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Development and quality evaluation of jelly coated cassava tapai as a cocktail product

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Abstract

The design process of cassava tapai products into cocktail products by heating with the high-temperature short-time method can extend the tapai's shelf life. But this treatment cannot improve the brittle texture to a consistent solid to meet a cocktail's requirements. This study aimed to design cassava tapai processed products with textures that meet the criteria to be made into cocktail cassava tapai. The coating of jelly on the cassava tapai is an alternative to design cocktail cassava tapai. Three kinds of jelly sources (grass jelly, carrageenan and gelatin) were experimented on, each in a single factor experiment arranged in separate completely randomised designs. Each treatment in each experiment was carried out with three replications. The grass jelly coating was processed from 200-275 g of green grass jelly leaves per 100 mL of water, while carrageenan- and gelatin-coating provided by carrageenan and gelatin concentration of 0-9 and 0-2.5%, respectively. Then selection of cassava tapai coatings then based on hedonic sensory responses to colour, texture, and taste. The data obtained were analysed using the Friedman test followed by the Dunn test. The treatment of the three jelly coatings affected significantly on the sensory properties ($p<0.05$) of cassava cocktail tapai for the total acceptance attribute. The grass jelly coated (200 g green grass jelly leaves per 100 mL), carrageenan coated (2.5%) and gelatin coated (7%) cassava tapai gave the best sensory acceptance of cocktail cassava tapai, each with a score (median) of 5, 6 and 6 (on a scale from 1-7 to strongly dislike to very much like), respectively. Based on the mean rank data, the 7% gelatin coated cassava tapai showed the highest hedonic response of total acceptance ($p<0.05$) among the three types of jelly coatings with a mean rank value of 3.14. In comparison, the other two jelly coating ingredients showed a mean rank of 2.98 and 2.93 for 2.5% carrageenan coated cassava tapai and 200 g/100 mL grass jelly coated cassava tapai, respectively. These results concluded that 7% gelatin coated cassava tapai is recommended as the cocktail cassava tapai.

1. Introduction

Tapai is one of Indonesia's indigenous fermented food products. The types of tapai common in Indonesia are cassava tapai and sticky tapai, but the ones mainly produced are cassava tapai (Barus and Wijaya, 2011). Cassava tapai is processed from the preferred yellow-fleshed cassava than white-fleshed cassava because yellow cassava has a smoother texture without coarse fibres (Candra *et al*., 2014).

The increase in the serving value of the cassava tapai has been carried out by Candra *et al*. (2014) by forming the cassava tapai into a ready-to-serve 2×2cm box. The increase in the economic value of cassava tapai constrained by a relatively short shelf life is overcome by heat treatment to stop the fermentation process, which aims to extend its shelf life. Heating the cassava tapai with the high-temperature short-time (HTST) method, at a temperature of 98±2°C for 12 mins, managed to maintain the texture of the cassava tapai for up to 3 weeks in cold storage (Candra *et al*., 2015).

Cassava tapai can be developed as a cocktail material such as fruit usually produced as canned fruit on an industrial scale. On the other hand, canned cassava tapai products are constrained by their brittle texture. This texture improvement can be overcome by using a coating material. Jelly is the right candidate for coating

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this canned cassava tapai product. Jelly ingredients that are widely used in food products are grass jelly, carrageenan and gelatin.

Grass jelly is a gelatin-like product obtained from grass jelly leaf extract (*Premna oblongifolia* Merr.), whose main component is pectin (Dewangga, 2013). Carrageenan is a polysaccharide extracted from seaweed from the Rhodophyceae family (Dewangga, 2013). Carrageenan is widely used in the food industry as a bulking agent, emulsifier, gelling agent, humectant, stabiliser, or thickener (Prajapati *et al*., 2014). On the other hand, gelatin is a transparent protein. Therefore, it is often used in the food industry, which functions as a thickening agent, coagulating agent and making products elastic for dessert products (jelly and pudding) (Arief, 2016).

This research is the first report on a cocktail cassava tapai to develop the tapai into an export-oriented tin cassava tapai product. The purpose of this study was to determine the effect of using grass jelly, carrageenan, and gelatin as a coating on the sensory properties of the cocktail cassava tapai product. This research benefited from the most suitable material among the three types of coating jelly studied as a coating on cocktail cassava tapai products.

