



Administration of Fermented Soursop (Annona Muricata) Leaf Water Extract Through Drinking Water on the Performance of Joper Male Chickens



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Abstract

This study aims to determine the effect of fermented soursop (Annona muricata) leaf water extract on the performance of male joper chickens. The experimental design used was a completely randomized design (CRD) with 5 treatments and 4 replications, each experimental unit consisting of 3 chickens aged 2 weeks. The treatment given was fermented water extract of soursop leaves (Annona muricata) through drinking water, namely P0 : 0%, P1: 1%, P2: 2%, P3: 3% and P4: 4%. The variables observed were the performance and microbes of the digestive tract. The results showed that administration of fermented soursop (Annona muricata) leaf aqueous extract had a significant effect (P<0.05) on ration consumption, drinking water consumption, weight gain, final body weight, feed conversion ratio (FCR), total bacteria (TPC), escherichia coli and coliform. Based on the results of the study it can be concluded that administration of fermented soursop (Annona muricata) leaf water extract can improve the performance of joper male chickens with the best results at 2% administration via drinking water.

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## 1 Introduction

Super free-range chicken or commonly called jowo super (joper) is a type of broiler that is widely cultivated in Indonesia. The joper chicken is the result of a cross between laying hens and native chickens (Aenih et al., 2016). Munandar & Pramono (2014), state that DOC joper chickens can be produced in large quantities with uniform weight, have a faster growth rate than local native chickens and has the same taste of meat as native chickens.

Chickens need at least the essential chemical compounds that must be present in the ration. These chemical compounds must be in sufficient quantities in an optimum ratio to others and in a form that is easy to obtain to stimulate growth (Novita et al., 2020). Antibiotic Growth Promoters (AGPS) can very well stimulate the growth of chickens. Very little use can provide a significant increase in chicken productivity. The government prohibits the use of Antibiotic Growth Promoters (AGPS) in feed to increase livestock productivity. This is because giving antibiotics to livestock can interfere with the health of people who consume meat as a result of residues in the meat produced (Widyajaya & Jayawardhita, 2021).

The use of herbal plants is a solution substitute for using antibiotics which leaves residue and has a negative impact (Rahayu & Frasiska, 2019). Soursop leaves are leaves that are used as herbal medicine, soursop leaves contain chemical compounds that have the potential as feed additives for joper chickens. According to Londok & Mandey (2014), soursop leaves contain chemical compounds called flavonoids, which function as growth hormones and enzyme inhibitors by forming complex compounds with proteins.

The use of herbal plants has a high crude fiber content, which has an unfavorable impact on the productivity of chickens because chickens are monogastric livestock making it difficult to digest the high crude fiber. According to Salombre et al. (2018), Crude fiber is a polysaccharide that has a complex composition and poultry does not have a good enough ability to digest it, so it is necessary to carry out fermentation to reduce the value of the crude fiber content contained in soursop leaves. Providing fermented feed will increase the amount of BAL and improve broiler health and absorption of feed nutrients (Widodo et al., 2015). Permatasari et al. (2013), stated that soursop (*Annona muricata*) leaf juice with concentrations starting at 25% can inhibit the growth of *Escherichia coli* bacteria Kogoya et al. (2019), reported that the addition of geddi leaf juice as a feed additive through drinking water in native chickens increased body weight gain and ration conversion at a dose of up to 20 ml/L was called the most efficient.

## 2 Materials and Methods

### *Place and time of research*

This research was conducted in Dajan Peken Village, Tabanan District, Tabanan Regency, Bali. The study lasted for 2 months (joper chickens aged 2-10 weeks).

### *Research design*

This study used a completely randomized design (CRD) with 5 treatments and 4 replications, each experimental unit consisted of 3 male joper chickens, so the number of chickens used was 60 with an average initial weight of  $128.43 \pm 2.82$ . The treatment in this research is; P0: 0% administration of fermented soursop (*Annona muricata*) leaf water extract through drinking water, P1: 1% administration of fermented soursop (*Annona muricata*) leaf water extract via drinking water, P2: 2% administration of fermented soursop (*Annona muricata*) leaf extract through drinking water, P3 : 3% administration of fermented soursop (*Annona muricata*) leaf water extract through drinking water, P4: 4% administration of fermented soursop (*Annona muricata*) leaf water extract through drinking water.

