Meat substitutes in Media Discourse

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Abstract

Shifting from meat consumption is critical for future dietary evolution. Mainstream newspapers and social media are the leading platforms for expressing this opinion. By analysing the media discourse, the proponents of the shift from meat, to plant-based meat and cultured meat were identified. The objectives were: a) to identify themes, word frequencies, and sentiment related to meat substitutes, b) to determine Chinese perceptions of the two meat substitutes, and c) to determine which food functions are of concern to Chinese consumers. Between July 2016 and July 2022, the researcher gathered data from People's Daily and China Daily online outlets and user comments. 574 news articles and 2,345 online comments were extracted. Three techniques were applied: sentiment analysis, thematic analysis, and word cloud analysis.

The results revealed that newspapers reported positively on meat substitutes, yet user comments showed negative public perception. Chinese people held positive attitudes toward plant-based meat and negative attitudes toward cultured meat. Thus, the insights from the media discourse provided valuable indicators for stakeholders to develop sustainable food education and consumption strategies.

Keywords: Meat substitutes; Plant-based meat; Cultured meat; Media discourse; Food education

1 Introduction

When the Earth's population reaches 10 billion, a "dietary shift" to a "plant-based diet" will be necessary for humans to remain within the planetary security boundary (Willett et al., 2019). However, with the development of the industrial world, people are attracted to the richness of meat without considering its impact on health (García-Santillán & Espinosa-Ramos, 2021). As a result, animal farming has expanded exponentially to maintain human meat consumption habits and one-third of the land used for crop production is used for livestock farming (Hillier et al., 2011). Land used for animal husbandry reduces the amount of food that should be available to the world's hungry. Thus, Lappé (1982) argues that meat production is an essential contributor to the global hunger problem (p. 75). As a result, more researchers are calling for a shift from animal meat to meat substitutes.

Changing eating habits is not a simple process, as eating habits are deeply rooted in subconscious perceptions (Cardello, 1995). Various factors can influence the perception of food, such as direct experience (Russell & Russell, 2010), family members (Lai, 2007), and the media (Meagher, 2019). In addition, brand marketing uses culture, tradition, science, and other means to create myths about meat and reinforce the demand and the consumption of meat (Bogueva & Phau, 2016). The development of the Internet has accelerated the influence of brand marketing on consumers' dietary choices, and the large Inter-

net user base in China has made online media one of the most critical platforms for influencing consumers' dietary decisions (Cai et al., 2013). With the rapid growth of the Internet, the massive number of Internet users in China's population has also made it one of the most profoundly media-influenced regions in the world. Many Chinese people live far from their home towns (Zhu, 2007) so the Internet has become the link between them and their home towns. Additionally, children growing up under the 30-year one-child policy are often lonely (Kane & Li, 2023) and have created their little world online. As a result, China has a massive number of internet users-close to 650 million, or 48% of the population (Sharma et al., 2017).

Online news articles, such as online newspapers, serve as a type of online media that can draw attention to specific topics. Some researchers have analysed online newspaper coverage of energy conservation (Chen & Zhang, 2022) and cultured meat (Goodwin & Shoulders, 2013). In addition, the voices of social media users can influence news media content decisions for policy considerations (Augoustinos et al., 2010). Some researchers have analysed social media to obtain people's perceptions of plant-based meat (Moreira et al., 2021) and perceptions of cultured meat (Specht et al., 2020). However, these studies did not consider newspaper articles and user comments simultaneously. This present study conducted a dual analysis of online newspaper articles and user comments to fill this research gap. Traditional methods are often inefficient when analysing large amounts of unstructured or structured text, while big data analytical methods are very efficient (Bakshi, 2012). In previous big data analytics applications, some researchers have studied the characteristics of lyrics through sentiment analysis (McGetrick, 2017). Other researchers have studied media opinions about social events through thematic analysis (Holt & Major, 2010). Younis (2015) used word cloud and sentiment analysis to obtain consumers' views of retail stores. Therefore, this study combined big data analytics methods – sentiment analysis and thematic analysis - with manual approaches to improve the understanding of meat substitutes by exploring online newspaper articles and microblog user comments.

This study delved into Chinese perceptions and attitudes toward plant-based and cultured meat by analysing the media discourse. The findings of this study could guide the development of sustainable food strategies, promoting a shift towards a sustainable meat system.

