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Quality of Chicken Sausage during Storage with Addition of Andaliman Fruit Powder

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ABSTRACT

The study aimed to evaluate the impact of Andaliman Fruit Powder (AFP) concentrations ranging from 0.5 to 1.5% on the quality of chicken sausages over a 4-week storage period. The result showed that a higher concentration of AFP had a significant ($p<0.05$) increase in total phenolics and total flavonoids, while the total microbes and free fatty acid content decreased. There were no significant differences ($p>0.05$) observed in the protein content, pH, texture, and panelists' acceptance of color, aroma, and taste in comparison with the control. The incorporation of 1.5% AFP can be applied to maintain the quality of chicken sausage during storage at 10°C.

Keywords: andaliman fruit powder, chicken sausage, flavonoid, natural preservative

INTRODUCTION

Chicken sausage is one of the most popular ready-to-eat products worldwide. During storage, the nutritional quality and flavor of chicken sausage often deteriorate because of lipid oxidation and microbial contamination. Borax, nitrites, and nitrates are chemicals commonly used as sausage preservatives by small and medium industries. However, nitrites are known to interact with amines found in meat, resulting in the formation of nitrosamines, which are harmful toxins to human health (Hu & Gänzle 2018). Andaliman (*Zanthoxylum acanthopodium* DC) is a species of shrub plant in the Rutacea (citrus) family which is used as a spice for traditional dishes in the Batak ethnic community in North Sumatra. Several studies have shown that andaliman fruit has antioxidant and antimicrobial activities (Muzafri *et al.* 2018) activity. The aim of this study was to evaluate the effect of andaliman fruit powder on the quality of chicken sausage during storage.

METHODS

Fresh andaliman fruits from farmers in Dairi Regency, North Sumatra Province were dried in an oven at 50°C for 24 hours, crushed, and sieved through a 60-mesh sieve. Chicken breast meat (100 g) was minced and vegetable oil (30 g), ice water (30 g), salt (1.5 g), sugar (2.5 g), pepper (0.2 g), garlic (2.0 g), skim milk (3.0 g), tapioca (10 g), sodium tripolyphosphate (1.0 g), and AFP (0.5%, 1.0%, and 1.5% by weight of meat) were added. The mixture was placed in a sausage casing, steamed in boiling water (30 minutes), cooled, wrapped in plastic, and stored in a refrigerator (10±2°C, 21 days). The sausages were analyzed for moisture, protein, total phenolics, total flavonoids, pH, thiobarbituric acid reactive substances/TBARS, total microbes (Sharma *et al.* 2020), and sensory characteristics (Canti *et al.* 2021) on days 0, 7, 14, and 21. Triplicate data obtained were analyzed using a two-way ANOVA and Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

A higher concentration of AFP significantly ($p<0.05$) increased the levels of flavonoids and phenolics, but decreased the moisture content, TBARS and total microbes, while the protein content and pH were not significantly affected ($p>0.05$) (Table 1). Moreover, incorporation of AFP up to 1.5% had no significant effect ($p>0.05$) on the characteristics of taste, aroma, and color of chicken sausage (Table 2).

The antioxidant and antimicrobial activities of phenolic and flavonoid compounds in AFP (Muzafri *et al.* 2018) allow the inhibition of TBARS formation and microbial growth. The maximum limit of total microbes in the sausage

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Table 1. Effect of concentration of AFP on the chemical and microbial characteristics of chicken sausage during storage

