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Extracting Consumers' Perceptions for Indonesian Spice Drinks Using Social Media Data Mining and Kansei Engineering

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ABSTRACT

Local factors and global influences shape consumers' perceptions through social media. In this regard, spice drinks as an agribusiness product have received increasing attention due to the Covid-19 pandemic. Therefore, understanding consumers' perceptions is crucial for promoting the development of spice drinks. This study aims to (1) extract consumers' perceptions of spice drinks based on discussions on social media using sentiment analysis and (2) classify the factors influencing their perceptions using factor analysis. The input dataset was obtained through Twitter data to acquire Kansei words. The results disclosed that Twitter could extract Kansei words and validate consumers' perceptions of spice drinks as an agribusiness product. The sentiment analysis revealed 78% positive and 13% neutral tweets. Subsequently, an online survey was conducted among 495 respondents aged 18 to 41, distributed through various social media platforms from June to August 2022. The respondents were Generation Z and Millennials, with Generation Z referring to individuals born between 1997 and 2012 and Millennials born between 1981 and 1996. Factor analysis identified four principal components influencing consumers' perceptions toward spice drinks: positive attitudes were associated with the quick, milky, mixed, healthy, quality, energy, fresh, warm, and safe; benefits were affiliated with the words enjoy, rest, life, smile, and story; quality concerned easy, flavour, and spicy; and sensory dealt with sweet, aroma, and bitter.

Keywords: Agribusiness; Consumer perception; Kansei; Spice drink; Social media

INTRODUCTION

Due to Covid-19, spice drinks have become increasingly popular as people are placing greater emphasis on their health (Feldmeyer & Johnson, 2022). Herbs and spices are among the most common agribusiness products, providing significant health benefits to consumers (Dini, 2018). Indonesia has made its natural agribusiness wealth for a decade through spices, including nutmeg, cinnamon, ginger, pepper, and cloves (Sulaiman et al., 2018). Food Agriculture Organization (FAO) data unveiled that in 2017, Indonesia became one of the leading spice producers, with export competitors from Vietnam, India, China, Madagascar, and the Netherlands (Sa'diyah & Darwanto, 2020). Most residents in rural or urban areas

have consumed spices as herbal medicines to prevent various diseases following their local beliefs (Elfahmi, Woerdenbag, & Kayser, 2014). Thus, the agribusiness products of herbs and spices are currently growing rapidly.

However, spices frequently lose their flavors, colors, and textures after storage and lengthy processing (Raghavan, 2006). Usually, entire spices are ground, roasted, or flaked before being added to processed foods. Therefore, dry spices and spice extractives are, by necessity, most often employed to formulate foods or beverages.

Indonesia has many kinds of spice drinks, such as *loloh* from Bali (Sujarwo, Keim, Savo, Guarrera, & Caneva, 2015), *kahwa daun* from West Sumatra (Novita, Kasim, Anggraini, & Putra, 2018), *tiwai* from Dayak Kalimantan (Saragih, Pasiakan, Saraheni, & Wahyudi, 2014), *jamu* from Java (Elfahmi et al., 2014), and *wedang uwuh* from Java (Palupi & Abdillah, 2020). All of these drinks are made from herbs and spices originating from Indonesia. Spice drinks exert antioxidant, anti-inflammatory, antidiabetic, antihypertensive, and other antimicrobial effects on people's health (Torres, Gassara, Kouassi, Brar, & Belkacemi, 2017). Spices are defined as the dried parts of a plant, whereas herbs originate from leaves (Peter, 2012). They are both classified into various groups based on the flavor or taste they impart to food (Embuscado, 2015).

Furthermore, Covid-19 has also significantly affected Indonesia's economy, health, and social sectors because consumers' behaviors and perceptions have altered due to uncertain circumstances. Hence, consumers' perceptions are essential to support the rapid development of agribusiness products in terms of technology, size, quality, features, variety, and complexity (Khannan, Tontowi, Herliansyah, & Sudiarso, 2021). The consumers' choice of agribusiness products during the pandemic was influenced by various factors related to demographics, psychographics, and product and market offerings. Nowadays, local and global factors influence consumers' perceptions through social media. Social media influences individual perceptions through its diverse content, exposing users to various viewpoints and opinions (Chiu & Lin, 2018). Platforms with large user bases, such as Facebook and Twitter, have a significant impact due to their widespread popularity and ability to reach and influence diverse audiences. Thus, it is essential to extract consumers' perceptions using social media. The community's opinions on social media allow industries to understand consumers' perceptions better because agribusiness products, foods, and drinks are some of the exciting topics discussed on Twitter (Feldmeyer & Johnson, 2022).

An appropriate method is required to extract consumers' perceptions through social media to fulfill their subjective needs, product design, and development preferences. This method aims to translate human psychology, such as feelings and emotions, into appropriate product design attributes. Therefore, Kansei (affective) Engineering is reliable for identifying consumers' perceptions based on physical and psychological desires (Nagamachi, 1995; Ushada & Okayama, 2016). Kansei words refer to affective adjectives and verbs representing consumers' perceptions of products in the form of measurable parameters (Ushada, Wijayanto, Trapsilawati, & Okayama, 2021). Engineering is the statistical modeling to extract the Kansei words to consumers' perceptions. Several studies combined text mining from

online reviews or social media with Kansei Engineering (KE) (S. Ali, Wang, & Riaz, 2020; Chiu & Lin, 2018; Ishihara, Nagamachi, & Tsuchiya, 2019; Sembiring, Adhinata, Wahyuni, & Hadi, 2019).

