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Profiling of Sensory Attributes Shrimp Crackers from East Java Using The Rate-All-That-Apply Method

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A B S T R A C T

Shrimp crackers are a traditional food that is quite popular among the public. The ingredients used in making shrimp crackers include tapioca flour, shrimp, eggs, sugar, salt, and garlic. The composition and proportion of the raw materials used in shrimp crackers can affect the sensory profile characteristics of the resulting shrimp crackers. This study aims to determine the sensory profile of shrimp crackers and consumer preferences for shrimp crackers from five producers with varying proportions of shrimp and tapioca flour. The sensory profile of shrimp crackers was determined using the Rate-All-That-Apply (RATA) method, which produced 12 sensory attributes, namely seafood aroma, fatty aroma, white color, golden brown color, crunchy texture, dense texture, shrimp flavor, savoury flavour, salty flavor, sweet flavor, gritty mouthfeel, and throat irritation. The best sample, based on consumer preference, was sample 964DM, with dominant sensory attributes including seafood aroma, shrimp flavour, savoury flavour, sweet flavour, salty flavour, and dense texture. In sample 964DM, the percentage of shrimp used was the highest among the other samples, at 25%. The panelists' preference results show that sample 964DM is preferred by 80-100% of the panelists.

Contribution to Sustainable Development Goals (SDGs):
SDG 2 : Zero Hunger
SDG 9 : Industry, Innovation, and Infrastructure
SDG 12 : Responsible Consumption and Production

1. INTRODUCTION

1.1. Research Background

Crackers are a traditional food that has long been part of people's diet [1]. According to SNI 01-4306-1996, crackers are dry food products made from raw materials with high starch content, such as tapioca or sago flour, with or without permitted food additives [2]. Shrimp crackers are crackers made with cassava and shrimp as the main ingredients, along with other additives as seasonings or flavour enhancers. The manufacturing process includes mixing, shaping, steaming or boiling, cooling, cutting, and drying [3]. According to the East Java Provincial Statistics Agency (2024), shrimp production in East Java reached 118,953 tons in 2024. Therefore, there are many shrimp cracker producers in East Java.

The sensory quality of crackers plays an important role in attracting consumers, leading to differences in cracker formulations [4]. These differences in formulation lead to variations in sensory quality, even though the main ingredients and compositions used by each manufacturer are generally similar [5]. Formulation differences result in different sensory characteristics [6].

Sensory evaluation is a scientific method used to identify, measure, analyze, and interpret responses to a product through the human senses [4]. The sensory characteristics of food products can be grouped into four categories: aroma, colour, texture, and taste [7].

Rate-All-That-Apply (RATA) is a quantitative method for objectively assessing consumer perceptions of product characteristics [8]. The Rate-All-That-Apply (RATA) method is used because it provides more specific sensory results than the Check-All-That-Apply (CATA) method [9]. The advantage of this method is that it can determine the intensity of each sensory attribute tested [10].

This study aims to identify the sensory attributes and consumer preferences for shrimp crackers from five producers in East Java using descriptive methods and the Rate-All-That-Apply (RATA) method.

1.2. Literature Review

1.2.1. Shrimp Crackers

Shrimp crackers are a type of dry food made from ingredients containing starch with added shrimp [3]. Another definition states that chips are food products that undergo volume expansion, forming porous, low-density products during the frying process [1]. Cracker development is caused by the sudden expansion of water vapour within the dough structure, resulting in a product with expanded volume and a porous texture [3].

During frying, the water bound in the starch gel evaporates as temperature increases, generating steam pressure that pushes the starch gel, causing expansion and the formation of air pockets in the fried crackers [1]. The ingredients or composition of shrimp crackers include tapioca flour, shrimp, garlic, eggs, salt, sugar, and seasonings [11]. The stages of the shrimp cracker manufacturing process include mixing the ingredients, forming the dough, molding, steaming, slicing, drying, and frying [3].

The quality of crackers is influenced by several factors, including the composition of ingredients and tapioca flour, the mixing method, the initial water content of the crackers, and the frying method. Differences in the composition of tapioca flour and shrimp can affect the organoleptic properties and sensory profile of the resulting crackers, including colour, aroma, taste, and texture [12]. Differences in the method of mixing the cracker dough between the conventional method and the use of machines affect the homogeneity of the dough, texture, and quality of the resulting crackers [13].

