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# Additional Effect of Soursop Leaf Extract Fermented Through Drinking Water on Joper Chicken Carcass

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**Abstract**---The research aims to determine the effect of adding fermented soursop leaf extract (*Annona muricata*) to drinking water on joper chicken carcasses. The research used a Completely Randomized Design (CRD), with 5 treatments and 4 replications, each experimental unit used 10 Joper chickens so that a total of 200 Joper chickens were used. The treatments in the experiment were: chickens without fermented soursop leaf extract through drinking water (P0), 1% fermented soursop leaf extract (P1), 2% fermented soursop leaf extract (P2), 3% fermented soursop leaf extract (P3). ), administration of 4% fermented soursop leaf extract (P4). The variables observed were the phytochemical content of soursop leaf extract, nutrient digestibility, Joper chicken carcass. The research results showed that the water extract of fermented soursop leaves (*Annona muricata*) contained phytochemicals phenol, flavonoids, tannins and antioxidant capacity. The addition of fermented soursop leaf extract to drinking water caused the digestibility of dry matter, protein and changes in GE to DE to be higher ( $P > 0.05$ ) compared to the control treatment. The addition of fermented soursop leaf extract to drinking water had a significant effect ( $P < 0.05$ ) on carcass weight, and abdominal lipid components but had no significant effect ( $P > 0.05$ ) on carcass percentage and carcass physical composition. It can be concluded that the addition of water extract of soursop leaves (*Annona muricata*) fermented through drinking water in joper chickens at a level of 2% produces the highest joper chicken carcasses.

**Keywords**---abdominal fat, fermented soursop leaves, joper chicken carcass, nutrient digestibility, phytochemicals.

## Introduction

Joper chickens are the result of a cross between laying hens and Bangkok village chickens. Joper chickens have the advantage of being able to be hatched in large quantities on the same day as broiler chickens or laying breeds. The taste of joper chicken meat resembles the taste of free-range chicken. Yaman (2013), stated that free-range chicken farming businesses still face obstacles because the rearing system is still traditional, productivity is low compared to broilers, genetic quality variations are varied, mortality rates are high and feeding is not following requirements in terms of quantity and quality. Intensive rearing can reduce mortality rates and requires better feeding management than extensive rearing systems. Growth Promoters (AGPs) have long been used by commercial animal feed producers to stimulate livestock growth rates. The use of antibiotics as growth factors or Antibiotic Growth Promoters (AGPs), is given through feed in small quantities or at sub-therapeutic levels but given over a long period. AGPs can cause the emergence of bacterial zoonotic strains that are resistant to antibiotics. It is feared that this condition could reduce the effectiveness of antibiotic therapy used in the treatment of various infections in humans as consumers (Dahiya et al., 2006). The ban on the use of AGPs in commercial animal feed has caused animal feed

nutritionists to look for alternatives to AGPs by utilizing phytochemicals in plants (Bitwell et al., 2023). Soursop leaf extract contains phytochemical compounds that have antimicrobial activation and can function as an antioxidant. Fermentation of soursop leaves aims to accelerate the process of decomposing lignin and cellulose by fungi and bacteria, increasing the content of lactic acid bacteria (LAB) and the main metabolite resulting from fermentation in the form of lactic acid along with other secondary metabolites (Jang et al., 2007). Lactic acid and other fermentation products can improve the condition of the livestock digestive tract thereby increasing the efficiency of feed use, livestock growth and higher carcass quality. The research results of Nuriyasa et al. (2023), found that cockerels that were given an additional 1% sugar apple leaf extract were not able to reduce pathogenic bacteria, namely escherichia coli and coliforms, but the addition of 2%, 3% and 4% sugar apple leaf extract through drinking water significantly reduced pathogenic bacteria.

## Research Methodology

### *Research design*

The experiment used a Completely Randomized Design (CRD) with 5 treatments and 4 replications, each experimental unit consisting of 10 joper chickens, so the number of chickens used was 200 chickens. The treatments used in this research were: joper chicken without additional soursop leaf extract in drinking water (P0), additional fermented soursop leaf extract 1% (P1), additional fermented soursop leaf extract 2% (P2), additional fermented soursop leaf extract 3 % (P3), additional fermented soursop leaf extract 4% (P4).