Consumers' perception factors of herbal drinks have been analyzed, yet it focused only on physical attributes, such as pricing, packaging, and labeling (Miftah, Ita, Hasni, & Mohammad A, 2020; Mu'tamar, Fakhry, & Ulya, 2021; Nuryanto & Indriyani, 2020). Therefore, this study is the first to examine deeply the affective attributes driving consumers' decisions regarding the consumption of spice drinks as an agribusiness product. Despite the increasing focus on developing spice drinks in Indonesia, knowledge about consumers' perceptions and choices of this product is still limited. According to Granqvist and Ritvala (2016), some consumers struggle to classify products accurately, leading to a lack of specific understanding of a product's function. This issue can contribute to delays in developing and marketing spice drinks in Indonesia. Therefore, this study aims to (1) extract the consumers' perceptions of spice drinks based on the discussion on social media using sentiment analysis and (2) classify the factors influencing their perceptions using Kansei Engineering.

This study provides the advantage of supporting agribusiness Small-Medium Entreprises (SMEs) in developing spice drinks. Additionally, the development of traditional spice drinks aims to promote Indonesia's proposal for the archipelago spice route as an intangible world cultural heritage to UNESCO, supported by scientific evidence of spice product innovation (Kumoratih, Anindita, Ariesta, & Tholkhah, 2021; Margana & Ushada, 2021). Understanding consumers' perceptions of spice drinks also offers the advantage of formulating effective marketing strategies and producing attractive agribusiness products for Generation Z and Millennials.

RESEARCH METHOD

Figure 1 exhibits the conceptual model for extracting consumers' perceptions using social media data mining from Twitter and Kansei Engineering. Kansei Engineering was categorized into Types I, II, and III (Nagamachi, 1995). Kansei Engineering Type I involves the classification of consumers' perceptions. Kansei Engineering Type II incorporates contemporary computer technologies like Expert Systems, Neural Network Models, and Genetic Algorithms. On the other hand, Kansei Engineering Type III employs a mathematical structure as its model. This study selected Kansei Engineering Type I to help define customers' desires (Chiu & Lin, 2018; Ishihara et al., 2019; Sembiring et al., 2019).

The conceptual model was adapted from Jin et al. (2022) and Ishihara et al. (2019). This study utilized the Kansei word approach (Ushada et al., 2023a), defined as a statement of impression depicting consumers' desires for the product (Nagamachi, 1995). The input dataset was extracted from tweets and then considered by expert judgments through a focus group discussion (FGD) to obtain the final Kansei words. Furthermore, the Kansei words were validated by Indonesian participants through an online questionnaire to acquire consumers' perceptions.

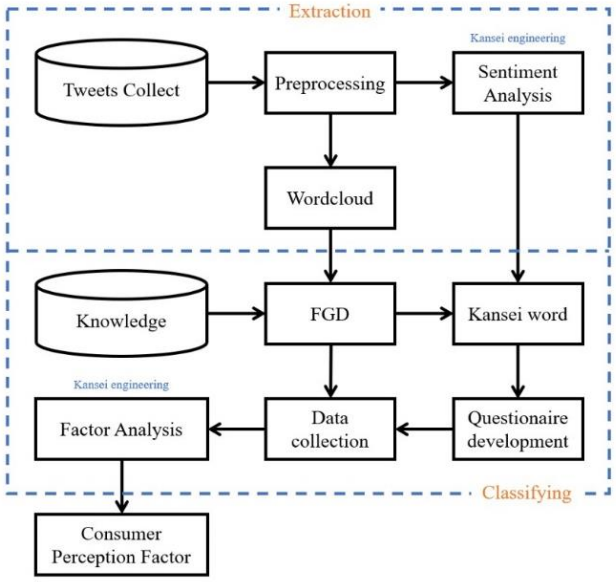

FIGURE 1. CONCEPTUAL MODEL OF RESEARCH

Tweet Collection

Twitter was selected in this study due to it is one of the most popular social media network services that openly circulate messages as tweets. Moreover, it has become necessary for individuals and organizations to broadcast and discuss opinions in real time (Zanini et al., 2019). The active users of this social media platform have been projected to reach 340,000,000 in 2024 from approximately 290,500,000 in 2019 (Hakim, Mujahidah, & Rusydiana, 2022). Twitter data have been employed in the industry to enable the analysis of consumers' perceptions of products (Borrero & Zabalo, 2021; Feldmeyer & Johnson, 2022), services (Shirdastian, Laroche, & Richard, 2019), and food products (Mostafa, 2018).

Tweet data were retrieved using a text mining library provided by Orange 3.34.0 software (Bioinformatics Laboratory, Faculty of Computer and Information Science, University of Ljubljana, Slovenia) with specific or combined keywords (Anggraini & Suroyo, 2019). The users must secretly input the keywords obtained from the Twitter Application Interface (API) to determine the query word list by selecting the appropriate language (Shirdastian et al., 2019). In this study, "spices and drinks or beverages" were the main keywords.

The number of characters on Twitter was limited, leading some users to tweet about spice drinks using abbreviations and other shortened words. However, based on the previous internet analysis, the keywords "spices and drinks or beverages" were deployed for searching criteria, as they yielded the most entries on Google. This approach was similar to research by Feldmeyer and Johnson (2022), who applied only the word "turmeric" to model consumers' perceptions using Twitter, and Borrero and Zabalo (2021), who utilized the keywords "strawberries" or "fresas" (Spanish for strawberries) to analyze consumers' opinions about strawberries on Twitter for marketing purposes. Tweets with "spices and drinks or beverages" as the primary keywords were generated from May 20 to 27, 2022, totaling 34,931. These

keywords were selected due to the broad definition of flavor, encompassing all parts of the plant rather than just herbs (Peter, 2012).