2 Materials and Methods

2.1 Collect and prepare samples of Chinese media data

Previous studies support the choice of data sources: the official newspapers - People's Daily and China Daily. Kwak et al. (2019) chose the official newspaper of Seoul in their study to explore socially focused topics. Similarly, García-Santillán and Espinosa-Ramos (2021) used the official newspaper of Mexico for thematic analysis. Moreover, the official Microblog has higher authority and more credibility than other social media platforms, and its users are also broader and more diverse. Thus, selecting data from the official Microblog platforms and mainstream newspapers for sentiment and thematic analysis is a feasible and effective data acquisition strategy (Shao et al., 2018). Therefore, this study chose China Daily and People's Daily newspaper articles and user comments from the official Microblog platforms of the two newspapers as supplementary data (Table 2).

There were several reasons for using the six years time frame from 2016-2022 for searching the newspaper articles and blog comments. Firstly, it aligns with the dietary guidelines for residents issued by the Chinese government, which recommends a diet based on plant-based foods supplemented by animal-based foods (Zhang et al., 2020). Specifically, the Chinese Nutrition Society (2016, May 13) released its first dietary guidelines, which had a significant impact on the topic of dietary transition in China. Examining sentiment and theme changes over these 6 years revealed the dynamic implications of these guidelines and policies on public perceptions. Therefore, this time frame provided a tangible link between the study and the specific examples of guidelines and policies mentioned, allowing for a

more comprehensive analysis.

As this study focused on plant-based and cultured meat substitutes in the context of meat transition, various terms were used to describe these concepts. The researcher searched for the following terminologies in the full text of both newspapers and their microblog comments, thus taking into account previous studies from other countries on meat substitutes (Graça et al., 2015) and from China (Chen & Zhang, 2022):

"人造肉 (artificial meat)", "植物肉 (plant-based meat)", "植物肉替代品 (plant-based alternatives)", "养殖肉 (cultured meat)", "细胞肉 (cell meat)", "实验室肉 (lab-grown meat)", "生物科技 (biotechnology)", "食品科技 (food technology)".

The search terms utilized in this study, including "plant-based meat," "plant-based," "plant-based alternatives," "cultured meat," "cell meat," "artificial meat," "lab-grown meat," "biotechnology," and "food technology," were selected based on their relevance to the topic of meat transformation. The conceptual terms "biotechnology" and "food technology" were included to ensure a comprehensive analysis of the broader context of alternative meat production. Meanwhile, the more specific terms related to alternative meat products, such as "plant-based meat," "cultured meat," and "cell meat," were chosen to capture the main themes and sentiments expressed in online newspaper articles and user comments. However, this study did not remove repeated online comments since text frequencies affected the results of word frequency analysis. For example, if many comments indicated poor taste, which would mean the importance of taste and flavours. In addition, to ensure consistency throughout the review process, the same researcher independently reviewed, coded, and analysed all samples twice.

To address the research questions, the analysis for this study was based on two primary sources:

1. newspaper articles related to meat substitutes published between 2016 and 2022; and

2. Microblog user comments related to meat substitutes within the same time frame.

Table 1 shows the scope of the data collected, consisting of 527 newspaper articles that were analysed and 2345 user comments retrieved from Microblogs.

2.2 Processing and Interpreting Data in the Context of Chinese Media

Sentiment analysis

Sentiment analysis involves identifying the affective state of a text by examining its linguistic features (Taboada, 2016). The main goal of sentiment analysis is to identify the categories of emotions expressed in a text, such as anger, fear, sadness, happiness, and analytical, and the extent to which these emotions are present (Pang & Lee, 2008). In previous applications of sentiment analysis, several researchers have studied the sentiment of song lyrics through the use of the IBM Watson Tone Analyzer (Al Marouf et al., 2019), the characteristics of spam emails (McGetrick, 2017), and the sentiment of users to comments on social platforms (Fan et al., 2019). To avoid bias in sentiment analysis algorithms, because they may not capture the sentiment overtones in text with complete accuracy, a manual review was performed after the researcher obtained the preliminary sentiment analysis results (Table 3). To determine the sentiment conveyed by the newspaper articles, the researcher used IBM Watson Tone Analyzer to detect seven emotions of the newspaper articles, as shown in Table 3. The researcher also employed the word cloud tool to determine the high-frequency words containing the sentiment. Before the analysis, Chinese stop-word lists were used to filter the stop words from the text (Guan et al., 2017). Also, the researcher examined the selection of the stop-word list for the meat substitute application scenario to achieve better sentiment analysis.

