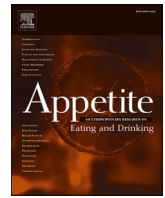




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Veganism during the COVID-19 pandemic: Vegans' and nonvegans' perspectives

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ABSTRACT

Although the COVID-19 pandemic has triggered growing public interest in veganism, veganism's conceptualization remains ambiguous. Moreover, vegans' and nonvegans' different perspectives have rarely been addressed. Hence, this study involved the opinions of both vegans and nonvegans in the COVID-19 context to understand their attitudes, motivations, and opinions related to veganism. We analyzed online discourses in vegan and antivegan online communities using Word2Vec analysis and qualitative analysis. We identified lists of terms associated with three key veganism dimensions (i.e., lifestyle, animal rights, and food). Moreover, we compared actual online discussions among vegans to those among nonvegans regarding specific veganism attributes. This study preliminarily identifies specific attributes associated with veganism in online discourse among vegans. The issues addressed in this study can be tested in future research. Our findings can also be useful for people in various stages of veganism—such as active vegans, people who are interested in veganism, or even nonvegans who are uninterested in veganism—to comprehend the different perceptions prevailing in each group.

1. Introduction

In recent years, consumer use of vegan foods and the practice of the vegan lifestyle—which is aimed at enhancing health and advancing sustainability—have become increasingly popular in society (Weder et al., 2021). As a recent trend, veganism has been increasing in popularity around the world. Veganism refers to “a particular dietary style that entails eating only plant-based foods and abstaining from all animal products” (Sneijder & Te Molder, 2009, pp. 622). Veganism supposes different attitudes and motivations regarding animal-rights-related aspects, environmental and health-related aspects, spiritual/religious aspects, moral/ethical motives, lifestyle sustainability, food, and personal health (Greenebaum, 2018; Simons et al., 2021). In Western cultures and various regions of Asia, the numbers of people who are vegan have considerably increased (Barford, 2018).

Vegan eating has gained attention in public discussions. Online users discuss all types of topics on online social networks (Jasser et al., 2021). Among many other networks, Reddit is “a network of communities where people can dive into their interests, hobbies and passions” (Reddit, 2021). This site allows Redditors to disseminate and discuss knowledge, information, news, thoughts, and personal opinions and

insights by sharing and commenting on posts. Reddit users anonymously discuss specific, prominent, situation-sensitive dialog and controversial events (Blackburn et al., 2018). The site also allows Redditors to rate and comment on other posts, which are generated by members according to their personal interests and the topics with which they choose to engage (Shaheer & Carr, 2022). Reddit has become the 11th-most-visited website in the world, with 52 million daily active users (36.2% female users and 63.8% male users; Datareportal, 2022) and about 140,000 active topical communities (i.e., subreddits; Marotti, 2018). Reddit is also ranked the 16th-most-used social platform in the world (fifth in the United States). Nevertheless, few studies (e.g., Park et al., 2020) have used Reddit for academic research.

Recently, the COVID-19 pandemic might have influenced people's food-related behaviors (e.g., food choice patterns and food purchase and consumption behaviors; Janssen et al., 2021). Nevertheless, Reddit, a platform where people discuss health-related issues, remains under-researched (O'Donnell & Guidry, 2020) in the food industry context.

Previous studies have investigated how veganism relates to variations in personality traits and sociodemographic variables (Tan et al., 2021). Prior research has also investigated veganism's sociopsychological predictors (Rosenfeld & Burrow, 2017). Moreover, existing

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quantitative and qualitative research has mainly focused on consumers' attitudes, knowledge, personal motives, values, and reasons related to their choice to adopt veganism (e.g., Janssen et al., 2016). Vegans have diverse perceptions of and attitudes and motivations regarding veganism, as well as a variety of reasons for becoming vegan—including their individual well-being, concern for their health, religion, food safety, cost savings, disliking animal products, environmental concerns, concern for animal welfare, political matters, climate stability, spiritual concerns, and other moral and ethical considerations (Hagmann et al., 2019; MacInnis & Hodson, 2021; Timko et al., 2012).

Prior studies have investigated vegans' and nonvegans' attitudes toward vegan foods (Martinelli & De Canio, 2021). According to Cole and Morgan (2011), veganism is sometimes viewed as a deviant practice, and this unfavorable perception is promoted through veganism's misrepresentation. Vegan food is generally considered healthy and natural, but remarkably, certain consumers (e.g., nonvegans) have negative attitudes toward vegan food and perceive it as unhealthy or artificial (Kilian & Hamm, 2021). Among antivegans, prejudices against veganism and pro-meat attitudes are explicitly expressed (Earle & Hodson, 2017). Although previous studies have mostly focused on the topic of vegan advocacy (i.e., the factors affecting attitudes and motivations related to the consumption of vegan products; Nezelek & Forstell, 2020; Raggiotto et al., 2018), this study explores nonvegans' motivations and attitudes to deepen our understanding of why they choose to oppose veganism. By understanding the prevailing bias against or image of veganism, we can recognize veganism as an expression of personal belief rather than as a deviant or radical activity.

Cooper et al. (2022) identified consumer perceptions among vegans and nonvegans on Twitter using text analytics. However, most relevant studies have involved traditional techniques, such as quantitative consumer surveys and interviews, to analyze perceptions of vegan food (e.g., Kilian & Hamm, 2021).

To fill this research gap, this study is aimed at examining vegans' and nonvegans' perceptions of veganism. We propose three research objectives: (1) to conceptualize the multiple dimensions of veganism, (2) to compare vegans' and nonvegans' opinions regarding aspects of veganism, and (3) to examine vegans' and nonvegans' experiences and perceptions related to the COVID-19 pandemic. To do so, we explored a data source that is unconventional for veganism studies: discourses in anonymous online communities. We analyzed the data using a traditional qualitative approach and a neural-network-based Word2Vec algorithm. Particularly, we explored both vegans' and nonvegans' sides to identify various motivations and personal reasons to pursue or not pursue veganism.