Pre-processing

This study performed data pre-processing, including clearance of the duplicated, empty, and unused lists, as well as the removal of lowercase, special characters, numbers, Uniform Resources Locator (URLs), tweet tokenizers, and unessential stop words and punctuation (Mostafa, 2018). Word spelling normalization and deletion were carried out using a manually built dictionary (Fried, Surdeanu, Kobourov, Hingle, & Bell, 2015).

Word Cloud

A word cloud is a visual representation of text data where the most frequently used words are displayed in larger font sizes and arranged in a cloud-like or cluster-like pattern (Graff, Moctezuma, Miranda-Jiménez, & Tellez, 2022). In a word cloud, the size of each word is typically proportional to its frequency of occurrence in the given text (Shahid, Ilyas, Alowibdi, & Aljohani, 2017). Hence, the more frequently a word appears in the text, the larger it appears in the word cloud. Otherwise, less common words were displayed in a smaller font size. This word cloud ~~can~~ gain quick insights into a large amount of text data from tweets, providing a visual summary of the main topics or themes present in the text and allowing users to grasp the overall content at a glance. This study utilized a word cloud to display the most popular keywords related to spices and drinks (Liu et al., 2019). The words in the word cloud ~~could be~~ considered to represent the topic with the highest possibility of being the main topic of a review. Furthermore, the experts considered the consumers' perceptions to select the Kansei words with the highest frequency of occurrence through an FGD.

Sentiment Analysis

The sentiment refers to the understanding, extracting, and processing textual data. It was deployed to analyze each tweet's meaning. This study employed the lexicon-based sentiment analysis adopted by Hu and Liu (2004). Each tweet was divided into three categories: positive, negative, and neutral. This method utilized single-word terms to define positive, negative, or neutral sentences. For example, Hu and Liu (2004) automatically generated a lexicon of 2,006 positive and 4,783 negative words using a machine-learning technique based on tweet data. The final score unveiling the value of a sentiment emerged as the difference between the positive and negative words normalized by the document length.

Focus Group Discussion

The FGD utilized the spice cosmopolis approach consisting of reconstruction, revitalization, and innovation. The reconstruction approach applied the historical background of spice to stimulate Kansei's words from experts. Revitalization employed the gap between the historical and present use of spice drinks to attract Generation Z and Millenials. Innovation deployed product design and development based on reconstruction

and innovation. However, not all words listed in the word cloud were relevant to the consumers' perceptions of spice drinks, requiring an FGD. Therefore, it was necessary to remove not correlated words and select the final Kansei words accurately representing consumers' desires to consume a specific product based on affective needs (Ushada, Amalia, Trapsilawati, & Putro, 2022; Ushada, Trapsilawati, Aji, Amalia, & Setyowati, 2023; Ushada, Trapsilawati, Amalia, & Putro, 2022). Moreover, the Kansei words from Twitter represented global perceptions; thus, to adjust to Indonesian consumers, the FGD was necessary. Mostafa (2018) and Jin et al. (2022) also utilized predefinitions of experts to determine the dictionary entry for polarity analysis and opinion mining from social media.

A six-person focus group, composed of four lectures working in the spice cosmopolis field and two beverage industry entrepreneurs, participated in this study. Finally, the selected Kansei words presenting the consumers' desires were utilized for questionnaire development in the subsequent stage. The FGD was described according to the modified method by comprising two teachers, three postgraduate students, and one person to eliminate the collected perceptual (Kansei) words for designing new products. The extraction was performed using an expert judgment from the FGD based on (1) words related to customers' perceptions (feelings and emotions) and (2) the elimination of the Kansei words with similar meanings.

Questionnaire Development and Data Collection

The extracted Kansei words from Twitter were employed to analyze the consumers' desires for spice drinks through an online questionnaire. This questionnaire contained two sections, intending to (1) acquire basic information and (2) measure consumers' perceptions.

Basic information, such as gender, age, educational background, region, income level, and spice drinking behavior, demonstrating the customers' awareness and local knowledge, was obtained in the first section. The second section was measured using a seven-point Likert scale ranging from least to most important. In Taherdoost's (2019) review, a seven-point Likert scale emerged as the best, most accurate, and most straig Taherdoost'htforward estimation method. Table 1 displays the list of questions in this study.

Each attribute of the questionnaire should be examined for validity and reliability, helping develop and test any survey instrument. The validity and reliability were tested using SPSS 23.0 software (IBM SPSS Inc., Chicago, IL, USA). Data are valid if the R-count is higher than R-table, the correlation coefficient of Pearson's table. Subsequently, reliability was tested based on Cronbach's α and confirmed as reliable based on the minimum R-count.

The questionnaire was distributed through an online survey from June to August 2022 to Generation Z and Millennial members aged 18 to 41. Random sampling was utilized with the criterion of having consumed spice drinks within the past two years. Based on the adequacy test, 495 respondents were selected. This survey was approved by the Research Ethics Committee of Universitas Gadjah Mada through KE/UGM/021/EC/2022.

TABLE 1. LIST OF QUESTIONS FOR THE QUESTIONNAIRE

Code	Question		
A.	**Pre-knowledge explanation and informed consent**		
B.	**Respondent profile**		
1.	Gender		
2.	Age		
3.	Residence		
4.	Educational background		
5.	Monthly income or salary		
C.	**Knowledge and background information**		
1.	How many times do you consume spice drinks in a month?		
2.	Do you believe that spice drinks can provide health benefits and boost the immune system?		
D.	**Kansei words**		
1.	Story	11	Healthy
2.	Easy	12	Life
3.	Spicy	13	Milky
4.	Bitter	14	Quick
5.	Warm	15	Aroma
6.	Mixed	16	Quality
7.	Fresh	17	Safe
8.	Flavor	18	Enjoy
9.	Sweet	19	Rest
10.	Energy	20	Smile
E.	**Future development of spice drinks**		
1.	How much do you think is a reasonable price for a spice drink product?		
2.	Do you believe that Indonesian spice drinks will develop at the international level?		