Thematic Analysis

Thematic analysis is a type of qualitative analysis to analyse classifications and propose themes (patterns) related to the data (Boyatzis, 1998). Online newspapers and Microblogs user comments can be valuable sources for extracting es-

Table 1: Social media means Microblogs of China Daily and People's Daily. Materials collected

	Type	Online Comments	Articles
China Daily & People's Daily	Print media		468
Social media of China Daily & People's Daily	Social media	2345	59
Total		2345	527

Table 2: Social media means social media platforms of China Daily and People's Daily. Sentiment analysis steps by using IBM Watson Tone Analyzer

Step	Description
1	Enter the IBM Watson Tone Analyzer
2	Enter the text with the stop words removed
3	Running sentiment analysis
	View analysis results
4	For example, Anger 0.01, Sadness 0.03, Fear 0.02, Analytical 0.01, Joy 0.83, Tentative 0.04, Confident 0.03
	The highest score, 0.83, was for Joy, so the article's sentiment is "Joy."
5	Verify the content and sentiment analysis results to avoid algorithmic bias
6	Plot sentiments in a line graph to show the sentiment dynamics over six years

Table 3: The definition of 7 sentiments. Sentiment categories and definitions used by IBM sentiment analysis tool.

Sentiment	*Definition*
Anger	The text expresses strong feelings of animosity, dissatisfaction, or rage.
Fear	The text expresses negative emotions such as nervousness, fear, anxiety, or panic.
Joy	The text expresses positive emotions such as happiness, pleasure, satisfaction, or excitement.
Sadness	The text expresses negative emotions such as loss, sadness, pain, or melancholy.
Confident	The text expresses a state of self-assurance, certainty, or positivity.
Tentative	The text expresses a state of hesitation, uncertainty, doubt, or concern.
Analytical	The text expresses a state of rational thinking, analysis, evaluation, or reasoning.

sential themes. For example, Holt and Major (2010) conducted a thematic analysis of newspaper articles to obtain media opinions on social events. In addition, Shepherd et al. (2015) conducted a thematic analysis of social media texts about mental health services. In this study, the researcher used a thematic analysis technique, taking newspaper articles and microblog comments as texts, following the steps outlined by Braun and Clarke (2006), as detailed in Table 4.

Word Cloud

Word cloud analysis is often used to aid thematic and sentiment analysis (Atenstaedt, 2017). It can help present the results of thematic and sentiment analysis more intuitively. For example, Kabir et al. (2020) employed word cloud analysis in combination with sentiment analysis to gain insights about consumer opinions on earphones. Furthermore, Zhou et al. (2022) employed word cloud analysis based on keywords used for thematic analysis about sustainable manufacturing. The present study used word cloud analysis after thematic and sentiment analysis by a visual text analysis tool – Weiciyun. The aim was to provide

Table 4: Thematic analysis steps. China Daily and People's Daily are official newspapers of China, with online versions known as "China Daily.com" and "People's Daily.com". Their Microblogs on Weibo are influential news media accounts in China.

Step	Description
1	Define research questions
2	Data collection: collecting online newspaper articles and online comments from China Daily and People's Daily and their Mcroblogs from 2016-2022
3	Data pre-processing: initial collation, classification of data, and removing stop-words
4	Defining themes: Defining themes through keyword extraction. For example, words that frequently appear in an article include "taste", "plant meat" and "plant protein." These words are the basis for defining a theme
5	Data analysis: the defined themes are analyzed to determine their frequency, importance, and links to other themes
6	Presentation of the results

a more intuitive answer to the study's findings.

3 Results and Discussion

3.1 Dynamic sentiments from the newspaper articles

Figure 1 illustrates the sentiment analysis results concerning meat substitutes from online newspapers. The overall sentiment during the six years was dominated by neutral and positive expressions, with no instances of anger and fear, and the proportion of negative emotions was also small. The absence of negative anger and fear may be due to various reasons. One possible explanation is that the concept of meat substitutes itself is not controversial or upsetting. On the contrary, this new technology and innovation were widely accepted and supported, and therefore mainstream newspapers preferred positive sentiment expressions (Du & Han, 2020). In addition, the sample for the sentiment analysis in this study was drawn from mainstream Chinese newspapers, which may avoid addressing controversial topics or expressing overly negative sentiments to maintain their objective and neutral stance.