2. Methods

2.1. Data collection

We targeted Reddit, which has approximately 50 million active users and more than 100,000 subreddits (Reddit, 2022), as this study's data source. *Subreddit* is a term used on Reddit to refer to a community centered on a specific topic (Reddit, 2022). Subreddit members who are interested in a topic on a subreddit can post about and comment on other posts about it. Using the Reddit API, we retrieved data from Reddit in December 2021. This study targeted two opposing types of subreddits, one at each end of the veganism spectrum, to compare their perspectives on vegan diets and animal product consumption. The vegan subreddit (r/Vegan) is the largest online community for vegans, with nearly 800,000 members (as of February 2022). This vegan community offers various resources and activities—such as documentaries, 30-day challenges, and an animal rights social network hub—to motivate its members and support veganism. The antivegan subreddit (r/AntiVegan) is an antivegan community with about 17,000 members. According to the subreddit's (r/AntiVegan) introduction, this antivegan community is open to “omnivores, carnivores, ex-vegans, vegetarians, and

pesccatarians” who aim to “oppose the ideology of veganism.” Although nonvegans are not necessarily antivegan, we selected an antivegan community because antivegan arguments can demonstrate why individuals oppose veganism. Moreover, this antivegan community's description denotes that the community embraces people with a wide range of meat consumption habits, including active nonvegans.

Because this study is focused on how the COVID-19 pandemic has influenced people's perceptions and opinions of veganism, we used three pandemic-related keywords (i.e., *coronavirus*, *covid*, and *pandemic*) to crawl posts and comments written between March 2020 and December 2021 and shared on vegan and antivegan subreddits. Consequently, we retrieved 5497 documents, including 76 original posts and 5421 comments, from the vegan subreddit. On average, each document received 71.3 comments. We excluded documents with fewer than three words from further text analysis, leaving 3523 documents from the vegan community available for analysis. The number of documents in the antivegan subreddit was much smaller than that in the vegan community. We gathered 347 documents, including 29 original posts and 318 comments. In the antivegan community, each post received an average of 10.9 comments. After we removed short documents, 234 remained for text analysis.

2.2. Study design

For this study, we implemented mixed methods to conceptualize veganism's dimensions and discover the latent attributes associated with each dimension. To construct a multidimensional conceptualization of changes in veganism during the pandemic, we followed three steps. First, we identified veganism's dimensions and the keywords highly associated with each dimension via a literature review. Second, we explored the specific attributes of veganism's dimensions with a neural network model (a Word2Vec algorithm). Finally, we searched for actual quotes associated with the key attributes within the posts and comments in the vegan and antivegan subreddits using manual content analysis. Fig. 1 summarizes the veganism conceptualization process used in this study.

Step 1 Veganism Dimension and Keyword Selection with Literature Review

We selected target keywords relevant to veganism based on the concept of veganism suggested by Gheihman (2021). Gheihman proposed three dimensions of veganism (i.e., lifestyle, animal rights, and food) and core values highly associated with each dimension (Fig. 1). As shown in Fig. 2, the three veganism dimensions each have core movements, but each dimension and movement overlaps with others. For this study, we selected keywords closely related to each dimension, and we interpreted our results with the consideration that each keyword was also related to other veganism dimensions.

Table 1 displays the keywords selected to represent each dimension of veganism. For the lifestyle dimension, we selected three keywords (*vegan*, *lifestyle*, and *environment*). According to Gheihman (2021), *environment* may overlap with all three dimensions (lifestyle, animal rights, and food). In the table, we included *environment* in the lifestyle dimension, but we considered all three dimensions for the interpretation of the results. For the animal rights dimension, we selected two keywords (i.e., *animal* and *society*). Although the keyword *society* belongs to the animal rights dimension, it can also be associated with other dimensions. Nevertheless, we included it in the animal rights dimension because pursuing animal rights is a social movement beyond a personal lifestyle choice (Gheihman, 2021). Finally, for the food dimension, we used the keywords *food* and *health*. Like *society*, the *health* attribute can be associated with two dimensions: the lifestyle dimension and the food dimension. The Word2Vec result for *health* demonstrated that this attribute is more closely related to food than to lifestyle. Therefore, we included this term in the food dimension.

STEP 1. Veganism dimensions & Keywords

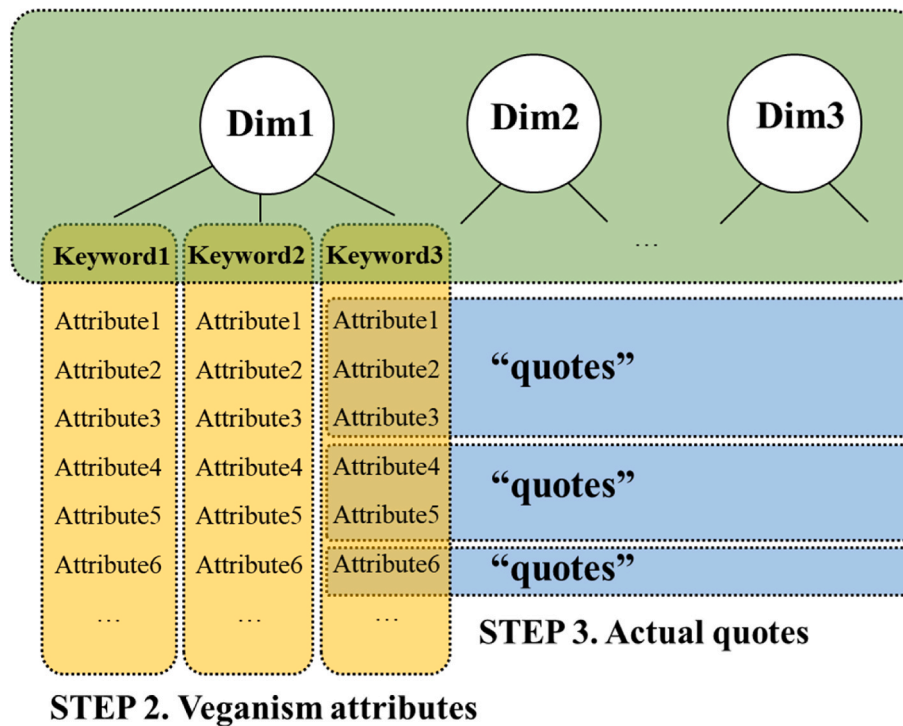


Fig. 1. Veganism conceptualization process.