Water content reduction can be achieved using several methods, such as sun drying and oven drying [14]. Shrimp crackers are deep-fried because this method allows for rapid, even expansion at high temperatures. This method produces a crispier texture than other techniques [3]. A certain level of dryness is required for raw crackers to achieve maximum steam pressure during frying, allowing the starch to expand. Drying crackers also aims to preserve and maintain quality [3].

Sensory attributes are a set of words used to describe the sensory characteristics of a food product, including color, aroma, taste, and texture [4]. The sensory characteristics of shrimp crackers are generally similar, including seafood aroma, golden-brown colour, white colour, shrimp flavour, savoury, sweet, and salty tastes, and a crispy, dense texture [15].

1.2.2. Sensory Evaluation

Sensory evaluation is a scientific method used to elicit, measure, analyze, and interpret the perceived responses to a product through the human senses [4]. Sensory testing plays an important role in product development by minimising the risks associated with decision-making. Panellists can identify sensory properties that will help describe the product [4]. Sensory evaluation has three methods: one is descriptive testing, which is used to determine product characteristics and their intensities. Descriptive testing is often used to explore the attributes of a food product related to its sensory characteristics [4].

In the food industry, descriptive sensory analysis is widely used to assess consumer acceptance, support quality control, and inform product development [8]. A new method for sensory evaluation, namely rapid sensory analysis [16], is being developed.

The Rate-All-That-Apply (RATA) method is a quantitative approach used in sensory profile testing to assess consumer perceptions of product characteristics. Through these characteristics, differences between samples can be objectively identified [9]. In the RATA method, panellists not only assess the attributes of food products but also rate the intensity of selected attributes [8]. Sensory testing using the RATA method is designed to have two stages (checklist and rating). Data analysis using the Rate-All-That-Apply method is carried out in stages, such as the Kruskal-Wallis test, PCA, and Preference Mapping [17].

RATA testing is generally accompanied by hedonic rating tests to determine consumer preference for the product being tested [9]. Hedonic rating tests are affective tests that aim to assess consumers' subjective responses to a product's acceptance or preference [10].

1.3. Research Objective

This study aims to identify the sensory attributes and consumer preferences for shrimp crackers from five producers in East Java using descriptive methods and the Rate-All-That-Apply (RATA) method.

2. MATERIALS AND METHODS

This research was conducted at the Food Processing Technology Laboratory, Food Entrepreneurship Laboratory, and Sensory Testing Laboratory of the Food Technology Study Program, Faculty of Engineering, UPN "Veteran" East Java, from August to October 2025. The sample products used in this study were sourced from five manufacturers in East Java with different formulations or compositions. Five samples were used, namely 193FN, 251KM, 487PM, 201BS, and 964DM.

The tools used included sample plates, questionnaires, labels, writing instruments, and XLSTAT software for statistical analysis. The sensory test involved 10 panellists in a Focus Group Discussion (FGD) to determine the attributes of the shrimp cracker samples, and 100 untrained panellists to assess consumer preferences.

The attributes evaluated included aroma, taste, color, texture, and mouthfeel. The Rate-All-That-Apply (RATA) method was applied, in which panelists identified relevant attributes and assessed their intensity on a five-point scale, followed by hedonic testing or liking assessment of the samples on a six-point scale. Samples were coded with a three-digit random number and two letters, and bottled mineral water was provided to cleanse the palate after tasting samples. Sensory data obtained from the RATA method can be analyzed using the Kruskal–Wallis test, Principal Component Analysis (PCA), and Preference Mapping.

Panellists' preference data for the presented samples were analysed using the Kruskal-Wallis test. This test was conducted to identify differences among samples based on the tested sensory attributes. If the p-value was ≤ 0.05, the Dunn test was performed

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to determine significant differences in each attribute between the samples. Principal Component Analysis (PCA) was performed to determine the characteristics of each sample. The results of this analysis were presented as a biplot that described the sensory profiles of the tested products and visualised the relationships among sensory attributes. A Preference Mapping analysis was conducted to map product quality characteristics based on consumer preferences.

