruijne, 2020).

63 Information disseminated through the many platforms of SM can greatly influence consumer behavior. SM
64 not only disseminate positive information, but also have the potential to spread messages or rumors that
65 may be confusing, untrue, or even harmful to consumers, including in the area of food. Some studies
66 examined the issue of rumors, for example, in the context of GMOs (Wang & Song, 2020) or food safety
67 information (Seah & Weimann, 2020) or even in the crisis period of COVID-19 (Cato et al., 2021). Due to
68 the immense increase in consumer use of SM, researchers from various disciplines are being attracted to
69 study behavioral issues (Spiro, 2016), with no exception for food behavior studies (Aleixo et al., 2020; Fat
70 et al., 2021; Hawkins et al., 2021; Kley et al., 2022; Pollack et al., 2022; Sass et al., 2020; Vidal et al.,
71 2015). The number of studies addressing the use of SM in the context of food is increasing, but a complete
72 understanding of the role or influence of SM on food consumer behavior is still insufficient. Many previous
73 reviews have discussed the link between SM and the food sector, focusing primarily on nutrition and health
74 topics. Reviews focused on the role of SM in relation to specific topics such as dieting and weight loss
75 (Hawks et al., 2020), body image and food choices (Rounsefell et al., 2020), nutrition (Chau et al., 2018;
76 Klassen et al., 2018), diet and physical activity behaviors (Williams et al., 2014), eating behaviors (Chung
77 et al., 2021), adolescent food choices (Kucharczuk et al., 2022), food communication (Ventura et al., 2021),
78 sustainable consumption (Bryła et al., 2022), and sensory-consumer science (Hutchings et al., 2023).

79 Therefore, this review focuses on summarizing studies that provide a broader link between SM and food
80 consumer behaviors. Insights are provided on how SM are used in relevant studies to further elucidate the
81 role of SM on consumer behavior. In this context, the main objective of this review was to identify and
82 unfold the elements of food consumer behavior studies based on SM and to describe the methodological

and outcome characteristics. Three research questions were posed: (1) What are the general characteristics of SM -based food consumer behavior studies? (2) What are the methodological characteristics of SM -based food consumer behavior studies? (3) What are the results of SM -based food consumer behavior studies? This paper first describes the methodology used to systematically conduct the study, then presents and discusses the results. Finally, the last section describes conclusions and directions for future areas of research.

2. Materials and methods

2.1. Study eligibility

This study followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) guidelines to conduct the systematic review study (Moher et al., 2009). Before searching and screening the articles related to the topic, a research protocol was established and agreed upon by the researchers. To establish the eligibility criteria, the objective and research questions of the study served as the main starting point and were supported by the PICO (Population, Intervention, Comparison, Outcome) framework. To be included in this review, studies should focus on the general human population (P), use social media (I), no specific comparison/consider all studies (C), and examine food consumer behavior or behavioral indicators (O). This review did not limit studies based on study design and included only studies published up until year 2022 and written in English. Exclusion criteria were also established, as follows: (1) if the SM were used only to recruit study participants; and (2) if the outcome measure was related only to health/clinical status.

2.2. Study screening/search process

Two electronic scientific databases, ISI Web of Knowledge and Scopus, were utilized to search for the relevant articles. The search began by using the developed syntax with key terms related to the following topics: 1) social media (e.g., 'Facebook', 'social media', 'social network', etc.); AND 2) food (e.g., 'food', 'diet', 'snack', etc.); AND 3) behavior or behavioral indicators (e.g., 'preference', 'attitude', 'hedonic', 'liking',

etc.). The syntax was applied to search the terms contained in the title, abstract, and keywords. The full syntax applied to both databases is in the supplementary material.

All retrieved articles from both databases were exported and merged using EndNote (X9, 2019) reference management software. Three authors screened and reviewed the articles for inclusion separately. Any emerged discrepancy was resolved through discussion and consensus. The screening process began with the removal of duplicates. Then, the remaining articles were screened based on the title and continued with abstract screening. Articles with irrelevant titles or abstracts were removed, and the remaining articles were subjected to in-depth full-text screening. The flow of the search strategy for the present review is shown in Figure 1.

[INSERT FIGURE 1 HERE]

2.3. Data extraction and analysis

Following screening, an extraction sheet was developed to facilitate data collection and extraction. The general information of the articles was extracted, such as the author, the year of publication, the general research topic, and the objectives of the studies. In addition, the main relevant information to be extracted was classified into four groups of characteristics related to SM (platform, social media intervention measures along with measurement method), sample (target population and sample size), methodology (research method, study design, data collection method), and outcome measures. The extracted data were coded numerically or textually to facilitate the analysis of the results. Because the design, variables, and outcome measures were not uniform across studies, no meta-analysis was performed in this review.

Because of the different characteristics of the included studies, further classification was performed to improve the understanding of the results presented in this review. The studies were classified according to how SM were used in the research. Three groups of SM features were identified: 1) Tool, where SM were actively used by either the researcher or participants for study purposes. For example, when researchers used a private group of a particular SM platform to deliver information to participants and later measured

the effect of the intervention on specific outcome variables; 2) Determinant, when studies measured SM - related variables and assessed the relationship between these variables and specific outcome variables. For example, in a study in which participants were required to answer questions about SM behavior and food consumption in a survey format, thus neither the researcher nor participants actively used SM; and 3) Source, when researchers extracted and analyzed data from SM (e.g., tweets or posts from a specific SM platform), thus no participants were recruited. Afterwards, the findings related to general, methodological and empirical characteristics were analyzed, summarized and presented based on the classifications per SM function.

3. Result

3.1. Study characteristics

A total of 367 papers were deemed relevant to the review, of which 84 papers were assigned to the Tool function, 154 papers to the Determinant function, and 129 to the Source function (Figure 1, list of studies in Supplementary material 1). Specifically in the Tool function, some papers presented multiple studies (e.g., two studies in Sharps et al. (2019) and three studies in Zhu et al. (2019)), resulting in a total of 94 studies included in this function. Figure 2 shows the distribution and increasing number of studies over the year. The same pattern was seen in the trend of the number of studies for all functions. Taken together, the number of studies peaked in 2020 with a total of 79 studies.

[INSERT FIGURE 2 HERE]

Countries in three continental regions, namely Asia (e.g., China, Indonesia, and Malaysia), Europe (e.g., Belgium, Spain, United Kingdom), and North America (e.g., United States), dominated the geographic distribution of studies (Figure 3). Multiple regions were also observed, especially in studies under the Source function. For example, study of Meza and Park (2016) compared consumers' tweets about organic food in Korean and Mexican. Compared to the other functions, some studies under the Source function also examined SM data without specifying the region, such as the study by Saura et al. (2020). To a lesser extent,

other continental regions were also observed, namely in Oceania (e.g., Australia), South America (e.g., Brazil), and Africa (e.g., South Africa).