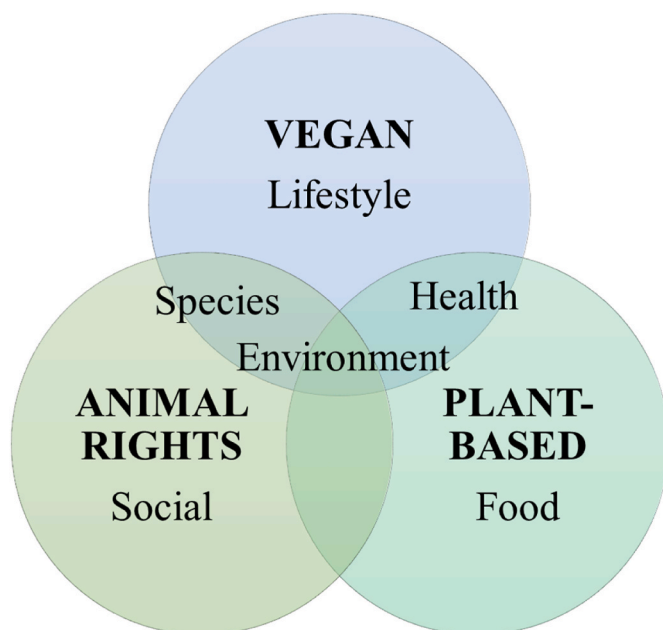


Fig. 2. Dimensions of veganism. Note. Adapted from Gheihman (2021).

Table 1
Keywords for Word2Vec analysis.

Veganism dimensions	Target keywords
Lifestyle	vegan, lifestyle, environment
Animal rights	animal, society
Food	food, health

Step 2 Attribute Search with Word2Vec

After selecting the keywords associated with each veganism dimension, we selected the specific attributes relevant to each keyword. For this purpose, we implemented a neural-network-based Word2Vec algorithm. Word2Vec, which was initially proposed by Mikolov et al. (2013), is a technique to discover the semantic similarities among words by calculating word vectors' cosine similarity. High similarity between two words indicates that the words are synonyms or share the same context. By implementing this algorithm, we discovered the specific attributes (i.e., words) that share high semantic similarities with vegan keywords.

To improve the model's accuracy, we conducted a data-cleaning procedure using the Natural Language Toolkit in Python. Data cleaning includes tokenizing, converting all characters into lowercase, removing non-English characters, lemmatizing, removing default and custom keywords, and creating bigrams. Because adverbs have little meaning, we conducted part-of-speech tagging to include only nouns, verbs, and adjectives in the corpus.

Because of the limited number of antivegan documents, we conducted a Word2Vec analysis with only the vegan community's documents. We used the antivegan documents only to compare antivegan ideas to the opinions prevailing in the vegan community.

The Word2Vec model was built using the Gensim library in Python. For model building, we included words that appeared at least 10 times (min_count = 10) in the data set and selected the 300 most frequent words (vector_size = 300). After building the Word2Vec model, we conducted data training with 60 iterations. We identified the 20 words that were most similar to the target keywords using the most similar (positive) function.

Step 3 Representative Quote Selection with Content Analysis

Although Word2Vec analysis results can provide a general understanding of veganism's dimensions, these results cannot demonstrate the

specific contexts or prevailing sentiments associated with each attribute. Hence, we conducted a manual content analysis with posts and comments in both communities to compare their perceptions of and sentiments toward specific veganism attributes. After grouping the words extracted using Word2Vec analysis, we selected words with the most significant meanings. We used these words as keywords when examining the documents associated with each veganism attribute. The comprehensive process of data collection and analysis is summarized in Fig. 3.

3. Results

To understand veganism, we suggest three dimensions of veganism (lifestyle, animal rights, and food). After selecting keywords representing each dimension, we searched for specific attributes (i.e., terms) related to each keyword using Word2Vec analysis. We estimated each term’s degree of relevance to each keyword using the similarity value (v). The higher the similarity value, the stronger the association between each keyword and term. To provide the context for each terms’ usage, we provide representative quotes containing the keywords and terms from actual posts and comments from the vegan community as examples. We also include prevailing arguments and opinions from the antivegan community to demonstrate the two communities’ different perceptions.

3.1. Lifestyle

For the lifestyle dimension’s three keywords (i.e., *vegan*, *lifestyle*, and *environment*), a set of terms closely related to each keyword is identified in Table 2. Moreover, we present representative quotes related to the lifestyle dimension in Table 3.