### Cage

This study used a battery colony cage model of 20 cages with each cage measuring 70 cm long, 50 cm wide and 40 cm high and made of BRC wire. Each cage is equipped with feed and drinking water containers made of bamboo and PVC pipes. The base of the cage is equipped with cardboard to collect chicken faeces, making it easier to clean the cage.

### Preparation of fermented soursop leaf water extract

Fermentation was carried out after the soursop leaves were washed using clean water and cut into small pieces, then the soursop leaves were fermented with an EM4 fermenter for as much as 5% of the total number of leaves for 5 days. Weigh fermented soursop leaves as much as 1 kg, then add 1 litre of clean water, then blend until it becomes homogeneous. Soursop leaf water extract with a ratio of 1:1, is then put into a bottle and can be used according to the treatment (Campbell-Platt, 1994; Je et al., 2005).

### Variables

The variables observed in this study were the performance of male joper chickens, including feed consumption, drinking water consumption, body weight gain, feed conversion ratio (FCR) final body weight. The composition of microbes in the digestive tract, including total bacteria (TPC), escherichia coli and coliform.

### Data analysis

The data obtained were analyzed using variance using SPSS Statistics 26. If the results were significantly different between treatments ( $P < 0.05$ ), the analysis was continued with Duncan's multiple-range test.

## 3 Results and Discussions

The results of the study on the performance of joper male chickens fed fermented soursop (*Annona muricata*) leaf water extract were as follows;

Table 1  
Performance of male joper chickens aged 2-10 weeks gave fermented soursop leaf water extract through drinking water

Variable	Treatment					SEM <sup>1)</sup>
	P0	P1	P2	P3	P4	
Ration Consumption (g/head)	2020,85 ±1.56 <sup>a2)</sup>	2018,40 ±1.63 <sup>a</sup>	2005,68 ±1.47 <sup>c</sup>	2009.05 ±2.25 <sup>b</sup>	1999,07 ±1.58 <sup>d</sup>	0.99
Water Consumption (ml/head)	3604,12 ±2.78 <sup>a</sup>	3572.57 ±2.88 <sup>b</sup>	3529.99 ±2.58 <sup>c</sup>	3515.84 ±3.94 <sup>d</sup>	3498,37 ±2.77 <sup>e</sup>	1.75
Weight Gain Body (g/tail)	634,19 ±56.69 <sup>bc</sup>	695,47 ±20.37 <sup>ab</sup>	723.08 ±44.54 <sup>a</sup>	639,23 ±9.27 <sup>bc</sup>	617,43 ±49.33 <sup>c</sup>	23,28
Final Body Weight (g/head)	762.60 ±56.72 <sup>a</sup>	824,23 ±20.91 <sup>ab</sup>	852,29 ±43,63 <sup>b</sup>	766,80 ±10.85 <sup>a</sup>	746,40 ±49.35 <sup>a</sup>	23,26
Feed Convention Ratio(FCR)	3,21 ±0.27 <sup>a</sup>	2.90 ±0.09 <sup>ab</sup>	2.78 ±0.18 <sup>b</sup>	3,14 ±0.04 <sup>ab</sup>	3,26 ±0.29 <sup>a</sup>	0.11

Information:

1. Standard Error of The Treatment Means
2. Values with different letters in the same row show a not significant difference ( $P < 0.05$ )

Consumption of male joper chicken rations given fermented soursop (*Annona muricata*) leaf water extract through drinking water showed significantly different results ( $P < 0.05$ ). The highest consumption in the P0 treatment had the highest value of 2020.85 g/head (Table 1.). Giving fermented soursop leaf water extract was able to reduce ration consumption as a result of fulfilling the nutrients contained in the ration. This is a result of increased digestive and metabolic activity (Ghazalah & Ali, 2008). That matters showed that fermented soursop leaf water extract has antimicrobial content that can increase the absorption of nutrients in the feed so that nutrient absorption is maximized (Badrie & Schauss, 2010; Artika et al., 2017). Soursop leaves have active compounds such as flavonoids which include quercetin and epicatechin, the combination of these compounds is essential for growth and reduces disease incidence (Teixeira et al., 2014) increasing feed utilization and causing less feed to be required to meet poultry rearing and production requirements, (Alabi et al., 2017). The results of this study are the same as those reported by Portugaliza & Fernandez (2012), who observed that the aqueous extract of *Moringa oleifera* leaves through drinking water significantly reduced broiler feed intake.