[INSERT FIGURE 3 HERE]

3.1.1. Social media (SM) platform

Various SM platforms were used in the studies (Figure 4). Facebook was the most used platform for studies that used SM as Tool (36 studies), followed by Instagram (25 studies). Specifically for the Determinant function, most studies (116 studies) evaluated SM in general, making the platform 'Unspecified', such as the study by Alhabash et al. (2020), which examined a relationship between general SM use and food preference and consumption. Among the studies under the Source function, Twitter was the most prominent platform (50 studies), followed by Instagram (20 studies) and Facebook (19 studies).

[INSERT FIGURE 4 HERE]

3.1.2. Sample types

Adult participants were the most frequently observed sample type in the Tool (64%) and Determinant (58%) functions. In the Source function, most samples were consumer-generated content from SM, such as tweets (31%), posts (18%), and reviews (18%) from SM. Sample sizes varied across studies, from 10 to 66,556 participants, while the size of sources varied from 3 pages to millions of tweets with specific content from SM. The sample types in the studies for the different functions are shown in Supplementary material 2.

3.1.3. Research topic / food product type

Due to the heterogeneity of product types in the different studies, similar or closely related product types were grouped into four food groups: 'Unspecified product type' (food in general), ‘Specified product type' (e.g., ramen, rum, cake), 'Specified as a healthy food' (e.g., fruits and vegetables), and 'Specified as an unhealthy food' (e.g., sugar-sweetened beverages/SSB, alcohol associated with unhealthy beverages) (Supplementary material 3).

Most studies in the Source (44%, 57 of 129 studies) and Determinant functions (34%, 53 of 154 studies) areas examined nonspecific product types as the subject of research. For example, Kim et al. (2022) examined the impact and relationship between viewing food-related content on any platform SM and eating habits (Determinant function). Karami et al. (2021) used Twitter to examine the differences between food-related discussions in Democratic, Republican, and swing states in the United States (Source function). Some studies under the Source function also examined a specific product type, such as Samoggia et al. (2020) on coffee. Fifty-two studies under the Determinant function also examined the topic of unhealthy foods, mostly related to alcohol (41 studies). One example is the study by Geber et al. (2021), which examined the role of alcohol content engagement (e.g., exposure and sharing) on Instagram and Snapchat on drinking behavior. On the other hand, most studies in the Tool function examined topics related to healthy eating/food, such as the study of Chung et al. (2017) on fruits and vegetables.

3.2. Methodological characteristics

3.2.1. General methodological characteristics

In general, quantitative research methods were used in most studies, especially in the Tool (86%, 81 of 94 studies) and Determinant (83%, 128 of 154 studies) functions. In contrast, in the Source function, most studies used mixed methods (35%, 45 of 129 studies). Most studies on the Determinant function (87%) used a cross-sectional design. For the Source function, studies used both cross-sectional designs (67%) and longitudinal designs (32%). For the Tool function, several studies used a cross-sectional design (49%), and other designs (23%) included randomized controlled trial (RCT)and mixed designs. Regarding the method of data collection, survey-based studies dominated for the Tool (89%) and Determinant (86%) functions, while for the Source function, most studies used data mining (86%) as the primary method of data collection. The summary of the general methodological characteristics can be seen in Figure 5.

[INSERT FIGURE 5 HERE]

3.2.2. Social media stimuli (Tool function)

Studies in this function generally examined the effect of SM -related stimuli on participants. Stimuli were operationalized primarily as SM content provided by researchers as part of the experiment. Two types of stimuli were observed: the real content and the manipulated content. In a small number of studies, SM were not used to provide content as stimuli. For example, using SM, to collect and examine content provided by participants (7 studies, e.g., Zhu et al. (2019), Study 1), and to observe real-time interaction related to food content (1 study, Zhu et al. (2019), Study 3).

Stimuli in the form of real content were examined in 39 studies, most of which revolved around the topic of improving eating behavior. Most of the real content provided to participants via SM aimed to assess whether providing knowledge, such as nutrition information, could have an impact on eating attitudes or behaviors. Some researchers used a private group feature on the platform SM to deliver the intervention, such as sharing healthy food or nutrition content with participants. For example, in the study by Vander Wyst et al. (2019), they examined the effect of SM -based nutrition education on the diet quality and knowledge of pregnant adolescents. Apart from a private group, nutrition content was also provided in the form of blogposts (e.g., Caplette et al. (2017) and Dumas et al. (2020)). Facebook was the most commonly used platform for this type of content (17 studies), with 14 studies using Facebook as the sole platform (e.g., Bakirci-Taylor et al. (2019) and Vander Wyst et al. (2019)), while 3 studies used Facebook together with another platform, e.g., Instagram (Trude et al., 2019) or YouTube and Twitter (James et al., 2013) or a combination with Instagram, YouTube, Twitter, and Pinterest (Adiba et al., 2020). The use of Twitter (Chung et al., 2017; Coccia et al., 2020), WhatsApp (Kaur et al., 2020), and other SM platforms (e.g., online forum in Brennan et al. (2020) and WeChat in Wang et al. (2020)) have also been studied.

Manipulated or mocked content as stimuli provided by researchers was observed in 47 studies. Most of these studies relied on Instagram (19 studies) or Facebook (15 studies). These types of stimuli were used when researchers intentionally manipulated the content to be presented to participants. For example, in the study by Folkvord and de Bruijne (2020), a manipulated post was presented on Instagram that showed a picture of an influencer with food to investigate whether this increased actual vegetable consumption. Some

231 other types of platforms were also observed, such as Twitter (5 studies), online video sharing (e.g.,
232 YouTube) in 4 studies, and others (3 studies). One example is Coates et al. (2019a), who investigated
233 whether the manipulated YouTube videos that showed influencer marketing as SM stimuli for the children
234 had any effect on food intake.

235 *3.2.3. Characteristics of the variables by research design (Tool and Determinant functions)*

236 *3.2.3.1. Quantitative studies.* Most quantitative studies in the Determinant function (54%, 84 of 154 studies)
237 examined SM use-related **independent variables** such as general use, engagement/interaction, content
238 creation/sharing/review, and situation during use (e.g., duration, frequency). For example, Chartier et al.
239 (2021) examined the relationship between use of SM and alcohol consumption. Other types of independent
240 variables were mostly related to attitude (21%, 33 of 154 studies, such as the study by Deng and Hu (2019))
241 or exposure (21%, for example, the study by Geusens and Beullens (2019)).

242 Given their similarities, **outcome variables** were compared between quantitative studies in the Tool (n =
243 81 studies) and the Determinant (n = 128 studies) functions (Figure 6A). Three types of measures were
244 observed. Most studies for both functions measured a behavioral-related outcome (44% and 58% of studies
245 for the Tool and Determinant functions, respectively). For example, in the Tool function, Dumas et al.
246 (2020) examined changes in healthy eating behaviors and food intake among mothers and children after
247 health information was provided in blog posts. In the Determinant function, Rahim et al. (2022) examined
248 the effects of influencers from SM on halal food purchasing behavior among Millennial consumers. Some
249 studies measured intention-related outcomes (35% and 20% of the total quantitative studies in the Tool and
250 Determinant functions, respectively), such as the study by Wilson et al. (2019), which examined intention
251 to eat (Tool function), or the study by Balakrishnan and Foroudi (2020), which examined intention to
252 purchase an innovative food product (Determinant function). Finally, quantitative studies that measured
253 attitude-related variables were also observed: about 25% for the Tool function (e.g., Brennan et al. (2020))
254 and about 15% for the Determinant function (e.g., Deng and Hu (2019)). Other types of outcome variables
255 were less frequently measured, e.g., knowledge, motivation, willingness, preference, and liking.