However, a sharp decline in positive sentiments (joy) was observed in the second half of 2019, while neutral emotions (analytical and tentative) increased, and negative sentiments (anger, sadness, and fear) and the other positive senti-ment (confident) emerged. One reason for the change is that policy, and regulatory environment changes have impacted newspapers attitudes. Chinese Institute of Food Science and Technology (2020) issued a notice on national standards for plant-based meat products, which generated more public attention and discussion on food safety. In addition, changing consumer preferences may result in the change. Plant-based meat, which went live on Tmall in late 2019, was unpopular with Chinese consumers due to its taste and texture, and its price was higher than natural beef (Agency, 2022). In addition, because meat substitutes are relatively new in the Chinese market, many consumers may not yet fully understand their characteristics and advantages, leading them to have a negative attitude.

3.2 Themes from newspaper articles and user comments

The thematic analysis presented in Figure 2 highlights the dominance of the local economy, biotechnology, and supply-related themes in newspaper articles. It reflected the Chinese government's focus on alternative meat products for local economic development and introducing policy measures to promote the development of meat alternatives, such as plant protein (Zhang et al., 2022). Moreover, it was found that there was increasing coverage of food therapy in the
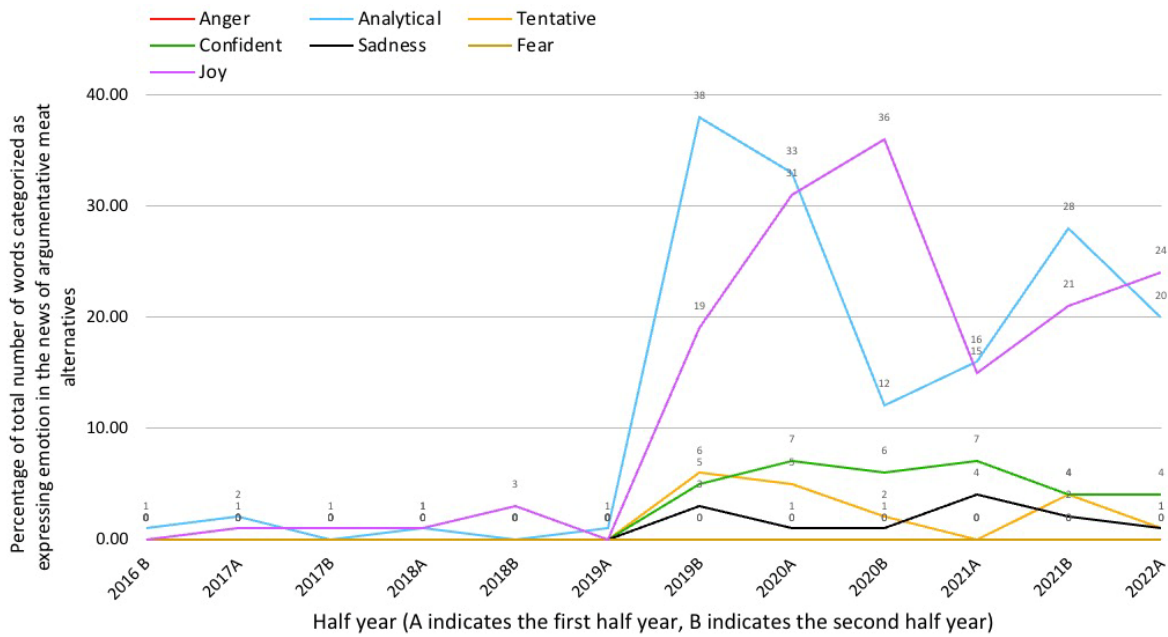
Figure 1: Newspaper sentiment of meat substitutes. The A after the year indicates January-June, and the B shows July - December. Different colours represent the different emotions.

official newspaper, reflecting the traditional Chinese food therapy aiming to maintain nutritional balance through diet (Wu & Liang, 2018).

User comments, on the other hand, tended to focus on themes such as price, food traditions, customs, and taste, which may have been related to consumer needs and preferences. According to Lennernäs et al. (1997), consumers consider several factors when purchasing food products, such as price, taste, brand, packaging, and nutritional value. Food taste may be a decisive factor in consumer purchases during festivals and occasions. Furthermore, cooking, customs, weight loss, and longevity were themes that appeared more frequently in user comments. It may have been related to Chinese culture and eating habits. Traditional Chinese food culture emphasizes health and wellness, so in consumers' minds, foods should have features such as weight loss, longevity, and healthy ingredients (Li & Hsieh, 2004).

