



From Pixels to Palate: Communication around #vegan on Instagram and its relation with eating intentions

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ABSTRACT

Social media is an increasingly important yet understudied context for eating behaviors in general and veganism in particular. In four studies, we first explored and described the information environment the platform Instagram presents related to veganism. Second, we examined how engaging with this environment is associated with offline eating intentions via psychological mechanisms. We scraped datasets of Instagram posts tagged with #vegan (44,316 posts in total) and employed network analysis with their hashtags (Study 1), as well as clustering with images and sentiment analysis with texts (Study 2). Studies 3 ($N = 117$) and 4 ($N = 251$) used online surveys to investigate associations between different forms of engaging with social media content, psychological constructs, and offline eating intentions. Posts about veganism were frequently related to food, health and fitness, cosmetics, and photography. Images most often depicted food (34.7%), non-food products (30.4%), people (7.9%), and animals (2.0%). The sentiment of most posts was positive. Being exposed to Instagram content about veganism was more strongly and consistently associated with eating intentions than active forms of engagement. Attitude and self-identity emerged as the most relevant mechanisms for these effects. Food is the most prominent yet not sole topic among posts about veganism on Instagram, and hashtags used in this context partially relate to motives for following a vegan diet. Exposure to this information environment might influence offline eating decisions via psychological mechanisms. With growing usage and its potential influence, social media should receive increasing attention in (health) psychological research and practice.

1. Introduction

Social media platforms are becoming increasingly important for meaning-making and communication about a large variety of topics (Anderson Steeves et al., 2016). The largest platforms (i.e., Facebook, YouTube, Instagram) have more than 1 billion users each (Perifanou et al., 2021). Especially young people spend a considerable amount of time on social media, with teenagers spending up to 6.5 h a day (Joshi et al., 2019). Engagement with these platforms has been shown to influence attitudes, norms, and actual behavior, for example, regarding alcohol consumption (Geusens et al., 2019) or fruit and vegetable intake (Kilb et al., 2023). Food in general and veganism in particular are among the most prominent topics on social media (Stano, 2021). On Instagram alone there are over 125 million posts containing the hashtag #vegan.

Studying veganism is important for several reasons: Plant-based diets

can promote human health and sustainability simultaneously (Clark et al., 2019). The vegan diet comprises plants and foods made from plants, thus excluding foods that come from animals, such as meat, dairy products, and eggs (NHS, 2023), which substantially contribute to global greenhouse gas emissions and are linked to several adverse health outcomes (Godfray et al., 2018). Compared with other diets that eliminate or reduce meat, such as vegetarianism, pescatarianism, or low-meat diets, veganism has the smallest environmental footprint (Scarborough et al., 2023). The share of people following a vegan diet is growing in many Western countries, especially among young people, and accounts for up to 10% of the population (Bakaloudi et al., 2021). Its growing popularity, health relevance, and environmental benefits make veganism an important diet to study.

Although veganism is a prominent topic on social media, research on the relation between online engagement with veganism-related social

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media content and offline eating behavior is scarce. In this paper, we aim to describe Instagram as an information environment for vegan eating by analyzing related hashtags, pictures, and texts of posts. Further, we explore associations between engaging with this environment, psychological constructs, and offline eating intentions.

1.1. Features of social media environments

A first step in understanding the role of social media as an environment for health-relevant behaviors is describing the themes, topics, and sentiments of the respective content. One important feature of social media posts is the hashtag (Erz et al., 2018). Hashtags communicate what topics a post might relate to and serve to increase the post's visibility (Page, 2012). Prior studies have systematically analyzed hashtags used in the context of different health-relevant topics. Santarossa et al. (2019), for example, investigated the most common hashtags associated with #orthorexia on Instagram and found that these frequently related to recovery from eating disorders and healthy eating behavior. Another defining feature of social media posts, especially on Instagram, is the inclusion of pictures and images. For instance, a study analyzed the pictures used in posts tagged #fitspo and found that most of these images depicted people, frequently in an objectifying fashion (Santarossa et al., 2016). Further, posts on most social media include short texts. Shamoï et al. (2022) conducted a sentiment analysis with Twitter posts in the context of veganism. They found that such posts were more frequently written in a positive rather than neutral or negative way. In Studies 1 and 2, we aimed to explore all three of these features—hashtags, images, and short texts—for Instagram posts with #vegan to explore and describe this information environment.

1.2. Veganism on social media

Earlier studies investigated communication about veganism on social media and found that vegan users on social media were mainly interested in food and health-related content (Horn et al., 2022). Phua et al. (2020) investigated how proveganism content on social media is perceived differently depending on source and message characteristics: Altruistic messages were perceived as having higher informational value than egoistic messages. Laakso et al. (2022) explored discussions about a Vegan Challenge campaign and showed that conversations covered a variety of eating-related practices, including production, distribution, purchase, and cooking. However, to our knowledge, there has not been a comprehensive study of Instagram as an information environment for veganism that investigated hashtags, images, and texts. We aimed to address this gap in the literature with Studies 1 and 2 presented here. Instagram might be an especially important informational environment in this context for several reasons: Pictures play a central role on the platform, there is a lot of content with the hashtag #vegan, and it is one of the most frequently used platforms overall (Pew Research Center, 2021).

1.3. Social media use and eating behavior

Social media use has been linked with offline health behaviors, including eating, in various studies (see Bartelmeß & Godemann, 2022, for a review). The majority of studies, though, have focused on the effects on unhealthy eating: Social media engagement has, for example, been associated with a higher frequency of unhealthy food consumption in children (Baldwin et al., 2018) and unfavorable eating patterns in adolescents (see Sina et al., 2022, for a systematic review). Even the prevalence of disordered eating, such as binge eating disorder, has been linked to increased social media use (Kim & Mackert, 2022). However, some literature also points to opportunities for social media to promote healthy eating (Qutteina et al., 2021): Posting on social media can support positive eating-behavior change in the context of fruit and vegetable consumption (Kilb et al., 2023), and social media exposure

might contribute to more sustainable consumption intentions (Arora et al., 2023). These findings suggest that social media use is not a homogeneous behavior but needs to be further differentiated. In Studies 3 and 4, we therefore differentiated between being exposed to social media content and sharing/posting content oneself. Geusens and Beullens (2018) showed that both of these ways of engaging with social media content relate to offline consumption—in different ways: In their study, posting alcohol-related content on social media had stronger effects on offline drinking than passive exposure. Similarly, Kilb et al. (2023) showed that social media content can influence both, the consumption behavior of those being exposed to content, as well as those posting themselves. In addition to posting and exposure, we assessed how frequently people interacted with posts regarding veganism on social media. We aimed to explore how publicly liking or commenting on a post related to veganism is associated with offline consumption intentions.