The **measurement** of variables in the quantitative studies can be compared between the independent and dependent variables within Determinant studies and the dependent variables between Determinant and Tool functions (Figure 6B). In all studies and functions, Likert scales were the most commonly used means of measuring the outcome variables, particularly the 5-point and 7-point scales. Other types were also noted, such as frequencies or counts, for example, in the Roberson et al. (2018) study, which measured the frequency of the number of days per week consumers spent at SM (independent variable) and the frequency of alcohol consumption (dependent variable) for the determinant function. Meanwhile, Trude et al. (2019) measured the number of self-reported fruit and vegetable servings (in cups) as the dependent variable, which is a tool function study. Time or duration was a particularly important aspect of the independent variables, such as in the study by Lwin et al. (2017), which measured the daily number of hours spent on SM to examine its influence on fast food consumption. In addition, dichotomous responses (e.g., CATA selection) and standardized questionnaires (e.g., Food Frequency Questionnaire (FFQ)) were also observed in several studies.

[INSERT FIGURE 6 HERE]

3.2.3.2. Qualitative studies Twenty-two studies in the Determinant function had a qualitative research design. Several studies examined determinants related to certain food behavior or attitudinal topics, with SM among the factors identified, as in a study of attitudes toward food consumption (Gilmour et al., 2020) and healthy eating (Mete et al., 2019). Meanwhile, there were also studies that specifically examined the relationship between SM and a particular dietary behavior/attitude, such as alcohol consumption (Jones et al., 2017), motivations and barriers to reducing meat consumption (Kemper, 2020), or the influence of SM on food consumption (Atwal et al., 2019). Only five studies in the Tool function used a qualitative research method (e.g., Ares et al. (2021) and Brennan et al. (2020)) to gain a deeper understanding of participants' views on food-related issues. For example, in the study conducted by Brennan et al. (2020), SM components such as forums, conversations, and online surveys facilitated the research to gain insights from young adult participants about their attitudes and feelings about healthy eating.

3.2.3.3. Mixed method studies Only four studies in Determinant function used a mixed methods research design (e.g., Allen et al. (2018) and Popy and Bappy (2022)). For example, for quantitative means, Allen et al. (2018) measured the frequency of their SM usage as part of the independent variable and dietary restraint and food intake with a 5-point Likert scale and counting the number of servings per day, respectively, as dependent variables. They also examined participants' opinions about clean eating using qualitative means. For the Tool function, eight studies used mixed methods. For example, the study of Rouf and Allman-Farinelli (2018) used a quantitative method to compare the rating (from 1 to 5) of the Facebook post on breakfast, while the determinants of participants' intention to consume more calcium-rich foods were examined using qualitative means.

3.2.4. ***Characteristics of the outcome of interest in the Source function***

The aim of the Source function studies (129 studies) was mainly to explore consumers' or users' insights or perspectives on food-related issues. A wide variety of behavioral and attitudinal outcomes were measured, with several studies evaluating multiple outcomes. Most studies (51%, 67 studies) examined general exploration of user-generated content (UGC) related to food, such as comments, topics, discussions, opinions, conversations, descriptions, and expressions. Exemplary study include Laakso et al. (2022), who analyzed consumers' online discussion of vegan dietary habits. Examining the types of foods and/or beverages mentioned by consumers on SM was also observed in several studies (19%, 25 studies), such as Turner-McGrievy et al. (2020), who examined the relationship between foods mentioned during four hurricane disasters, and Ito et al. (2018), who examined the relationship between different weather contexts, topics, and foods posted on Twitter. A sizable portion of the studies in the Source function specifically examined consumers' sentiments about food products, restaurants, or brands (26%, 34 studies), such as the study of Samoggia et al. (2020). Other outcome measures included consumer attitudes or perceptions (13%, 17 studies, e.g., Pilar et al. (2018) regarding organic food), emotions (9%, 12 studies, e.g., Song et al. (2020) regarding food safety), and experiences (8%, 10 studies, e.g., Brochado et al. (2019) regarding sensory experiences in wineries). In terms of measurement, there was no apparent difference between the outcome variables. Most of the data collected in the studies were in text form. Content analysis was used in most

studies as the first stage of interpreting the results before more advanced analysis was conducted. Sentiment analysis and topic modeling, among others, were mostly used to analyze the results.

3.3. Scope of findings across social media (SM) functions

Due to the heterogeneity of the study characteristics and the description of findings from the studies, the scope of findings was summarized based on the type of finding (Figure 7). As key findings in the studies in the Tool and the Determinant functions were relatively comparable, the same type of findings of the studies were used, i.e., food intake versus attitude/behavior related findings. Studies in the Source function have a more distinctive scope of findings and are generally focused on content-related findings (e.g., observing UGC data rather than participant data).

[INSERT FIGURE 7 HERE]

3.3.1. Tool and Determinant functions

Two types of outcome indicators emerged to summarize the main findings of these studies: food intake related, and attitude/behavior related. Many of the studies showed the impact of SM on intended outcome measures. In the food intake related group, studies reported on whether SM influenced the consumption of certain foods/beverages. Studies under the Tool function mainly reported positive impact on healthy food intake, such as in the study by Wang et al. (2020), who reported a significant impact after an intervention using a private WeChat group. Some studies reported the effect of SM in reducing intake of unhealthy foods, such as Sharps et al. (2019) in relation to sugar-sweetened beverages (SSB) and high energy density foods (HED) or Kaur et al. (2020) related to intake of fat, sugar, and salt. Meanwhile, many of the studies under the Determinant function in this group found a relationship between SM related activities/variables and alcohol consumption, such as Geusens et al. (2019) and Litt et al. (2021). However, a smaller number of studies also reported mixed or no effects of SM on food intake, including eight studies on the Tool function (e.g., Folkvord and de Bruijne (2020) and Vander Wyst et al. (2019)) and four studies on the Determinant function (e.g., LaBrie et al. (2021) and Sumaedi and Sumardjo (2020)).

In the second group (attitude/behavior related), many of the studies under both functions reported the effect of SM on attitude-, behavior- and intention-related outcome measures. In terms of the Determinant studies, for example, the work of Balakrishnan and Foroudi (2020) found that SM engagement had a significant impact on purchase intention for innovative food products among consumers in the US and India. Meanwhile, Liu et al. (2022) under the Tool function detailed the promotion of purchase intention following manipulated stimuli on SM. Some studies also reported an increased knowledge. For example, Coccia et al. (2020) (Tool function) reported increased nutrition knowledge after a 6-weeks nutrition intervention via Twitter. Similar with previous group, a small number of studies reported neutral or mixed effects of SM: six and four studies under Tool function (e.g., Rouf and Allman-Farinelli (2018)) and Determinant function (e.g., Rahim et al. (2022)), respectively.