However, there was a relative lack of discussion on animal welfare and natural resources in newspapers and online comments (Figure 2). It seems

that this may have been due to low awareness of related topics in Chinese society and insufficient engagement in disseminating public opinion (Carnovale et al., 2021). Moreover, some traditional beliefs and values in Chinese culture may also influence the attention and presentation of related issues in the media and public opinions, such as the lack of perceived value of animals and natural resources and emotional attachment to traditional meat products (Bryant et al., 2019).

3.3 Behind the high-frequency words

Figure 3 shows that artificial meat was the most frequent word in newspaper articles and user comments. In addition, health and plant protein appeared as high-frequency words in newspaper articles and online reviews. A comparison of word frequencies showed that newspapers focus on plant-based meat, food, health, plant protein, development, low carbon, innovation, nutrition, and technology (Figure 3). User comments, however, emphasised soy products, cultured meat,
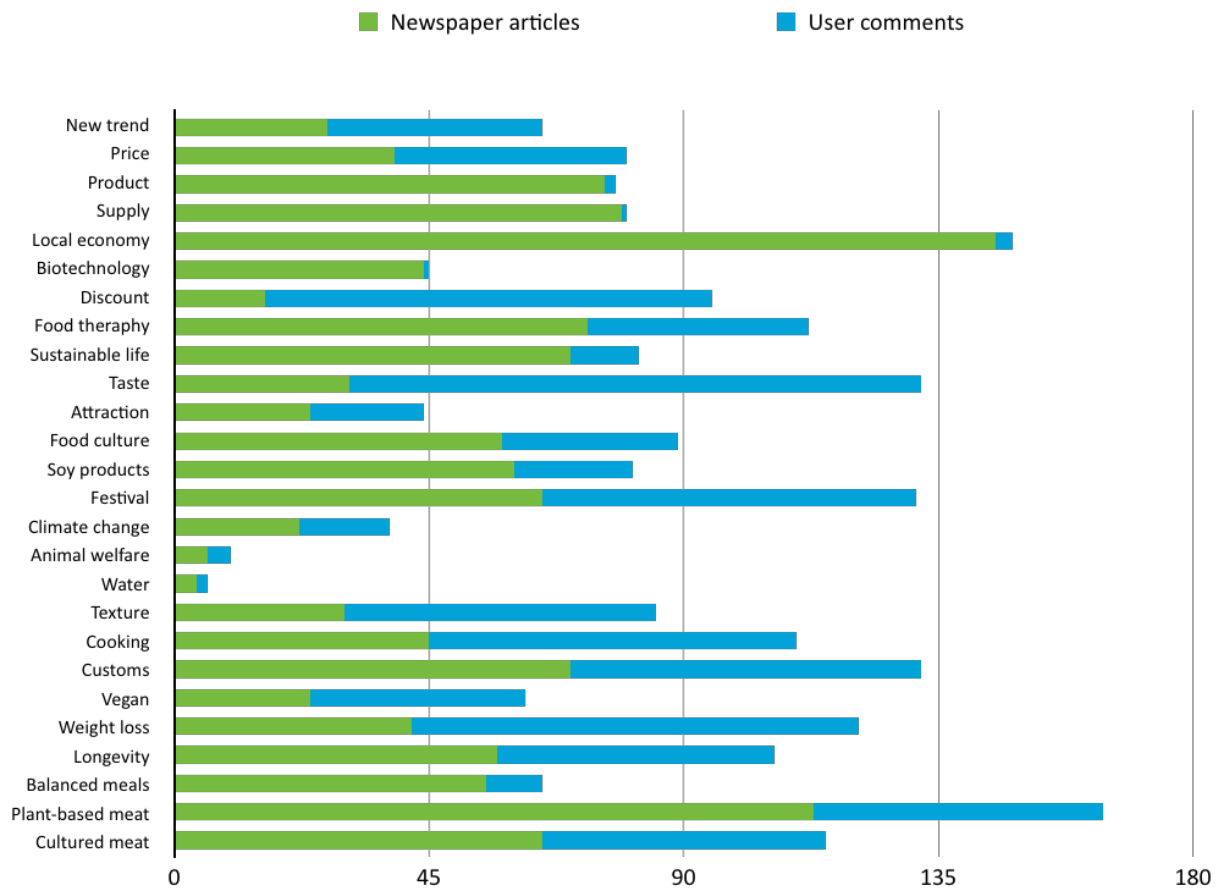
Figure 2: Thematic distribution concerning meat substitutes from news and online comments. Green represents the number of themes explored in the news about meat substitutes, and blue represents the number of themes explored in online comments about meat substitutes.

vegetarian, high cost, health, taste, unemployment, and safety. Newspaper articles carried positive sentiments for high-frequency words, although technology had an opposing view. In contrast, user comments showed higher negative emotions for artificial meat, safety, and unemployment (Figure 3).

