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Effect of Addition of Glutamic Acid-Producing Lactic Acid Bacteria Isolate on the Sensory Properties of *Sere Kedele*

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Abstract---*Sere kedele is a traditional Balinese fermented food. We often find this food in the Gianyar and Klungkung Regencies. Sere kedele is made through spontaneous fermentation, meaning no microbes are added to the process. The addition of lactic acid bacteria (LAB) isolates that produce glutamic acid during fermentation can affect the sensory properties of sere kedele. This research aimed to determine the effect of adding lactic acid bacteria isolates that produce glutamic acid on the sensory properties of sere kedele. The research used 4 treatments with 4 replications using the Completely Randomized Design (CRD) method. The addition of lactic acid bacteria isolates that produce glutamic acid did not have a significant effect on the sensory properties of soybean sere with the results being a yellowish brown color with a normal rating, a pleasant aroma, a savory taste with a favorable rating and overall acceptance of liking.*

Keywords---*glutamic acid, isolate of lactic acid bacteria, sensory properties, sere kedele.*

Introduction

Sere kedele consists of the words *sere* meaning shrimp paste and *kedele* meaning soybeans. The word shrimp paste as *sere* is commonly known by the Balinese people. *Sere kedele* has the same aroma as shrimp paste. *Sere kedele* is obtained from fermentation and mixed with spices. *Sere kedele* fermentation comes from a container, air and leaves which are used as a cover (Koswara, 1997). Lactic acid bacteria (LAB) are microbes which, when added to food, are safe or food grade microorganisms because they are not toxic and do not produce toxins. LAB are bacteria that can produce glutamic acid, which are Gram-positive bacteria that are considered safe and environmentally friendly. Besides that, LAB is classified as a microbe that does not pose a health risk or is called Generally Recognized As Safe (GRAS) (Sari et al., 2019). The presence of glutamic acid can cause an umami taste in food (Kurihara, 2015). Glutamate bound in protein does not provide an umami taste to food. Therefore, protein hydrolysis is needed to free glutamate bound to protein to become free glutamate by heating food and the fermentation process (Jinap & Hajep, 2010). The addition of LAB isolates that produce glutamic acid during fermentation will affect the sensory properties of the *sere kedele* produced. Making *sere kedele* with the addition of LAB isolate that produces glutamic acid as follows: soybeans are selected and cleaned from impurities such as twigs, and gravel, then weighed 1 kg, then washed twice with water intending to remove the impurities in the soybeans (Lesschaeve & Noble, 2005; Hekmat & Reid, 2006; do Egypto et al., 2013). The soybeans are then boiled for 2 hours with a soybean and water ratio of 1:4 until cooked. Once the soybeans are cooked, drain them until no water drips out. The soybeans are cooled and then 600 g is transferred to a sterilized container for the fermentation process. Before fermentation, LAB isolate producing glutamic acid was added. A total of 600 g of cooked soybeans was inoculated with LAB starter with a bacterial population of 10^7 CFU/mL in 30 mL of 5% concentration. Next, the soybeans are fermented at room temperature for 2 days (Koswara, 1997). After completing the fermentation process, the finished *sere kedele* is seasoned with the spice composition as in Table 1 (results of interviews with Muliasih & Setiawati, 2020). *Sere kedele* is ready to be served. *Sere kedele* is eaten as a complement and side dish (Widyantari et al., 2017). *Sere kedele* with the addition of LAB isolates producing glutamic acid can be seen in Figure 1.

This research aimed to determine the effect of adding lactic acid bacteria isolates that produce glutamic acid on the sensory properties of *sere kedele*. It is hoped that the results of this research will be useful for the utilization and development of traditional Balinese fermented food products, especially *sere kedele* (Lee et al., 2016; Maldonado et al., 2012; Adnan & Tan, 2007).