3.3.2. Source function

The results were classified according to three approaches: (1) content exploration, (2) content observation, and (3) sentiment classification. In the content exploration group, the studies explored the content and some further categorized the content based on a particular theme of the corresponding study. For example, Moreira et al. (2021) studied consumers' opinions regarding the expected benefits of consuming plant-based meat on Instagram and used a marketing mix approach to analyze the 13 categories that emerged. In the group of content observation, many studies focused on reporting the most frequent content that appeared on SM. For example, several studies examined the most frequently occurring words, such as words related to food and beverages. Ito et al. (2018) reported that the most frequently occurring words in Twitter related to food included 'soba' (buckwheat noodles) and 'cake' during the low-temperature weather in Japan. In the sentiment classification group, researchers evaluated the sentiments, experiences, or ratings consumers gave to foods based on UGC extracted from SM. The results generally classified the valence of the outcome as positive, neutral, or negative. In this group, the outcome of the studies was mainly dominated by positive feelings. For example, Mostafa (2019) reported that a large proportion of tweets were positive and about 40,000 tweets expressed happiness about halal foods.

4. Discussions

The ubiquity of social media (SM) potentially influences user behavior, including food. This systematic review aimed to explore and summarize the scientific research landscape related to SM and food consumer behavior. The topic is becoming increasingly important, as evidenced by the trend in the number of studies from the early years (2009) to recently in 2022. The identified studies were mainly focused on Europe, North America (especially the United States), and Asia (mainly China). Ventura et al. (2021) found a similar result when this topic is progressive in the United States. Although they focus on children and adolescents, most of the studies on this topic reviewed by Sina et al. (2022) were also conducted in North America and Europe. As mentioned by Hutchings et al. (2023), the studies on SM and on food consumption and sensory sciences were mainly conducted in WEIRD (Western, Educated, Industrialized, Rich, Democratic) countries. This leaves a gap for other regions, such as Africa and Oceania. This review found a large number of studies investigating the relationship between SM and consumer attitudes or behaviors related to food. This is another indication that SM and food are attracting increasing interest, prompting researchers to explore the connections. To provide a better overview of our review, studies were divided into three categories based on how researchers used the SM element in their study (the function of SM). This review identified three functions: (1) Tool (94 studies); (2) Determinant (154 studies); and (3) Source (129 studies).

Studies in the Determinant function generally examined the relationship or influence of SM-related variables on food attitudes or behavioral variables. In the absence of actual SM use, researchers usually strive to design data collection (e.g., survey, focus group, or interview and probing questions) according to the research topic and recruitment of participants. For studies in the Tool function, there was generally another element on top of those experienced by researchers in the Determinant function, which was the design of the treatment or stimulus group. As contents are the main element of SM, in studies in the Tool function, researchers incorporated content as a treatment, such as nutrition knowledge provided in a private group on the SM platform or the presentation of manipulated posts to participants. Some studies compared the treated group to the no-treatment group, which would help researchers gain more insight into whether

385 the SM treatment influenced consumers' targeted diet-related attitudes/behaviors. Studies in the Source
386 function had a different nature than studies in the other functions because these studies did not involve
387 active participants and thus no effort was made to recruit participants. Researchers collected data directly
388 from SM, specifically user-generated SM content, typically referred to as user-generated content (UGC),
389 which can be in the form of text (e.g., from Twitter) or images (e.g., from Pinterest or Instagram). Thus, to
390 conduct this type of research, some specific skills are required, particularly in extracting, storing, and
391 analyzing data in an appropriate format to enable subsequent data cleaning and analysis (Vidal et al., 2018).

392 Since each function has its own characteristics, the insights gained from the studies on the functions can
393 improve and provide a clearer understanding of the subject. Similar to the conventional method mentioned
394 by Hutchings et al. (2023), the studies that included recruited participants, which was the case for Tool and
395 Determinant functions, allow for better precision and distinction compared to the studies using SM data.
396 However, these studies are vulnerable to biases such as self-selection bias, social desirability bias, and
397 Hawthorne effect (Hutchings et al., 2023; Ross & Bibler Zaidi, 2019). For example, social desirability bias
398 influences the outcome of studies, particularly those that rely on self-reported responses (e.g., survey data).
399 Meanwhile, SM -based data for Source function studies can be collected in real-time and cost-effectively
400 compared to participant-based data, and large amounts of data can be obtained in a relatively short period
401 of time, as shown by Sass et al. (2020) and Kāle et al. (2021). Real-time data collected from consumers at
402 SM could provide insights into their attitudes toward food or their behaviors on specific occasions or at
403 specific moments, evidenced by the studies by Vidal et al. (2015) and Kāle et al. (2021). However, these
404 types of studies require balancing with other necessary resources related to SM data processing (e.g., data
405 extraction skills, analysis, etc.). On top of that, the vast amounts of data available at SM are mostly
406 unstructured and come from diverse and uncontrolled situations (Hutchings et al., 2023). Therefore, future
407 researchers should examine these considerations before designing new studies on this topic.
408

In terms of platforms, Facebook, Twitter, and Instagram are the most commonly used SM platforms by researchers in this field. Facebook topped the list of observed platforms used (specifically for studies in the Tool function), as it was also the platform with the most users worldwide (Kemp, 2022). Twitter was more prominent for studies in the Source function, which was also reflected in the typical sample type (tweets) for the studies in this function. Researchers emphasized the ease of use to obtain spontaneous or open responses triggered by real life circumstances and the free access to the data from Twitter (Sass et al., 2020; Vidal et al., 2015). This finding is consistent with the review conducted by Hawks et al. (2020), which found that studies examining SM content mostly analyzed textual data. Twitter's textual data might be easier to handle and store than other types of data, such as image data from Instagram or short videos from Snapchat or TikTok, or even different types of data such as those from Facebook. However, Vidal et al. (2015) also pointed out that manual analysis of data obtained from Twitter is tedious. Meanwhile, most studies in Determinant function examined SM in general, without specifying the platform (116 out of 154 studies), thus obtaining a global perspective regarding the influence of SM on eating behavior. However, this also left a certain gap to investigate the multifaceted influence of the specific SM platforms.

An interesting finding of this review was related to the research topic of the studies. The total number of studies that focused on foods designated as healthy was the lowest compared to the other research topics, with most studies falling under Tool function. Consistent with this review, Hawks et al. (2020) reported that fruits and vegetables appeared less frequently than unhealthy foods, which were posted and liked more often on SM. Unhealthy foods or beverages were most frequently advertised in traditional and online or SM, with some reports indicating that approximately 80% of food advertisements were for foods high in salt, saturated fat, or sugar, which in turn contributed to overweight and obesity (Kent et al., 2019). Many of the studies identified in this review also focused on alcohol in SM and its negative impact on consumers. Further research to better understand this topic is needed to mitigate the negative effects of SM and unhealthy foods, especially to aid the policy implication to guide the society in avoiding possible harmful effects of unhealthy food advertising in SM.