### *Procedure for making fermented soursop leaf extract*

Soursop leaves are picked in 5 pieces from the oldest leaves on each branch, then the leaves are washed thoroughly using well water. Before fermenting, the soursop leaves are cut into 2 cm pieces. Fermentation of soursop leaves was carried out using an EM4 fermenter at 5% of the weight of the fermented soursop leaves (Artika et al., 2017). Weigh 1 kg of fermented soursop leaves, add 1 liter of clean water then blend. Water extract of fermented soursop leaves in a 1:1 ratio, put into a closed bottle and stored in the refrigerator to be used according to treatment. The treatment of 1% fermented soursop leaf extract (P1) is the administration of 99ml of drinking water and 1ml of fermented soursop leaf extract, then for treatments P2, P3 and P4 follow the P1 treatment pattern.

### *Joper chicken feed*

Joper chicken feed is prepared from feed ingredients such as yellow corn, polar, fish meal, coconut oil, Tapioca flour, mineral mix, and NaCl with the formulation as in Table 1 and Table 2.

Table 1  
Composition of joper chicken feed ingredients

Feed Ingredients	Composition (%)				
	P0	P1	P2	P3	P4
Yellow corn	45	45	45	45	45
Polar	26.8	26.8	26.8	26.8	26.8
Fish meal	16	16	16	16	16
Coconut oil	4.4	4.4	4.4	4.4	4.4
Tapioca flour	7.1	7.1	7.1	7.1	7.1
Mineral mix	0.45	0.45	0.45	0.45	0.45
NaCl	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Fermented soursop leaf extract	0	1	2	3	4

Table 2  
Joper chicken feed nutrient content

Feed Nutrient	Treatment				
	P0	P1	P2	P3	P4
Metabolic Energy (Kcal/kg)	2903.92	2903.92	2903.92	2903.92	2903.92
Crude protein (%)	16.01	16.01	16.01	16.01	16.01
Lipid (%)	9.25	9.25	9.25	9.25	9.25
Crude fiber (%)	8.06	8.06	8.06	8.06	8.06
Ca (%)	1.07	1.07	1.07	1.07	1.07
P (%)	0.6	0.6	0.6	0.6	0.6

Proximate analysis (2023)

#### *Research variable*

##### *Digestibility of Dry Matter and Nutrients*

Dry matter digestibility of feed and nutrient digestibility were calculated using the total collection method when Joper chickens were 9 weeks old. The excreta is collected and dried in the sun until air-dried, then placed in the oven at a temperature (100 - 105<sup>0</sup>C) for 5 hours until the excreta is dry. The amount of energy in excreta was calculated using a bomb calorimeter and excreta protein was determined using Kjeldhal analysis. Feed dry matter digestibility and nutrient digestibility are calculated using the formulation:

$$\text{Digestibility} = \frac{(A - B)}{A} \times 100\%$$

Information:

A: Consumption of dry matter or feed nutrients (g)

B: Amount of dry matter or nutrient excreta (g)

##### *Slaughter Weight*

Slaughter weight was obtained by weighing the body weight of the joper chicken at the end of the study (10 weeks of age). The sample of joper chickens that will be slaughtered to obtain carcass data is selected from 2 joper chickens whose body weight is closest to the body weight of the joper chickens in each treatment (Guerin et al., 2010; Hue et al., 2010).

##### *Joper Chicken Carcass*

Carcass weight is the weight after the chicken is slaughtered, then the feathers are removed, the internal organs are removed, and the head, neck and legs are cut off. The carcass percentage is obtained by comparing the carcass weight with the slaughter weight multiplied by 100%. The physical composition of the carcass is obtained by separating the bones, meat, subcutaneous fat and skin from the carcass. Pad fat weight is obtained from the results of weighing the fat under the skin around the stomach. Ventriculus fat is obtained from the results of weighing the fat around the gizzard. Mesenteric fat is obtained by weighing the fat that attaches to the small intestine to the colon.