Table 1
The spices added to make *sere kedele* are per 600 g of soybeans

Name of Spices	Amount (g)
Garlic	36
Galangal	24
Turmeric	24
Aromatic ginger	18
Chili	30
Salt	24
Coconut oil	6
Flavoring	0,16



Figure 1. *Sere kedele* with the addition of LAB isolates producing glutamic acid (private collection)

Materials and Methods

The LAB isolate as a starter which was added during fermentation was obtained from *sere kedele* in several producers in Gianyar Regency, for the *sere kedele* LAB isolate was isolated and the LAB was characterized (Putri & Kusdiyantini, 2018) then the glutamic acid content was searched for to obtain LAB isolates as producers of glutamic acid (Lawal et al., 2011). Then the LAB isolates which had the highest levels of glutamic acid were selected, resulting in 4 LAB isolates producing the highest glutamic acid (Bajaj & Singhal, 2011; Populin et al., 2007; Dutta et al., 2013). Making inoculum for fermentation (Wasis et al., 2019; Sujana et al., 2020). Making *sere kedele* with the addition of LAB isolates produces the highest glutamic acid (Koswara, 1997). After fermentation, the *sere kedele* is immediately seasoned with spices as in Table 1. The design used was a completely randomized design with 4 treatments with 4 replications. Next, the sensory properties were analyzed.

Testing sensory properties used score and hedonic tests for color and taste, while the aroma and overall acceptability used hedonic tests (Lawless & Heymann, 2010). Data analysis uses analysis of variance (ANOVA), if the treatment has a significant effect ($P < 0.05$) it will be continued with the Duncan Multiple Range Test (Gomez & Gomez, 2010). The software used for data analysis is SPSS (Statistical Program for Social Science) 24 for Windows.

Results and Discussion

The glutamic acid content of *sere kedele* LAB isolates from many producers in Gianyar Regency can be seen in Table 2. The glutamic acid content of many producers in Gianyar Regency showed a very significant effect ($P < 0.01$). In Table 2, the glutamic acid content of LAB isolates ranges from 0.99% to 2.15%. The highest glutamic acid content was in SKBT 7.4.1 isolate, namely 2.15% and the lowest glutamic acid content was in SKBT 8.3.1 isolate, 0.99%. LAB is reported to produce glutamic acid (Maslami et al., 2018), such as *Lactobacillus plantarum* MNZ from

Malaysian fermented food (Zereain et al., 2012), LAB isolated from Tapaipulut (Ishak, et al. 2017), in addition to LAB producing acid glutamate is found in Lactobacillus from skim milk (Zalan et al., 2010) and Bacillus spp from vegetable protein (Lawal et al., 2011). Hajeb & Jinap (2013), stated that the fermentation process produces high levels of glutamic acid which functions in the formation of the umami taste of the product.

Then four LAB isolates were selected which had the highest glutamic acid content, namely SKBT 7.4.1, SKBT 7.2.1, SKS 2.5.1 and SKS 1.2.1. The effect of adding glutamic acid-producing LAB isolates on the sensory properties of *sere kedele* can be seen in Table 3.

Table 2
The glutamic acid content of *sere kedele* LAB isolates from many producers in Gianyar Regency (%)

Name of Isolate	Average	Notation
SKS 1.1.1	1.40	i
SKS 1.2.1	1.64	d
SKS 1.3.1	1.48	g
SKS 1.4.1	1.45	h
SKS 1.5.1	1.20	p
SKS 2.1.1	1.31	l
SKS 2.2.1	1.23	o
SKS 2.3.1	1.29	m
SKS 2.4.1	1.54	f
SKS 2.5.1	1.67	c
SKS 2.6.1	1.19	p
SKBP 3.1.1	1.16	q
SKBP 3.2.1	1.38	j
SKBP 4.1.1	1.40	i
SKBP 4.2.1	1.13	r
SKBP 4.3.1	1.21	o
SKB 5.1.1	1.26	n
SKB 6.1.1	1.59	e
SKBT 7.1.1	1.33	k
SKBT 7.2.1	1.87	b
SKBT 7.4.1	2.15	a
SKBT 8.1.1	1.15	q
SKBT 8.2.1	1.09	s
SKBT 8.3.1	0.99	t