In China, artificial meat is the name of a cold dish made from pure plants. Along with the prevalence of Buddhist culture in China, artificial meat has become a mainstay of traditional vegetarian dishes in China (Duan, 1994). The fact that meat substitutes were referred to as artificial meat in newspapers and in user comments indicated that consumers lack knowledge about meat substitutes, and newspaper articles confuse these concepts. In addition, there was a difference in the focus of consumers and mainstream newspapers - newspapers focused on the technology and nutrition of plant proteins. In contrast, consumers focused on traditional soy products, price, taste, and the problems associated with meat substitutes. This difference may have been due to the tendency of newspaper articles to prioritize text about policy, technological innovation, and other broad topics (Domingo et al., 2008). Consumers, on the other hand, are more concerned with their own food-buying experiences and needs.

Newspaper articles			Online comments		
Words	**Frequency**	**Sentiment**	**Words**	**Frequency**	**Sentiment**
Artificial meat	329		Artificial meat	89	
Plant-based meat	261		Soy products	68	
Food	102		Cultured meat	24	
Health	78		Vegan	16	
Plant protein	63		High cost	16	
Development	50		Health	15	
Low carbon	36		Cell meat	15	
Innovation	32		Taste	15	
Nutrition	31		Unemployment	11	
Technology	30		Safety	8	

Figure 3: The ten most frequently occurring words in the text. The green colour in the sentiment column represents positive emotions, the orange colour represents neutral emotions, and the red colour represents negative.

3.4 Word cloud analysis

An analysis of the word clouds provided a valuable insight into the portrayal of meat alternatives. Figure 4 (d) shows that the word cloud of newspaper articles about meat substitutes focused on "artificial meat," "protein," "health," and "cuisine. Figure 4 (c) shows that user comments about meat substitutes focused on "artificial meat," "real," "people," and "food." and "food. In addition, Figure 4 (a) shows that newspaper articles about cultivated meat focused on artificial. This suggests that technology and consumer demand were vital considerations in the innovation and development of meat substitutes under cultural context and social environment. Plant-based meat focused on climate change, greenhouse gases, sustainability, health, and food traditions. It showed that the cultural symbolism of plant-based meat as an environmentally friendly and sustainable alternative was closely related to the environment, health, and other values.

The word cloud graph on meat substitutes also reflected the contradiction between the traditional and the new - traditional meat and meat substitutes. Regarding the cultural symbol of meat, there are very different views between cultures. In Chinese culture, meat is an essential ingredient with a cultural character beyond merely providing nutrition (Li & Hsieh, 2004). Traditional meat culture is, therefore, not only a food choice but also a symbol of cultural signification. Due to the specific nature of Chinese culture, some meat alternatives face particular challenges in the Chinese market.

3.5 The role of mainstream newspapers in food education

Mainstream newspapers are a form of news media that play a crucial role in disseminating public information, shaping social perspectives, and influencing public attitudes (Iyengar & Kinder, 1987). While mainstream newspapers have covered science, technology, nutrition, and policy content in the meat transition process, there have been gaps and deficiencies in their reporting and commentary on meat substitutes.

