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REGULAR ARTICLE

SENSORY EVALUATION TEST OF READY TO DRINK COFFEE PRODUCT USING CATA (*Check All That Apply*) PROFILING

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ABSTRACT
Sensory evaluation describes the quality of food, which is closely linked to the choice of raw materials, ingredients, food additives, and the production process. The demand for various types of coffee drinks and preparation methods continues to grow each year. "Ready to Drink" (RTD) beverages refer to drinks that come in packaging and can be consumed without any further processing. The CATA (Check All That Apply) method is a structured questionnaire in which respondents select terms from a list that are relevant or have characteristics related to the sample being evaluated. The CATA method's output can be visualized using a biplot graph generated through Principal Component Analysis, illustrating the relationship between the tested product and its variables to determine differences in flavor characteristics among three commercial RTD coffees and the ideal coffee preferred by consumers. The results show that Product A is the most favored among the three, falling into the 'Like' category, while Products B and C are in the 'Somewhat Dislike' category. Product A is found to have attributes that are closer to the ideal RTD coffee as perceived by the panelists, particularly in terms of flavor characteristics.

Keywords: CATA (Check All That Apply), coffee, flavor, RTD (Ready to Drink), sensory analysis

INTRODUCTION
Sensory evaluation of food products can be carried out to determine the preferences and perceptions of consumer panelists regarding the food produced. Sensory evaluation values describe food quality which is closely related to the selection of raw materials, ingredients, food additives used, and the production process. It is thought that the application of sensory evaluation can be used to determine the position of a food product on the market and its proximity to the ideal product that consumers expect.

Coffee is an agribusiness product that has a very large market. The demand for coffee drinks of various types and preparation methods continues to increase every year. The Central Statistics Agency (BPS) noted that Indonesia's coffee production has tended to increase in the last five years. Indonesia produced 663.8 thousand tons of coffee in 2016, then increased to 716.1 thousand tons of coffee in 2017, and 756.1 thousand tons in 2018. The decline in coffee production occurred in 2019, namely 752.51 thousand tons or a decrease of 0.47% compared to 2018. In 2020, coffee production increased again by 1.31% to 762.38 thousand tons. People's plantations dominated total coffee production in 2020, amounting to 757.3 thousand tons. This figure represents 99.3% of the total coffee production in Indonesia based on type of business. Coffee production from large state-owned plantations only reached 3.7 thousand tons, while large private plantations reached 1.4 thousand tons **(BPS, 2020).**

Based on the General Standard For Food Additives (GSFA) Codex, Ready To Drink (RTD) coffee is included in the beverage category other than dairy products with food category number 14.1.4 **(GSFA, 2021).** This standard was adopted through Perka BPOM No. 34 of 2019, coffee is included in food category 14.1.5, namely Non-Carbonated Flavored Water-Based Beverages, Including Punches and Ades. It explains that coffee drinks are drinks made from ground coffee, instant coffee, and/or coffee extract, and drinking water, with or without adding sugar and other food ingredients. The basic characteristics regulated in ready-to-drink coffee products are coffee content of not less than 4% (calculated on a dry weight basis). **(BPOM, 2019)**. **SNI (1996)** explains that packaged coffee drinks are drinks made from a mixture of coffee extracts and/or without the addition of other food ingredients and permitted food additives, packaged hermetically. “Ready to Drink”

drink is a term used to describe types of drinks that are sold in packaging and can be consumed immediately without having to be processed further. This term is also used to indicate differences with the types of drinks that are sold in special packaging but require further processing before being consumed in the form of powder, syrup, dip, etc (**Prameswari, 2009)**.

The CATA (Check All That Apply) method is a structured question model where respondents are given a list of terms and asked to choose from the list the terms that are appropriate / have characteristics related to the sample being tested **(Jaeger *et al.*, 2015)**. One of the main advantages of CATA questions is that consumers find product evaluations easy, quick, and non-tedious to complete **(Ares & Jaeger, 2013).** Therefore, the CATA method is widely used to evaluate the sensory profile of a product. **Adawiyah *et al.,* (2019)** used the CATA method to analyze the sensory profile of green tea products, **Adawiyah & Yasa (2017)** researched the sensory profile of commercial sweeteners using CATA, and **Hunaefi *et al.,* (2019)** specifically examined the profile of commercial coffee products combining CATA and QDA (Quantitative Descriptive Analysis) methods. The output of the CATA method can be presented with a biplot graph from Principle Component Analysis which shows the position between the observed product and its variables. This research explains the difference in flavor characteristics of 3 commercialized RTD coffees and the ideal coffee characteristics that consumers preferred.