2. Materials and methods

2.1 Material

The *Manihot esculenta* var. Kuning used in this study is the yellow cassava (aged 8-10 months) obtained from Tanjung Redeb, Berau Regency, East Kalimantan Province, Indonesia. Na Kok Liong (NKL) yeast tapai as a fermentation agent is obtained from traditional markets in Samarinda. Grass jelly leaves are obtained from grass jelly artisans in Samarinda city. Gelatin powder type A from beef bone and kappa powder carrageenan (Food Grade) were obtained from CV. Nura Jaya, Surabaya.

2.2 Experiment design and data analysis

This study was designed into three separate single-factor experiments (jelly ingredient concentration), each arranged in a completely randomised design with three replications. Grass jelly is prepared from grass jelly leaf extract weighing 200, 225, 250 and 275 g per 100 mL of water. Carrageenan jelly is prepared with concentrations of 1.0, 1.5, 2.0 and 2.5%, while jelly gelatin is formulated with 3, 5, 7 and 9% concentrations. In each of these experiments, a control treatment was added, that is cassava tapai without coating.

The parameters observed were the hedonic sensory properties and the cocktail cassava tapai hedonic quality for aroma, colour, taste, texture, and total acceptable attributes. Hedonic sensory scores 1-7 indicate very dislike, dislike, somewhat dislike, mediocre, rather like, like, like very much. The hedonic quality sensory scores 1-5 for each attribute for cocktail cassava tapai type were described in Table 1.

A total of twenty-five semi-trained panellists, namely students who had passed the Organoleptic Test Course, were used in this study. The data obtained for each treatment level was 75 received from each of the three replications tested by 25 panellists (Setyaningsih *et al*., 2010). The data obtained were analysed with non-parametric statistics, Friedman test followed by multiple comparison test (Dunn's test) using SPPS version 25.

To find the best jelly coating type, the data from the best treatment in each experiment (three different jelly type) were reanalysed using Kruskal-Wallis test followed by multiple comparison test (Mann-Whitney test) using SPPS version 25.

Table 1. Attributes and scores of hedonic quality sensory test for tapai dan jelly coated tapai

Product	Attributes	Description (Score scale 1 → 5)
Tapai	Taste	very sour, sour, slightly sweet, sweet, very sweet
Grass jelly coated cassava tapai	Colour	very pale, pale green, slightly green, dark green, very dark green
	Aroma	unscented, slightly scented grass jelly, scented grass jelly, very scented grass jelly, scented mix of grass jelly and cassava tapai
	Texture	very hard, hard, somewhat chewy, chewy, very chewy
	Taste	bitter, slightly bitter, unpleasant grass jelly, rather unpleasant, not unpleasant
Carrageenan coated cassava tapai	Colour	pale yellow, slightly yellow, yellow, bright yellow, very bright yellow
	Aroma	not determined (unscented)
	Texture	very hard, hard, somewhat chewy, chewy, very chewy
	Taste	slightly sour, sour, slightly sweet, sweet, very sweet
Gelatin coated cassava tapai	Colour	very cloudy, cloudy, slightly translucent, translucent, very apparent
	Aroma	scented very gelatinous, scented gelatinous, scented slightly gelatinous, unscented gelatinous, very unscented gelatinous
	Texture	very hard, hard, slightly chewy, chewy, very chewy
	Taste	unpleasant, slightly unpleasant, not sweet, somewhat sweet, sweet

2.3 Research procedure

2.3.1 High-Temperature Short Time (HTST) cassava tapai preparation

Tapai was prepared from 1.5 kg yellow cassava for each experiment according to the method described by Candra *et al*. (2014). Cassava was sorted, peeled, and washed. The peeled-washed cassava was then cut into 1.5×1.5×1.5 cm form and steamed for 20 mins. The steamed cassava was then cooled at room temperature, followed by inoculating a 3.28 g of yeast tapai per kg cassava. The inoculated cassava was fermented for three days at room temperature (28°C) in a box covered by clean, dry linen. The cassava tapai produced has characteristics of alcohol content and sugar content of 4.3 and 19%, respectively. Furthermore, the cassava tapai was pasteurised using HTST, according to Candra *et al*. (2015), using a temperature of 98±2°C for 12 mins to stop the fermentation process. It is followed by coating jelly in the process of making a cocktail cassava tapai.