3. RESULT AND DISCUSSION

3.1. Focus Group Discussion (FGD)

Sensory profiles of shrimp crackers from several producers in East Java were conducted using the Rate-All-That-Apply (RATA) method. The initial stage involved Focus Group Discussions (FGD) with 10 panellists selected based on specific qualifications, including understanding of the characteristics of shrimp crackers, no allergies to shrimp, good physical and mental health, and having consumed shrimp crackers in the past month. The FGD aimed to identify the relevant sensory attributes of the product, including colour, aroma, texture, taste, and mouthfeel. Based on the FGD process, 12 attributes were identified by the FGD panellists. The details of the sensory attributes determined during the FGD are presented in **Table 1**.

Table 1. Sensory Attribute from FGD Result

No	Attribute	Description
1	Fatty Aroma	Aroma associated with fats that are processed as a result of cooking with cooking oil
2	Seafood Aroma	Aroma associated with processed shrimp products
3	White Color	The sample appears white due to the tapioca flour used.
4	Golden Brown Color	The colour of the sample is due to the presence of astaxanthin compounds, the Maillard reaction, and the addition of food colouring.
5	Shrimp Flavor	The flavor contained in the product due to the addition of shrimp ingredients
6	Savory Flavor	The taste associated with the amino acid glutamate in shrimp
7	Sweet Flavor	The taste that can be stimulated by the amino acid glycine in shrimp
8	Salty Flavor	Flavors associated with seafood products
9	Crunchy Texture	The texture of the sample when consumed produces a loud or sharp sound.
10	Dense Texture	The sample has a dense texture when broken due to the addition of shrimp raw materials.
11	Gritty Mouthfeel	A gritty or coarse sensation in the mouth due to coarse samples resulting from poor mixing of the dough.
12	Throat Irritation Mouthfeel	Rough sensation when swallowing the product due to coarse samples resulting from incomplete gelatinization

3.2. Sensory Attribute Profiling of Shrimp Crackers

Attributes obtained from the FGD results were then used in the Rate-All-That-Apply (RATA) method on five samples of shrimp crackers from several producers in East Java. The data obtained from the RATA method were analysed in XLSTAT to determine whether there were significant differences between samples. The data analysis was carried out in several stages, including the Kruskal-Wallis test, Principal Component Analysis (PCA), and preference mapping. The analysis of this data aims to identify differences between samples and to describe the overall characteristics and preferences of each product.

The results of the data analysis will yield a p-value for each attribute. These values were used to determine the significance of differences among samples for the respective attributes. The sensory testing results indicated that the type of shrimp crackers significantly influenced sensory attributes (p-value < 0,05). The p-values for each shrimp cracker attribute are shown in **Table 2**. Based on the Kruskal-Wallis test, significant differences were found among the 12 sample attributes of shrimp crackers with different formulations. This is greatly influenced by the difference in the percentage of tapioca flour and shrimp used. In addition, panellists can perceive differences in the intensity of sensory attributes across all samples.

Table 2. p-values of Sensory Attributes in Shrimp Crackers

No	Sensory Attribute	p-value
1	Fatty Aroma	< 0.0001
2	Seafood Aroma	< 0.0001
3	White Color	< 0.0001
4	Golden Brown Color	< 0.0001
5	Shrimp Flavor	< 0.0001
6	Savory Flavor	< 0.0001
7	Sweet Flavor	0.00043
8	Salty Flavor	0.00023
9	Crunchy Texture	0.001
10	Dense Texture	< 0.0001
11	Gritty Mouthfeel	< 0.0001
12	Throat Irritation Mouthfeel	< 0.0001

3.2.1. Panelists' Responses to Different Attributes

The Kruskal-Wallis test is performed to determine the p-value of the attribute. If the attribute is significantly different, a Dunn's post hoc test is performed at the 5% significance level. The letter notation indicates a significant difference between the samples. Attribute-intensity data are shown in **Table 3**.

