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DEVELOPMENT OF HERBAL-BASED FOOD PROCESSES AS IMMUNOSTIMULANT AND ANTI-MICROBIAL PRODUCTS TO PREVENT THE SPREAD OF COVID-19 INFECTION

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ABSTRACT
The effect of milk on physicochemical and functional properties of kencur jelly drink has been investigated. The results of the analysis showed a decrease in water, ash, total sugar, phenol and flavonoid content, antioxidant activity, and syneresis in the kencur-milk jelly drinks. However, the addition of milk was detected to increase protein, fat, pH, and antibacterial activity against Salmonella typhimurium and Escherichia coli bacteria.
Keywords: Physicochemical and Functional Properties, Flavonoid Content, Antioxidant Activity, Herbal, Kencur.
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INTRODUCTION
The 2019 Coronavirus (COVID-19) pandemic triggered 6.5 million cases and nearly 400,000 deaths worldwide within four months.[1] So far vaccines have been proposed as a solution.[2] Herbal plants can increase body resistance and reduce viral pathogenic factors.[3-5] Kencur has anti-inflammatory, antimicrobial, and antioxidant activities. However, the kencur bitter taste affects the preference for the extract. To improve the taste of the kencur jelly drink, additional palm sugar, tamarind, and fresh cow's milk are used. For the thickener, a combination of agar and gelatin is used.[6-8]

EXPERIMENTAL
Making of Kencur and Kencur-Milk Jelly Drink
Kencur extract is made from 20 g of kencur and 7.5 g of ginger. Kencur boiled in 1 L of water for 3 minutes and added to it pandan leaves and tamarind. One part of the extract is used to grind rice that has been roasted and immersed for 1 hour. The results are filtered. 13% (w/w) palm sugar was added to another part of the extract and heated until dissolved. Added thickener from agar (viscosity>21 mPs) and gelatin (bovine type B-gelatin, viscosity 1.5-7.5 MP) combination.[9-10] Thickener and rice extract were added to the hot extract. Kencur drinks are put in the refrigerator for 24 hours. The same procedure is also applied to the kencur-milk jelly drink production.
The difference lies in the use of a lower water volume (500 mL) in the kencur extract. The addition of fresh cow's milk with a ratio of 1:1 to the extract was carried out after the thickener addition.

Analysis
Table-1: Physico-chemical Properties, Functional, and Contamination Analysis Method

Determination	Method/Instrument	Determination	Method/Instrument
Water	Gravimetric	Total flavonoid	Aluminum chloride[11]
Ash		Total Phenolic	Gallic acid[12]
Total sugar	Luff schrool	Antioxidant	DPPH (IC_{50})[13]
Protein	Kjeldahl	Antibacterial	Disc diffusion[14]
Fat	Weibull	Metal	AAS
Acidity (pH)	Martini Mi-150 pH meter	Microbial	Total Plate Count (TPC) Pour plate Most Probable Number (MPN)
Syneresis	Gravimetric		

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RESULTS AND DISCUSSION

Proximate Level

Kencur jelly drink has a higher water content than milk kencur jelly drink (Table-1). Milk is a colloidal system that contains insoluble particles so that the same volume contains less water.[15] Overall, the kencur jelly drink has a low ash content. Filtration is considered to be related to this because it allows the content of the inorganic compounds in the extract to be lower.[16] The milk addition results in lower ash content. This is in line with Vinifera and Nurina's (2016) publications which reported lower milk minerals (0.65-0.76%) compared to kencur.[17]

Table-2: Physico-Chemical Properties, Total Flavonoid, and Phenolic Compound of Kencur Jelly Drink

Beverage Type	Proximate Level (%)		Total Sugar (%)	Protein (%)	Fat (%)	Syneresis (%)	pH	Total Flavonoid (mg/100g)	Total Phenolic (mg/100g)
	Water	Ash							
A	77.47	0.72	14.70	2.41	0.07	29.220	4.8	29.81	46.25
B	75.95	0.15	11.66	2.66	0.73	20.470	5.0	8.68	17.14

A: Without milk; B: With milk

Total Sugar

Sugar has an important role in food products because it can bind water and help the junction zone formation in hydrocolloids to form a gel.[18] Kencur jelly drink uses brown sugar as a sweetener. Better nutritional content makes this sweetener ideal.[19] The kencur-milk jelly drink showed lower sugar content than the kencur. The decrease in the kencur extract volume caused the sweetener mass to decrease, while the sugar content of fresh cow's milk was only 29%.