##### *Statistical Analysis*

Data obtained were analyzed using the general linear model (GLM) and was performed with the software program IBM SPSS Statistics 25. The Least Significant Difference (LSD) test was applied to compare the differences in means.

## Results and Discussion

### *Phytochemical Content of Fermented Soursop Leaf Water Extract*

The results of proximate analysis of fermented soursop leaf water extract at the Analytical Laboratory of Udayana University, Bali, Indonesia found that fermented soursop leaf water extract contained 0.38% phenol, 0.15% flavonoids, 0.21% tannin, and an antioxidant capacity of 1,413,366 mg./LAAEAR, as in Table 3.

Table 3  
Phytochemical content of fermented soursop leaf water extract

No	Variable	Method	Unit	Results
1	Phenol	Spektrofotometri	%	0.38
2	Flavanoid (%)	Spektrofotometri	%	0.15
3	Tanin	Spektrofotometri	%	0.21
4	Antioxidant Capacity	Spektrofotometri	mg/LAAEAC	1.413.366

### *Nutrient digestibility*

The digestibility of dry matter feed in joper chickens that received treatment without the addition of soursop leaf water extract through drinking water (P0) was 73.24%. The addition of 1% soursop leaf water extract to drinking water (P1) was 4.06% higher ( $P>0.05$ ), while treatments P2, P3 and P4 were 15.34%; 13.98% and 11.61% higher ( $P<0.05$ ) than P0. The P4 treatment was 2.17% lower ( $P<0.05$ ) compared to P3, as in Table 4. Joper chickens that received the P0 treatment had a protein digestibility of 66.77%. Protein digestibility in Joper chickens that received P1, P2, P3 and P4 treatment was 7.55%; 27.27%; 25.55% and 20.15% higher ( $P<0.05$ ) compared to P0 treatment. The efficiency of changing GE to DE in joper chickens that did not receive additional water extract of fermented soursop leaves (P0) was 78.58%, while in P1, P2, P3 and P4 it was 3.50%; 15.11%; 15.78% and 13.30% higher ( $P<0.05$ ) than P0 treatment.

Table 4  
Nutrient Digestibility in Joper Chickens Added with Fermented Soursop Leaf Extract in Drinking Water

Variable	Treatment					SEM
	P0	P1	P2	P3	P4	
Dry Matter Digestibility (%)	73.24 <sup>d</sup>	76.15 <sup>cd</sup>	84.48 <sup>a</sup>	83.56 <sup>a</sup>	81.74 <sup>b</sup>	0.78
Crude Protein Digestibility (%)	66.77 <sup>d</sup>	71.81 <sup>c</sup>	84.98 <sup>a</sup>	83.83 <sup>a</sup>	79.96 <sup>b</sup>	0.84
Change of GE to DE (%)	78.58 <sup>c</sup>	81.33 <sup>b</sup>	90.45 <sup>a</sup>	89.98 <sup>a</sup>	89.03 <sup>a</sup>	0.73

#### Information:

- 1) Treatment without adding Srikaya leaf extract to drinking water (P0); addition of 1% Srikaya leaf extract to drinking water (P1); addition of 2% sugar apple leaf extract to drinking water (P2, addition of 3% sugar apple leaf extract to drinking water (P3), addition of 4% sugar apple leaf extract to drinking water (P4).
- 2) SEM: Standard Error of the Treatment Means
- 3) Different superscript letters on the same line indicate significantly different ( $P<0.05$ )

Dry matter digestibility in joper chickens that received additional treatment with soursop leaf extract through drinking water (P1, P2, P3 and P4) was higher than the control treatment (P0). As recommended by [Hernandez et al. \(2020\)](#), plant extract supplements can increase nutrient digestibility in the poultry digestive tract. Herbal plant extracts can improve pancreatic enzyme activity and microenvironmental conditions for better nutrient utilization. Fermented soursop leaf extract is rich in various secondary metabolites, such as phenols, flavonoids, tannins and antioxidants which can improve the microbial composition in the digestive tract ([Cerrate et al., 2019](#)). According to [Adibmoradi et al. \(2006\)](#), the active herbal compounds in garlic can increase the height of the villi and the depth of the crypts, and reduce the thickness of the epithelium and the number of villous cells in the duodenum, jejunum and ileum of poultry. Increasing the height of the villi, as well as the thickness of the epithelium and goblet in the duodenum, jejunum and ileum will increase nutrient uptake which can increase nutrient digestibility ([Batal & Parsons, 2002](#); [Refstie et al., 1999](#)). Soursop leaf extract functions as a prebiotic and EM4 as a probiotic, both of