1.4. Potential mechanisms based on the theory of planned behavior

Beyond investigating correlative associations between the use of social media and eating behavior, it is crucial to also better understand potential underlying mechanisms, both for scientific advancement and evidence-based practice. The theory of planned behavior (Ajzen, 1991) assumes that behavior is preceded by a behavioral intention. This behavioral intention, in turn, is predicted by attitudes, norms, and perceived behavioral control regarding the behavior. Attitudes describe the favorable or unfavorable evaluation of a behavior, norms refer to the subjective perception of social pressure to perform a behavior, and perceived behavioral control denotes the perceived difficulty or ease of performing the behavior (Ajzen, 1991). In line with the theory of planned behavior and various other theories, it is highly plausible that engaging with social media content influences these psychosocial constructs. For example, according to social norms theory (Perkins & Berkowitz, 1986), being exposed to content on a topic might influence *social norms* by altering the perception of how other people behave. Social norms could also be shaped by false consensus beliefs as a result of sharing (Geusens & Beullens, 2018), or potentially liking or commenting on content. The effects of exposure on *attitudes* could be explained by evaluative conditioning (Hofmann et al., 2010): Many posts have a positive sentiment (Shamoï et al., 2022), which over time might result in a more positive attitude toward veganism. Sharing and interacting with content could shape attitudes, as social media users use their own actions as a source of information regarding their attitudes (Geusens & Beullens, 2018). *Perceived behavioral control* might be increased because posts provide examples of how to overcome barriers to following a vegan diet and, potentially, social support. Geusens et al. (2019) argue that perceived behavioral control can also be influenced by self-perceiving one's own social media use. They also provide empirical support for this notion and generally for the role of attitudes, social norms, and perceived behavioral control as mechanisms behind the effects of engaging with social media content on offline consumption behavior (Geusens et al., 2019). Based on these theoretical and empirical considerations, we examine the constructs from the TPB as potential mechanisms in our studies.

1.5. Research questions and overview

Overall, we conducted four studies, in which we aimed to answer the following research questions: 1) What topics and themes are reflected in the hashtags and pictures of posts tagged with the hashtag #vegan on Instagram? (Studies 1 and 2), and 2) how is the engagement with Instagram content on veganism related to offline eating intentions via psychosocial mechanisms? (Studies 3 and 4). Studies 1 and 2 aimed to enhance comprehension of the social media information environment related to veganism through analyzing scraped Instagram posts using different methods of text and image analysis. Studies 3 and 4 consisted

of online surveys assessing engagement with Instagram content, offline eating intentions, and potential psychological mechanisms underlying their association. These studies aimed at better understanding the behavioral implications of social media use. The ethics board of the University of Mannheim approved the scraping and the survey paradigm used in this paper.

2. Study 1

The aim of this study was to better understand what topics users communicate about in the context of veganism on Instagram. Such topics are often reflected in the hashtags that users add to their posts (Zappavigna, 2015). We therefore focused on these hashtags to identify clusters of posts with similar topics. Beyond a descriptive exploration, we expected that topics of Instagram posts tagged #vegan would

partially reflect what people usually indicate as their motives for following a vegan diet: health, environment, and animal welfare (see, e.g., Janssen et al., 2016, for an interview study).

2.1. Method

Using the online-tool Instagram Scraper (Borra, 2015), we collected 10,062 posts in 49 separate scrapings. This stand-alone application allows to retrieve sets of posts containing a given username or hashtag (in our case, #vegan) by interfacing with Instagram's API. Data were exported in .csv and .GXF formats for the network analysis. A co-occurrence network analysis was conducted using the open-source visualization tool Gephi (Bastian et al., 2009). This produces a network in which nodes, that is, hashtags, are connected by edges that represent co-occurrences. As the analysis was about co-occurrence of



Fig. 1. Co-occurrence network of hashtags. Colors represent the identified communities (green = food, blue = photography, red = health and fitness, yellow = cosmetics). Font size of hashtags represents frequency of usage in the dataset.

hashtags and did not explore directionality, we chose the undirected graph type. Parallel edges connecting the same nodes (i.e., when the same hashtags were used together in more than one posting) were merged. In the graph, the frequency of co-occurrence is represented by the thickness of edges (i.e., line width). The initial network including all hashtags consisted of 18,955 nodes and 20,718 edges. We calculated each node's degree, which denotes the number of co-occurrences of a node with other nodes (i.e., the sum of initial edges per node). After deleting all nodes with a degree of 0, that is, no co-occurrences with other hashtags except #vegan, 1867 nodes and all 20,718 edges remained. Following the procedure of [Ichau et al. \(2019\)](#), we further reduced the number of nodes for interpretative purposes. Excluding seldomly used hashtags also reduces noise and makes it possible to limit the analysis to the most prominent hashtags, which was our target of interest. After excluding all nodes with a degree of less than 30, the network consisted of 213 nodes and 4126 edges. We next calculated its density, which represents how close a network is to being fully connected. To identify common clusters of hashtags, Gephi's modularity algorithm was employed. Based on co-occurrences, this algorithm assigns hashtags to communities. Hashtags in one community are more closely connected to each other than to nodes in other communities. For the graphical representation of the network, nodes were colored depending on their community. The algorithm *ForceAtlas2* was used for generating the graph. It is a force-directed layout algorithm that facilitates interpretation of graphs by causing linked nodes to gravitate toward each other and nonlinked nodes to be pushed apart.

2.2. Results

The average degree of the final network was 38.74 (i.e., each node was connected on average to almost 39 other nodes), and the density was 0.18 (i.e., 18% of theoretically possible edges were present in the network). Four communities emerged from the network analysis (see [Fig. 1](#) for a graphical representation of the network). The largest community (green in [Fig. 1](#)) represents 33.80% of all hashtags, most of which referred to food (e.g., #food, #foodie, #veganfood). The second largest community (blue, 30.99% of hashtags) was centered around the topic of photography (e.g., #photography, #picoftheday, #portrait). Shown in red, 21.60% of hashtags were assigned to a community strongly related to health and fitness (e.g., #healthy, #fitness, #healthylifestyle). The fourth and smallest community comprised 13.62% of hashtags, most of which referred to cosmetics (e.g., #cosmetics, #skincareroutine, #salon). As can be seen in [Fig. 1](#), there were also some hashtags related to animal welfare (i.e., #crueltyfree) and the environment (i.e., #nature, #sustainable), yet these were not used frequently enough to emerge as communities.

2.3. Discussion

This study, to our knowledge, provides the first systematic investigation of themes and topics reflected in hashtags used together with the hashtag #vegan on Instagram. Food seems to be the most prominent topic in this context, but the communication also goes further, including topics such as photography and cosmetics. As expected, health, animal welfare, and the environment, and thus the main motives for following a vegan diet ([Janssen et al., 2016](#)), are represented in some of the posts. The themes and topics reflected in hashtags used in posts about veganism on Instagram seem, at least in part, to relate to people's motives for following a vegan diet. However, this social media information environment analysis focusing on hashtags also reveals topics that are usually not mentioned in interviews or surveys, such as cosmetics and photography.

3. Study 2

Hashtags—as analyzed in Study 1—are one important feature of

social media posts. By considering additional relevant post features, that is, images and accompanying texts in Study 2, we aimed at achieving a more comprehensive understanding of the social media information environment related to veganism. We expected food to be prominently featured again. At the same time, we explored whether additional relevant themes and insights might be revealed by examining images and accompanying texts of posts.