2.3.2 Jelly coating material preparation

Grass jelly was prepared from grass jelly leaves by sorting, removing the midribs and washing. According to the treatment level, some grass jelly leaves were soaked in hot water (80°C) for 1 min. The grass jelly leaves were then transferred to a container containing 100 mL of water, and two drops (about 0.10 g) of lime water were added, then squeezed until the water became green and allowed to thicken.

Carrageenan of 1-2.5% was prepared by mixing carrageenan powder in water. The mixture was added with liquid sugar to have a concentration of sugar of 15%. The mixture was then heated at 65°C until all the carrageenan perfectly became jelly.

Gelatin of 3-9% was prepared by pouring gelatin powder into water and mixed perfectly. An amount of liquid sugar was added to have a sugar concentration of 15%. An amount of 0.5% of carrageenan was also added (Sulistyo *et al*., 2018). The gelatin jelly material was heated at a temperature of 70˚C so that all the ingredients become jelly. Two drops of vanilla essence are added during heating to neutralise the aroma of gelatin.

2.3.3 Cocktail cassava tapai production

The jelly formed was left to stand at room temperature to 50°C, then poured into an aluminium mould with a structure of small boxes measuring 1.9×1.9×1.9 cm, which already contained HTST cassava tapai. The jelly was poured evenly until all parts (sides) of the cassava tapai were entirely coated, which make a 0.4 cm thick jelly coating. The product was left at room temperature to allow the jelly to solidify.

3. Results and discussion

3.1 Determination of the concentration of grass jelly coated cassava tapai

The grass jelly amount applied in extracting the jelly agent affected the hedonic sensory and hedonic quality properties significantly for the attributes of colour, aroma, texture, taste, and total acceptance of cocktail cassava tapai (Table 2).

The hedonic sensory properties of the cocktail cassava tapai coated with the grass jelly from several concentrations gave a significant effect compared to the control. Different concentrations of green grass jelly

Table 2. Sensory response of grass jelly coated cassava tapai with different leaf weights

Attributes	Leaf's weight (g) per 100 mL of water				
	0 (Control)	200	225	250	275
Hedonic sensory characteristics					
Colour	5 (3.68)^{c}	5 (3.07)^{b}	5 (2.87)^{ab}	4 (2.88)^{ab}	4 (2.49)^{a}
Aroma	6 (3.91)^{b}	4 (2.83)^{a}	4 (2.80)^{a}	4 (2.77)^{a}	4 (2.69)^{a}
Texture	6 (3.63)^{b}	5 (2.96)^{a}	5 (2.91)^{a}	5 (2.85)^{a}	4 (2.65)^{a}
Taste	5 (3.94)^{b}	4 (2.85)^{a}	4 (2.89)^{a}	4 (2.51)^{a}	4 (2.81)^{a}
Total acceptance	5 (3.79)^{c}	5 (2.93)^{b}	4 (2.87)^{ab}	4 (2.75)^{ab}	4 (2.66)^{a}
Hedonic quality sensory characteristics					
Colour of coating	*	4 (2.59)^{b}	4 (2.09)^{a}	4 (2.69)^{b}	4 (2.63)^{b}
Aroma of coating	*	3 (2.47)	3 (2.41)	3 (2.74)	3 (2.37)
Texture of coating	*	4 (2.79)^{b}	4 (2.52)^{ab}	4 (2.39)^{ab}	4 (2.31)^{a}
Taste of coating	*	3 (2.79)^{b}	3 (2.52)^{ab}	3 (2.39)^{a}	2 (2.31)^{a}
Taste of tapai	4 (3.35)^{b}	4 (2.92)^{ab}	4 (2.93)^{ab}	3 (2.73)^{a}	4 (3.07)^{ab}

Values are presented as median (mean rank) analysed by the Friedman test. Values with different letters within the same row are significantly different ($p<0.05$) by Dunn's test.

*Non-coated cassava tapai as control.

have substantial differences in the attributes of colour and total acceptance, while the attributes of aroma, texture and taste are not significantly different. On the other hand, the hedonic quality attributes of colour, texture, coating taste and cocktail cassava tapai taste are significantly different between the green grass jelly concentrations.