Protein Level

According to the category of the Food and Drug Monitoring Agency (BPOM) of the Republic of Indonesia (RI), all kencur jelly drinks are low-protein foods. However, the dominance of vegetable protein causes the protein of the kencur jelly drink to be lower than that of kencur-milk.[20]

Fat Level

According to the BPOM RI classification, kencur jelly drinks are low-fat, while kencur-milk are high-fat food. The dominance of low-fat raw materials in kencur jelly drinks and the use of full cream milk in kencur-milk is predicted to be the respective causes.[21]

Syneresis

Syneresis is triggered by a decrease in the gel network's ability to bind water. Protein and fat, as well as water holding capacity, are syneresis determinants.[22] The milk addition triggers the formation of micelles that form a protein matrix. Micelle casein (paracasein) is reactive so that it can form several new bonds triggering the formation of a more complex gel structure (steric effect).[23] Furthermore, the high-fat content increases the total mass of milk solids, increasing viscosity, and decreasing syneresis.[24] The reaction of fat with water produces free fatty acids and glycerol. The formation of intermolecular hydrogen bonds of fatty acids outside the carboxyl group triggers an increase in viscosity.[25]

Acidity (pH)

Acidity affects the gel formation in jelly drinks. Too low pH triggers syneresis, while too high pH triggers stiff gel-forming. All herbal jelly drinks have a pH of 4.8-5.0. The emergence of acidic properties was triggered by the presence of phenol in kencur.[26] However, the kencur jelly drink is still safe for consumption because it has the required pH for beverages, which is 3.5-5.0.[27] While the kencur-milk jelly drink has a lower pH. This is closely related to the presence of sugar in milk. Low sugar content provides minimum nutrients for the growth of lactic acid bacteria resulting in a higher pH.

Total Phenolic and Flavonoid Compound

Phenolic compounds (PCs) are phytochemicals in most plant tissues. Phenolic compounds are divided into several subgroups, including flavonoids.[28] The flavonoids availability is influenced by the presence of protein in food. Flavonoids form complex with proteins, which causes changes in their structural, functional, and nutritional properties. Proteins also modify essential amino acids resulting in decreased bioavailability of phenolic compounds.[29] The addition of milk with a protein content of 8% triggers a decrease in phenolic and flavonoid levels.

Antioxidant Activity

Antioxidants are compounds that can inhibit damage due to the oxidation process. Curcumin in kencur can donate electrons to oxidants so that their activity can be inhibited.[30] The performance of antioxidants is inhibited by protein and fat. This can be seen from the inhibitory concentration (IC_{50}) which was higher in the kencur-milk jelly drink than in the kencur.

Table-3: Antioxidant and Antimicrobial Activity of Herbal Jelly Drink

Beverage Type	IC_{50}	Antioxidant Properties	*Salmonella Typhimurium* (mm)	Control (mm)		*Escherichia coli* (mm)	Control (mm)	
				(+)	(-)		(+)	(-)
A	0.0547	Very Strong	12.65	8.10	15.35	12.00	7.15	14.60
B	0.0932	Very Strong	13.78			13.33		

A: Without milk; B: With milk

Antibacterial Activity

Bacteria are pathogens that even at low concentrations cause therapeutic toxicity.[31] Kencur containing bioactive alkaloids and essential oils (borneol) can bind to amino acids from bacterial proteins to form hydrophilic conjugate products that inhibit bacterial cell metabolism.[32] The kencur-milk jelly drink has better antibacterial activity against Gram-positive bacteria (*E. coli* and *S. Typhimurium*) than non-dairy products. This is associated with the additional antibacterial activity of cow's milk proteins, including immunoglobulins, lactoferrin (LF), lactoperoxidase (LPO), lysozyme, and Nagase.

CONCLUSION

The manufacture of functional drinks in the form of kencur and kencur-milk jelly drinks has been done. The analysis results showed a decrease in water and ash content, total sugar, phenolic and flavonoid levels, antioxidants, and syneresis. On the other hand, the milk addition has an effect on increasing protein, fat, pH as well as antibacterial activity needed to maintain immunity against Covid-19.

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