3.1. Method

We scraped a new dataset of 34,254 Instagram posts containing the hashtag #vegan, this time using *PhantomBuster* ([PhantomBuster, 2023](#)), a cloud-based software that can be used for data extraction of publicly available social media content. To enable statistical analyses, the images were first converted to a numeric representation, that is, a 768-dimensional vector, using the CLIP (contrastive language–image pre-training) model ([Radford et al., 2021](#)). CLIP is a neural network trained on a variety of image–text pairs. Its image encoder takes an image as an input and creates a multidimensional vector retaining the most important content of the image.

With the UMAP (uniform manifold approximation and projection) approach ([McInnes et al., 2018](#)), we then reduced the dimensionality of the vectors such that a clustering of the images was possible. We used a target dimensionality of 5 to have a vector that is sufficiently expressive but not too large for the subsequent clustering and set the number of neighbors (other vectors close in the vector space) to 100. As the distance metric, we used Euclidean distance, which is the default recommended by the developers of the approach. To cluster the images, we used the HDBSCAN (hierarchical density-based spatial clustering of applications with noise) algorithm ([Campello et al., 2013](#)), which produces the clusters based on the density of images in the low-dimensional vector space. Multiple runs with different density threshold (ϵ values) were performed and the results were merged to achieve a stable solution. To get a small number of coarse-grained clusters, it is necessary to pick a large value for the minimum cluster size s (we used 600) and a small value for the distance parameter α (we used 0.3). To apply the algorithm, we provided all the five-dimensional image vectors, and the clustering approach produces an assignment from images to clusters.

The sentiment analysis model “twitter-xlm-roberta-base-sentiment-multilingual” from CardiffNLP ([Camacho-collados et al., 2022](#)) is a large multilingual language model that was initially trained on approximately 200 million tweets and fine-tuned to detect the sentiment in a short piece of text (positive, neutral, negative). We applied the model to the texts accompanying Instagram images for an analysis of a post's sentiment. Before we provided the post to the model, we preprocessed it by removing references to other Instagram users and replacing URLs with placeholders. Then, we passed the processed text to the model and retrieved a prediction of the most likely sentiment.

3.2. Results

The clustering resulted in six categories of images ([Fig. 2](#)). Two of the clusters contained images of food (overall 34.7%), one mainly featuring images of savoury dishes (19.5%) and the other mainly of pastry (15.2%). A third cluster contained images of non-food products (30.4%), often cosmetics, frequently in the context of advertisements. A cluster with images of people accounted for 7.9% of posts, and pictures of animals for 2.0%. Of all pictures, 25.0% could not be categorized in one of the above-mentioned clusters and formed their own category. Examples include images of a tree, a hand, a door, and text. No common topic could be identified in those pictures. The sentiment analysis revealed that clusters did not vary substantively regarding the share of posts with different sentiments. Between 65% and 73% of posts were categorized as positive, 21%–28% as neutral, and 3%–14% as negative. Posts containing images of people had the highest share of positive sentiment, whereas those with pictures of animals most frequently were

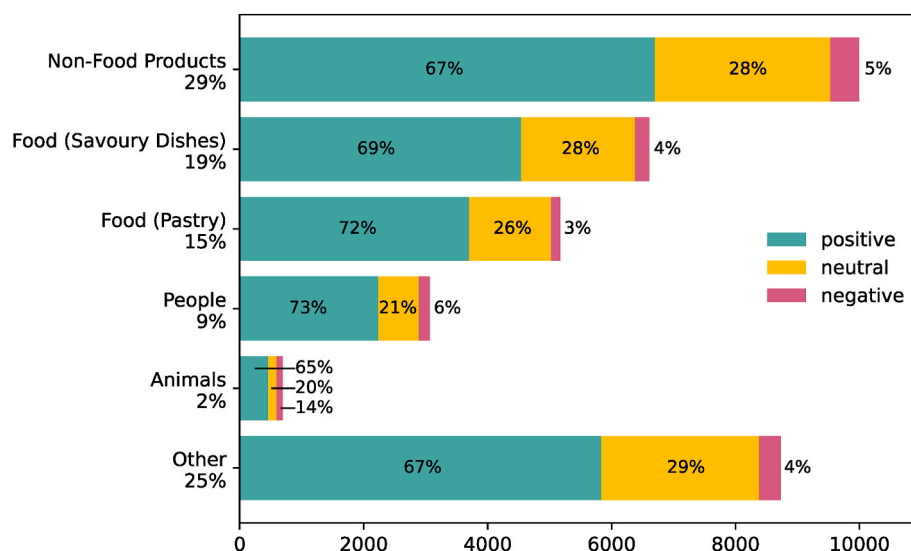


Fig. 2. Contents of pictures as categorized by the HDBSCAN algorithm and sentiment of texts as assigned by the twitter-xlm-roberta-base-sentiment-multilingual model. Text labels on the left represent the category of image (e.g., animals), and the percentages on the left refer to the proportion of all posts analyzed that were described by this image category (e.g., 2.0%). Percentages of individual segments refer to the relative frequency of posts with different sentiments within each category. Numeric labels on the y-axis represent the absolute frequency of posts.

accompanied by texts with negative sentiment.

3.3. Discussion

Like Study 1, this study highlights that food is a prominent topic in posts about veganism on Instagram. Both savoury dishes and sweet pastries account for a substantial share of the pictures. However, this analysis of images also shows that social media communication goes further. Products such as cosmetics are also depicted frequently. This is an interesting finding, since cosmetics were also prominently present in the hashtags in Study 1 but do not seem to play a central role in self-report and interview studies on veganism. This highlights the value of conducting such information environment analyses in addition to self-report studies. With a multifaceted methodological approach, we were able to identify a broader range of motives and topics. A smaller share of images depicts people and animals. About a quarter of images could not be assigned to any of the other categories, highlighting the diversity of image contents. About two-thirds to three-quarters of all posts had text with a positive sentiment. This study and Study 1 provide a descriptive analysis of Instagram as an information environment. Using publicly observable data, we have gained an understanding of topics and themes present in the communication about veganism on Instagram beyond those identified in self-report studies.

4. Study 3

In this study, we explored whether and how engaging with the social media information environment examined in Studies 1 and 2 influences psychosocial predictors of behavior regarding veganism in the offline world. Based on the theory of planned behavior (Ajzen, 1991) and previous research (Geusens et al., 2019), we expected that more frequent (a) exposure to, (b) sharing of, and (c) interaction with posts related to veganism on Instagram would be related to a higher behavioral intention to follow a vegan diet through attitudes, social norms, and perceived behavioral control.

4.1. Method

A questionnaire survey was conducted using SoSci-Survey (Leiner, 2019) to assess online engagement with posts, social cognitive

constructs, and the intention to follow a vegan diet in the future. Some measures of the survey were not part of this study and will thus not be described hereafter. Invitations were sent out via Instagram to all accounts of which posts were included in the scraped dataset of Study 1. In return for their participation, participants had the chance to win one of five Amazon.com gift cards worth 25 dollars in a lottery. After providing informed consent to participate in the study, participants were asked how often they followed a vegan diet on a 5-point scale from “all of the time” to “I do not follow a vegan diet.”