First, the keyword *vegan* had a high degree of similarity to terms indicating social relationships, such as *friend* ($v = 0.940$), *family* ($v = 0.860$), *parent* ($v = 0.856$), and *guy* ($v = 0.849$). After reviewing the posts and comments containing these terms, we found that the vegan community members had shared their perceptions of or experiences with human relations and how they influenced and were influenced by others. Quotes 1 and 2 retrieved from the vegan posts and comments demonstrate that vegans care about whether nonvegans (e.g., friends or family) eat meat. However, attitudes toward such behaviors may differ in their levels of tolerance or rejection. The member who wrote Quote 1 supported veganism but accepted others’ nonvegan lifestyles. Compared to Quote 1, Quote 2 contains more negative perceptions of the meat-eating behavior of the poster’s family and friends. Some vegan community members perceived COVID-19 as an opportunity to change their or others’ lifestyles. For example, one vegan community member stated the following:

Before the pandemic, I was so busy that I was rarely eating *meals* with my family ... I enjoy making food for others, but also because I want to

minimize animal products being eaten around me and showing others how awesome *vegan cooking* is.

This quote demonstrates that this vegan community member spent time educating their family about veganism. Another vegan community member said the following: “Anyone here become a vegan during this pandemic? ... once we went into lockdown, I felt like it was the perfect time to take the step into veganism since I was *cooking* all my *meals* myself.” This person believed that social distancing during the pandemic provided an opportunity to undertake veganism without others’ interference. Many vegans also stated that they suffered from stigma and social isolation, as shown in Quote 3, which is from an original post in the vegan community that received 164 comments and had a high upvote probability (0.98). Upvote probability increases with the ratio of *upvotes* (meaning “I agree with you”) on a post to its *downvotes* (meaning “I disagree with you”). The high upvote probability score of the post about social stigma may indicate that many vegan community members had similar experiences. Quotes 4 and 5 are from the antivegan community and partly demonstrate why their posters opposed veganism. Many nonvegans viewed vegans’ strong beliefs and behaviors as a form of coercion grounded in moral superiority. Antivegan community members agreed that veganism should be a personal choice and that people’s morality should not be judged based on whether they eat meat.

Second, terms highly relevant to the keyword *lifestyle* connote how the vegan community’s members switched to the vegan lifestyle, as shown in the following terms with high similarity scores: *choice* ($v = 0.950$), *transition* ($v = 0.929$), *begin* ($v = 0.928$), *mind* ($v = 0.944$), *consciousness* ($v = 0.934$), and *sense* ($v = 0.927$). These terms describe people’s mindfulness or awareness, suggesting that their vegan lifestyle transitions were prompted by enlightenment about veganism’s importance or impact. The keyword *lifestyle* was also highly associated with terms related to media sources, such as documentaries ($v = 0.950$) and books ($v = 0.939$), that addressed vegan-related issues. As the following quotes from the vegan community (i.e., Quotes 6 and 7) demonstrate, the vegan community’s members believe that documentaries and books are useful for disseminating information about veganism and changing people’s perceptions and attitudes toward the vegan lifestyle. In the antivegan community, various media were also used to communicate beliefs and opinions to others. For instance, Quote 8 came from a comment on an antivegan community post about a member’s guilt over environmental degradation and animal welfare issues after eating meat because of health issues. As shown in Quote 8, like the vegan community, the antivegan community featured the prevalent use of various media, especially videos and books, to disseminate messages.

Finally, the term *environment* was strongly linked to terms related to nonvegan lifestyles’ negative consequences (e.g., *suffering* [$v = 0.933$] and *damage* [$v = 0.933$]). Furthermore, the high associations of the keyword *environment* with the terms *earth* ($v = 0.962$), *planet* ($v = 0.944$), and *world* ($v = 0.942$) imply that vegans considered the impact

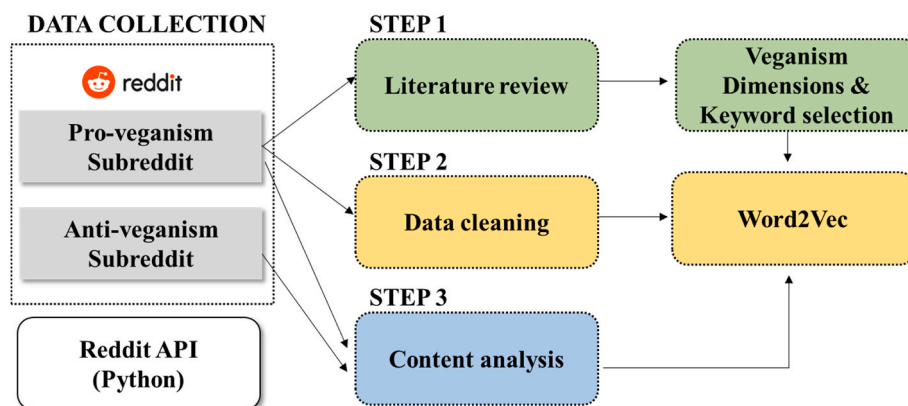


Fig. 3. Summary of proposed data analysis.

Table 2
Key terms associated with vegan lifestyle.

Dimensions	Lifestyle		environment	
Keywords	vegan	value	lifestyle	value
Terms	<i>friend</i>	0.940	<i>position</i>	0.967
	<i>advice</i>	0.884	<i>mental</i>	0.951
	<i>mind</i>	0.881	<i>documentary</i>	0.950
	<i>doctor</i>	0.874	<i>choice</i>	0.950
	<i>lifestyle</i>	0.873	<i>listen</i>	0.944
	<i>plan</i>	0.871	<i>mind</i>	0.944
	<i>hard</i>	0.871	<i>personal</i>	0.942
	<i>activity</i>	0.862	<i>book</i>	0.939
	<i>family</i>	0.860	<i>topic</i>	0.937
	<i>omnivore</i>	0.859	<i>original</i>	0.936
	<i>nutritionist</i>	0.858	<i>opposite</i>	0.935
	<i>parent</i>	0.856	<i>omnivore</i>	0.934
	<i>choice</i>	0.853	<i>conscious</i>	0.934
	<i>Facebook</i>	0.850	<i>later</i>	0.932
	<i>guy</i>	0.849	<i>transition</i>	0.929
	<i>young</i>	0.845	<i>fit</i>	0.929
	<i>fun</i>	0.845	<i>begin</i>	0.928
	<i>crazy</i>	0.833	<i>sense</i>	0.927
	<i>perspective</i>	0.832	<i>safe</i>	0.926
	<i>shame</i>	0.831	<i>note</i>	0.924
			<i>earth</i>	0.962
			<i>resource</i>	0.945
			<i>planet</i>	0.944
			<i>sentient</i>	0.944
			<i>world</i>	0.942
			<i>majority</i>	0.942
			<i>goal</i>	0.940
			<i>reduce</i>	0.938
			<i>population</i>	0.937
			<i>decision</i>	0.937
			<i>future</i>	0.936
			<i>effect</i>	0.936
			<i>industry</i>	0.936
			<i>contribute</i>	0.933
			<i>suffering</i>	0.933
			<i>damage</i>	0.933
			<i>corporation</i>	0.932
			<i>natural</i>	0.930
			<i>ethical</i>	0.930
			<i>rate</i>	0.929