MATERIAL AND METHODS

Materials

The main materials used are 3 RTD (Ready to Drink) coffee products sampled as A, B, and C which were purchased at the same time and have adjacent production codes, a set of writing instruments, and sensory test equipment. Table 1 shows the difference of composition between products stated on its labels.

Table 1 The composition of RTD coffee products

Product	Composition
A	Main ingredients: Water, sugar, coffee extract (4%), skim milk powder, anhydrous milk fat. Food Additives: stabilizer (E407), class IV caramel coloring (E150d), emulsifier (E473), milk coffee synthetic flavor.
B	Main ingredients: Water, sugar, coffee extract (4%), powdered skim milk, vegetable creamer, Food Additives: vegetable stabilizers, synthetic coffee flavors, vegetable emulsifiers
C	Main ingredients: Water, sugar, milk solids, instant ground coffee (1.1%), vegetable creamer (contains milk protein). Food Additives: stabilizer, acidity regulator, synthetic flavor, soy lecithin emulsifier, natural sweetener steviol glycoside.

Hedonic Rating Sensory Analysis (Meilgaard *et al.,* 2015)

Sensory analysis of preferences for this coffee drink is with a hedonic rating. The hedonic test is a test in organoleptic sensory analysis which is used to determine the magnitude of the difference in quality between several similar products by providing an assessment or score on certain properties of a product and to determine the level of liking of a product. This level of liking is called a hedonic scale, such as very like, like, somewhat like, somewhat dislike, dislike, really dislike and so on. In this research, panelists were asked to rate coffee beverage products on 7 hedonic scales. The panelists' assessments were converted into a numerical scale of 1-7, where 1 = dislike very much, 2 = dislike, 3 = dislike somewhat, 4 = neutral, 5 = somewhat like, 6 = like, 7 = very much. The ANOVA test continued by Tukey's advanced test with a confidence level of 95% was used to analyze data from the organoleptic hedonic rating test results from the three ready-to-drink coffee samples and statistical analysis was carried out using the Minitab 16 program.

CATA Sensory Profiling (Hunaefi *et al.,* 2019)

The sensory attributes of coffee are limited to five parts, namely aroma, flavor, taste, mouthfeel/body and aftertaste, because the number of sensory attributes of coffee is very large. In the aroma sensory attribute there are thirteen parameters, seven parameters for flavor, six parameters for taste, five parameters for mouthfeel/body and five parameters for aftertaste. This research assuming that the process of making the three commercial RTD coffee products was carried out using the same process.

In the CATA (Check-All-That-Apply) method, there is an ideal perception profiling according to consumers. The panelists used were consumer panelists with the same sample presentation. Before tasting

the sample, panelists were asked to fill in the ideal coffee criteria column first. Then the panelist tasted the sample and assessed what sensory attributes were felt in the sample by giving a check mark to the sensory attributes which could describe the sample **(Dooley *et al.*, 2010).** Profiling test data using the CATA method was processed using the Minitab 16 program using Principal Component Analysis.

Principal Component Analysis (PCA) is a multivariate data analysis method that investigates multidimensional datasets with quantitative variables. PCA is used to reduce the dimensionality of a dataset, while preserving as much statistical information as possible **(Joliffe & Cadima, 2016)**. One of the outputs from PCA is a Biplot graph. This graph simultaneously presenting n objects of observation and p variables in a two-dimensional plane space, so that the characteristics of the variables and objects of observation as well as the relative position between the objects of observation and the variables can be analyzed **(Joliffe 2002**).

RESULTS

Table 2 shows the level of panelists' preference for RTD coffee based on the overall components contained in the coffee. The results of the hedonic rating analysis show that Product C and Product B have an average liking value of 3,182 and 3,273, respectively, which is in the 'Somewhat Dislike' category. Product A has an average value that is significantly different from the other two coffees, proven using the Tukey test with a 5% significance level. Product A's favorability value, namely 4,818, is close to the 'Like' category. This proves that Product A is more preferred than Product C and Product B, both of which do not have significantly different levels of liking.