Newspapers often use the term "artificial meat" in the articles, leading to negative impressions and misunderstandings among the public (Fig-
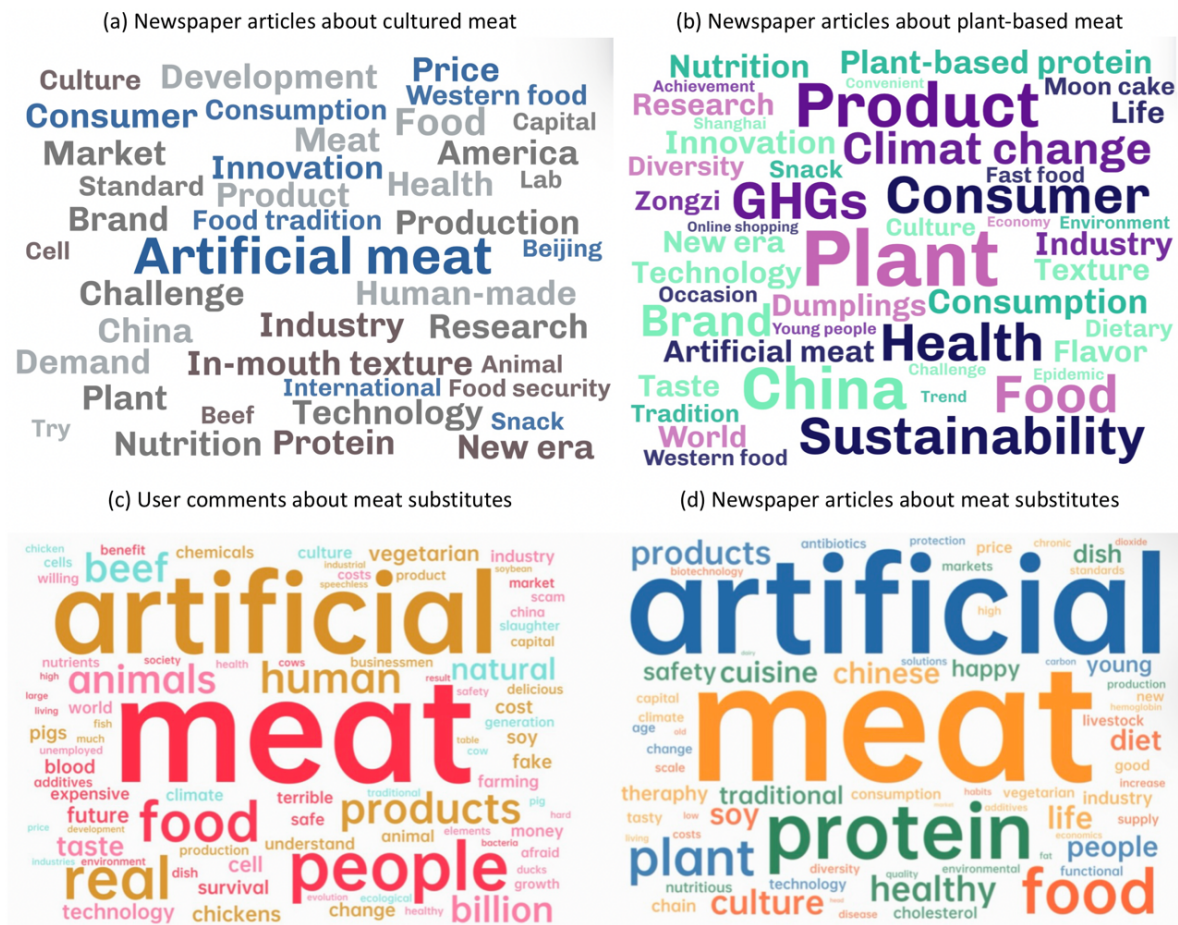
Figure 4: Word cloud of online comments and newspapers of meat substitutes. The word cloud displays words according to their frequency, with size indicating importance in the text.

ure 3). The reason is that consumers prefer natural food over artificial food (Scott et al., 2020). Furthermore, mainstream newspapers neglect traditional foods and over-promote new brands. Such practices can bias the public's perception and value of traditional food products. In summary, there are shortcomings in the coverage of meat transformation and meat substitutes in mainstream newspapers. These deficiencies include misuse of terminology, lack of coverage of balanced diets, lack of technological and environmental information, and confusion over concepts such as "plant-based," "cultured meat," and "artificial meat" in Chinese vegetarian cul-

ture, which can easily lead to public misunderstanding and confusion (Figure 5).

Mainstream newspapers must promote food education, scientific, technical, and policy issues, balance culture, pre-existing habits, and personal preferences. Achieving dietary shifts, therefore, requires a concerted effort by the government, businesses, social organizations, the media, and individuals.
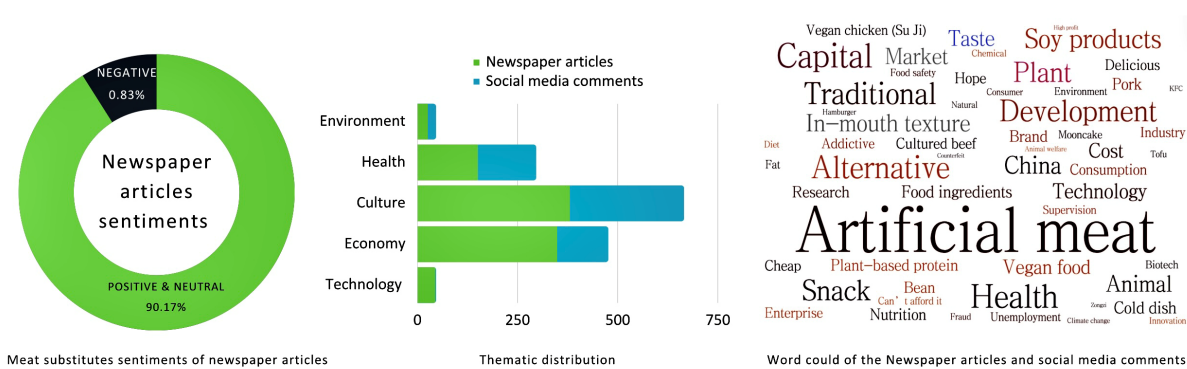
Figure 5: Infographic summary of this study. This infographic summarises the findings of this study, including sentiment analysis with the majority being positive or neutral, a thematic distribution into five categories, and a word cloud highlighting frequently used terms from newspaper articles and user comments.