Table 3
Representative quotes associated with vegan lifestyle.

Dimensions	Keywords	Community	Quotes	Type	Date
Lifestyle	<i>vegan</i>	Pro-vegan	(1) "We live in a world where things are happening that I don't like i.e <i>friends/family</i> eating meat, wearing leather etc. that I have to and can accept. It's just when my own choice to abstain for these things and live my life in the way that I think is right is being taken away that I struggle with."	Comment	Feb 2021
		Pro-vegan	(2) "I can't deal with <i>friends/family</i> eating animals in front of me anymore ... Due to COVID-19, time spending with <i>family</i> increased."	Original post	Jan 2021
		Pro-vegan	(3) "I'm sick of the <i>guys</i> I work with making fun of my lifestyle."	Original post	Jul 2021
	Anti-vegan	(4) "I have had recently the displeasure to meet someone on a discord server that was a very very <i>rabid vegan</i> Why vegans are morally superior to everyone else and why you should be one."	Original post	May 2021	
	Anti-vegan	(5) "I have meet 2 type of vegans. Vegans that respect other people and just take that as a life choice and the vast majority wich is the <i>cult vegan</i> ."	Comment	May 2021	
	<i>lifestyle</i>	Pro-vegan	(6) "My favorite quote from the <i>Gamechangers Documentary</i> : How do you get as strong as an ox without eating meat?"	Comment	May 2020
		Pro-vegan	(7) "The <i>books</i> 'the China study' and 'proteinaholic' are also great resources about vegan health, although it would be much more difficult to get your parents to read an entire book than to watch a documentary."	Comment	Apr 2020
		Anti-vegan	(8) "If you want to ease some of the environmental and animal welfare concerns, you might want to look into 'The Sacred Cow' <i>book or movie</i> as well as the regenerative agriculture movement in general. I truly believe buying local beef from a good farm is the best thing you can do for the environment and animal welfare."	Comment	Mar 2021
		<i>environment</i>	Pro-vegan	(9) "I think there is going to be a major push to replace an-ag (animal agriculture) with lab-grown meats ... We seriously don't have a choice in the matter, our <i>planet's</i> survival is at stake."	Comment
	Pro-vegan		(10) "I'm vegan for the animals, but I also see caring for the <i>planet</i> as a big factor of my veganism."	Comment	Oct 2020
	Anti-vegan		(11) "Let's forget about those <i>billionaires who pollute</i> the most and attack the people at the lowest rungs of society being able to afford cheap and nutritious food and hope it solves the pandemic and climate change"	Original post	Oct 2020

of a nonvegan lifestyle at the collective level. In the vegan community, the author of Quote 9 recognized that animal agriculture can threaten the environment and therefore came to support plant-based eating. Consistent with a previous study (Gheihman, 2021), we found that environmental issues overlapped with other veganism dimensions (e.g., animal rights), as shown in Quote 10. In the antivegan community, as shown in Quote 11, environmental issues are not simply caused by individuals' meat consumption; rather, companies and society must address them together. This idea implies that nonvegans believe that blaming meat eating for environmental problems is unfair to the average person who chooses meat as a nutritious and inexpensive food item.

3.2. Animal rights

For the animal rights dimension, we selected two keywords: *animal* and *society*. Table 4 displays the terms associated with animal rights, and

Table 5 demonstrates representative quotes associated with animal rights gathered from both online communities.

First, the keyword *animal* was highly related to the following terms, which are related to animal experiments for product development, animal agriculture, and other forms of animal exploitation for profit: *billion* ($v = 0.953$), *exploit* ($v = 0.926$), *domesticate* ($v = 0.915$), *breed* ($v = 0.909$), *slaughter* ($v = 0.905$), *exploitation* ($v = 0.903$), and *industry* ($v = 0.889$). Quote 12 from the vegan community alluded to vegan citizens' concerns about animal farms, particularly in the COVID-19 context. Quote 12's original post had a 0.99 upvote probability, indicating that many vegan community members opposed animal farms. Because COVID-19 is thought to have originated in animals, some linked the pandemic to zoonotic diseases produced by animal exploitation (see Quotes 13 and 14). Quote 15, which came from an original post in the antivegan community, claims that the poster used to eat ethically raised meat. However, this person could no longer afford these items because

Table 4
Key terms associated with animal rights.