Factor Analysis

In the factor analysis, the Kansei words were classified as consumers' perception factors toward spice drinks. These Kansei words' attributes were called "factors," depicting the primary or original information. However, all the original attributes tend to be indicated by factors after dimensional reduction (Yong & Pearce, 2013). The factors refer to the cluster classifying several attributes in the same group.

Factor analysis possesses several methods, including Principal Component Analysis (PCA), maximum likelihood, axis, and alpha or image factoring. This study adopted PCA to extract meaningful information from multivariate data (Jollife & Cadima, 2016). PCA could help obtain preliminary data insights by looking at trends and clustering (Buvé et al., 2022). The extraction method was PCA based on Varimax rotation (Vlontzos, Kyrgiakos, & Duquenne, 2018).

Two main elements of PCA are factor loadings and the sum of squared loadings. Factor loadings interpret whether a dataset affects the factor formed (Vlontzos et al., 2018). If the loading varies between 0.5 and 0.7, the degree of participation is considered satisfactory, and if it is 0.7 and above, the factor is highly supported. Meanwhile, if the loading of a variable is below 0.5, that variable should be excluded (Rahardjo, 2013; Santoso, 2012). The sum of

squared loadings describes the amount of variance of a factor. PCA was performed with IBM SPSS 23.0. Therefore, this method facilitated the structural simplification, interpretation, and designation of factors. This analysis generated the consumers' perception factors toward spice drinks.

RESULTS AND DISCUSSION

Extraction of Kansei Words

A total of 5,000 tweets were obtained after removing replies, retweets, and unused data. Due to the rapidly changing consumers' perceptions (Shirdastian et al., 2019) following lifestyle (Li, Li, Qing, & Hu, 2021), the extraction was performed in a short period. It is similar to research by Shirdastian et al. (2019), quickly analyzing customers' desires for Starbucks. In this case, Twitter was employed to extract Kansei words based on product trends in other countries (Hinduan, Anggraeni, & Agia, 2020). The tweets of "spices and drinks or beverages" as the primary keywords from Twitter were summarized in the word cloud.

Word Cloud

FIGURE 2 illustrates the word cloud using "spices and drinks or beverages" as the primary keywords from Twitter. This word cloud was obtained after removing URLs, numbers, emojis, and unnecessary information, such as "and," "to," "if," "on," and "but." The removed words were listed in the stopwords. The figure exhibits that "ingredients," "like," "spices," "herbs," and "drinks" dominated this word cloud.

FIGURE 2. WORD CLOUD FROM TWITTER DATA

Sentiment Analysis Results

Table 2 displays examples of tweets and sentiment values. Content numbers 1, 3, and 4 were indicated as positive sentiments because they contained positive words, such as "sweet," "refreshing," "easy," "quick," "beautiful," "appealing," and "boost immunity." Meanwhile,

content 2 was neutral because it had no positive or negative comments. Moreover, content number 5 was a negative sentiment because it contained the words "difficult" and "slowly."

TABLE 2. EXAMPLES OF TWEETS AND SENTIMENT ANALYSIS

No	Content	Sentiment	Meaning
1	…Traditional lassi is often flavored with cumin, but there are **sweet** and salted varieties as well.	7.32	Positive
2	… The spices here can be used to make drinks from all over the world without leaving home." https://t.co/fTM3hq5Wsp	0	Neutral
3	Jamun Panna is a **refreshing** and cooling drink made of Jamun juice and some spices. **Easy**, **quick** to make, and looks absolutely **beautiful**. The color makes it even more **appealing.**	8.51	Positive
4	…Add flavor or spices like rosemary, cucumber, ginger, lemon, strawberries these too **boost your immunity**…	1.92	Positive
5	… is a beverage made from black tea and spices. It can be a **difficult** drink to make well, as it needs to be brewed **slowly** and carefully to avoid bitterness.	-2.09	Negative

The results disclosed that 78% of the tweets were positive, 13% were neutral, and the rest were negative. A suitable Liu-hu lexicon method obtained accuracy rates ranging from 75% to 77% (Khoo & Johnkhan, 2018). The positive opinions toward spice drinks indicated that people tended to recommend them to others because they discussed the drinks' positive impact. According to Desmet (2018), customers frequently use positive words while posting about a consumption experience.

These results implied that Twitter could generate tweets or messages containing Kansei words depicting customers' desires related to affective needs. Twitter has become one of the popular social media platforms enabling users to post and discuss either a general or particular topic. It allows people to post their thoughts and comments on products or services.

A few studies only combined text mining from online shopping or social media to classify Kansei words. However, research on Kansei word classification is still limited. For example, a classification was implemented based on the interval of the polarity scores rather than the nature of Kansei's emotions (Jin et al., 2022). Chiu and Lin (2018) utilized text mining and Kansei Engineering on the road bike topic. However, the research did not involve end users in the communication step.

Consumers' Perceptions Based on Kansei Words

The word cloud included the entire words listed in Figure 2. However, to summarize these heterogeneous data, an expert judgment analysis was conducted using (1) words related to customers' perceptions and (2) elimination of the Kansei words with similar meanings, with only the most frequent and related words being considered. Figure 3 portrays the 20 selected Kansei words by expert judgment.