In terms of methodological characteristics, this review found that most studies followed a quantitative research approach and a cross-sectional design, which leaves room to explore other types of approaches and study designs. Longitudinal studies may be of interest for future research, particularly to observe the causality effects of SM-related treatment on participants over time. This is particularly true for the Determinant function, where the vast majority conducted cross-sectional studies. Therefore, causality between the influence of SM and the targeted attitude/behavior could not be established. As mentioned by Hawkins et al. (2020) and Robinson (2015), in cross-sectional studies focusing on social norms, a false consensus effect could occur, in which a bias toward one's own behavior in terms of egocentricity occurs when speculating other people's behavior. They suggested, among other things, manipulating norms directly in SM settings to examine causality between SM social norms and eating behaviors.

The present review also focused on outcomes related to dietary behavior and/or attitude. A smaller number of studies focused on measuring liking, preference, willingness, and knowledge. Future studies could therefore also focus on these outcomes to add to the literature on studies of consumer food behaviors and attitudes. To illustrate, only five studies in the Tool function examined consumer food preference and focused on children, young adults, and adolescents (e.g., Coates et al. (2019b); Sharps et al. (2019)), leaving an opportunity to evaluate adult participants and gain a better understanding of this population. However, Sharps et al. (2019) did not find a significant result and Coates et al. (2019b) did not discuss in detail of the participants' food liking, thus more studies are needed to verify whether SM -based intervention in fact are indeed unrelated to food liking. Regarding the studies in the Source function, several observed outcome interests differed from those in the other functions that could not be directly compared. The investigation of the studies in the Source function was able to elicit the intended outcome interest (e.g., consumers' sentiments or perceptions) related to the general food topic or specific food products via SM consumer-generated content (UGC). Massive amount of big data made it possible to collect consumer-related data, with researchers sometimes determining the topic in advance. One strategy employed by researchers afterwards was to use classification categories, such as sentiment classification or categorizing topics. This

strategy was needed to analyze the enormous amount of data extracted and present it in an understandable form. For example, consumer sentiment was the most frequently analyzed outcome in the studies in which researchers classified sentiment based on valence (positive, negative, or neutral), both manually analyzed by researchers (Hsieh et al., 2019) and automatically analyzed by machine learning (Kim & Jeong, 2015).

Although each study has its own limitations, the unbalanced distribution of the number of studies across the functions may indicate the possibility that there are some gaps or challenges for researchers in conducting studies using SM as a Tool (94 studies, compared with more than 100 studies for the other functions), such as time duration, resources, and feasibility. For example, several studies in the Tool function were conducted over a period of time to assess whether an intervention using the SM element affects participants' eating behaviors (e.g., 10 weeks in Bakirci-Taylor et al. (2019) and 6 months in Caplette et al. (2017)). To get a complete picture of the relationship between SM and consumers' food attitudes or behaviors, one should consider the findings from the studies on the three functions as they are interrelated, rather than looking at a single function. Hsieh et al. (2019) proposed to further investigate the topic by developing a survey and collecting data from consumers (e.g., hotel guests), which led to the direction of the study utilizing Determinant function. The study of Hawkins et al. (2020) in Determinant function implies that further investigation through norm manipulation in SM is needed to better understand the causality of SM 's influence on consumers' food consumption, suggesting further study in the context of the Tool function.

This review was conducted systematically according to PRISMA guidelines and was guided by a protocol established prior to the review. This review addressed the broad topic of the relationship between SM and consumer food attitudes and/or behaviors. The inclusion criteria were comprehensive in terms of methodology, type of data (participants and SM data), and outcome of interest. Due to the large number and diversity of included studies, this review was able to improve the understanding of the results by classifying the studies based on the SM functions (Tool, Determinant, and Source). However, this review was not without limitations. First, only two electronic databases were used in this review, namely Web of Science

and Scopus. Although these two databases are well known for systematic reviews, this review could miss potentially relevant studies that are not indexed in the databases. In addition, this review only included studies published in English, thus limiting the other studies with non-English publications. The key findings reported in this review might be rather general in nature, suggesting the reader interpret the results with caution and is advised to look up the specific studies for more detailed consideration (see Supplementary material 3). Finally, because of the diversity of studies, it was not possible to perform a meta-analysis due to the heterogeneity of the outcome of interest.

5. Conclusion

As social media (SM) become ubiquitous and integrated into consumers' daily lives, food attitudes and behaviors are also influenced by SM. This review aimed to elucidate the relationship between SM and consumers' attitudes/behaviors toward food. In this review, a total of 377 relevant studies were systematically extracted. SM and food-related studies were diverse in terms of their general characteristics, methodology, and outcome of interest. To improve the understanding of the findings, the studies in this review were classified according to the function of SM in the study: Tool (94 studies), Determinant (154 studies), and Source (129 studies). The differences between studies in terms of functions served as the basis for describing characteristics. Participants and SM data (e.g., user-generated content/UGC) were observed as data sources for the studies, with UGC being the typical data used by the studies in the Source function. This also reflected the differences in data collection methods between the functions, with researchers in the Tool and Determinant functions collecting data from participants through surveys, interviews, or focus groups, while researchers in the Source function analyzed data from SM directly without recruiting participants. Of all the SM platforms, Facebook was the most commonly studied in the Tool function and Twitter was the most typical for studies in the Source function. Regardless of the SM functions, most studies were cross-sectional and quantitative. Most studies in the Tool and Determinant functions assessed intention and behavior (including food intake), while studies in the Source functions mainly reported on consumers' sentiments towards food. Knowledge from all functions, rather than a single function, should be considered

509 to provide a complete picture of the relationship between SM and consumer attitudes and behaviors toward
510 food.
511

Acknowledgement

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 862957.

AUTHORS' CONTRIBUTIONS STATEMENT (CRediT)

Rini, Listia: Conceptualization, Investigation, Formal analysis, Software, Data Visualization, Writing – Original draft, Writing – Review & Editing,

Schouteten, Joachim Jietse: Conceptualization, Validation, Supervision, Writing – Review & Editing

Faber, Ilona: Writing – Review & Editing

Perez-Cueto, Federico J.A.: Supervision, Project Administration

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De Steur, Hans: Conceptualization, Validation, Supervision, Writing – Review & Editing, Validation

Conflict of interest

The authors declare no conflict of interest.

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Figures

Figure captions

Figure 1. Flowchart of the search and selection of articles for this systematic review study.