Dimensions	Animal rights			
Keywords	<i>animal</i>	value	<i>society</i>	value
Terms	<i>billion</i>	0.953	<i>movement</i>	0.962
	<i>suffer</i>	0.946	<i>push</i>	0.945
	<i>suffering</i>	0.944	<i>logic</i>	0.944
	<i>exploit</i>	0.926	<i>act</i>	0.944
	<i>domesticate</i>	0.915	<i>accept</i>	0.942
	<i>breed</i>	0.909	<i>activism</i>	0.942
	<i>slaughter</i>	0.905	<i>communism</i>	0.940
	<i>exploitation</i>	0.903	<i>ignore</i>	0.938
	<i>extinct</i>	0.902	<i>language</i>	0.937
	<i>specie</i>	0.895	<i>action</i>	0.937
	<i>wild</i>	0.895	<i>fire</i>	0.936
	<i>extinction</i>	0.892	<i>attention</i>	0.936
	<i>population</i>	0.892	<i>negative</i>	0.936
	<i>planet</i>	0.891	<i>deny</i>	0.933
	<i>captivity</i>	0.889	<i>dangerous</i>	0.933
	<i>industry</i>	0.889	<i>fit</i>	0.933
	<i>endanger</i>	0.888	<i>context</i>	0.932
	<i>kill</i>	0.884	<i>personal</i>	0.930
	<i>bear</i>	0.882	<i>strong</i>	0.930
	<i>individual</i>	0.881	<i>response</i>	0.929

they lost their job during the pandemic. Quote 16 is a comment on this post, explaining that most US-raised beef is grass-fed, so there is no need to feel guilty about meat consumption. Thus, Quotes 15 and 16 indicate that, like vegans, nonvegans also care about animal rights, which is reflected in their product choices. Therefore, despite their differences, animal rights can matter to nonvegans and vegans. For instance, vegans advocating animal rights disagree with breeding, slaughter, and exploitation, whereas nonvegans advocating animal rights support ethically raising animals. Unlike the vegan community’s members, the antivegan community’s members tend to support animal farms, considering the meat industry’s economic benefits (e.g., job creation; see Quote 17). Given COVID-19’s detrimental impact on the global economy, nonvegans emphasize the meat industry’s economic value because many people depend on this large industry.

Second, the keyword *society* was associated with terms calling for vegans’ attention or involving social changes, such as *movement* ($v = 0.962$), *act* ($v = 0.944$), *activism* ($v = 0.942$), and *action* ($v = 0.937$). Various delicate topics in veganism (e.g., the advantages and downsides of lab-grown meat) were actively discussed in the vegan online community (see Quote 18). These discussions likely occurred because this

Table 5
Representative quotes associated with animal rights.

Dimensions	Keywords	Community	Quotes	Type	Date
Animal	<i>animal</i>	Pro-vegan	(12) “All <i>mink fur farms</i> to shut in the Netherlands due to COVID-19 outbreaks”	Original post	June 2020
		Pro-vegan	(13) “Zoonotic, in this usage of the word, means ‘from <i>animal exploitation</i> ’.”	Original post	Sep 2021
		Pro-vegan	(14) “With the whole coronavirus thing I believe it’s a human karma for keeping <i>animals</i> in terrible conditions in wet markets.”	Original post	Feb 2021
		Anti-vegan	(15) “I used to get grass fed beef, raw milk, and shopped at stores that had <i>ethically raised animals</i> . Due to the pandemic, I can no longer afford these items, as I am most likely loosing my job, and my husband might as well. I am having a lot of ethical issues.. How do I ease my guilt?”	Original post	Oct 2020
		Anti-vegan	(16) “Almost all beef produced in the US is <i>grass-fed</i> for most of their lives. Meaning they live most of their lives roaming around on a pasture, eating grass. They do not live in a factory. ‘Grass-fed’ really doesn’t mean much, because all beef is grass-fed. The difference comes in finishing.”	Comment	Oct 2020
	Anti-vegan	(17) “Vegan: I hope coronavirus takes out the <i>meat industry</i> . My response: ... Do you know just how extensive the meat industry is? It’s not just farmers and slaughterhouses. You have geneticists, feed mills, extension specialists, veterinarians, equipment manufacturers, truckers, every single industry that relies on animal byproducts, and thousands of others.”	Original post	May 2020	
	<i>society</i>	Pro-vegan	(18) “Does a widespread practice of using animals in this manner (lab grown meat), as well as a <i>society</i> that continues to eat lots of meat, does this have any psychological side-effects the vegan <i>movement</i> has to worry.”	Comment	Oct 2020
		Pro-vegan	(19) “In the vegan <i>movement</i> , there has been anti-Asian sentiment, regarding dogs, bats, and covid. People have been racist and ignorant regarding Asians, which is a huge problem.”	Original post	Mar 2021
		Anti-vegan	(20) “Imagine that, a company that sells a shittier version of meat for 5 times the cost loses money in a pandemic where thousands of people lost their jobs.”	Comment	Nov 2020

online community ensures anonymity and, therefore, was deemed to be a secure environment to freely communicate any thoughts or beliefs. Concurrently, some posters provided warnings about the spread of ideas they believed were extremely radical, abusive, or misleading. For example, a member of the vegan community brought attention to the fact that there have been several attacks on specific groups related to the controversy surrounding COVID-19, as evidenced by Quote 19. Some vegan community members were excited about developments in alternative meat, whereas some of the nonvegan community members viewed alternative meat as more expensive but less nutritious than real meat, as shown in Quote 20.

3.3. Food

For the food dimension, we selected the keywords *food* and *health*, and the keywords associated with this dimension are presented in Table 6. The representative quotes associated with this dimension are included in Table 7. Although these two keywords share similar themes, they have different foci. Whereas the keyword *food* relates to food ingredients’ characteristics and how they are prepared, the keyword *health* is primarily concerned with nutritional factors.

First, the keyword *food* is highly associated with terms describing plant-based ingredients’ characteristics, such as *gluten* ($v = 0.941$), *green* ($v = 0.939$), *salad* ($v = 0.936$), and *veggie* ($v = 0.932$). Regarding food, the vegan community members were interested in cooking and flavors, as reflected by the following terms: *recipe* ($v = 0.940$), *taste* ($v = 0.932$), *cooking* ($v = 0.932$), *texture* ($v = 0.925$), and *cook* ($v = 0.924$). As shown in Quote 21, many vegans sought advice about vegan cooking or vegan options at restaurants. Because vegan diets have limited options, many people sought advice or shared innovative and useful meal preparation ideas (see Quote 22).