The 200 g grass jelly leaves extract concentration showed the highest hedonic sensory acceptance scores for colour, aroma, texture. The hedonic sensory of total acceptance showed a median and mean rank value of 5 and 2.93. The panellists have preferred the cocktail cassava tapai with characteristics of dark green, having grass jelly aroma, chewy and sweet. The higher the grass jelly leaf concentration will decrease the panellists' preference for all sensory attributes, which might cause dark green colour, unpleasant smell, harsh texture, and bitter taste.

Colour is an important parameter that determines the level of preference and acceptance by panellists to a product. The dark green colour produced by green grass jelly is caused by chlorophyll content (Palupi, 2015). Chlorophyll or green pigment in green grass jelly leaves is relatively high, namely 21.53 mg/g and chlorophyll is water-soluble (Setiari and Nurchayati, 2009). The higher the concentration of green grass jelly leaf extracts used as a jelly ingredient, the darker the colour of the cocktail cassava tapai coating. The consumer's assessment only reaches an ordinary scale.

Apart from chlorophyll, green grass-jelly leaves are high in gel content, so it affects the texture of the resulting jelly because the gel will dissolve in water along with the chlorophyll. The gel will thicken like jelly after being left for a while at room temperature (Lestari, 2019). Grass jelly leaves contain about 5% hydrocolloid to dramatically affect gel formation (Farida *et al*., 2018). Besides that, grass jelly leaf extract also contains pectin, increasing the compactness of the hydrophilic colloid system gel matrix. The higher concentration of grass jelly leaves extracts causes a decrease in elasticity in jelly produced (Artha, 2001). The hedonic test results of the cocktail cassava tapai coating texture from green grass-jelly leaves showed that the panellists gave a response of mediocre to rather like with a median scale of 4-5 of the score 1-7 for very dislike to like very much.

Taste is an important quality attribute in consumer acceptance of the product. Panellists' response to the hedonic sensory for the taste of grass jelly coated cassava tapai is standard with a scale of 4. Meanwhile, the hedonic quality has a scale of 2-3, slightly bitter and unpleasant grass jelly. The bitter taste produced in samples with high grass jelly leaves is caused by the alkaloid components, polyphenols, saponins, and flavonoids in green grass jelly (Abduh and Maulana, 2018). This content acts as one of the components forming aroma and taste. The bitter taste is caused by the hydrolysis of alkaloid components, polyphenols, saponins, and flavonoids during the heating process during processing.

Panellists' acceptance of all grass jelly coated cassava tapai ranged from 4-5, which shows that the panellist like the grass jelly coated cassava tapai. The panellists favoured the total consumer acceptance of the hedonic value of 200 g of green grass jelly leaf extract compared to the higher concentrations. Panellists, on average, like jelly with a chewy texture, green jelly colour and a non-bitter taste. These attributes can increase the taste and enjoyment of food.

3.2 Determination of the concentration of carrageenan coated cassava tapai

The concentration of carrageenan jelly as a cassava tapai coating for cocktail cassava tapai significantly affects hedonic sensory properties and hedonic quality on the attributes of colour, texture, taste, and total acceptance of cocktail cassava tapai (Table 3). Carrageenan provides a neutral (unscented) aroma (Nurhuda *et al.*, 2017). In this experiment, carrageenan coated cassava tapai showed an unscented smell, so they were not subjected to a hedonic quality test for aroma attributes.

The use of carrageenan significantly affected the colour hedonic sensory characteristics and total acceptance of the cocktail cassava tapai compared to the control. Carrageenan concentrations affected the hedonic quality sensory characteristics of texture and taste of the cocktail cassava tapai. Overall, the panellists' acceptance rate was around a median score of 6, which inform that the Carrageenan coated cassava tapai has a response of like based on the parameters of colour, texture, taste, and total acceptance.

In hedonic sensory characteristics, panellists prefer cocktail cassava tapai coated with 2.5% carrageenan with a median and mean rank of 6 and 2.98 compared to other concentrations in the attributes of colour, texture, and taste. It is because the resulting jelly has a chewy texture with a bright yellow colour.