Participants’ exposure to posts related to veganism was assessed with two questions asking how often they saw posts on veganism someone else shared or commented on. Posting was assessed by asking how often they themselves shared or reposted posts related to veganism. Interaction with posts on veganism was measured by asking how often they commented on and liked posts about veganism. All questions on online engagement behaviors were answered on 8-point scales from “several times a day,” to “never.” If participants answered “several times a day, week, or month,” they were asked to numerically indicate the exact frequency in an open format. This allowed us to calculate the frequency of all online engagement behaviors per week. Afterward, participants’ attitudes toward a vegan diet were assessed using a semantic differential consisting of 13 word pairs, for example, “bad–good,” “unappealing–appealing,” “unhealthy–healthy,” with a 5-point scale on which participants indicated which word better reflected their perception of a vegan diet (adapted from Carfora et al., 2019).

Social norms were measured with four items about the expected approval of vegan eating and the perceived dieting behavior of people important to the participants (adapted from Geusens et al., 2019; e.g., “How do you believe most people who are important to you would react if they knew you follow a vegan diet?”), which participants answered on a 5-point scale from “strong approval” to “strong disapproval.” A seven-item measure of perceived behavioral control assessed participants’ perceived capability to follow a vegan diet (adapted from Geusens et al., 2019; e.g., “I am capable of following a vegan diet”), answered on a 5-point scale from “strongly agree” to “strongly disagree.” Thereafter, participants were asked to indicate how much they intended to follow a vegan diet and to incorporate into their diet days on which they would have only vegan meals. Both questions were answered on 5-point scales from “strongly agree” to “strongly disagree.” Sum scores were calculated for attitude (Cronbach’s $\alpha = 0.90$, McDonald’s $\omega = .90$), norms ($\alpha = .71$,

$\omega = .67$), perceived behavioral control ($\alpha = .79$, $\omega = .79$), and intention ($\alpha = .73$). Last, frequency of Instagram use and demographic details were assessed. To analyze the associations between constructs, we conducted a path analysis using the lavaan package version 0.6–16 (Rosseel, 2012) in R version 3.6.1 (R Core Team, 2018).

4.1.1 Sample. A total of 117 participants finished the questionnaire, 82 of whom identified as female, 30 as male, and 5 as diverse. The mean age was 34.87 years (range 20–59). Most participants were employed (43.7%) or self-employed (33.3%) at the time of answering the questionnaire. Regarding veganism, 58.1% of participants indicated they followed a vegan diet all the time, and another 31.6% said they eat a vegan diet most of the time or often. The average daily time spent on Instagram was 55.18 min ($SD = 62.7$).

4.2. Results

The most frequent of the three ways to engage with social media posts was being exposed to content about veganism, with an average of 80.98 times ($SD = 139.13$) per week, followed by interacting with such content ($M = 51.29$, $SD = 86.48$) and actively sharing content about veganism ($M = 8.00$, $SD = 23.65$). The path model showed a nonsignificant chi-square value, $\chi^2(3, N = 117) = 2.67$, $p = .446$, which should be interpreted in light of the rather low sample size and, thus, statistical power. The comparative fit index (CFI) of 1.00, root-mean-square error of approximation (RMSEA) of 0.00, and standardized root-mean-square residual (SRMR) of 0.02 also indicated a very good model fit. Fig. 3 shows the estimated coefficients of the path analysis.

Online engagement showed mostly positive associations with the potential psychosocial mechanisms. Yet, only being exposed to content about veganism on Instagram was significantly associated with more positive attitudes about veganism and higher perceived behavioral control. Interacting with posts and sharing posts about veganism were not significantly related to any of the examined psychosocial mechanisms. Attitudes and perceived behavioral control positively and significantly predicted the intention to follow a vegan diet, whereas social norms did not.¹ The indirect effect of exposure on intention via attitude was significant ($\beta = .092$, $p = .035$), but none of the other indirect effects were statistically significant.

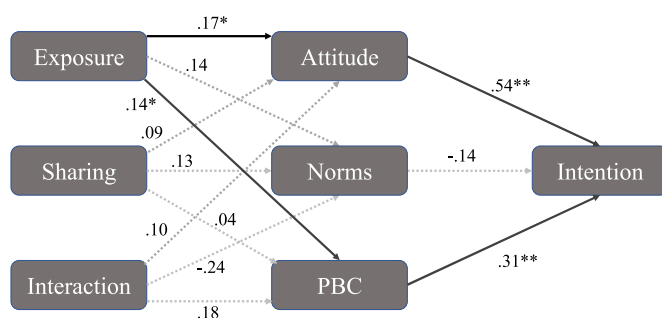


Fig. 3. Estimated standardized parameters of the path model. In the specified model, the covariances between the three social cognitive constructs were included. For reasons of clarity, these are not depicted here but can be found in Table S1 in the Supplementary Materials. Exposure, Sharing, and Interaction refer to content about veganism on Instagram. Attitude, Norms, PBC, and Intention refer to following a vegan diet. PBC = perceived behavioral control. * $p < 0.05$. ** $p < 0.01$.

¹ Social norms were assessed as one construct with four items overall. Analyzing injunctive and descriptive norms separately did not change the pattern of results, i.e., neither predicted behavioral intentions nor mediated an effect of online engagement behaviors on intention.

4.3. Discussion

Being exposed to social media content on veganism can influence offline eating intentions via attitudes. Perceived behavioral control was also predictive of the intention to follow a vegan diet in the future, but social norms were not. This is surprising, since social norms could be expected to be particularly relevant given the social nature of social media. The role of social norms as well as other social constructs should be further explored in future research on understanding how engaging with social media content influences offline intentions and behaviors.

5. Study 4

The aim of this study was to investigate the role of further social mechanisms in explaining effects of engaging with social media content on offline eating intentions: In addition to the psychosocial constructs from the theory of planned behavior investigated in Study 3, we expected the following social constructs to be relevant - based on findings in prior literature (e.g., Di Pasquale & Rivolta, 2018; Herman et al., 2019; Nestle et al., 2009): peer pressure, social comparison, modeling, relatedness, social support, social identity, and self-identity. The Method section contains further information on the constructs and their measurement, including exemplary items.

5.1. Method

This study was conducted using SoSci-Survey (Leiner, 2019). After giving informed consent, participants indicated how often they used Instagram on an 8-point scale from “never” to “several times a day.” Exposure, sharing, and interaction with posts were measured analogously to Study 3. Afterward, participants reported how frequently they followed a vegan diet on a 5-point scale from “all the time” to “not at all.” Next, seven potential social mechanisms for the association of engaging with social media content and eating intentions were measured: peer pressure (eight items, adapted from Santor et al., 2000; e.g., “I’ve felt pressured to eat vegan”; $\alpha = .85$, $\omega = .84$), social comparison (eight items, adapted from Gibbons and Buunk, 1999; e.g., “I always want to know how others would behave in my situation”; $\alpha = .79$, $\omega = .78$), modeling (five items, adapted from Martin and Bush, 2000; e.g., “Others who eat vegan are role models for me”; $\alpha = .95$, $\omega = .95$), relatedness (eight items, adapted from Deci and Ryan, 2000; e.g., “I consider the Instagram users I regularly interact with to be my friends”; $\alpha = .60$), social support (eight items, adapted from Carbonneau et al., 2018; e.g., “Other Instagram users made positive comments on my consumption of vegan foods”; $\alpha = .72$, $\omega > .99$), social identity (six items, adapted from Leach et al., 2008; e.g., “I feel connected to other people who eat vegan”; $\alpha = .94$, $\omega = .94$), self-identity (seven items, adapted from Snippe et al., 2021; e.g., “Eating vegan is an important part of who I am”; $\alpha = .92$, $\omega = .92$). All items were answered on Likert scales. Afterward, attitude ($\alpha = .93$, $\omega = .93$), norms ($\alpha = .74$, $\omega = .70$), perceived behavioral control ($\alpha = .82$, $\omega = .81$), and the intention to eat vegan in the future ($\alpha = .80$) were assessed as in Study 3, followed by demographic information. Bivariate correlation analyses were conducted to identify relevant psychological mechanisms for the associations between online engagement behaviors and eating intentions, which were then jointly investigated in a path analysis, again using lavaan version 0.6–16 (Rosseel, 2012) in R version 3.6.1 (R Core Team, 2018). Constructs showing no significant correlation with either online engagement behaviors or eating intention were not included in the path model.