Second, *health* had a strong association with the term *plant-based* ($v = 0.939$). Regarding plant-based food, we found that many vegans were excited about vegan meat’s increased popularity during the pandemic. The term *health* is also closely related to the nutritional or medical area, as shown by its associations with the following terms: *medical* ($v = 0.883$), *doctor* ($v = 0.859$), *nutrition* ($v = 0.824$), and *nutritionist* ($v = 0.805$). Some vegan community members shared their experiences with nutritionists and doctors who did not fully support vegan diets. When vegan members were challenged by nutritionists or doctors, they asked other members for advice on how to deal with these situations, and most vegan community members replied with information about vegan diets’

Table 6
Key terms associated with food.

Dimensions	Food			
Keywords	food	value	health	value
Terms	<i>meal</i>	0.952	<i>plant_base</i>	0.929
	<i>easy</i>	0.944	<i>diet</i>	0.917
	<i>gluten</i>	0.941	<i>follow</i>	0.896
	<i>friendly</i>	0.941	<i>medical</i>	0.883
	<i>recipe</i>	0.940	<i>dietary</i>	0.875
	<i>cheap</i>	0.940	<i>expert</i>	0.869
	<i>green</i>	0.939	<i>body</i>	0.861
	<i>salad</i>	0.936	<i>plan</i>	0.859
	<i>item</i>	0.934	<i>doctor</i>	0.859
	<i>taste</i>	0.932	<i>weight</i>	0.853
	<i>veggie</i>	0.932	<i>limit</i>	0.847
	<i>cooking</i>	0.932	<i>improve</i>	0.844
	<i>drink</i>	0.932	<i>nutrition</i>	0.824
	<i>amazing</i>	0.932	<i>quality</i>	0.823
	<i>nutritional</i>	0.927	<i>effective</i>	0.822
	<i>dish</i>	0.925	<i>omnivore</i>	0.822
	<i>fast</i>	0.925	<i>control</i>	0.819
	<i>texture</i>	0.925	<i>original</i>	0.815
	<i>cook</i>	0.924	<i>nutritionist</i>	0.805
	<i>ingredient</i>	0.923	<i>subject</i>	0.797

health benefits. Nevertheless, some special circumstances generated controversy among the members. For instance, Quote 23 came from a 13-year-old vegan who had a conflict with their mother about their diet. Most of the comments on this post supported this Redditor and shared various resources to help them convince their mother of the vegan diet's benefits. Quote 24 is from a patient who underwent surgery and had trouble finding vegan meal options for their postsurgery diet. Responders to this post shared various opinions: Some advised the poster to follow the doctor's instructions, others recommended seeking second opinions from vegan doctors or nutritionists, and a few suggested ways to maintain a vegan diet. Some antivegan community members were concerned that the vegan diet could cause nutritional imbalances, such as iron deficiency (Quote 24). Some members doubted whether the vegan diet's health benefits had been proven.

4. Discussion and conclusion

This study was the first to investigate online discourses in vegan and nonvegan communities. We explored an unconventional data source in vegan studies—anonymous online community discourses—and we analyzed the data with a traditional qualitative approach and a neural-network-based Word2Vec algorithm. Through this study, we specifically attempt to address three primary research objectives: (1) conceptualizing veganism's multifaceted aspects, (2) comparing perceptions of veganism prevalent in vegan and nonvegan online communities, and (3) investigating such perceptions relating to the COVID-19 pandemic.

To investigate the first research question, we suggest three dimensions of veganism—lifestyle, animal rights, and food—based on a review of past veganism studies. We then use this framework to explore actual online veganism discourses. In the vegan online community, the main keyword, *vegan*, was highly associated with social-relationship-related terms, showing that social relationships were a main theme in discussions about the vegan lifestyle. Social relationships matter for the vegan lifestyle because vegans often face challenges, such as social isolation or stigma, because of their lifestyle choices. At the same time, many vegan members were motivated to disseminate information about veganism's benefits, with a particular focus on individuals in their close social groups. To this end, community members widely used inspiring and informative media, especially documentaries and books.

Regarding animal rights, the vegan online community members noted that animal rights issues were closely related to animal exploitation. Although lifestyle choices tend to be viewed from an individual moral perspective (e.g., "I/We should change my/our lifestyle/lifestyles

Table 7
Representative quotes associated with food.

Dimensions	Keywords	Community	Quotes	Type	Date
Food	<i>food</i>	Pro-vegan	(21) "There aren't many vegan restaurants in my area ... How do you make <i>meals</i> interesting/ <i>tasty</i> when you go out to restaurants?"	Original post	Jun 30, 2020
		Pro-vegan	(22) "My new favorite way to cook tofu is the twice-frozen method. Medium firm, throw it in the freezer, defrost, throw it back in the freezer, defrost, squeeze all the water out and you have this very tender meaty tofu and it's <i>delicious</i> in stir fries or as 'fried chicken'"	Comment	Sep 24, 2020
	<i>health</i>	Pro-vegan	(23) "I'm 13yo, brought up veganism to my mom around 3 months ago ... [My mom] even took me to a <i>Nutritionist</i> , who said that veganism isn't recommended for children, [because] you won't have strong bones and stuff, and you basically shouldn't go vegan."	Original post	Apr 2020
		Pro-vegan	(23) Please Help, My <i>Nutritionist</i> and <i>Doctors</i> Want Me To Eat Dairy! ... They didn't really have any vegan options in the hospital for a liquid and then a soft diet that I could eat	Original post	Jul 2020
		Anti-vegan	(24) "I actually tried donating blood when i was VEGETARIAN (not vegan) and they turned me down for low <i>iron</i> . I tried to get my iron from seeds and greens the night before, lol."	Comment	Jun 2020
		Anti-vegan	(25) "At this day, we don't	Original post	Jul 2021

(continued on next page)

Table 7 (continued)

Dimensions	Keywords	Community	Quotes	Type	Date
			have any scientific proof that veganism works for anyone at any stage of life. We don't have any experimental study, randomized, with control group, over few years, etc ... And as long as there is no such thing, all other subjects are irrelevant."		

to reduce the negative impact of nonvegans' diets"), the vegan community members emphasized collective efforts related to animal rights, such as industrial and societal reforms. In the online sphere, members discussed various social issues related to veganism from various perspectives and made efforts to watch out for biased or misleading information.