Table 2 Results of hedonic rating analysis

Product	Mean hedonic rate
A	4.818[a]
B	3.182[b]
C	3.273[b]

Legend: Numbers followed by the same letter in the same column are not significantly different at Tukey test 5% level significance

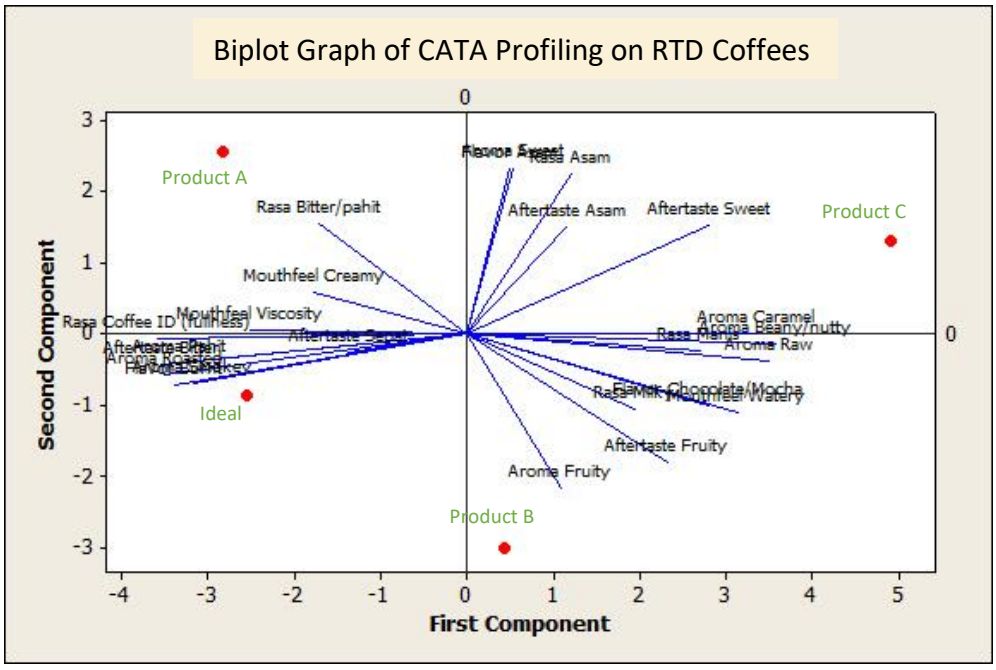

Figure 1 Biplot diagram of the relationship between coffee flavor, RTD coffee products, and ideal RTD coffee according to panelists' perceptions

Matjik & Sumertajaya (2011) explained that there are 4 important points that can be obtained from the biplot graph as follows:

1. Proximity/similarity between observed objects determined where two objects that have the same characteristics will be described as two adjacent points
2. Diversity of variables determined where variables that have small diversity are described as short vectors while variables that have large diversity are described as long vectors.
3. Correlation between variables determined where two variables that have a positive correlation are depicted as two lines in the same direction or forming a narrow angle. On the other hand, two variables

that have a negative correlation are depicted in opposite directions or form a wide (obtuse) angle. If two variables are not correlated, they are depicted in the form of two lines with angles approaching 90 degrees.

4. Relative value of an object's variable determined where an object that is located in the same direction as the variable vector direction can be stated that the object has a value above the average. On the other hand, if the object is located in the opposite direction from the variable vector, then the object has a value below the average.

Product A is close to the flavors of bitter taste, creamy mouthfeel, and viscosity mouthfeel. Product C is close to the flavors of sweet aftertaste, sour aftertaste, caramel aroma, beany/nutty aroma, and sweet taste (sucrose). Product B is close to the flavors of fruity aroma and aftertaste, raw aroma, milky taste, watery mouthfeel, and chocolate/mocha flavor. Other flavor characteristics are in different quadrants from the three, and are closer to the ideal RTD coffee type perceived by the panelists. According to the test panelists, the three RTD coffee samples that are in commercial circulation also do not meet the ideal RTD coffee because the three RTD coffees are in different quadrant positions compared to the ideal RTD coffee.

Product C has the opposite quadrant position from ideal RTD coffee, so it can be concluded that Product C has characteristic attributes that are very different from ideal RTD coffee according to the panelists. This is because only Product C uses instant ground coffee (1.1%) compared to Products A and B which use 4% coffee extract. The positions of Product A and Product B are in a quadrant that is not too far from the ideal RTD coffee, but the two also have very different flavor characteristics. Product A is considered closer to the ideal RTD coffee because it has a smaller angle than Product B. Product C has ingredients with the smallest amount of coffee compared to other coffee. The use of acidity regulators in Product C is thought to be the cause of the dominant acid characteristics detected in this type of RTD coffee.