Figure 2. Number of studies over time, per SM function

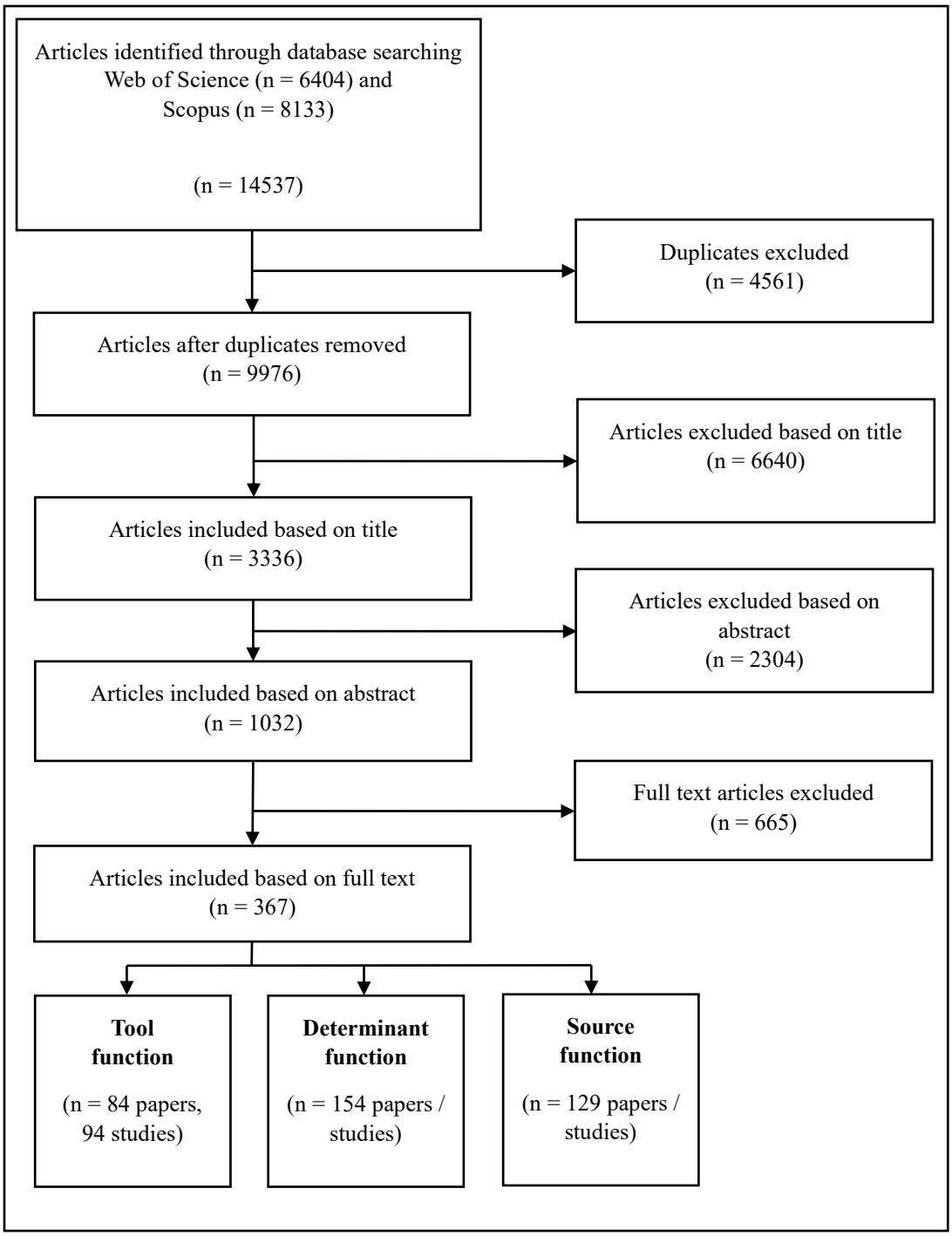
Figure 3. Geographic distribution of studies across all functions, per SM function

Figure 4. Social media platforms across studies under all functions
Note: Some studies used more than one platform. Therefore, the number of all studies exceeds the total number of studies mentioned in this review.

Figure 5. Summary of the methodology characteristics across functions

Figure 6. (A) Target variables and (B) and their measures in quantitative studies between Tool (T) and Determinants (D) functions.

Figure 7. Scope of findings, per social media (SM) function and type of finding (food intake, attitude/behavior, and content).
Note. The figure shows the number of studies corresponding to the type of findings. Findings in the tool and determinant functions (upper part of the figure) were presented based on impact. Studies with mixed/neutral/no impact were shown in the stacked gray bar. Specifically for sentiment classification in the Source function (lower part of the figure), the proportion of studies with type of sentiments is shown in the pie chart. Some studies belong to more than one group.



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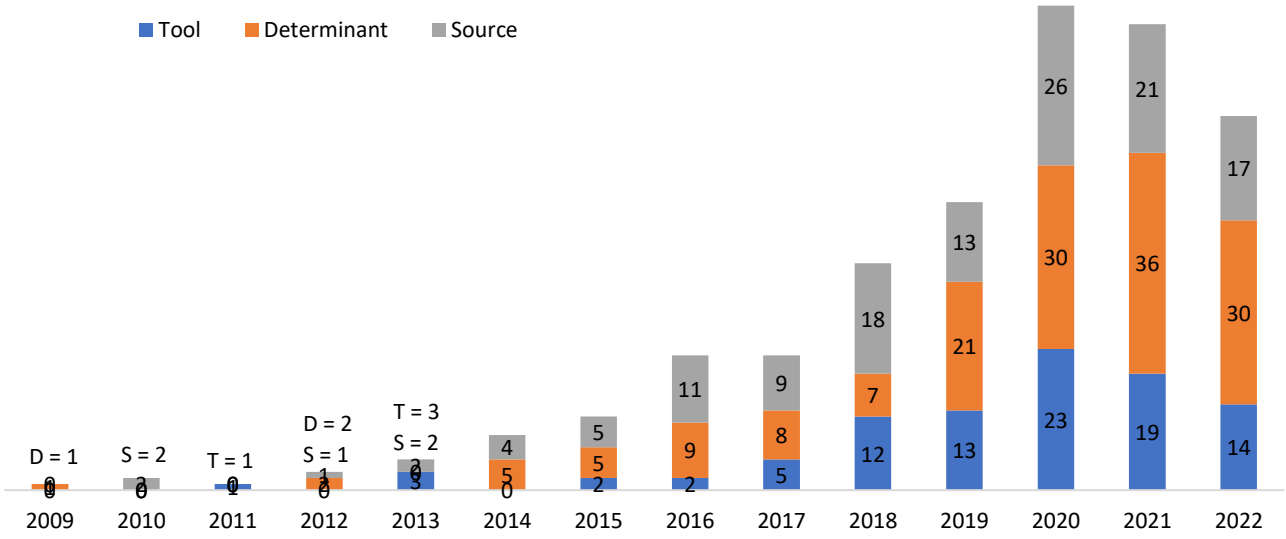