Table 3. Sensory Attribute Intensity of Shrimp Crackers

Sensory Atrribute	**Sample**				
	193FN	**251KM**	**487PM**	**964DM**	**201BS**
Fatty Aroma	2,16^{b}	1,54^{c}	2,87^{a}	1,73^{c}	2,71^{a}
Seafood Aroma	2,32^{b}	2,77^{b}	1,36^{c}	3,55^{a}	1,18^{c}
White Color	3,76^{a}	1,95^{c}	1,10^{d}	2,38^{b}	1,36^{d}
Golden Brown Color	1,05^{c}	2,30^{b}	3,03^{a}	1,88^{b}	2,98^{a}
Shrimp Flavor	2,44^{c}	3,07^{b}	1,58^{d}	3,30^{a}	1,56^{d}
Savory Flavor	3,38^{bc}	3,79^{ab}	3,20^{cd}	4,14^{a}	2,92^{d}
Sweet Flavor	0,97^{ab}	1,48^{a}	0,85^{b}	1,66^{a}	1,06^{ab}
Salty Flavor	1,63^{b}	2,35^{a}	2,04^{ab}	2,40^{a}	1,87^{ab}
Crunchy Texture	2,86^{abc}	2,55^{bc}	3,27^{a}	2,47^{c}	3,14^{ab}
Dense Texture	2,08^{ab}	2,34^{a}	1,73^{b}	2,43^{a}	1,72^{b}
Gritty Mouthfeel	1,40^{b}	1,15^{b}	2,13^{a}	1,05^{b}	2,08^{a}
Throat Irritation Mouthfeel	0,67^{b}	0,94^{b}	1,81^{a}	0,85^{b}	1,16^{ab}

Note: Mean values followed by different letters indicate significant differences ($p \leq 0.05$). Scale criteria: 1 (low), 2 (somewhat low), 3 (moderate), 4 (somewhat high), 5 (high).

In terms of fatty aroma, sample 487PM had the highest average value of 2.87. The fatty aroma in sample 487PM was not significantly different from that of sample 201BS, but was significantly different from the other three samples, namely 193FN, 964DM, and 251KM. Differences in fatty aroma can be influenced by the oil-absorption capacity of shrimp crackers during frying. The oil absorption capacity of shrimp crackers is influenced by pore formation. Shrimp crackers can expand and form pores that can bind oil during frying due to the presence of amylopectin, which can form a pore structure in fried crackers [18]. In samples 487PM and 201BS, the tapioca flour content was 90% and 88.5%, respectively.

The seafood aroma in the five samples differed significantly. This was due to differences in the shrimp composition in each sample. Sample 964DM had the highest intensity value of 3.55 because it had the highest percentage of shrimp compared to other samples. Sample 964 had a shrimp percentage of 25%. The more TMA compounds, the stronger the seafood aroma of the product, so the percentage of shrimp greatly affects the seafood aroma attribute [19].

The white color of the five samples differed significantly. The white colour of the samples was influenced by two factors: the percentages of tapioca flour and shrimp used, and the use of colouring. This attribute arose from the lack of astaxanthin and protein compounds, which were influenced by the percentage of shrimp, thereby reducing browning [20]. 193FN had the highest value of 3.76. This is because the percentage of shrimp used in sample 193FN is the lowest among samples that do not use food colouring, namely 946DM and 251KM, while samples 201BS and 487PM have food colouring added to enhance the colour of the shrimp crackers.

The golden brown color intensity values in samples 487PM and 201BS were the highest, at 3.03 and 2.98, respectively. However, the percentages of shrimp in these two samples were the lowest among the samples, at 10% and 11.5%. This may be because food coloring was added to samples 487PM and 201BS. Processing at too high a temperature or for too long can cause astaxanthin to undergo oxidative degradation, resulting in a darker or duller color [21].

The shrimp flavor attributes of the five samples differed significantly. This was due to the composition of the shrimp raw materials used in the shrimp chips. Shrimp contains the amino acids glutamate and inosine monophosphate, which are sources of nucleotides that enhance umami flavor [22]. Sample 964DM had the highest shrimp flavour intensity (3.30) and was significantly different from the other samples. This may be due to the use of the highest ratio of shrimp as an ingredient in its composition, namely 25%.

The salty flavor attribute of the shrimp chips samples tested differed significantly. This was due to the amount of shrimp and salt used by each manufacturer in their shrimp chips, as well as the fact that shrimp contains sodium compounds that can trigger a salty taste. Sample 946DM had the highest intensity value of 2.40. Sample 946DM had a higher percentage of shrimp than the other samples, namely 25%. The natural mineral content, such as sodium, increased during cooking, then interacted with umami compounds, producing a savoury, distinctive shrimp flavour [23].

The sweetness attribute of the five different cracker samples was significantly different. This could be due to the use of sugar as an additive and the presence of the amino acid glycine in shrimp. The sweetness attribute in shrimp is mainly caused by the amino acid glycine, which is naturally present in shrimp meat, and the presence of glycogen, which is hydrolyzed into simple sugars during cooking [24]. Sample 964DM had the highest intensity value among the five samples. This was due to the higher percentage of shrimp used compared to the other samples, namely 25%.