The median value of hedonic quality on the colour attribute is yellow to bright yellow on a score of 3-4, and the mean rank value is yellow on a scale of 2.67-2.98. The colour attribute shows that there is no significant difference between the different carrageenan concentrations. The yellowish-white carrageenan colour does not affect the colour of the resulting cocktail

Table 3. Effect of carrageenan coating concentration on the sensory response of cocktail cassava tapai

Attributes	Carrageenan (%)				
	0 (Control)	1.0	1.5	2.0	2.5
Hedonic sensory characteristics					
Colour	6 (3.50)^{b}	6 (2.89)^{a}	6 (2.72)^{a}	6 (2.91)^{a}	6 (2.98)^{a}
Texture	6 (3.36)	6 (2.86)	6 (3.02)	6 (2.87)	6 (2.89)
Taste	6 (3.55)^{c}	6 (2.77)^{ab}	6 (2.95)^{ab}	5 (2.64)^{a}	6 (3.08)^{bc}
Total acceptance	6 (3.47)^{b}	6 (2.84)^{a}	6 (2.90)^{a}	6 (2.81)^{a}	6 (2.98)^{a}
Hedonic quality sensory characteristics					
Colour	4 (3.53)^{b}	4 (2.87)^{a}	3 (2.67)^{a}	4 (2.98)^{a}	4 (2.95)^{a}
Texture	*	4 (2.55)^{b}	4 (2.78)^{b}	4 (2.53)^{ab}	4 (2.13)^{a}
Taste	4 (3.19)	4 (2.95)	4 (2.85)	4 (2.96)	4 (3.05)

Values are presented as median (mean rank) analysed by the Friedman test. Values with different letters within the same row are significantly different ($p<0.05$) by Dunn's test.

*Quality hedonic sensory for the texture of the control treatment level was not tested.

cassava tapai product because the cocktail cassava tapai is dominated by the colour of the raw material used (Widawati and Hardiyanto, 2016).

Taste is one of the factors that influence a person's acceptance of food. Table 3 shows that the addition of carrageenan at different concentrations does not affect the hedonic test of the cocktail cassava tapai, with the median value on a scale of 4, which is normal. Still, the mean rank value tends to increase at the carrageenan concentration of 2.5%. Meanwhile, the hedonic quality shows that the addition of carrageenan at different concentrations significantly affects the taste of the cocktail cassava tapai, with a median scale of 5-6 and a mean rank of 2.64-3.08.

The texture is essential in food, exceptionally soft foods like jelly candy. The median value of the hedonic quality of the carrageenan coated cassava tapai was 4 (chewy), where there was a significant difference between the carrageenan concentration of 2% and carrageenan concentrations of 1.1.5 and 2.5%. The overall mean rank value ranges from 2.13-2.78 with a hard to somewhat chewy scale because the higher the carrageenan concentration can produce jelly with a harder texture. The type of carrageenan structure influences the strength of the jelly texture of carrageenan. Kappa carrageenan can provide a firmer jelly texture than the iota and lambda carrageenan types (Fauziah *et al.*, 2015).

Overall acceptance will be the key to determining whether a product is liked or disliked so that consumers decide whether to consume the product or not (Parnanto *et al.*, 2016). The median value of the panellists' preference for the total acceptance of carrageenan coated cassava tapai was 6 (like) with the highest mean rank value of 2.98 at 2.5% carrageenan concentration. So that the level of panellists' preference for carrageenan coated cassava tapai tends to be 2.5% carrageenan concentration.

3.3 Determination of the concentration of gelatin-coated cassava tapai

The concentration of jelly gelatin as a cassava tapai coating for cocktail cassava tapai products has a significant effect on hedonic sensory properties and hedonic quality for the colour and taste attributes of cocktail cassava tapai (Table 4).

The hedonic test showed that the gelatin concentration was significantly different from the colour and total acceptance of the panellists, while the aroma, texture and taste were not significantly different. The median value for the colour parameter of the gelatin-coated cassava tapai ranged from 5-6 (slightly like to like), and the mean rank value ranged from 2.55-3.12. Gelatin 7% has the highest value, namely a median of 6, which indicates that the panellists like the gelatin-coated cassava tapai, and the mean rank value are 3.12. The total acceptance of panellists at 7% gelatin concentration also showed the highest value with a 6 (like) score and significantly differed from the other concentrations.