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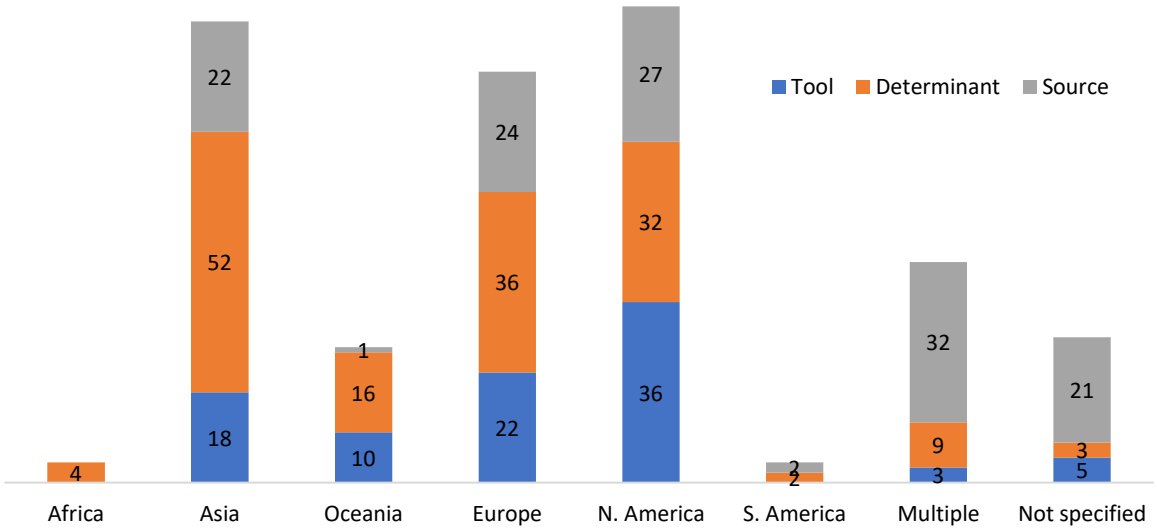

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856 Figure 3. Geographic distribution of studies across all functions, per SM function

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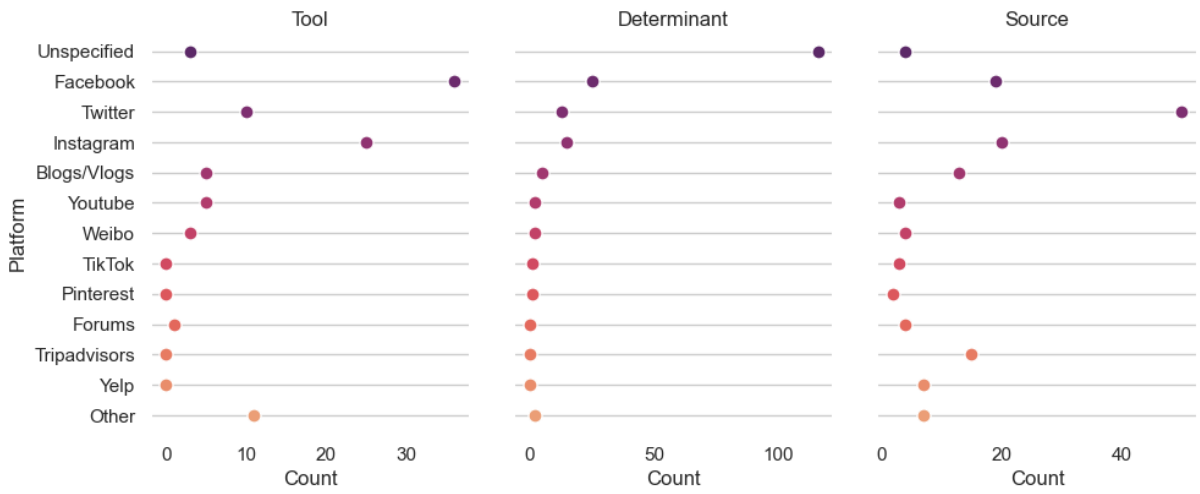

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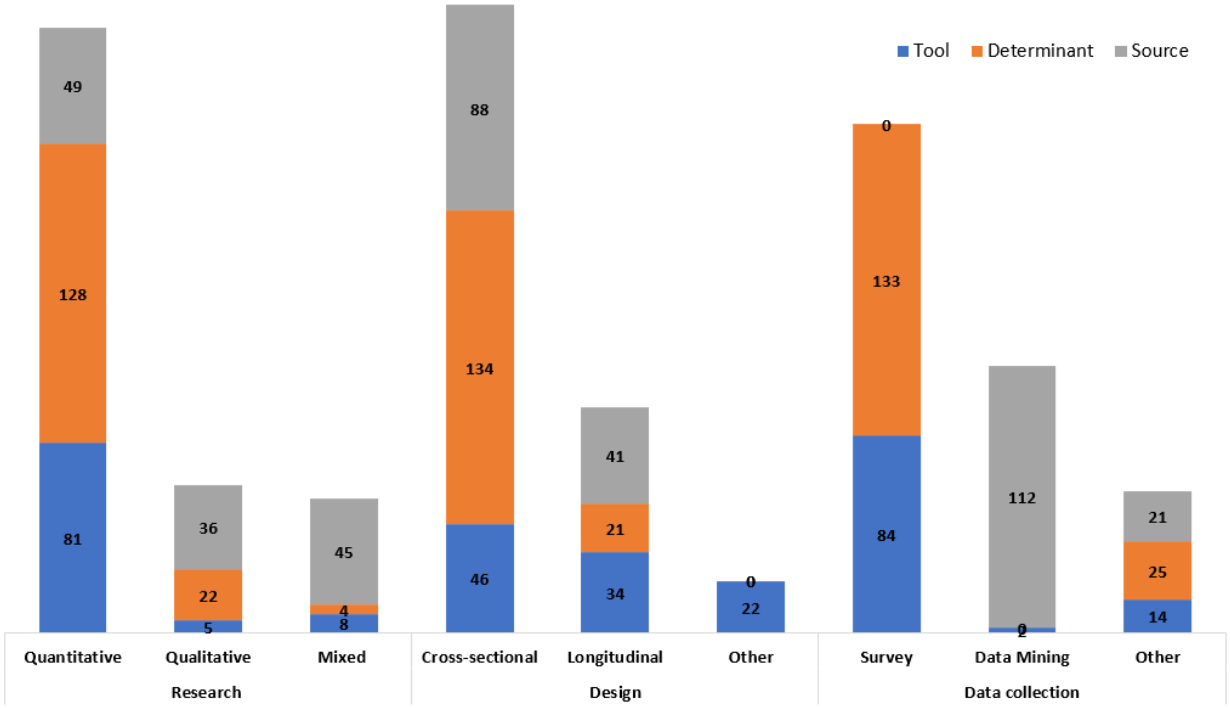