5.1.1 Sample. A total of 254 participants finished the questionnaire, three of whom were excluded from further analyses because they reported a low proficiency in German, the study language. Among the 251 remaining participants, 196 identified as female and 55 as male. The mean age was 24.20 years (range 18–40). Most participants were students (84.5%), and 14.3% indicated they were employed; 16.0%

reported following a vegan diet all or most of the time and another 51.4% often or sometimes, and 32.7% did not follow a vegan diet. The average daily time spent on Instagram was 63.81 min ($SD = 53.66$).

5.2. Results

As in Study 3, being exposed to content about veganism was the most frequent way of engaging with social media content with an average of 11.55 times ($SD = 24.49$) per week, followed by interacting with such content ($M = 2.81$, $SD = 10.76$) and sharing content about veganism ($M = 0.44$, $SD = 3.45$). The bivariate correlation analyses revealed that social comparison and relatedness did not significantly correlate with any of the online engagement behaviors or offline eating intentions (see Table S2 in the Supplementary Materials for all bivariate correlations). The specified path model showed an acceptable model fit. The chi-square value reached significance, $\chi^2(4, N = 244) = 10.78$, $p = .029$; the CFI of 0.996, RMSEA of 0.08, and SRMR of 0.05 indicated a sufficient fit to interpret the estimated model parameters. Fig. 4 shows the standardized estimates for all paths that reached statistical significance ($p < 0.05$; see Table S3 in the Supplementary Materials for all estimated parameters). Being exposed to content on veganism had significant positive effects on all potential mechanisms, including all social mechanisms, except peer pressure. Sharing and interaction were associated with fewer psychosocial constructs than exposure. Of the potential mechanisms, self-identity and attitudes significantly predicted offline eating intentions; the others did not.¹ The indirect effects of exposure on intention via self-identity ($\beta = .106$, $p = .007$) and attitude ($\beta = .103$, $p = .005$) were both positive and significant.

5.3. Discussion

Exposure to posts about veganism is the most predictive way of engaging with social media content for changes in psychological mechanisms and the only one that shows significant indirect effects on the intention to follow a vegan diet in the future, replicating the findings from Study 3. Again, attitude mediated the relation between online engagement behavior and offline eating intention. This highlights how social media can shape beliefs and convictions and ultimately might influence offline behavior. Additionally, self-identity might play an important role in this context. Given our results, it seems plausible that social media shapes not only how one perceives others and their behaviors but also how one sees oneself, which in turn shapes one's own behaviors. These results add to our understanding of pathways by which

social media use could influence offline eating intentions and behavior.

6. General discussion

Social media presents an increasingly important yet understudied information environment for eating behaviors. Across four studies, we conducted the first systematic descriptive analysis of hashtags, pictures, and texts posted in the context of veganism on Instagram and investigated how engaging with this context relates to offline eating intentions via underlying psychological predictors. The results of Study 1 show that posts about veganism on Instagram use hashtags that can be categorized into four overarching topics, that is, food, health and fitness, photography, and cosmetics. Although food formed the largest community, our results show that it is not the only topic of Instagram posts in the context of veganism. Many hashtags related to health, which is one of the primary motives for people following a vegan diet (Janssen et al., 2016). This is also in line with prior research showing that vegans using social media often do so with an interest in health (Horn et al., 2022). Other motives frequently mentioned in self-report and interview studies, namely, animal welfare and the environment, were also present in some hashtags but in such low frequency that they did not form major communities—in contrast to interview studies. On the other hand, fitness and cosmetics—both related to beauty—were important topics in the social media environment analyses but have not been frequently discussed in interview studies about veganism. It should be noted that social media users might have various motivations for posting about veganism that go beyond expressing their motives to eat vegan, so a certain discrepancy between our results and interview studies might be expected. However, these diverging findings underline the value of a multimethod approach for better understanding the topics and themes of online and offline communication about veganism.

Study 2 analyzed pictures and texts of posts with the hashtag #vegan. Again, with this additional type of data, food emerged as the biggest topic. Yet the images also showed new content, such as cosmetic products, people, and animals. The sentiment of the accompanying texts was mostly positive, which is in line with the findings from a sentiment analysis of Twitter posts on veganism (Shamoi et al., 2022). This has implications for how engaging with this content might influence psychological constructs. Through evaluative conditioning (Hofmann et al., 2010), attitudes might become more positive the more frequently people engage with content on veganism. This would not be expected had posts mostly shown a negative sentiment. It is also an interesting finding given that other media outlets such as newspapers have frequently portrayed veganism in a negative fashion (Brookes & Chahupnik, 2023).

In Study 3, we found that being exposed to content about veganism on Instagram seemed more important than actively posting or interacting with such content for predicting eating intentions via underlying psychosocial factors. This might be partially explained by exposure being the most frequent way of engaging with content in our Studies 3 and 4. Interacting was already considerably less common, and actively posting, on average, was the least frequent. This might also speak to the fact that—while most social media users are exposed to and consume content—many might not actively post themselves so that a minority of users creates the majority of the content. This should be considered when interpreting the differential effects of exposure, interaction, and sharing. However, our observations highlight that the passive consumption of social media content can be sufficient to shape behavioral intentions, and active engagement is not necessary. Somewhat surprisingly, our results suggest that only attitudes and perceived behavioral control are predictive of offline eating intentions, whereas the genuinely social predictor—social norms—is not. This is contrary to our expectation and previous research, which identified norms as important mechanisms for the association of engaging with social media content and offline consumption in the context of alcohol consumption (Geusens et al., 2019).