"Story" was the word most frequently used in spice drink-related tweets, signifying that people believed herbal drinks historically provided health benefits, as exemplified by the following tweets. Historically, the written record of spices could be traced to India, China,

and Egypt. In 1550 B.C.E., Ebers Papyrus explained several medicinal procedures and 800 remedies. #spice #history

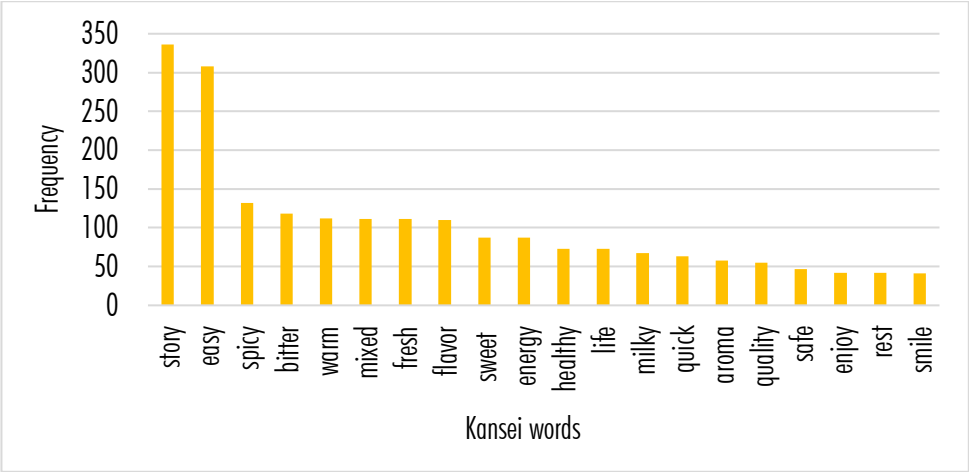

FIGURE 3. SELECTED KANSEI WORDS

Concerning this topic, Sujarwo et al. (2015) explained that Balinese people believe that all diseases tend to be cured with the help of nature. This way of thinking is based on interpreting and understanding natural phenomena. People believe that Covid-19 can be warded off by consuming spice drinks to maintain strong immunity. This belief is supported by a group that mostly consumes herbal medicine and drinks (Ratnawatia, Anom, Pudentia, Kusuma, & Soriente, 2021). Several traditional drinks related to local beliefs are also consumed in other countries, such as India, Russia, and China.

Masala Chai, a popular spice-infused tea in India, is deeply rooted in the country's cultural and medicinal traditions. According to local beliefs, blending spices with tea leaves dates back thousands of years (Shukla & Yadav, 2018). In Russia, *Sbiten* is a traditional spice drink with a long history closely connected to the country's folk culture and ancient beliefs (Vazhov & Leonova, 2018). In Russian folklore, *Sbiten* is considered a magical elixir that can ward off evil spirits and protect against illnesses. The combination of honey and spices is believed to have healing properties, and *Sbiten* is often prepared during special occasions, such as weddings and religious ceremonies.

Meanwhile, Chinese Herbal Tea, also known as "liang cha," has a rich cultural history and is an integral part of traditional Chinese medicine (Holl, 2023). The story of Chinese Herbal Tea is intertwined with the country's ancient medical practices and belief in the balance of Yin and Yang energies. According to traditional Chinese medicine, the human body must balance these opposing forces harmoniously to achieve good health. Herbal tea has been thought to help restore this balance and promote wellness. Therefore, the story of the traditional perspective emerged as one of the essential factors of people consuming spice drinks discovered in this study.

The second most employed word was "easy." People preferred ready-to-drink beverages for being easy to consume and instant. This perception is supported by Dubey et al. (2019), mentioning that the trend among young consumers is to be proactive in choosing ready-to-drink (RTD) tea as a suitable beverage option as it offers several health benefits due to the

presence of antioxidants and other essential ingredients. RTD was a good alternative for consumers seeking refreshing products without sacrificing taste.

This study was conducted with experts to filter and select the final Kansei words with similar meanings. The final words selected encompassed story, easy, spicy, bitter, warm, mixed, fresh, flavor, sweet, energy, healthy, life, milky, quick, aroma, quality, safe, enjoy, rest, and smile. Subsequently, these Kansei words were validated by Indonesian respondents using an online questionnaire to obtain the final factors of consumers' perceptions of spice drinks.

Development of Questionnaire

A pilot test was conducted with 30 respondents to ensure all questions were understandable. Having 30 respondents for a pilot test of a questionnaire ~~could~~ provide helpful insights into the questionnaire's reliability. The pilot test evaluated the clarity, feasibility, and overall effectiveness of the questionnaire before conducting a full-scale survey. Ali and Ali (2020) also conducted a pilot survey of 30 respondents for a reliability test. From this test, 20 questions were valid, indicating R-count being higher than R-table by 0.361, with a significance rate of 5%. The questionnaire had high reliability due to it had Cronbach's α of 0.849 (Singh & Verma, 2017).

Respondents' Characteristics

Table 3 displays that demographically, the respondents consisted of Generation Z and Millennials. Generation Z refers to individuals born between 1997 and 2012, whereas Millennials were born between 1981 and 1996 (Michael, 2018). In this study, 36.77% of the respondents were aged 24 to 29, 23.23% were aged 18 to 23, 27.27% were aged 30 to 35, and 12.73% were aged 36 to 41. This distribution indicated that consumers aged 24 to 29 had the highest response rate and were more interested in spice drinks than those in other age ranges. Of the 495 participants, 22.42% were male, and 77.58% were female. Females accounted for the most respondents because most housewives regularly consume spice drinks before and after menstruation for health and fitness (Ratnawatia et al., 2021).