Hedonic characteristics and hedonic quality showed the highest score at 7% gelatin concentration with a slightly disliked score. The panellists liked the coating closer to a somewhat translucent colour, flavoured somewhat with gelatin, somewhat chewy texture with an unsweetened coating taste.

The hedonic quality test of gelatin-coated cassava tapai showed significant differences in colour attributes between gelatin concentrations and controls with a median score of 2-3 (cloudy - slightly translucent) and a mean rank value of 2.33-4.32 (cloudy-translucent). Sachlan *et al.* (2019) reported that the increasing the gelatin concentration, the darker the jelly candy colour would be.

Table 4. Effect of gelatin coating concentration on the sensory response of cocktail cassava tapai

Attributes	Gelatin (%)				
	0 (Control)	3	5	7	9
Hedonic sensory characteristics					
Colour	6 (3.74)^{c}	6 (2.55)^{a}	6 (2.94)^{ab}	6 (3.12)^{b}	5 (2.65)^{ab}
Aroma	6 (2.86)	6 (3.16)	6 (2.96)	6 (3.13)	6 (2.89)
Texture	5 (2.70)	6 (3.14)	5 (2.91)	6 (3.29)	5 (2.96)
Taste	6 (3.26)	6 (2.87)	6 (2.99)	6 (3.01)	6 (2.87)
Total acceptance	6 (3.14)^{b}	6 (2.93)^{ab}	6 (2.95)^{ab}	6 (3.14)^{b}	6 (2.84)^{a}
Hedonic quality sensory characteristics					
Colour	3 (4.32)^{c}	2 (2.33)^{a}	2 (2.75)^{ab}	2 (2.98)^{b}	2 (2.72)^{ab}
Aroma	*	4 (2.58)	4 (2.47)	4 (2.51)	4 (2.43)
Texture	*	4 (2.36)	4 (2.47)	4 (2.71)	4 (2.45)
Taste	4 (3.45)^{b}	4 (3.01)^{a}	4 (2.58)^{a}	4 (2.91)^{a}	4 (3.05)^{a}

Values are presented as median (mean rank) analysed by the Friedman test. Values with different letters within the same row are significantly different ($p<0.05$) by Dunn's test.
*The hedonic quality of colour and texture for the control was not tested.

The taste hedonic quality was significantly different between the gelatin-coated cassava tapai and control. The medium score shows a score of 4, which is rather sweet and a mean rank score of 2.58-3.45 (slightly unpleasant - not sweet). Wijana *et al.* (2014) reported that gelatine's taste could cause jelly's foreign taste because the higher the gelatin, the stronger the gel tends to be. The high gelation effect is thought to mask the taste of the jelly candy.

The texture attribute is not significantly different between treatments with a median value of 4, which has a chewy texture. It indicates that the panellists prefer a chewy coating texture because it is suitable for chewing power. The average value of the hedonic quality of texture in 7% gelatin has a mean rank score of 2.71 (close to a bit chewy), which is better than 9% gelatin with a mean rank score of 2.45 for a hard texture. Zia *et al.* (2019) reported the gel's strength and stability depend on the concentration of gelatin added. If the gelatin concentration is too high, the gel that is formed will be stiff.

On the other hand, if the gelatin concentration is too low, the gel becomes soft or does not form a gel. Besides, gelatin jelly has rubber-like properties and soft consistency. This change in texture can be due to the addition of large gelatin concentrations resulting in decreased water content in jelly because the total solids increase so that the texture of the gel that is formed is getting harder, besides, it can also reduce the sweetness caused (Maryani *et al.*, 2010; Prihardhani and Yunianta, 2016).

The hedonic quality test of aroma was also not significantly different between treatments with a median value of 4, which was not gelatinous, with a mean rank value of 2.36-2.71, which was gelatinous and slightly gelatinous. The 7% gelatin had a better score, namely with a mean rank of 2.71 flavoured somewhat with gelatin compared to other concentrations with gelatin aroma. Wijana *et al.* (2014) determined that gelatin has a scent that can cause a foreign smell to jelly candy if the concentration is excessive. Besides, the increase in hydrocolloid levels in the food formulation will increase the related product's thickness. Hence, the increase in hydrocolloid levels reduces the original taste and aroma of the product so that the cassava cocktail with a gelatin coating has a slightly gelatinous aroma.