In Study 4, we again found exposure to be the most predictive online

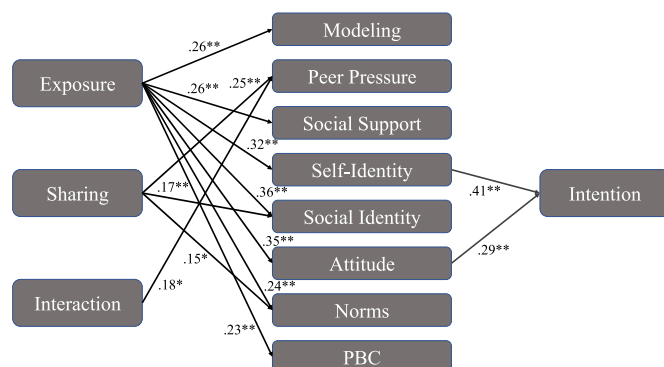


Fig. 4. Estimated standardized parameters of the path model. Only parameters with $p < 0.05$ are depicted. In the specified model, the covariances between some of the potential mediators were included to optimize model fit. For reasons of clarity, these are not depicted here but can be found in Table S3 in the Supplementary Materials. Exposure, Sharing, and Interaction refer to content about veganism on Instagram. All potential mechanisms and Intention refer to following a vegan diet. PBC = Perceived behavioral control. * $p < 0.05$. ** $p < 0.01$.

engagement behavior. Attitudes and self-identity stand out as the only significant mediators for the effect of exposure on offline eating intention. Prior research has shown that for vegans, their diet is more central to their identity than it is for vegetarians (Rosenfeld, 2019). Thus, it is both plausible and interesting that identity also seems to play a role in the effect of social media use on offline eating intentions. This should be considered in interventions trying to promote veganism on social media and elsewhere. Messages and content might be more effective if they align with and reinforce the personal values and self-identity of recipients.

The current study utilized a multimethodological approach to understanding Instagram as an information environment for eating and its behavioral relevance. Combining different sources and types of data allowed for a comprehensive investigation of the current research questions. The information environment analyses revealed topics that self-report studies on veganism have seldom discussed, such as cosmetics or fitness. On the other hand, the surveys conducted in Studies 3 and 4 allowed us to investigate self-perceptions of users and psychological constructs that cannot be inferred or measured from scraped social media data alone. Therefore, our study bridges the gap between subjective experiences and publicly observable data and paves the way for a more nuanced understanding of how online environments can subtly yet significantly influence offline eating behaviors.

6.1. Limitations and future research

Besides these advantages, some limitations should be considered when interpreting our findings. The sample sizes of Studies 3 and 4 were comparably low given the number of parameters estimated in the path models. Validation of our results in larger samples would allow for higher precision in estimation and higher power to detect small associations. However, fit indices in both studies met common thresholds (Hu & Bentler, 1995), and sample sizes exceeded lower bounds for structural equation modeling suggested in prior literature (Bentler & Chou, 1987). Additionally, these studies were both cross-sectional, and thus their results cannot be interpreted causally. Future studies should aim to investigate the effects of engaging with social media content on offline eating longitudinally and experimentally, building on the potential mechanisms we identified in this paper. Since such experiments have their own limitations (e.g., external validity, demand effects, ethical considerations), combining insights from studies with different methodologies seems most promising.

In Studies 3 and 4, we assessed the intention to eat vegan in the future as the outcome. While behavioral intentions are commonly assumed to be important predictors of actual behavior, intentions do not always translate into behavior, a phenomenon often referred to as intention-behavior gap (Rhodes & De Bruijn, 2013). Future studies should aim to build on the current findings and investigate how online social media engagement relates to offline food consumption. Relatedly, we build on the theory of planned behavior (Ajzen, 1991), which is one of the most prominent theories of behavior change. However, it has a strong focus on motivational processes, i.e., intention formation, and less on volitional processes, i.e., how intention is translated into behavior. Future research could explore the relevance of such volitional processes in the context of social media influences on eating behavior.

In this study, we focused solely on Instagram as an information environment for eating behavior in the context of veganism. While we did so for important reasons—high usage, relevance of food and veganism, and centrality of images—communication about veganism on other social networks might be different and relate differently to offline eating intentions. Also, as social media is constantly developing, its type of content is changing, too. Although we explored different features of Instagram posts (i.e., hashtags, images, and descriptions), future studies might choose to focus on new types of content, such as reels. Since this new content frequently evolves from prior types of content and shares many of their attributes, our research likely will be of

value for future research in this area.

6.2. Conclusion

With a total of four studies, we contribute to an improved understanding of Instagram as an information environment for eating behavior and its associations with offline intentions. Food emerged as the most prominent—but not sole—topic of Instagram posts about veganism. The primary motives for following a vegan diet are partially reflected in the hashtags, though health was more frequently represented than animal welfare and the environment. Hashtags used in the context of veganism also relate to topics such as fitness, photography, and cosmetics. Lifestyle seems to have been a central aspect of the communication associated with veganism on Instagram. Uncovering such topics is a central contribution of information environment analyses with publicly observable data in addition to self-report and interview studies. Images also mainly but not exclusively depicted food. Interestingly, passive exposure to Instagram content on veganism had stronger and more consistent effects on eating intentions via psychological mechanisms than active forms of engagement. Interpreting and contextualizing such observations can be facilitated greatly by combining them with descriptive insights about the content users are exposed to, such as the predominately positive sentiments we found in Study 2. Exposure to negative content would likely result in very different behavioral implications. Therefore, our studies not only enhance our understanding of the communication associated with veganism on Instagram and its effects on eating intentions but also demonstrate the utility and necessity of multimethodological approaches in social media research. We hope this work inspires further exploration and methodological innovation in the field and ultimately contributes to the development of more effective health communication strategies in the digital age.

Ethical statement

Hereby, I, Philipp Kadel, consciously assure that for the manuscript 'From Pixels to Palate: Communication Around #vegan on Instagram and Its Relation With Eating Intentions' the following is fulfilled.

- 1) This material is the authors' own original work, which has not been previously published elsewhere.
- 2) The paper is not currently being considered for publication elsewhere.
- 3) The paper reflects the authors' own research and analysis in a truthful and complete manner.
- 4) The paper properly credits the meaningful contributions of co-authors and co-researchers.
- 5) The results are appropriately placed in the context of prior and existing research.
- 6) All sources used are properly disclosed (correct citation). Literally copying of text must be indicated as such by using quotation marks and giving proper reference.
- 7) All authors have been personally and actively involved in substantial work leading to the paper, and will take public responsibility for its content.
- 8) The methods of data collection used in this study were approved by ethics commission of the University of Mannheim.

I agree with the above statements and declare that this submission follows the policies of *Appetite* as outlined in the Guide for Authors and the Publishing Ethics.

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CRediT authorship contribution statement

Philipp Kadel: Writing – original draft, Visualization, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Nicolas Heist:** Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Heiko Paulheim:** Validation, Supervision, Resources, Funding acquisition, Conceptualization. **Jutta Mata:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Funding acquisition, Conceptualization.

Declaration of competing interest

None.

Data availability

For parts of the data the authors do not have permission to share. Other data will be made available on request.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.appet.2024.107518>.