A total of 83.23% of the participants were located in Java, indicating that people in this area were more concerned about traditional drinks than those in other areas. This situation is similar to that reported by Prabawani (2017), who disclosed that approximately 80% of consumers surveyed for the perceptions and segmentation of Indonesian Jamu were selected from Java. Meanwhile, 10.71%, 3.03%, 1.62%, and 1.41% of the other participants were in Sumatera, Kalimantan, Sulawesi, and Nusa Tenggara and Bali, respectively. A total of 49% of consumers had a monthly allowance of IDR 2,000,000 to 5,000,000. In Indonesia, this income range is considered middle class because it is equivalent to the regional minimum wage (Najib et al., 2022). Moreover, 30.5%, 16.4%, and 4.04% of the consumers had a monthly allowance of less than IDR 2,000,000, IDR 5,000,000 to 10,000,000, and above IDR 10,000,000, respectively. Approximately 89% of the participants consumed spice drinks once a week, signifying the interest of Generation Z and Millennials in spice drinks. Covid-19 appeared to be one of the reasons for the increase in the consumption of spice drinks in

Indonesia. According to Wachyuni and Wiweka (2020), health drinks were typical foods most frequently purchased during the pandemic.

Respondent Analysis of Consumers' Perceptions

Table 3 depicts that most respondents (60.81%) consumed spice drinks more than five times a month (aware respondents), while 39.19% consumed them less than five times a month (unaware respondents). In other words, Generation Z and Millennials have been aware of consuming spice drinks, probably due to these drinks belonging to functional food. Kljusurić & Čačić (2014) confirmed that the young generation tends to be more aware of functional food. Table 4 depicts the demographic characteristics and awareness of spice drinks. The proportion of aware and unaware respondents did not differ between genders. Despite the higher number of female respondents than males, both genders were conscious about consuming spice drinks. According to Prabawani (2017), women have a more robust perception that spice drinks in Indonesia are free from chemical additives, while more men consider the classification of Jamu before purchasing or consuming the product.

TABLE 3. SOCIOECONOMIC AND DEMOGRAPHIC CHARACTERISTICS OF THE PARTICIPANTS

Characteristic	Category	*n*	Percentage
Gender	Male	111	22.42
	Female	384	77.58
Age	18–23	115	23.23
	24–29	182	36.77
	30–35	135	27.27
	36–41	63	12.73
Residence	Java	412	83.23
	Sumatra	53	10.71
	Kalimantan	8	3.03
	Sulawesi	15	1.62
	Nusa Tenggara and Bali	7	1.41
Educational background	High School	288	58.18
	Bachelor's Degree	175	35.35
	Master's Degree	31	6.26
	Doctoral Degree	1	0.20
Monthly income or salary	Less than IDR 2,000,000	151	30.51
	IDR 2,000,000–5,000,000	243	49.09
	IDR 5,000,000–10,000,000	81	16.36
	More than IDR 10,000,000	20	4.04
How many times in a month do you consume spice drinks?	More than 5 times	301	60.81
	Between 1–4 times	146	29.49
	Less than 1 time	48	9.70

Furthermore, age and income level particularly impacted respondents' awareness and unawareness of spice drinks ($p < 0.05$). Notably, the age group between 18 and 21 (middle Generation Z) significantly differed from other age groups, demonstrating the lack of awareness of this generation about consuming spice drinks. As Rani and Tjong (2020)

asserted, when Generation Z purchases spice drinks like jamu, they consider brand equity; however, most spice drinks in Indonesia do not have a strong brand presence yet.

TABLE 4. DEMOGRAPHIC CHARACTERISTICS AND AWARENESS ABOUT SPICE DRINKS

Characteristic		Awareness about spice drink				Total respondent	Sig.
		Aware		Unaware			
		n	%	n	%		
Gender	Male	62	12.53	49	9.9	111[a]	0.226
	Female	239	48.28	145	29.29	384[a]	
Age	18-23	37	7.47	78	15.76	113[a]	<0.01
	24-29	114	23.03	68	13.74	182[b]	
	30-35	103	20.81	32	6.46	135[b]	
	36-41	47	9.49	16	3.23	63[b]	
Income (IDR)	< 2,000,000	61	14.7	78	18.8	139[a]	<0.01
	2,000,000 – 5,000,000	132	31.81	43	10.36	175[b]	
	5,000,000 – 10,000,000	59	14.22	22	5.3	81[b]	
	>10,000,000	16	3.86	4	0.96	20[a,b]	

Note: In the same row, different letters show significant differences at $p \leq 0.05$

Consumers with an income under IDR 2,000,000 demonstrated a lack of awareness about consuming spice drinks compared to other income groups. It could be attributed to the fact that spice drinks are recognized as health and wellness products, categorized with significant health benefits, which, according to Ali and Ali (2020), could lead to relatively higher prices than regular food products. Prabawani (2017) also emphasized that price, as an extrinsic attribute, has significantly influenced consumers to buy spice drinks.

Factors Influencing Consumers' Perceptions of Spice Drinks

The survey asked the consumers to rate each Kansei word according to its importance. Kaiser–Meyer–Olkin was applied to quantify the suitability of data. The results revealed a sample adequacy of 0.933, more significant than the experience value of 0.5. Bartlett's spherical test of chi-square approximation, degree of freedom, and significance acquired 5459.599, 190, and 0.000, respectively. Table 5 indicates the reliability of factor analysis for this study.

TABLE 5. KMO AND BARTLETT'S TEST RESULTS

Kaiser–Meyer-Olkin Measure of Sampling Adequacy		0.933
Bartlett's spherical test	Approx. chi-square	5459.599
	Df	190
	Significance	0.000

Table 6 displays sufficient correlations to justify the application of factor analysis. In this table, only five influential factors of the correlation coefficients were listed due to space

limitations. To determine the strength of the relationship between items, there must be evidence of correlation coefficients greater than 0.3 in the correlation matrix (Shrestha, 2021). For example, this study discovered high correlations between warmth and energy (0.577) as well as freshness and energy (0.646).