Gelatin-coated cassava tapai at a concentration of 7% gave the best total acceptance score by the panellists compared to gelatin concentrations of 3, 5 and 9%. Panellists gave a favourable response to the resulting jelly coating.

3.4 Determination of cocktail cassava tapai coating material

The best cocktail cassava tapai coated with jelly material is calculated from the panellists' sensory hedonic response. Based on the panellists' mean rank score, the highest score for hedonic sensory properties was produced in the treatment of grass jelly coated 200 g per 100 mL, carrageenan coated 2.5% and gelatin coated 7%. Tapai coating with different jelly ingredients for cocktail cassava tapai products influences hedonic sensory properties for the attributes of colour, aroma, taste, and total acceptance of cocktail cassava tapai (Table 5).

The hedonic sensory properties of cocktail cassava tapai with various jelly coatings, namely grass jelly, carrageenan, and gelatin, significantly affect one another. Types of coatings have significant differences in all attributes, including colour, aroma, texture, taste, and

Table 5. Hedonic sensory response of cocktail cassava tapai with different jelly coatings

Attributes	Jelly type		
	Grass jelly 200 g/100 mL	Carrageenan 2.5%	Gelatin 7%
Colour	5 (3.07)[a]	6 (2.98)[b]	6 (3.12)[a]
Aroma	4 (2.83)[a]	*	6 (3.13)[b]
Texture	5 (2.96)[a]	6 (2.89)[b]	6 (3.29)[a]
Taste	4 (2.85)[b]	4 (3.05)[a]	6 (3.01)[c]
Total acceptance	5 (2.93)[b]	6 (2.98)[a]	6 (3.14)[a]

Values are presented as median (mean rank) analysed by the Kruskal Wallis test. Values with different letters within the same row are significantly different ($p<0.05$) by Mann-Whitney test.
*Colour attribute in carrageenan treatment was not tested.

total acceptance. Of the three coatings, 7% gelatin jelly coatings showed the highest total acceptance 6 and 3.14 for the median and mean rank, compared to other coating jelly materials. Then followed by 2.5% carrageenan, namely 5 and 2.93 for median and mean rank, respectively. The lowest hedonic sensory response is grass jelly prepared by 200 g grass jelly leaves, which showed the median and mean rank of 5 and 2.93.

Panellists preferred gelatin as a coating material on aroma attributes, taste, and total acceptance with a score of 6, which is somewhat like to like. Gelatin is used as a gelling agent in the food industry because it has a unique characteristic, namely "melt-in-mouth" or melts in the mouth. It also affects the level of panellist acceptance of the resulting jelly taste (Nelwwan *et al.*, 2015).

Combining these two gelling agents produces a varied texture considering the different characteristics of carrageenan and gelatin in making a gel texture. In combination with carrageenan, the gelatin jellies improve their physical characteristics to be more robust and stable (Derkach *et al.*, 2018). According to Ahmad and Mujdalipah (2017), if the gelatin concentration is too low, the gel will become soft or not even form a gel, but if the gelatin concentration used is too high, the gel that is created will be stiff.

The grass jelly has a lower value than other coatings in the attributes of colour, aroma, texture, and total acceptance. It can be because the colour produced by grass jelly is green from the chlorophyll content, which causes a decrease in panellists' preference (Palupi, 2015). Grass jelly leaves have alkaloid components, polyphenols, saponins, and flavonoids in green grass jelly (Abduh and Maulana, 2018). These contents play a role as one of the components forming a slightly unpleasant aroma and bitter taste. So that the panellists do not like the coating of jelly from grass jelly leaves.

4. Conclusion

Cocktail cassava tapai with coating jelly produced from grass jelly, carrageenan, and gelatin gave significantly different sensory responses ($p<0.05$) for all attributes, including colour, aroma, texture, taste, and total acceptance. Of the three coating jelly types, 7% gelatin has hedonic properties for the highest total acceptance of coating jelly ingredients, namely 6 (median) and 3.14 (mean rank), so it is most suitable for coating jelly cocktails cassava tapai. Followed by carrageenan 2.5%, which shows a median and mean rank of 6 and 2.98, respectively, and grass jelly extract (200 g per 100 mL of water), with median and mean rank of 5 and 2.93, respectively.

Conflict of interest

The authors declare no conflict of interest.

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