which can work symbiotically. Prebiotics are a source of nutrients for the life and development of lactic acid bacteria. Prebiotics are nutritional supplements to increase the number of beneficial bacteria in the intestine, such as fructose oligosaccharide (FOS). Prebiotics can take the form of carbohydrates that cannot be digested by the small intestine but are fermented by bacteria in the colon. This component is a Non-Digestible oligo saccharide (NDO). NDO can stimulate the growth of beneficial bacteria, thereby suppressing pathogenic bacteria. This is what causes dry matter digestibility, protein digestibility and changes in GE to DE in Joper chickens that received soursop leaf extract added to drinking water to be higher than without the addition of sugar apple leaf extract (control treatment).

#### *Joper Chicken Carcass*

The slaughter weight of Joper chicken which was not given additional fermented soursop leaf extract (P0) was 760.33 g. The slaughter weight of joper chicken given the addition of 1%, 3% and 4% fermented soursop leaf extract was 8.42% respectively; 0.87%; higher ( $P>0.05$ ) and 1.83% lower ( $P>0.05$ ) compared to P0 treatment. Joper chickens given the addition of 2% fermented soursop leaf extract (P2) were 12.06% higher ( $P<0.05$ ) compared to the P0 treatment, as in Table 5.

Carcass weight of joper chickens treated without the use of fermented water extract of soursop leaves (*Annona muricata*) (P0) was 453.08 g. The P1 and P3 treatments produced carcass weights of 5.34% and 0.94% higher respectively but were not statistically significantly different ( $P>0.05$ ) compared to the P0 treatment but the P2 treatment was 11.91% higher. Statistically significantly different ( $P<0.05$ ) compared to P0 treatment. Treatment P4 was 4.45% lower, statistically not significantly different ( $P>0.05$ ) compared to treatment P0.

Carcass percentage of joper chickens in the control treatment (P0) resulted in a carcass percentage of 59.59%. Treatments P1, P2 and P4 produced carcass percentages of 2.84% each; 0.13% and 2.68% lower, but not statistically significantly different ( $P>0.05$ ) compared to the P0 treatment. The P3 treatment produced a carcass percentage of 0.08% higher but was not statistically significantly different ( $P>0.05$ ) compared to the P0 treatment.

The percentage of bone in joper chickens that received P0 treatment was 32.08%. Treatments P1, P2 and P4 produced a bone percentage of 3.87% each; 6.45% and 7.88% lower, statistically not significantly different ( $P>0.05$ ) compared to the P0 treatment.

The skin percentage of male joper chickens in the treatment without the use of fermented water extract of soursop leaves (*Annona muricata*) (P0) was 12.20%. Treatments P1 and P4 produced skin percentages of 25.53 and 7.15% higher but were not statistically significantly different ( $P>0.05$ ) compared to treatment P0, while treatments P2 and P3 were 2.26% and 0.34% lower ( $P>0.05$ ) compared to P0 treatment.

The pad fat of joper chickens that received control treatment (P0) was 1.27%. Treatments P1, P2, P3 and P4 produced a pad fat percentage of 45.84; 70.87; 44.67 and 20.82% were significantly lower ( $P<0.05$ ) than the P0 treatment.

Joper chickens that received control treatment (P0) produced ventriculus fat of 0.44%. Treatments P1, P2, P3 and P4 produced a percentage of ventricular fat of 30.60; 50.08; 5.82 and 9.21% lower ( $P<0.05$ ) than P0 treatment. The percentage of mesentery fat in joper chickens that received control treatment (P0) was 0.20%. Treatments P1, P2, P3 and P4 produced mesentery fat of 46.56; 69.80; 25.08 and 14.64% lower, which was statistically significantly different ( $P<0.05$ ) than the P0 treatment.