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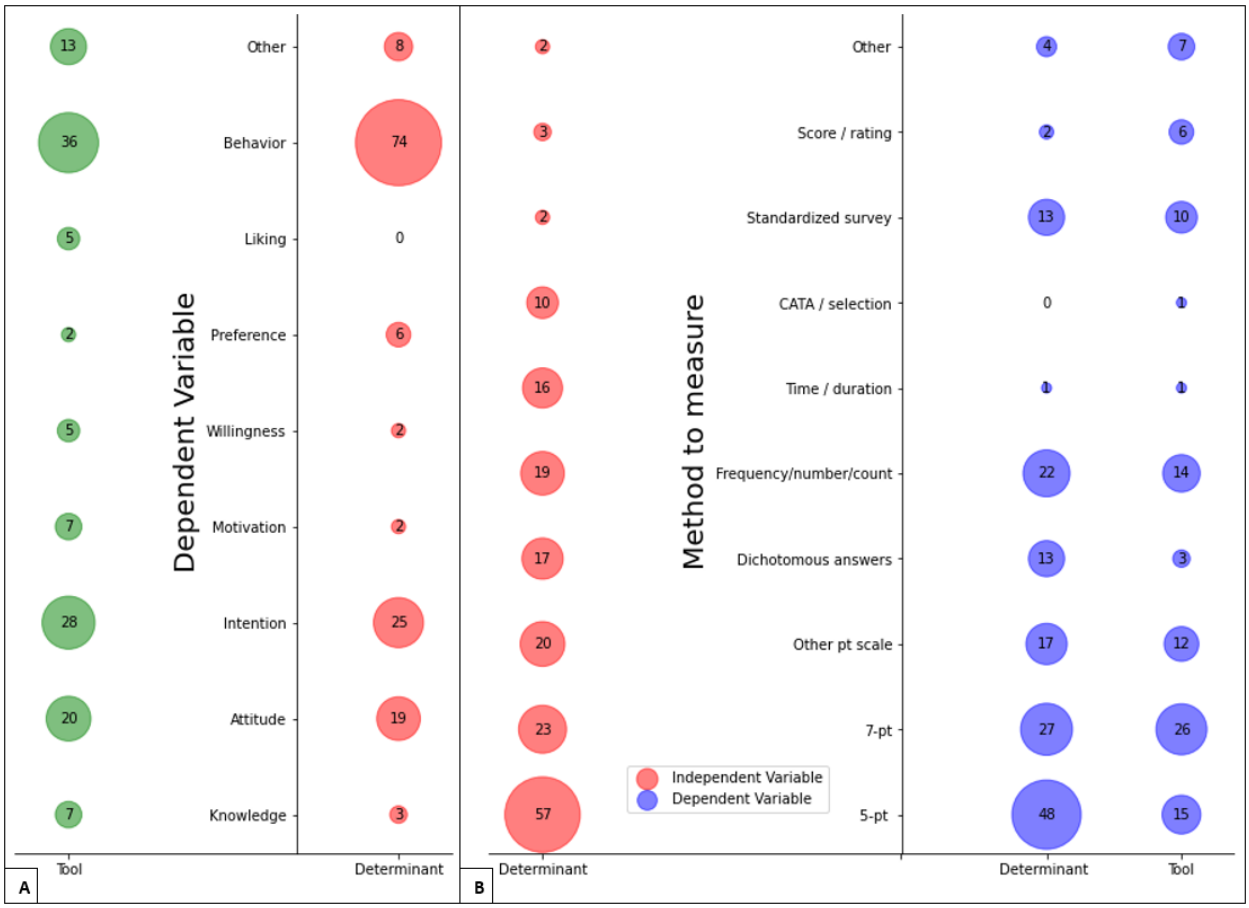

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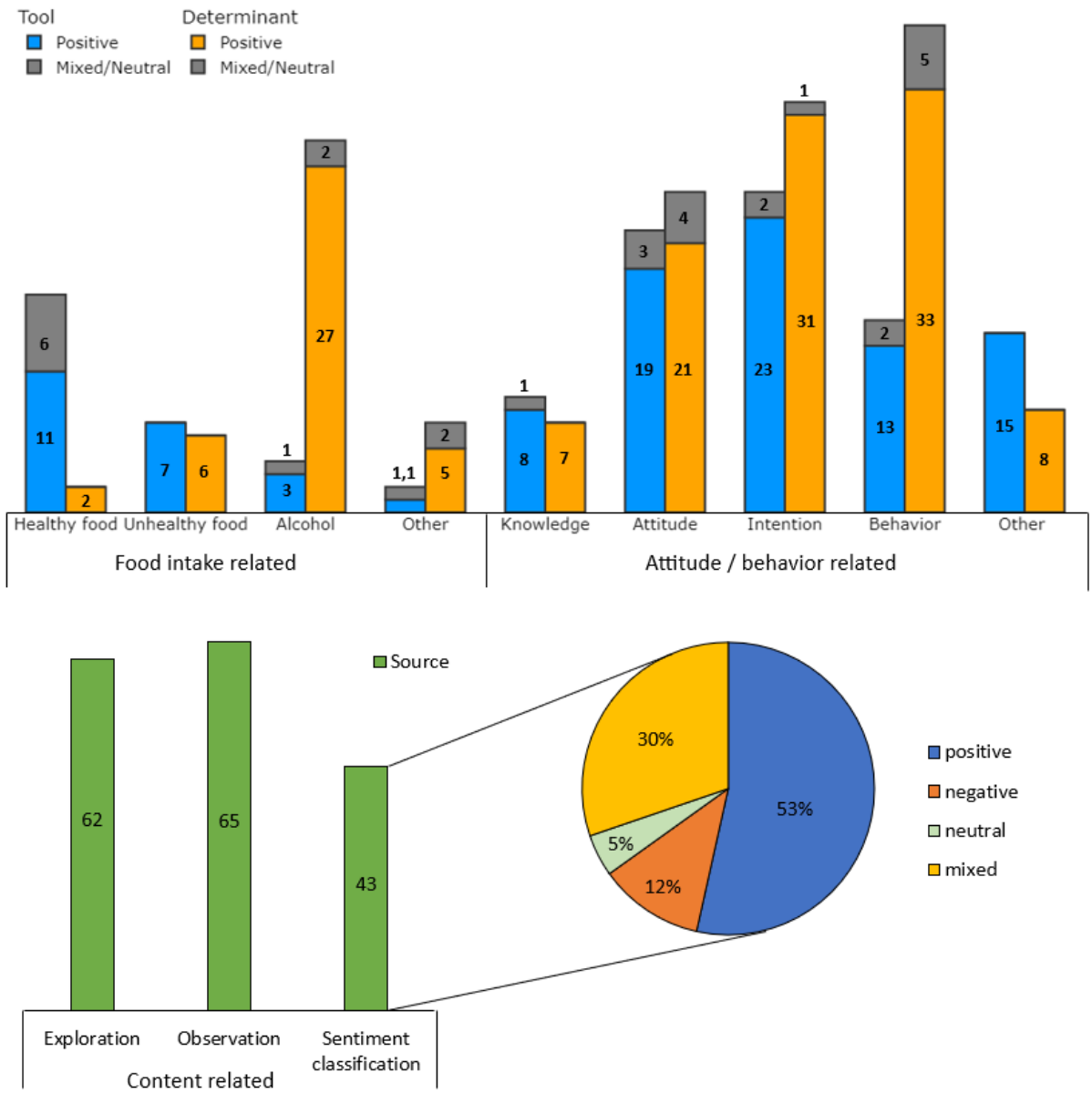

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Supplementary materials

Supplementary material captions

Supplementary material 1 – List of studies

Supplementary material 2. Studies' sample types and details per function.

Supplementary material 3. Research topic of the studies across functions

Supplementary material 4 – Search syntax