Savoury flavour attributes of the five shrimp cracker samples differed significantly. This was due to the use of different types of shrimp in the composition of the shrimp crackers. The savory flavor of shrimp is mainly caused by the amino acid glutamate content, which contributes to the umami

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or savory taste [25]. Sample 946DM had the highest average value of 4.14 and was not significantly different from sample 251KM, but it was significantly different from the other three samples.

The five shrimp cracker samples tested showed significant differences in crispiness. This may be due to differences in the percentage of tapioca flour used. Tapioca flour serves as the main structural component of crackers due to its high starch content, such as amylose and amylopectin [5]. The highest crispiness intensity value was found in sample 487PM. Sample 487PM had a tapioca flour content of 90% and a shrimp content of 10%.

The solid texture attribute of the five samples differed significantly. This was influenced by the percentage of shrimp used. The protein in shrimp can form a denser matrix during frying, thereby making the crackers more solid [5]. The highest intensity value for the solid texture attribute was 2.43 in sample 964DM. Sample 964DM had the highest percentage of shrimp (25%) and the lowest percentage of tapioca flour (75%).

The gritty mouthfeel of the five shrimp cracker samples differed significantly. The gritty texture of shrimp crackers is due to tapioca starch granules that are not fully gelatinised or to an uneven distribution of ingredients in the dough. This can occur due to imperfect dough mixing processes resulting from the methods used. Samples 201BS and 487PM had the highest values at 2.13 and 2.08, respectively. Differences in dough mixing methods between conventional and machine methods affect dough homogeneity, texture, and the quality of the resulting crackers [12].

The mouthfeel and throat-irritation attributes of shrimp cracker samples differed significantly. This could be due to incomplete gelatinisation, resulting in coarse cracker particles. In addition, the composition of shrimp and tapioca flour could be another factor contributing to the voids in the shrimp crackers. Mouthfeel and throat irritation can be influenced by the smoothness of the particles, which is affected by incomplete mixing [26]. In sample 487PM, the dough preparation process still used conventional methods. Differences in dough mixing methods between conventional and machine methods affect dough homogeneity, texture, and the quality of the resulting crackers.

3.3. *Principal Component Analisys (PCA)*

. Principal Component Analysis (PCA) can be used to describe the relationships among attributes and to group them into characteristics of a sample. The relationship between attributes can be observed through several aspects, such as the positions of attributes and sample points in the quadrant, the proximity of the vector angles between attributes and samples, and the distances of attribute or sample points from the centre axis of the graph [27]. The results of PCA analysis are combined into loading and score plots to form a biplot [28]. The PCA biplot graph can illustrate the relationship between each attribute and the attributes as a whole [29].

PCA is used to identify and visualise differences in perception and interactions among sensory attributes in greater depth, using a biplot that displays the distribution and correlations of attributes as points on a graph. PCA will produce loadings (or weights) for the criteria that make up the principal components. Principal Component Analysis (PCA) using XLSTAT software produces eigenvalue data, a scree plot, a score plot, a loading plot, and a biplot [27].

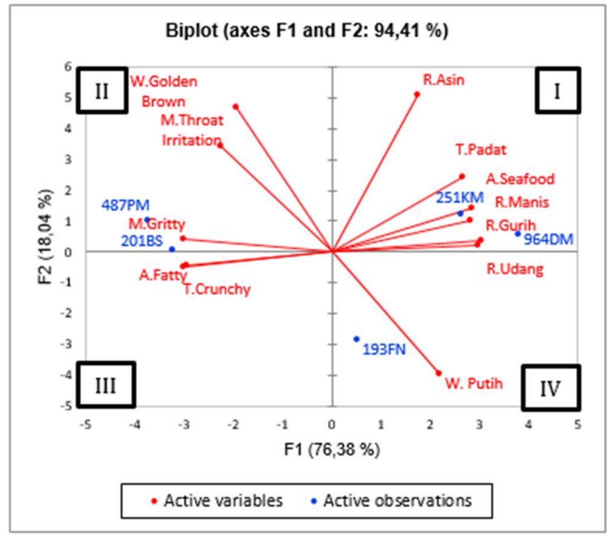

Figure 1. PCA Biplot Graph of Shrimp Crackers

PCA in this study has two main components that can be used to interpret the data because they explain 88.91% of the total diversity in the attributes (F1 61.84%; F2 27.07%). Based on Figure 1, the 964DM and 251KM samples are in the same quadrant, namely the first quadrant. Both samples exhibit dominant sensory attributes, including seafood aroma, dense texture, shrimp flavour, savoury flavour, sweet flavour, and salty flavour.