DISCUSSION

The dominant sweet taste and aftertaste in Product C is thought to be caused by the addition of the natural sweetener steviol glycoside. Steviol glycoside (E960) has been designated as a sweetener, but its effect has not been studied when used as an ingredient. The natural sweetener steviol glycoside comes from the *Stevia rebaudiana* which is capable of producing a sweet taste 200-300 times higher than sucrose sugar **(Sinta *et al.*, 2015)**. There are various types of steviol glycosides based on the position of the sugar molecule that binds to the aglycone group. Rebaucide-A and stevioside are the main components most commonly found in stevia leaves. The sweetness level of stevioside and rebaucide A increases as concentration increases, but then decreases after reaching the maximum amount (1-2 mM RebA in 5 mL of water), because stevioside and rebaucide A are able to bind and inactivate the allosteric group on the sweet receptor. RebA also has good synergy with sucrose sugar, because the intensity and sweet aftertaste can be increased with a 50:50 proportion **(Hergesell *et al.*, 2013)**.

Based on **Putri *et al.,* (2016)**, the vegetable creamer ingredients used in Product B and C coffee products are creamers made from constituent ingredients in the form of vegetable oil, protein, stabilizers and emulsifiers which are combined into one solution and can then be dried to produce a powdered vegetable creamer product. This vegetable creamer is commonly used in coffee, tea, chocolate drinks and other food products. This ingredient is useful for enhancing desired color changes and forming texture on the product. Adding creamer in the right proportion will produce a good texture and be liked by consumers.

Product A uses a stabilizer in the form of carrageenan polysaccharide (E407). Carrageenan is a polysaccharide extracted from the red seaweed Rhodophyceae, belonging to the sulfated galactan family, which is hydrophilic and has a linear shape. Carrageenan is widely used in the food industry, because it has physical and functional properties such as gelling, thickening and stabilizing. The hydrophilic part will bind water to the food so that the product thickens **(Bono *et al.*, 2014)**. Product A also uses the emulsifier sucrose esters fatty acid (E473) in its formulation. Sucrose ester with a hydrophilic-lipophilic balance (HLB) ranging from 8-18 which has the ability to emulsify the oil in water phase has the characteristics of providing better stability and providing a creamy mouthfeel sensation **(Whitehurst, 2007)**. These two compounds play a role in showing the viscosity and creamy mouthfeel characteristics of Product A.

Another difference in ingredients found in the three RTD coffees is the use of anhydrous milk fat and milk creamer. Even though it has a function that is not much different, namely influencing the texture of the product, it has been proven from this research that the use of anhydrous milk fat in Product A shows better results than the milk creamer used in Products B and C. Anhydrous milk fat (AMF) is a mixture of triacylglycerols containing 60 or more different fatty acids which have unique thermal and chemical properties. The addition of anhydrous milk fat to food products will affect product phase changes, such as changing to become more solid or liquid, which will affect the texture of the product **(Szafranska et al., 2021)**

The dominant characteristic that differentiates the three types of RTD probably comes from the type of food additives used. For example, Product A clearly states carrageenan as a stabilizer, but other coffees do not mention the type of stabilizer used, so it is suspected that other stabilizers do not have better thickening abilities than carrageenan, because the mouthfeel viscosity is dominant in Product A. The flavors used in Product A coffee B is thought to have a dominant fruity aroma and aftertaste, but it is not explained in detail on the label regarding the flavors used. Product A is also become the product who has higher value in hedonic

sensory score and closer to Ideal coffee compared to product B position. Product A also closer with the cluster of ideal product flavor characteristics compared to other products. Ingredients of Product A believed to be the closest to the ideal RTD coffee flavor compared to Product B and C, but modification in formulation is still needed.

CONCLUSION

By using the Biplot graph of Principle Component Analysis (PCA), Check All That Apply (CATA) method can describes the flavor characteristics of RTD products through the closeness of angles and positions of the variable and observation from the graph. The results indicate that Product A is the most preferred among the three, falling into the 'Like' category, while Products B and C are in the 'Somewhat Dislike' category. Product A is found to have characteristics that are closer to the ideal RTD coffee as perceived by the panelists, especially in terms of flavor attributes.

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