From the food perspective, members of the vegan community were primarily concerned about the ingredients included in plant-based diets and these ingredients' nutritional value. In particular, we noticed practical difficulties in maintaining a vegan diet, such as limited options, high cost, lack of information, and negative opinions from others. For example, many vegan community members discussed vegan cooking ideas and restaurant options, demonstrating that many vegans desire more options in home cooking and dining out as well as to include pleasant flavors in their vegan diet.

To answer the second research question, this study explored both vegans' and nonvegans' opinions to identify various motivations and personal reasons for pursuing or opposing veganism. Although veganism has recently gained popularity, many nonvegans still perceive strict veganism to be too radical or unreasonable (Kalte, 2020). This study confirmed this idea from vegans' statements about their experiences of social isolation. To address this issue, this study involved the identification of nonvegans' opinions to comprehend the prevailing perceptions and practical difficulties that keep nonvegans from pursuing veganism.

Regarding veganism's various facets, we discovered that vegans' and nonvegans' opinions differed. The vegan community's members had various personal motives—such as animal rights, personal health, and environmental issues—for maintaining the vegan lifestyle. Regardless of their personal motives, they voiced concerns about nonvegan diets' negative impact on the environment and society. To address nonvegan diets' negative consequences, community members actively discussed specific measures to reduce these negative effects. In short, the vegan lifestyle is in the realm of personal choice, but the decision to pursue it often stems from a desire for the collective good. Hence, the vegan community's members strive to inspire others through their lifestyle choices and activities. However, these efforts may provoke negative reactions among nonvegans. Some nonvegans believe that vegans push others to become vegans because they believe their lifestyle is morally superior.

In terms of animal rights, vegans believe human inconvenience or sacrifice is inevitable and justifiable to reduce the meat industry's negative impact. In contrast, nonvegans approached animal-related businesses from an economic standpoint, emphasizing the economic value generated by these industries. For example, nonvegans argued that many jobs are dependent on animal industries and that downsizing the animal business therefore would disturb the economy.

In the context of health, many vegans stated that their primary

obstacles to remaining vegans were others' concerns about possible nutritional imbalances and other adverse health effects resulting from the vegan diet. Similarly, the nonvegan community discussed the potential health risks associated with vegan diets, such as a lack of essential nutrients.

Finally, to address the third research question, we examined how the COVID-19 pandemic influenced vegans and nonvegans' attitudes and perceptions. The pandemic certainly produced dramatic changes in vegans' lives and sometimes even escalated tensions between vegans and nonvegans. For instance, some vegan community members discussed how changes in their lifestyles during the COVID-19 pandemic, such as lockdowns and social distancing, influenced their meal preparation habits and their relationships with nonvegans. The pandemic influenced not only individual lifestyles but also industry conditions. Many vegans welcomed the growing popularity of alternative meat consumption and disseminated news featuring increased interest in veganism during the pandemic. One member shared a news article entitled "Vegan Meat Sales Surge 280% Due to Fears Over Meat During Coronavirus Epidemic." Similarly, another member posted about a news article reporting the growth of plant-based meat's popularity in the food service industry. However, many nonvegans claimed that their ability to purchase ethically grown meat or meat alternatives had decreased because of the economic deterioration caused by COVID-19, emphasizing that their choices may depend on their economic situations.

Our findings may provide an opportunity for vegans and nonvegans to understand each other's personal motives and behaviors. Our findings can also be useful to various stakeholders associated with veganism to develop strategies to communicate veganism to a wider range of people by addressing nonvegans' concerns and difficulties. In this study, we applied an innovative approach to comprehend veganism from various perspectives using many documents available from two online communities, one including passionate vegans and one including passionate nonvegans. Therefore, this study highlights the usefulness of online discourse available on Reddit for obtaining honest opinions on delicate topics that are difficult to discuss with others. Reddit has been widely utilized to obtain social opinions on sensitive matters (e.g., political opinions) from a vast number of individuals (Low et al., 2020; Massachs et al., 2020; Robards, 2018). Reddit's online communities have been seen as digital spaces for the development of true identities and viewpoints through the formation of social bonds among members (Robards, 2018).

Nevertheless, our data from two online communities may not be representative because only certain demographics are likely to actively use online communities. Consequently, our findings should be interpreted with caution in terms of generalization. Although this study can contribute to the literature on veganism by offering valuable insight into vegans' and nonvegans' perspectives, its findings should be validated and broadened using various methodologies and demographics. To strengthen veganism literature, future research should use in-depth interviews or surveys to discover the sociodemographic characteristics that significantly influence veganism perceptions, attitudes, and behaviors. Furthermore, to understand the factors that encourage or discourage the adoption of veganism, the studied demographics should be expanded to include people who are not currently vegan but are not opposed to veganism. Finally, we propose a systematic review of the published research on veganism to discover research gaps and assess specific vegan research topics' progress with bibliometric analysis.

Ethical statement

This study did not require ethical approval because it did not qualify as human subjects research. All data was posted in a social media was publicly available.

Declaration of competing interest

The authors declare no conflicts of interest.

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