In quadrant II, samples 487PM and 201BS met attribute criteria such as crunchy texture, golden brown colour, and a throat-irritating mouthfeel. In quadrant IV, sample 193FN has a dominant attribute of white colour. Sample 193FN appears to have a whiter colour than the other samples, even though it underwent the same frying process. The formulation differences in shrimp cracker samples are the main factor behind the differences in the sensory profile attributes of shrimp crackers, with certain samples showing dominant attributes. Proportion of flour to the main raw material used in making crackers can affect the crispness and density of the resulting cracker texture [18]. The results of PCA and AHC can be used to determine consumer preferences.

3.4. *Panelists' Preference Mapping for Shrimp Crackers*

Preference mapping techniques are methods for determining the sensory attributes preferred or desired by consumers. This method can be used by the R&D (Research and Development) division in a company's marketing department. Preference mapping analysis requires two types of data: descriptive data on a product's sensory attributes and panellists' preferences.

Consumer preference data previously analysed using AHC, which produced several clusters, was used to conduct the Preference Mapping analysis. These clusters represent a group of panelists with the same level of preference for a particular sample.

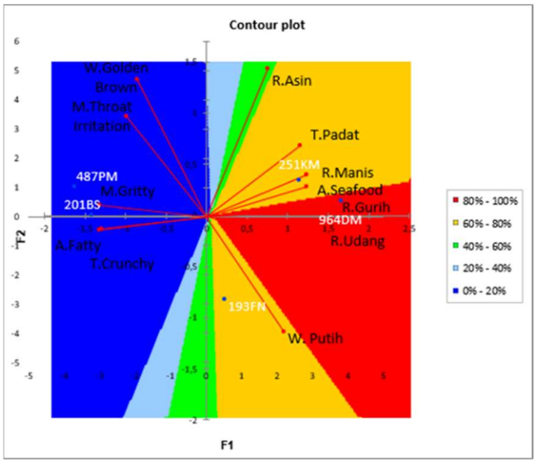

Figure 2. Preference Mapping of Samples and Sensory Attributes of Shrimp Crackers

Red indicates the number of panellists with above-average preferences (80%-100%), decreasing to yellow (60%-80%), green (40%-60 %), light blue (20%-40%), and dark blue (0%-20%). Based on Figure 3, which shows the PCA overlay and contour plot results, sample 964DM is shown in red, indicating that 80-100% of panellists liked it. Meanwhile, samples 251KM and 193FN are in yellow, indicating that 60-80% of panellists liked them. Figure 3 shows the results of the PCA overlay and contour plot for samples 201BS and 487PM, which are in dark blue, meaning that 0-20% of panelists liked these samples.

The attributes are in red, such as shrimp flavor and savory taste. This means these attributes have a panellist-preference rating of 80-100%, indicating that panellists want them to be dominant in shrimp crackers. In the yellow area, with a panelist preference level of 60-80%, there are four attributes: seafood aroma, sweet taste, firm texture, and white color. Next, in the green area, there is the salty taste attribute. This shows that 40-20% of panelists like this texture. Finally, in the dark blue area with a panelist preference level of 0–20%, panelists dislike these attributes in shrimp crackers. In the dark blue area, there are several attributes, such as mouthfeel throat irritation, golden brown color, mouthfeel gritty, and fatty aroma.

4. CONCLUSION

The results of the sensory attribute profiling identified 12 attributes in five shrimp cracker samples from five manufacturers. The attributes that emerged included fatty aroma, seafood aroma, white colour, golden brown colour, shrimp flavour, sweet taste, savoury taste, salty taste, crunchy texture, dense texture, gritty mouthfeel, and throat-irritating mouthfeel. Based on the results of sensory profiling of the five shrimp cracker samples using the Rate-All-That-Apply (RATA) method, differences in the intensity of sensory attributes were found in the five samples due to differences in the composition of the ingredients used. The Preference Mapping results showed that the sensory attributes most preferred by the panellists were in the red zone, with preference levels of 80%-100%, namely sample 964DM and the attributes of shrimp flavour and savoury flavour.