References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211.
- Anderson Steeves, E., Jones-Smith, J., Hopkins, L., & Gittelsohn, J. (2016). Perceived social support from friends and parents for eating behavior and diet quality among low-income, urban, minority youth. *Journal of Nutrition Education and Behavior*, 48(5), 304–310. <https://doi.org/10.1016/j.jneb.2015.12.014>
- Arora, N., Rana, M., & Prashar, S. (2023). How does social media impact consumers' sustainable purchase intention? *Review of Marketing Science*, 21(1). <https://doi.org/10.1515/roms-2022-0072>
- Bakaloudi, D. R., Halloran, A., Rippin, H. L., Oikonomidou, A. C., Dardavesi, T. I., Williams, J., Wickramasinghe, K., Breda, J., & Chourdakis, M. (2021). Intake and adequacy of the vegan diet. A systematic review of the evidence. *Clinical Nutrition*, 40(5), 3503–3521. <https://doi.org/10.1016/j.clnu.2020.11.035>
- Baldwin, H. J., Freeman, B., & Kelly, B. (2018). Like and share: Associations between social media engagement and dietary choices in children. *Public Health Nutrition*, 21(17), 3210–3215. <https://doi.org/10.1017/S1368980018001866>
- Bartelmeß, T., & Godemann, J. (2022). Exploring the linkages of digital food communication and analog food behavior: A scoping review. *International Journal of Environmental Research and Public Health*, 19(15). <https://doi.org/10.3390/ijerph19158990>. Article 8990.
- Bastian, M., Heymann, S., & Jacomy, M. (2009). Gephi: An open source software for exploring and manipulating networks. *Proceedings of the Third International ICWSM Conference*, 3(1), 361–362.
- Bentler, P. M., & Chou, C.-P. (1987). Practical issues in structural modeling. *Sociological Methods & Research*, 16(1), 78–117. <https://doi.org/10.1177/0049124187016001004>
- Borra, E. (2015). *Instagram scraper*. <https://wiki.digitalmethods.net/Dmi/ToolInstagramScraper>.
- Brookes, G., & Chalupnik, M. (2023). Militant, annoying and sexy: A corpus-based study of representations of vegans in the british press. *Critical Discourse Studies*, 20(2), 218–236. <https://doi.org/10.1080/17405904.2022.2055592>
- Camacho-collados, J., Rezaee, K., Riahi, T., Ushio, A., Loureiro, D., Antypas, D., Boisson, J., Espinosa Anke, L., Liu, F., & Martínez Cámara, E. (2022). Tweetnlp: Cutting-edge natural language processing for social media. In *Proceedings of the 2022 Conference on empirical methods in natural language processing: System Demonstrations* (pp. 38–49). <https://doi.org/10.18653/v1/2022.emnlp-demos.5>
- Campello, R. J. G. B., Moulavi, D., & Sander, J. (2013). Density-based clustering based on hierarchical density estimates. In J. Pei, V. S. Tseng, L. Cao, H. Motoda, & G. Xu (Eds.), *Advances in knowledge discovery and data mining* (Vol. 7819, pp. 160–172). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-37456-2_14
- Carbonneau, E., Bradette-Laplanche, M., Lamarche, B., Provencher, V., Bégin, C., Robitaille, J., Desroches, S., Vohl, M.-C., Corneau, L., & Lemieux, S. (2018). Social support for healthy eating: Development and validation of a questionnaire for the French-Canadian population. *Public Health Nutrition*, 21(13), 2360–2366. <https://doi.org/10.1017/S1368980018001209>
- Carfora, V., Catellani, P., Caso, D., & Conner, M. (2019). How to reduce red and processed meat consumption by daily text messages targeting environment or health benefits. *Journal of Environmental Psychology*, 65, Article Article101319. <https://doi.org/10.1016/j.jenvp.2019.101319>
- Clark, M. A., Springmann, M., Hill, J., & Tilman, D. (2019). Multiple health and environmental impacts of foods. *Proceedings of the National Academy of Sciences of the United States of America*, 116(46), 23357–23362. <https://doi.org/10.1073/pnas.1906908116>
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01
- Di Pasquale, R., & Rivolta, A. (2018). A conceptual analysis of food parenting practices in the light of self-determination theory: Relatedness-enhancing, competence-enhancing and autonomy-enhancing food parenting practices. *Frontiers in Psychology*, 9. <https://doi.org/10.3389/fpsyg.2018.02373>. Article 2373.
- Erz, A., Marder, B., & Osadchaya, E. (2018). Hashtags: Motivational drivers, their use, and differences between influencers and followers. *Computers in Human Behavior*, 89, 48–60. <https://doi.org/10.1016/j.chb.2018.07.030>
- Geusens, F., & Beullens, K. (2018). The association between social networking sites and alcohol abuse among Belgian adolescents: The role of attitudes and social norms. *Journal of Media Psychology*, 30(4), 207–216. <https://doi.org/10.1027/1864-1105/a000196>
- Geusens, F., Bigman-Galimore, C. A., & Beullens, K. (2019). A cross-cultural comparison of the processes underlying the associations between sharing of and exposure to alcohol references and drinking intentions. *New Media & Society*, 22, 49–69. <https://doi.org/10.1177/1461444819860057>
- Gibbons, F. X., & Buunk, B. P. (1999). Individual differences in social comparison: Development of a scale of social comparison orientation. *Journal of Personality and Social Psychology*, 76(1), 129–142. <https://doi.org/10.1037/0022-3514.76.1.129>
- Godfray, H. C. J., Aveyard, P., Garnett, T., Hall, J. W., Key, T. J., Lorimer, J., Pierrehumbert, R. T., Scarborough, P., Springmann, M., & Jebb, S. A. (2018). Meat consumption, health, and the environment. *Science*, 361(6399). <https://doi.org/10.1126/science.aam5324>. Article eam5324.
- Herman, C. P., Polivy, J., Pliner, P., & Vartanian, L. R. (2019). *Social influences on eating*. Springer International Publishing. <https://doi.org/10.1007/978-3-030-28817-4>
- Hofmann, W., De Houwer, J., Perugini, M., Baeyens, F., & Crombez, G. (2010). Evaluative conditioning in humans: A meta-analysis. *Psychological Bulletin*, 136(3), 390–421. <https://doi.org/10.1037/a0018916>
- Horn, L., Budulan, M.-A., & Lohin, M. (2022). *Motives for veganism and the influence of social media* (Vol. 2). Cadernos de Investigação Do Mestrado Em Negócio Eletrónico CIMNE. https://doi.org/10.56002/ceos.0067_cimne_1_2
- Hu, L.-T., & Bentler, P. M. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 76–99). Sage.
- Ichau, E., Frissen, T., & d'Haenens, L. (2019). From #selfie to #edgy. Hashtag networks and images associated with the hashtag #jews on Instagram. *Telematics and Informatics*, 44. <https://doi.org/10.1016/j.tele.2019.101275>. Article 101275.
- Janssen, M., Busch, C., Rödiger, M., & Hamm, U. (2016). Motives of consumers following a vegan diet and their attitudes towards animal agriculture. *Appetite*, 105, 643–651. <https://doi.org/10.1016/j.appet.2016.06.039>
- Joshi, S. V., Stubbe, D., Li, S.-T. T., & Hilty, D. M. (2019). The use of technology by youth: Implications for psychiatric educators. *Academic Psychiatry*, 43(1), 101–109. <https://doi.org/10.1007/s40596-018-1007-2>
- Kilb, M., Giese, H., & Mata, J. (2023). How eating-related social media postings influence healthy eating in senders and network members: Two field experiments with intensive longitudinal data. *Appetite*, 182. <https://doi.org/10.1016/j.appet.2022.106430>. Article 106430.
- Kim, B. R., & Mackert, M. (2022). Social media use and binge eating: An integrative review. *Public Health Nursing*, 39(5), 1134–1141. <https://doi.org/10.1111/phn.13069>
- Laakso, S., Niva, M., Eranti, V., & Aapio, F. (2022). Reconfiguring everyday eating: Vegan Challenge discussions in social media. *Food, Culture and Society*, 25(2), 268–289. <https://doi.org/10.1080/15528014.2021.1882796>
- Leach, C. W., Van Zomeren, M., Zebel, S., Vliek, M. L. W., Pennekamp, S. F., Doosje, B., Ouwerkerk, J. W., & Spears, R. (2008). Group-level self-definition and self-investment: A hierarchical (multicomponent) model of in-group identification. *Journal of Personality and Social Psychology*, 95(1), 144–165. <https://doi.org/10.1037/0022-3514.95.1.144>
- Leiner, D. J. (2019). *SoSci survey [computer software]*. <https://www.sosicurvey.de>.
- Martin, C. A., & Bush, A. J. (2000). Do role models influence teenagers' purchase intentions and behavior? *Journal of Consumer Marketing*, 17(5), 441–453. <https://doi.org/10.1108/07363760010341081>
- McInnes, L., Healy, J., & Melville, J. (2018). Umap: Uniform manifold approximation and projection for dimension reduction. <https://doi.org/10.48550/ARXIV.1802.03426>
- Nestle, M., Wing, R., Birch, L., DiSogra, L., Drewnowski, A., Middleton, S., Sigman-Grant, M., Sobal, J., Winston, M., & Economos, C. (2009). Behavioral and social influences on food choice. *Nutrition Reviews*, 56(5), 50–64. <https://doi.org/10.1111/j.1753-4887.1998.tb01732.x>
- NHS. (2023). *The vegan diet*. <https://www.nhs.uk/live-well/eat-well/how-to-eat-a-balanced-diet/the-vegan-diet/>.