The percentage of abdominal fat in Joper chickens that received P0 treatment produced abdominal fat of 1.91%. Treatments P1, P2, P3 and P4 produced abdominal fat of 42.40; 65.09; 33.62 and 17.48% lower ( $P<0.05$ ) than the P0 treatment.

Table 5

Effect of additional fermented soursop leaf extract in drinking water on joper chicken carcasses at 10 weeks of age

Variable	Treatment <sup>1)</sup>					SEM <sup>2)</sup>
	P0	P1	P2	P3	P4	
Slaughter weight	760.33 <sup>b3)</sup>	824.32 <sup>ab</sup>	852.04 <sup>a</sup>	766.95 <sup>b</sup>	746.38 <sup>b</sup>	20.28
Carcass weight (g)	453.08 <sup>b</sup>	477.28 <sup>ab</sup>	507.05 <sup>a</sup>	457.33 <sup>b</sup>	432.90 <sup>b</sup>	15.61
Carcass percentage (%)	59.59 <sup>a</sup>	57.90 <sup>a</sup>	59.51 <sup>a</sup>	59.63 <sup>a</sup>	58.00 <sup>a</sup>	1.32
Meat (%)	27.86 <sup>a</sup>	26.96 <sup>a</sup>	29.03 <sup>a</sup>	27.36 <sup>a</sup>	28.69 <sup>a</sup>	1.58
Bone (%)	16.04 <sup>a</sup>	15.42 <sup>a</sup>	15.00 <sup>a</sup>	16.56 <sup>a</sup>	14.78 <sup>a</sup>	1.40
Skin (%)	6.10 <sup>a</sup>	7.65 <sup>a</sup>	5.96 <sup>a</sup>	6.08 <sup>a</sup>	6.54 <sup>a</sup>	1.21
Pad fat (%)	1.27 <sup>a</sup>	0.69 <sup>c</sup>	0.37 <sup>d</sup>	0.70 <sup>c</sup>	1.00 <sup>b</sup>	0.07

Variable	Treatment <sup>1)</sup>					SEM <sup>2)</sup>
	P0	P1	P2	P3	P4	
Ventriculus fat (%)	0.44 <sup>a</sup>	0.31 <sup>c</sup>	0.22 <sup>d</sup>	0.42 <sup>ab</sup>	0.40 <sup>b</sup>	0.01
Mesenterium fat (%)	0.20 <sup>a</sup>	0.11 <sup>ab</sup>	0.06 <sup>b</sup>	0.15 <sup>ab</sup>	0.17 <sup>ab</sup>	0.04
Abdominal fat (%)	1.91 <sup>a</sup>	1.10 <sup>c</sup>	0.67 <sup>d</sup>	1.27 <sup>c</sup>	1.58 <sup>b</sup>	0.07

Information :

1. Treatment of drinking water

P0: Drinking water without the addition of fermented soursop leaf water extract

P1: Drinking water with 1% water extract of fermented soursop leaves

P2: Drinking water with 2% water extract of fermented soursop leaves

P3: Drinking water with 3% water extract of fermented soursop leaves

P4: Drinking water with 4% water extract of fermented soursop leaves

2. SEM: Standard Error of the Treatment Mean

3. Values with different letters on the same row are significantly different (P<0.05)

Giving water extract of fermented soursop leaves (*Annona muricata*) at a level of 2% (P2) through drinking water, gave the best results on the slaughter weight of joper chickens (Macêdo et al., 2023; Martínez-Mendoza et al., 2023). Soursop leaves function as antioxidant, antidiabetic, antimicrobial, antiparasitic, antiviral, hepatoprotective, cytotoxic, genotoxic, antitumor activity, and anti-lice agents (Mohammadi Gheisar & Kim, 2018). The phytochemical content of fermented soursop leaf water extract includes; phenol 0.38%, tannin 0.21%, flavonoids 0.15% and antioxidant capacity 1,413.37 mg/l (Table 3). Soursop leaves contain phytochemical compounds of alkaloids, terpenoids, coumarins, lactones, anthraquinones, cardiac glycosides, phenols, phytosterols and saponins (Gavamukulya et al., 2014). Soursop leaves also contain fatty acids, heterocyclic compounds and esters (Gavamukulya et al., 2015). Plants containing flavonoids and alkaloids show the ability to inhibit the growth of pathogenic bacteria (Bhardwaj & Bhardwaj, 1970). This condition causes joper chickens that receive additional fermented soursop leaf extract to have a healthier digestive tract, the efficiency of feed use is higher and the resulting slaughter weight is higher than joper chickens given control treatment (P0).