REFERENCE

[1] Koswara, S. (2009). Pengolahan Aneka Kerupuk. *Ebookpangan.com*, 31.

[2] Badan Standardisasi Nasional. (2018). *Tentang Kerupuk Udang* (SNI 2714.1-2009). Jakarta.

[3] Jamaluddin, J. (2018). Pengolahan Aneka Kerupuk Dan Keripik Bahan Pangan. Makassar: Badan Penerbit Universitas Negeri Makassar.

[4] Tarwendah, I. P. (2017). Jurnal Review: Studi Komparasi Atribut Sensoris Dan Kesadaran Merek Produk Pangan. *Jurnal Pangan dan Agroindustri*, *5*(2).

[5] Multazam, F., Kurniasih, R. A., & Anggo, A. D. (2023). Pengaruh Rasio Tepung Udang Rebon (Acetes sp.) dan Tepung Tapioka Terhadap Karakteristik Sensori, Fisik dan Kimia Kerupuk. *Jurnal Ilmu dan Teknologi Perikanan*, *5*(1), 10-18.

[6] Destrasia, R. F. (2012). Studi Komparasi Pembuatan Kerupuk Kepala Udang Dengan Composite Flour (Pati Ganyong Dan Tepung Tapioka). Food Science and Culinary Education Journal, 1(1).

[7] Giacalone, D. & Hedelund, P.I. (2016). Rate-All-That-Apply (RATA) with Semi-Trained Assessors: An Investigation of The Method Reproducibility at Assessor-, Attribute- And Panel-Level. *Food Quality and Preference*, 51: 65–71.

[8] Fibrianto, K. & Dwihindarti, M. (2016). Profiling Atribut Jamu Kunyit Asam dan Jamu Sinom dengan Metode Rata (Rate-All-That-Apply) pada Beberapa Kota di Jawa Timur (Profiling. Jurnal Reka Pangan, 10(1): 15–22.

[9] Ares, G., Bruzzone, F., Vidal, L., Cadena, R.S., Giménez, A., Pineau, B., Hunter, D.C., Paisley, A.G. & Jaeger, S.R. (2014). Evaluation of a rating-based variant of check-all-that-apply questions: Rate-all-that-apply (RATA). Food Quality and Preference, 36: 87–95.

[10] Adawiyah, A., Apriningrum, N., & Elvandari, M. (2024). Analisis Uji Organoleptik dalam Pembuatan Yoghurt dari Tiga Jenis Susu Kurma yang Berbeda. *Innovative: Journal of Social Science Research*, *4*(5), 265-277.

[11] Rahman, S., & Dwiani, A. (2021). Pengaruh Substitusi Tepung Tapioka dan Tepung Terigu serta Lama Waktu Pengukusan Terhadap Mutu Kerupuk Sape. Jurnal Triton, 12(1), 45-57.

[12] Pakpahan, N., & Nelinda, N. (2019). Studi Karakteristik Kerupuk: Pengaruh Komposisi dan Proses Pengolahan. Jurnal Teknologi Pengolahan Pertanian, 1(1), 28-38.

[13] Kurniawan, M. I., & Satoto, H. F. (2025). Rancang Bangun Alat Pengkalis Adonan Kerupuk Krecek untuk Meningkatkan Kualitas Adonan dan Produktivitas pada UMKM Kerupuk Krecek di Nganjuk. JURNAL SURYA TEKNIKA, 12(1), 295-302.

[14] Nugroho, T. S., & Sukmawati, U. (2020). Pengaruh Metode Pengeringan Kerupuk Udang Windu (Paneaus Monodon) Terhadap Daya Kembang Dan Nilai Organoleptik. Manfish Journal, 1(2), 107-114.

[15] Nurminah, M., & Novianti, N. (2021). Sensory Profile of Sanjai Balado Chips in West Sumatra. In E3S Web of Conferences (Vol. 332, p. 01013). EDP Sciences.

[16] Saputra, R. A., Pratiwi, I. D. P. K., & Yusasrini, N. L. A. (2023). Evaluasi Profil Sensori Produk Kopi Instan Starbucks VIA Ready Brew Unflavored Menggunakan Metode CATA (Check-All-That-Apply).