- Page, R. (2012). The linguistics of self-branding and micro-celebrity in Twitter: The role of hashtags. *Discourse & Communication*, 6(2), 181–201. <https://doi.org/10.1177/1750481312437441>
- Perifanou, M., Tzafilkou, K., & Economides, A. A. (2021). The role of instagram, facebook, and youtube frequency of use in university students' digital skills components. *Education Sciences*, 11(12). <https://doi.org/10.3390/educsci11120766>. Article 766.
- Perkins, H. W., & Berkowitz, A. D. (1986). Perceiving the community norms of alcohol use among students: Some research implications for campus alcohol education programming. *International Journal of the Addictions*, 21(9–10), 961–976. <https://doi.org/10.3109/10826088609077249>
- Pew Research Center. (2021). *Social media use in 2021*. <https://www.pewresearch.org/internet/2021/04/07/social-media-use-in-2021/>.
- PhantomBuster. PhantomBuster: More leads, less effort. <https://phantombuster.com>.
- Phua, J., Jin, S. V., & Kim, J. J. (2020). Pro-veganism on Instagram: Effects of user-generated content (UGC) types and content generator types in Instagram-based health marketing communication about veganism. *Online Information Review*, 44(3), 685–704. <https://doi.org/10.1108/OIR-06-2019-0213>
- Qutteina, Y., Hallez, L., Raedschelders, M., De Backer, C., & Smits, T. (2021). Food for teens: How social media is associated with adolescent eating outcomes. *Public Health Nutrition*, 25(3), 290–302. <https://doi.org/10.1017/S1368980021003116>
- R Core Team. (2018). *R: A language and environment for statistical computing [computer software]*. R Foundation for Statistical Computing.
- Radford, A., Kim, J. W., Hallacy, C., Ramesh, A., Goh, G., Agarwal, S., Sastry, G., Askill, A., Mishkin, P., Clark, J., Krueger, G., & Sutskever, I. (2021). Learning transferable visual models from natural language supervision. *Proceedings of Machine Learning Research*, 139, 8748–8763. <https://doi.org/10.48550/ARXIV.2103.00020>
- Rhodes, R. E., & De Bruijn, G. (2013). How big is the physical activity intention-behaviour gap? A meta-analysis using the action control framework. *British Journal of Health Psychology*, 18(2), 296–309. <https://doi.org/10.1111/bjhp.12032>
- Rosenfeld, D. L. (2019). A comparison of dietarian identity profiles between vegetarians and vegans. *Food Quality and Preference*, 72, 40–44. <https://doi.org/10.1016/j.foodqual.2018.09.008>
- Rosseel, Y. (2012). Lavaan: An R package for structural equation modeling and more. *Journal of Statistical Software*, 48(2), 1–36.
- Santarossa, S., Coyne, P., Lisinski, C., & Woodruff, S. J. (2016). #fitspo on instagram: A mixed-methods approach using netlytic and photo analysis, uncovering the online discussion and author/image characteristics. *Journal of Health Psychology*, 24(3), 376–385. <https://doi.org/10.1177/1359105316676334>
- Santarossa, S., Lacasse, J., Larocque, J., & Woodruff, S. J. (2019). #Orthorexia on instagram: A descriptive study exploring the online conversation and community using the netlytic software. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, 24(2), 283–290. <https://doi.org/10.1007/s40519-018-0594-y>
- Santor, D. A., Messervey, D., & Kusumakar, V. (2000). Measuring peer pressure, popularity, and conformity in adolescent boys and girls: Predicting school performance, sexual attitudes, and substance abuse. *Journal of Youth and Adolescence*, 29(2), 163–182. <https://doi.org/10.1023/A:1005152515264>
- Scarborough, P., Clark, M., Cobiac, L., Papier, K., Knuppel, A., Lynch, J., Harrington, R., Key, T., & Springmann, M. (2023). Vegans, vegetarians, fish-eaters and meat-eaters in the UK show discrepant environmental impacts. *Nature Food*, 4(7), 565–574. <https://doi.org/10.1038/s43016-023-00795-w>
- Shamoi, E., Turdybay, A., Shamoi, P., Akhmetov, I., Jaxylykova, A., & Pak, A. (2022). Sentiment analysis of vegan related tweets using mutual information for feature selection. *PeerJ Computer Science*, 8, Article e1149. <https://doi.org/10.7717/peerj-cs.1149>
- Sina, E., Boakye, D., Christianson, L., Ahrens, W., & Hebestreit, A. (2022). Social media and children's and adolescents' diets: A systematic review of the underlying social and physiological mechanisms. *Advances in Nutrition*, 13(3), 913–937. <https://doi.org/10.1093/advances/nmac018>
- Snippe, M. H. M., Peters, G.-J. Y., & Kok, G. (2021). The operationalization of self-identity in reasoned action models: A systematic review of self-identity operationalizations in three decades of research. *Health Psychology and Behavioral Medicine*, 9(1), 48–69. <https://doi.org/10.1080/21642850.2020.1852086>
- Stano, S. (2021). Veganism 2.0: Gastronomica, nutrition, and digital communication. *Digital Age in Semiotics & Communication*, 4(3–4.2), 12–30. <https://doi.org/10.33919/dasc.20-21>
- Zappavigna, M. (2015). Searchable talk: The linguistic functions of hashtags. *Social Semiotics*, 25(3), 274–291. <https://doi.org/10.1080/10350330.2014.996948>