TABLE 6. CORRELATION COEFFICIENT MATRIX OF FACTORS

	1. Warm	2. Mixed	3. Fresh	4. Sweet	5. Energy	.....
1. Warm	1.000	0.495	0.497	0.288	0.577	
2. Mixed	0.495	1.000	0.471	0.265	0.488	
3. Fresh	0.497	0.471	1.000	0.263	0.646	
4. Sweet	0.288	0.265	0.263	1.000	0.355	
5. Energy	0.577	0.488	0.646	0.355	1.000	
.....						

Note: Due to space limitations, only five influential factors of the correlation coefficients are listed. The entire table is available upon request.

The Kansei words were extracted using the principal components and the orthogonal rotation based on Varimax to obtain the main factor influencing people to consume spice drinks. Following TABLE 7, only four factors had eigenvalues above 1. Due to space limitations, only five components were listed. The sum of extraction and rotation collectively accounted for 64.195% of the original 20 factors. This rate implied that these original factors were sufficient and effective. The first, second, third, and fourth components explained 26%, 15%, 11%, and 11% of the total variance with eigenvalues of 5.277, 2.982, 2.306, and 2.274, respectively.

TABLE 7. DEVIATION CONTRIBUTION RATE OF INFLUENTIAL FACTORS

Component	Initial eigenvalue			Extraction sum of squared loading			Rotation sum of squared loading		
	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %	Total	Variance %	Cumulative %
1	8.874	44.372	44.372	8.874	44.372	44.372	5.277	26.385	26.385
2	1.755	8.775	53.147	1.755	8.775	53.147	2.982	14.911	41.297
3	1.148	5.741	58.888	1.148	5.741	58.888	2.306	11.530	52.827
4	1.061	5.307	64.195	1.061	5.307	64.195	2.274	11.368	64.195
5	0.767	3.835	68.031						
...									

Extraction Method: PCA

*Only five components are listed in **Table 7** due to space limitations. The entire table is available upon request.

TABLE 8 exhibits the diagonal anti-image correlation, commonality after extraction, mean, standard deviation, and factor loadings. The diagonal anti-image correlation stretched the sampling adequacy of each attribute because it had a value of more than 0.5. Meanwhile, the commonalities indicated the common variance after extraction. The loading values communicated the relationship of each attribute with the underlying factors. Attributes with loading values higher than 0.50 represent the factors (Shrestha, 2021). Therefore, attributes with values lower than 0.50 were excluded from the factor components.

The results revealed four main components influencing consumers' perceptions of spice drinks. Each component contained Kansei words indicating people's emotional feelings toward the product.

Component 1: positive attitudes toward spice drinks and their characteristics

The first loading factors included quick, milky, mixed, healthy, quality, energy, fresh, and warm, with correlations of 0.820, 0.814, 0.766, 0.748, 0.712, 0.666, 0.662, and 0.575 respectively. The Kansei word safe had a loading factor of 0.460, below 0.5, indicating a weak factor and must be excluded from component 1 (Rahardjo, 2013; Santoso, 2012).

TABLE 8. SUMMARY OF FACTORS RELATED TO SPICE DRINKS

	Factor	Diagonal anti-image correlation	Communality after extraction	Mean	SD	Factor loading
Kansei words	Component 1					
1	Quick	0.949	0.754	6.725	0.621	0.820
2	Milky	0.948	0.714	6.735	0.584	0.814
3	Mixed	0.940	0.683	6.671	0.681	0.766
4	Healthy	0.945	0.646	6.717	0.621	0.748
5	Quality	0.950	0.690	6.610	0.711	0.712
6	Energy	0.946	0.688	6.507	0.802	0.666
7	Fresh	0.968	0.592	6.588	1.479	0.662
8	Warm	0.940	0.584	6.636	0.732	0.575
9*	Safe	0.969	0.381	6.527	0.932	0.460
Kansei words	Component 2					
10	Enjoy	0.872	0.783	5.984	1.287	0.761
11	Rest	0.892	0.765	6.170	1.131	0.751
12	Life	0.941	0.687	6.184	1.122	0.720
13	Smile	0.940	0.615	6.230	1.047	0.526
14	Story	0.974	0.448	6.137	1.215	0.511
Kansei words	Component 3					
15	Easy	0.931	0.651	6.141	1.187	0.740
16	Flavor	0.922	0.640	6.090	1.168	0.724
17*	Spicy	0.906	0.616	5.299	1.478	0.674
Kansei words	Component 4					
18	Sweet	0.888	0.711	5.956	1.248	0.776
19	Aroma	0.911	0.710	6.287	1.054	0.751
20*	Bitter	0.938	0.481	6.572	0.794	0.390

*Need to be excluded from the component factors

Additionally, the Kansei words quick and milky acquired mean scores of 6.73 and 6.74, the highest among all the factors. The findings revealed that quick and milky served as crucial factors in consumers' consumption decisions on spice drinks. Mixed, healthy, quality, energy, fresh, and warm attained an average score of above 6.5, placing them as the supporting factors influencing consumers' perceptions of spice drinks. Based on the standard deviation, the fresh attribute had the highest error among all the factors, illustrating various customers' perceptions. Healthy, quality, and energy corresponded to positive attitudes, while quick,

milky, mixed, fresh, and warm were related to characteristics. Therefore, the Kansei words for these common loading factors were "positive attitudes toward spice drinks and their characteristics."

These factors indicated positive attitudes, and characteristics became the most influential factor when deciding to consume spice drinks. Nuryanto and Indriyani (2020) explained that attitude significantly affects Indonesian intention toward herbal products, such as indicated by kansei words of health, quality, and energy. Moreover, most consumers assume that spice drinks have no side effects because they are a natural compound (Prabawani, 2017). Herbs and spices contain high amounts of chemicals with beneficial pharmacological properties, including anti-inflammatory, antidiabetic, anticancer, antitumor, antioxidant, antifungal, and antimicrobial effects, which is related to the Kansei word of health (Bishnoi, 2017) because they commonly are developed as a functional food (Sharma, Gupta, & Prasad, 2017). Similarly, Sutakwa (2022) asserted that people regularly consume herbal products or supplements mainly to boost immunity against viruses and prevent diseases.