[17] Meyners, M., Jaeger, S.R. & Ares, G. (2016). On the analysis of Rate-All-That-Apply (RATA) data. Food Quality and Preference, 49: 1–10.

[18] Agusta, G., Rahmiati, R., & Sigit, B. (2025). Rasio Tapioka: Tepung Tulang Ikan Mujahir (Oreochromis mossambicus) Terhadap Sifat Fisik, Kimia dan Organoleptik Kerupuk yang Dihasilkan. Jurnal Teknologi Pangan dan Hasil Pertanian, 20(2), 65-76.

[19] Li, X., Wang, C., Yanagita, T., Xue, C., Zhang, T., & Wang, Y. (2024). Trimethylamine N-oxide in aquatic foods. Journal of agricultural and food chemistry, 72(26), 14498-14520.

[20] Barlin, I. M., Alsuhendra, A., & Ridawati, R. (2025). Pengaruh Substitusi Tepung Tapioka Pada Pembuatan Tepung Panir Terhadap Kualitas Fisik dan Daya Terima Fish Finger. *Jurnal Ilmiah Wahana Pendidikan*, *11*(1. C), 65-73.

[21] Yang, S., Zhou, Q., Yang, L., Xue, Y., Xu, J., & Xue, C. (2015). Effect of Thermal Processing on Astaxanthin and Astaxanthin Esters in Pacific White Shrimp Litopenaeus Vannamei. Journal of oleo science, 64(3), 243-253.

 https://doi.org/10.29165/ajarcde.v10i1.907

[22] Umah, L., Agustini, T. W., & Fahmi, A. S. (2021). Karakteristik Perisa Bubuk Ekstrak Kepala Udang Vanamei (Litopenaeus Vannamei) dengan Penambahan Konsentrat Tomat (Lycopersicum Esculentum) menggunakan Metode Foam Mat Drying. Jurnal Ilmu dan Teknologi Perikanan, 3(1), 50-58.

[23] Seulalae, A. V., Prangdimurti, E., Adawiyah, D. R., & Nurjanah, N. (2023). Evaluasi Tingkat Keasinan Relatif dan Profil Sensori Garam Rumput Laut Menggunakan Metode Magnitude Estimation dan Rate-All-That-Apply (RATA). Jurnal Pengolahan Hasil Perikanan Indonesia, 26(1), 54-66.

[24] Karomah, S., Haryati, S., & Sudjatinah, S. (2021). Pengaruh Perbedaan Konsentrasi Ekstrak Karapas Udang Terhadap Sifat Fisikokimia Kaldu Bubuk yang Dihasilkan. Jurnal Teknologi Pangan dan Hasil Pertanian, 16(1), 10-17.

[25] Zhang, C., Shi, R., Mi, S., Chitrakar, B., Liu, W., Xu, Z., ... & Wang, X. (2024). Effect of Different Thermal Processing Methods on Flavor Characteristics of Penaeus Vannamei. LWT, 191, 115652.

[26] Linardi, G. F., Kuswardani, I., & Setijawati, E. (2013). Karakteristik Fisikokimia dan Organoleptik Kerupuk Pada Berbagai Proporsi Tapioka dan Tepung Kacang Hijau. Jurnal Teknologi Pangan dan Gizi (Journal of Food Technology and Nutrition), 12(2), 101-106

[27] Suyanto, A., Hersoelistyorini, W., Arinachaque, F., Santoso, W. I., & Khamdi, A. (2023). Analisis Komponen Utama dalam Pemetaan Karakteristik Sensori Mi Basah Tepung Beras Menir Termodifikasi dengan Penambahan Xanthan Gum. Edible: Jurnal Penelitian Ilmu-ilmu Teknologi Pangan, 12(1), 14-22.

[28] Gunawan, M. I. F., Riandani, A. P., Saleh, E. R. M., Rodianawati, I., Budaraga, I. K., Surani, S., dan Fayyadh, Z. N. (2024). Teknik Evaluasi Sensori Produk Pangan (I).

[29] Winarti, S., & Adawiyah, I. (2024). Pengaruh Penambahan Prebiotik Inulin Terhadap Profil Sensoris Kaldu Bubuk Rasa Sapi “HALAWA”. Jurnal Teknologi Pangan, 18(2).