Note: Average values followed by different letters in the same column indicate significant differences (P<0.05)

Table 3
The addition of LAB isolates that produce glutamic acid on the sensory properties of *sere kedele* produced

Treatment of the Addition of LAB Isolate	Color		Flavor	Taste		Overall Acceptance
	Score *	Hedonic **	Hedonic **	Score ***	Hedonic **	Hedonic **
SKBT 7.4.1	3,47 a	3,73 a	3,00 a	2,87 a	2,13 a	3,00 a
SKBT 7.2.1	3,53 a	3,87 a	2,93 a	3,07 a	2,53 a	3,13 a
SKS 2.5.1	3,33 a	3,73 a	3,07 a	3,07 a	2,67 a	3,07 a
SKS 1.2.1	3,53 a	4,00 a	2,93 a	3,40 a	2,87 a	3,33 a

Note: Average values followed by different letters in the same column indicate significant differences (P<0.05)

* 1 = clear, 2 = light yellow, 3 = yellow, 4 = yellowish brown, 5 = brown

** 1 = dislike very much, 2 = dislike, 3 = normal, 4 = like, 5 very much like

***1 = not savory, 2 = normal, 3 = slightly savory, 4 = savory, 5 = very savory

SKBT 7.4.1 = *sere kedele* LAB isolate Banjar Teruna 7.4.1, SKBT 7.2.1 = *sere kedele* LAB isolate Banjar Teruna 7.2.1, SKS 2.5.1 = *sere kedele* LAB isolate Sukawati Village 2.5.1, SKS 1.2.1 = *sere kedele* LAB isolate Sukawati Village 1.2.1.

Table 3 shows the results of the analysis of various scoring tests, the treatment of adding LAB isolate to *sere kedele* on color had no significant effect ($P>0.05$). The average color scoring value of *sere kedele* is between 3.33 to 3.53 (yellow). The addition of LAB isolate produces yellow *sere kedele*. The average value of the *sere kedele* hedonic test is between 3.73 to 4.00 (normal to like). The panelists' assessment of the *sere kedele* color ranged from normal to like the color.

The addition of LAB isolate to the aroma of *sere kedele* showed no significant effect ($P>0.05$). The average value for the aroma of *sere kedele* was between 2.93 (dislike) to 3.07 (usual). The panelists gave a rating of dislike to normal for *sere kedele* with the addition of LAB isolate. The effect of adding LAB isolate did not affect the aroma of *sere kedele*. Aroma through the sense of smell is the overall condition that is felt visually. Panelists' sense of smell can judge whether a product is liked or disliked and aroma can also cause panelists' interest in a product (Thariq et al., 2014).

The results of the analysis of various scoring tests on taste, the addition of *sere kedele* BAL isolate showed no significant effect ($P>0.05$). The *sere kedele* value ranged from 2.87 (not savory) to 3.40 (slightly savory). The panelists rated the *sere kedele* sample as not savory to slightly savory (Wipradnyadewi et al., 2023).

Hedonic test on the taste of *sere kedele*, the addition of LAB isolate had no significant effect ($P>0.05$). The *sere kedele* value for taste ranged from 2.13 to 2.87 (dislike). Taste can determine whether you like or dislike the product. Taste is a factor that determines the final decision to accept or reject a food even though other assessment parameters are good (Thariq, et al., 2014).

Overall acceptance for the hedonic test, the addition of LAB isolate showed no significant effect ($P>0.05$). The overall acceptance of *sere kedele* ranges from 3.00 to 3.33 (usual). Aspects of color, aroma and taste are combined aspects for overall acceptability. The results of overall acceptance of a food show that the panelists accepted that food (Purwandari, et al. 2021).

Conclusion

Sere kedele with the addition of BAL isolates SKBT 7.4.1, SKBT 7.2.1, SKS 2.5.1 and SKS 1.2.1 had yellowish brown color results with a normal rating, aroma with a liking rating, savory taste with a liking rating and overall acceptance with a liking rating.

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