3.6 The voice of the public and future studies

Food aversion refers to an individual's reluctance to try or to accept new foods (Bernstein & Borson, 1986). Unsurprisingly, Chinese internet users also exhibited a cautious and negative attitude toward meat substitutes (Figure 4). The reasons for resistance to meat substitutes are multifaceted and include cultural traditions, taste preferences, values, food safety concerns, lack of environmental education, and the influence of traditional vegetarian culture (Figure 5). For example, studies have shown that traditional Chinese food culture values meat as an essential source of nutrition, leading some consumers to reject meat substitutes as 'fake meat' (Liu et al., 2021). Texture and taste preferences are also important factors, as the texture of meat substitutes may not match the traditional Chinese meat cooking methods (Schösler et al., 2012).

Moreover, values may influence consumer choice, as consumers who identify as male may perceive consuming real meat as a sign of respect for health and life and thus reject meat substitutes (Rothgerber, 2013). The production process of meat substitutes is also a paramount concern (He et al., 2020). The lack of environmental and food education makes it difficult for consumers to understand how dietary shifts relate to global sustainability priorities such as climate change, global change, and animal welfare (Palmer, 1998). In addition, the influence of traditional Chinese vegetarian culture may lead consumers to reject new alternatives because traditional vegetarian food consists mainly of plant-based ingredients such as soy products. Vegetarian meat is low in fat and calories. Its taste and texture are often similar to meat. This competition between the old and the new may increase resistance to meat alternatives.

It is imperative to consider the influence of traditional vegetarian cultures and endeavour to adapt meat alternatives to local food cultures and preferences. Future food education research could consider these perspectives, including 1) considering the influence of cultural traditions, taste preferences, values, food safety, and other factors on the acceptance of meat alternatives; 2) exploring the mixture pattern of traditional vegetarian meat culture and meat alternatives to increase public awareness and acceptance of them; 3) conducting in-depth research on the environmental benefits and sustainability of meat alternatives to raise consumer awareness and knowledge of sustainable food; 4) developing diverse food education strategies, such as using social media and food education campaigns, to increase public awareness and acceptance of meat alternatives and sustainable food.

4   Conclusions

Lichtenberg and Zimmerman (1999) argue that the news media can be a powerful tool for shaping public opinion and influencing people's attitudes and beliefs. The results of this study suggested that newspapers have positive attitudes toward meat substitutes, which may help shape public opinion and encourage the adoption of such products. On the other hand, the negative sentiment expressed in social media comments about meat alternatives highlights the potential challenges of promoting alternatives and consumer dietary shifts. In addition, the lack of education and coverage of food and eating habits in newspapers arguably represents a missed opportunity to inform and educate the public about healthier, more sustainable food choices. In addition, the lack of newspaper attention to the cultural aspects of food and eating habits can limit the scope of public discussion about meat alternatives. Because eating habits are deeply rooted in culture and tradition, understanding and incorporating cultural factors into discussing meat alternatives is critical to promoting their acceptance and adoption. Overall, this study reveals the role of the news media in shaping public perceptions of meat alternatives and highlights areas for possible improvement in online newspaper coverage and education about food and eating habits.

It is worth noting that this study did not include data from other media channels. Therefore, future studies should collect data more comprehensively to draw more inclusive conclusions. Nonetheless, this study provides valuable insights into the market outlook for meat alternatives, consumer acceptance, and strategies to drive dietary change. Future research should continue to explore the needs of consumers, policymakers, and industry experts in the quest for a more comprehensive, equitable, and sustainable food industry development.

Acknowledgements

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