Component 2: Product benefits

The second component contained five attributes, including enjoy, rest, life, smile, and story, with correlations of 0.761, 0.751, 0.720, 0.526, and 0.511, respectively. Enjoy, rest, and life correlated strongly with product benefits because their loading factors were higher than 0.7. Among these five attributes, smile obtained the highest mean score and smallest standard deviation, the most significant factor being taken into account by consumers. The Kansei words in component 2 were considered "benefits of spice drinks."

Rest, life, and smile corresponded with the consumers' perceptions of emotions while consuming spice drinks. Köster (2015) and Jiang (2014) reported that emotions affect consumers' eating behavior. Hanmontree (2022) presented several methods to measure traditional drinks' emotional and wellness profiles. Although the Kansei word enjoy had the lowest mean among all factors in component 2, it acquired the highest loading factor, indicating a factor influencing people to consume spice drinks. Meanwhile, the word story attained the second lowest mean among all factors and the lowest loading factor. These findings signified that Generation Z and Millennials did not believe in the historical health benefits of spice drinks. The young generation nowadays has easy access to product information, leading them to seek evidence regarding the health benefits of spice drinks (Kljusuric et al., 2014). Torri (2013) highlighted that young people in their mid-twenties prefer purchasing traditional spice drinks, such as jamu, from chemist shops. Even though the product might not be fresh, it has a relatively long shelf life and is already clinically tested.

Component 3: Product Quality

The third component included easy and flavor with correlations of 0.740 and 0.724, indicating their average being higher than 6. Meanwhile, the mean score for spiciness was only 5.299, making it the lowest average among all the factors. Therefore, it was not considered an essential consumers' perception factor. The spiciness was somewhat correlated with the taste of the spice drinks. It was consistent with the findings in component 1, where the young

generation favored spice drinks with a milky flavor due to their preference for sweetness over spiciness. Thus, the third component was the "quality of spice drinks."

Product quality, associated with ease and good taste in this result, was the third factor component affecting consumers' perceptions. Roosinda (2021) emphasized that spice drinks, like jamu, must be developed to make them fast, easy, and practical. It is further supported by Torri's findings (2013), uncovering that the younger generation favored convenient beverage products as they could keep them in the cupboard and use them at any time. Hence, most consumers desired delightful products, while traditional drinks often exhibit spiciness and bitterness. These attributes were essential to enhance the quality of spice drinks.

Component 4: Product sensory

The last component covered only two attributes, sweet and aroma, with correlations of 0.776 and 0.751 and the means of 5.956 and 6.287. The Kansei word bitter had the lowest loading factor of 0.390, indicating a weak factor and must be excluded from component 4 (Rahardjo, 2013). The bitter aftertaste is undesirable and may promote dislike (Wilianto & Ervina, 2023). The bitter aftertaste is closely associated with the ginger aftertaste or hot sensation of spice drinks (Sarkar & Alam, 2018). Thus, sweetness and aroma depicted that the fourth component was "sensory of spice drinks."

Sensory emerged as the fourth component to consider when producing spice drinks as functional foods (Surya, Romulo, & Susilo, 2021). Sweetness and aroma were the main factors in this category. This study disclosed that young consumers (18-41), both Generation Z and Millennials in Indonesia, preferred spice drinks with light sensory aspects instead of strong ones. According to Fitriarni et al. (2021), mixing spice drinks with fruit would help improve the sensory properties of the drinks to be more accepted by consumers of all ages or for those who do not even like the unpleasant smell of spices. Similarly, Wilianto and Ervina (2023), who evaluated the sensory of bandrek, revealed that panelists tended to like the sample with low intensity of bitter aftertaste. It contributed to consumers' liking because the bitter taste does not overpower the drink's taste and is still covered by other aromatic sensory attributes, such as the sweet taste of sugar.

CONCLUSION

The sentiment analysis uncovered that consumers' perceptions of spice drinks were favorably being discussed on social media. It indicated that people tended to recommend spice drinks to others due to their positive impact. Additionally, a total of 20 main Kansei words affecting consumers' preferences, encompassing quick, milky, mixed, healthy, quality, energy, fresh, warm, safe, bitter, enjoy, rest, life, smile, story, easy, flavour, spicy, sweet, and aroma were obtained from Twitter data. Indonesian participants validated these Kansei words using an online questionnaire. Four principal components were identified through factor analysis: positive attitudes toward spice drinks and their characteristics, benefits, quality, and sensory.

Positive attitudes were associated with quick, milky, mixed, healthy, quality, energy, fresh, warm, and safe, while benefits corresponded with enjoy, rest, life, smile, and story.

Meanwhile, quality included easy, flavour, and spicy, while sensory covered sweet, aroma, and bitter. These results unveiled that Twitter data could help generate Kansei words and be combined with engineering to provide validated consumers' preferences for an agribusiness product of spice drinks. Furthermore, the agribusiness SMEs should consider these results while developing their products. These findings are also valuable for academia and other scientists, providing evidence that consumers' perceptions could be extracted from social media, not only using interviews or questionnaires as standard methods.

Several limitations were acknowledged in this research: (1) This study only involved Indonesian participants to validate the Kansei words through an online questionnaire, and (2) the sample of objects used was not specific. Future studies should consider collecting additional data from participants in other countries to compare consumers' perceptions of spice drinks. Additionally, it is essential to compare different spice drink brands and collect the data from social media.

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