Parameters	% AFP	Storage time (days)			
		0	7	14	21
Moisture (%)	0	65.48±0.33^{e}	66.03±0.21^{cd}	67.02±0.33^{b}	67.96±0.10^{a}
	0.5	64.59±0.42e	65.27±0.52^{e}	66.01±0.39^{cd}	67.43±0.21^{b}
	1.0	64.39±0.53^{g}	65.01±0.30^{f}	65.49±0.07^{f}	66.36±0.16^{c}
	1.5	63.93±0.39^{h}	64.65±0.22^{g}	64.75±0.05^{f}	65.06±0.61^{f}
Protein (%)	0	14.88±0.88	13.86±0.25	11.58±0.22	9.77±0.67
	0.5	17.21±0.51	15.89±0.31	13.42±0.50	10.64±0.67
	1.0	18.09±0.51	16.04±0.62	14.29±2.8	11.23±0.51
	1.5	19.69±0.76	17.64±0.25	15.17±0.50	11.95±0.51
Phenolic (mg GAE/g)	0	16.67±3.08^{bc}	15.98±3.64^{bcd}	14.89±0.22^{e}	13.14±3.75^{de}
	0.5	18.71±2.20^{bcd}	17.64±1.33^{d}	16.13±3.29^{bcd}	15.61±1.89^{cd}
	1.0	21.52±4.40^{abcd}	20.18±1.99^{ab}	18.76±0.35^{d}	17.86±1.32^{d}
	1.5	22.93±2.67^{a}	20.75±0.83^{a}	19.54±0.24^{b}	19.06±0.37^{b}
Flavonoid (mg QE/g)	0	5.82±0.00^{g}	5.34±0.01^{i}	4.89±0.00l	4.20±0.07^{n}
	0.5	6.35±0.00^{c}	5.56±0.00^{h}	5.18±0.01^{j}	4.54±0.08^{m}
	1.0	6.56±0.00^{b}	6.13±0.02^{e}	5.57±0.12^{h}	4.90±0.07^{k}
	1.5	6.92±0.01^{a}	6.31±0.01^{d}	5.91±0.05^{f}	5.18±0.02^{j}
pH value	0	6.59±0.07	6.43±0.09	6.23±0.06	5.76±0.43
	0.5	6.60±0.07	6.48±0.13	6.41±0.10	6.21±0.06
	1.0	6.64±0.07	6.55±0.12	6.50±0.13	6.50±0.13
	1.5	6.65±0.07	6.56±0.11	6.55±0.12	6.55±0.12
TBARS (mg MDA/kg)	0	0.47±0.00^{c}	0.49±0.00^{b}	0.51±0.01^{a}	0.52±0.00^{a}
	0.5	0.45±0.01^{d}	0.47±0.00^{c}	0.49±0.00^{b}	0.49±0.00^{b}
	1.0	0.43±0.01^{e}	0.45±0.00^{d}	0.47±0.00^{c}	0.47±0.01^{c}
	1.5	0.41±0.00^{f}	0.43±0.00^{e}	0.45±0.00^{d}	0.45±0.01^{d}
Total microbe (log CFU/g)	0	3.25^{i}	4.18^{d}	5.34^{b}	5.47^{a}
	0.5	3.25^{i}	4.00^{e}	4.18^{d}	4.26^{c}
	1.0	3.25^{i}	3.80^{g}	3.94^{f}	4.10^{e}
	1.5	3.25^{i}	3.35^{i}	3.43^{h}	3.94^{f}

The value in table is presented as mean±SD. Means followed by different letter between rows and columns for each parameter are different from each other by Duncan's tests ($p<0.05$); AFP: Andaliman Fruit Powder
GAE: Gallic Acid Equivalent; QE: Quercetin Equivalent; MDA: Malonaldehyde; CFU: Colony Form Unit

products is $1x10^5$ (National Standarization Agency (NSA) 2015). The total microbes of the sausage products with the AFP treatment were still within this permissible limit, except for the treatment with 0% AFP.

Table 2 shows that the panelists could not distinguish between treatments and still accepted the taste, aroma, and color of chicken sausage with the addition of AFP up to 1.5%.

Table 2. Effect of concentration of AFP on sensory characteristics of chicken sausage during storage

Parameters	% AFP	Storage time (days)			
		0	7	14	21
Taste	0	5.52±0.12	5.60±0.09	5.41±0.02	5.41-0.07
	0.5	5.65±0.02	5.73±0.03	5.68±0.02	5.59±0.07
	1.0	5.88±0.05	5.74±0.08	5.70±0.01	5.58±0.08
	1.5	6.04±0.14	5.78±0.12	5.64±0.11	5.74±0.07
Aroma	0	5.53±0.15	5.74±0.04	5.93±0.06	6.04±0.07
	0.5	5.53±0.05	5.72±0.15	5.92±0.20	6.04±0.05
	1.0	5.51±0.02	5.76±0.15	5.93±0.15	5.96±0.30
	1.5	6.26±0.04	5.47±0.03	5.89±0.02	5.91±0.04
Color	0	5.36±0.04	5.51±0.13	5.38±0.02	5.44±0.08
	0.5	5.66±0.02	5.79±0.12	5.83±0.06	5.64±0.04
	1.0	5.98±0.08	5.78±0.02	6.06±0.04	6.18±0.07
	1.5	6.25±0.08	5.87±0.12	6.16±0.24	5.86±0.10

The value in the table is presented as mean±SD; AFP: Andaliman Fruit Powder
Taste, aroma, and color were tested using a 7-point hedonic scale (ranging from "strongly disliked" to "strongly liked"

CONCLUSION

Incorporation of 1.5% AFP in chicken sausage could maintain the quality of chicken sausage for 21 days of storage at 10°C with acceptable sensory characteristics. Andaliman Fruit Powder (AFP) has the potential as a natural preservative in chicken sausages.

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DECLARATION OF CONFLICT OF INTERESTS

The author have no conflict of interests.

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