Carcass weight of joper chickens given 2% fermented soursop leaf water extract (P2) through drinking water showed the highest yield was 507.05 g (Table 5). This is because giving water extract of fermented soursop leaves through drinking water at a level of 2% gives the highest slaughter weight results, thus affecting the carcass weight of joper chickens. Carcass weight is related to slaughter weight, the higher the carcass weight, the higher the carcass weight produced (Nuriyasa et al., 2021).

The addition of fermented soursop leaf water extract to drinking water was not able to affect the carcass percentage of joper chickens. This condition is caused because joper chickens with higher carcass weights are produced from higher slaughter weights so the percentage of carcasses produced is not significantly different from Nuriyasa et al. (2018). The same opinion was expressed by Suartiningsih et al. (2018), that the high percentage of chicken carcasses is due to a high increase in body weight. The carcass percentage in the results of this study was around 58-59%, this range is below ideal. Siswanto et al. (2022), stated that the ideal carcass percentage is around 65-67% of live weight. Providing water extract of fermented soursop leaves through drinking water does not affect the physical composition of the carcass which includes the percentage of meat, bones and skin of male joper chickens. This is because the physical composition of the carcass (meat, bones and skin) is higher resulting from a higher carcass weight, so the physical composition of the resulting carcass is not significantly different. The results of this research are supported by Yadnya et al. (2016), that the physical percentage of the carcass is not significantly different because the weight of the physical composition of the carcass increases in direct proportion to the increase in carcass weight.

Fat percentage consists of the percentage of pad fat, gizzard, mesenteric and abdominal fat. Abdominal fat is a layer of fat found around the gizzard and the layer between the abdominal muscles and intestines (Salam et al., 2017). The addition of fermented soursop leaf water extract through drinking water to joper chickens resulted in the lower pad, gizzard, mesenteric and abdominal fat compared to treatment without the addition of soursop leaf extract through drinking water. This is because fermented soursop leaf water extract contains 0.15% flavonoid compounds which can inhibit fat formation. Flavonoids can inhibit Fatty Acid Synthase (FAS), an important enzyme in fat metabolism. The presence of inhibition of FAS directly reduces the formation of fatty acids (Darni et al., 2016). Providing water extract of fermented soursop leaves at levels of 3% (P3) and 4% (P4) through drinking water caused the fat percentage of joper chickens to increase compared to the treatment level of 2% (P2). This is due to the gross energy content of soursop leaves of 4195 kcal/g (Londok & Mandey, 2014). The formation of abdominal fat occurs

when excess energy is consumed (Putra et al., 2020). The percentage of abdominal fat in this study ranged from 0.67-1.91%. This result is higher than the abdominal fat percentage of 11-week-old joper chickens with additional herbal concoction treatment in drinking water, namely, around 0.10-0.73% (Tuhalele et al., 2018).

## Conclusion

It can be concluded that fermented soursop leaf extract contains phytochemicals of 0.38% phenol; flavonoids of 0.15%; tannin of 0.21%; and an antioxidant capacity of 1,413,366 mg/LAAEAR. The addition of fermented soursop leaf water extract to drinking water at a level of 1-4% causes the digestibility of dry matter, protein, and the efficiency of changing GE to DE to be higher than without the addition of soursop leaf extract to drinking water. The addition of fermented soursop leaf water extract to drinking water can increase the carcass weight of joper chickens but does not affect the physical composition of the carcass.

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## Authors Contribution

I Made Nuriyasa, I Gusti Agung Arta Putra compiled the research idea, Anak Agung Putu Putra Wibawa performed the analysis of nutrient digestibility in joper chickens, I Made Nuriyasa was responsible for statistic analysis, all authors contributed equally to writing the final manuscript

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