Water consumption of male joper chickens given fermented soursop (*Annona muricata*) leaf water extract through drinking water showed significantly different results ( $P < 0.05$ ). The higher the level of administration of fermented soursop leaf water extracts through drinking water, the lower the water consumption. Male joper chickens that were given treatment P0, P1, P2, P3 and P4 were 3604.12; 3572.57; 3529.99; 3515.84 and 3498.37 ml/head (Table 1). This shows that the administration of fermented soursop leaf water extract can affect drinking water consumption. Scott et al. (1982), stated that consumption of drinking water can be reduced by treatment with additives. This is following the results of a study by Durrani et al. (2008), that feeding additive neem leaf flour through drinking water can significantly reduce feed consumption and drinking water consumption in broilers.

The weight gain of joper male chickens given fermented soursop (*Annona muricata*) leaf water extract through drinking water showed significantly different results ( $P < 0.05$ ). The successive administration of P1 and P2 levels of 1 and 2% through drinking water increased the weight gain of joper male chickens by 695.47 and 723.08 grams which were statistically significantly different (Table 1.). The successive administration of P3 and P4 at levels of 3 and 4% gave decreased results, namely 639.23 and 617.43 grams, which were not statistically significantly different. Qurniawan et al. (2016), states that the factors that influence body weight gain are differences in sex, feed consumption, environment, seeds and feed quality. The function of scoring is to stimulate cell growth and repair damaged body cells (Dharmawati et al., 2013). Excessive feeding can reduce the weight gain of joper male chickens because the compounds contained in water extract of fermented soursop leaves given in excess can reduce the metabolism of food substances in the digestive tract of male joper chickens which act as anti-nutrition (Nagai et al., 2003).

Feed Conversion Ratio (FCR) male joper chickens given fermented soursop (*Annona muricata*) leaf aqueous extract through drinking water showed significantly different results ( $P < 0.05$ ). Treatments P1 and P2 at levels of 1 and 2% respectively reduced the FCR values by 2.90 and 2.88 statistically significantly different, whereas in treatments P3 and P4 at levels of 3 and 4% the FCR values increased by 3.14 and 3.26, statistically not significantly different from treatment P0 (Table 1.). Sejati et al. (2019), stated that the lower the ration conversion, the more efficient the livestock's ability to convert rations into meat. This proves that the administration of fermented soursop leaf water extract containing active compounds that act as antioxidants and antimicrobials has been able to increase the absorption of nutrients found in feed to convert them into the meat. Soursop leaf water extract has antimicrobial content that can accelerate the absorption of nutrients in the feed so that the absorption of nutrients is also maximized. The use of phytobiotics as feed additives in poultry feed functions as antioxidants, antimicrobials, growth promoters, antioxidant activity and anti-inflammatory activity (Li et al., 2012; Muhammadi Gheisar & Kim, 2016). However, excessive feeding cannot help the joper chickens convert feed into meat because the availability of active compounds from fermented soursop leaf water extract increases into anti-nutritional substances that can indirectly affect the joper chickens in converting feed into meat. Compounds contained in soursop leaves act as inhibitors or anti-nutrients which can reduce the metabolic power of food substances in the digestive tract (Montoya-Weiss, & Calantone, 1994; Fullerton & McWatters, 2001).

Table 2  
Microbes in the digestive tract of male joper chickens aged 2-10 weeks given fermented soursop leaf water extract through drinking water

Variable	Treatment					SEM <sup>1)</sup>
	P0	P1	P2	P3	P4	
TPC (CFU/gr)	1.6x10 <sup>5e2)</sup> ±0.04	1.9x10 <sup>5d)</sup> ±0.08	3.0 x10 <sup>5c)</sup> ±0.05	4.7x10 <sup>5b)</sup> ±0.11	5.7x10 <sup>5a)</sup> ±0.08	4.38
Escherichia Coli (CFU/gr)	1.5x10 <sup>4a)</sup> ±0.04	5.7x10 <sup>3b)</sup> ±0.08	3.9x10 <sup>3c)</sup> ±0.04	1.9x10 <sup>3d)</sup> ±0.08	1.7x10 <sup>3d)</sup> ±0.04	0.09
Coliform (CFU/gr)	8.5x10 <sup>4a)</sup> ±0.08	6.1x10 <sup>4b)</sup> ±0.08	5.0x10 <sup>4c)</sup> ±0.04	4.2x10 <sup>4d)</sup> ±0.14	3.5x10 <sup>4e)</sup> ±0.08	0.49

Information;

1. *Standard Error of The Treatment Means*
2. Values with different letters in the same row show a not significant difference ( $P < 0.05$ )

The total bacteria (TPC) of male joper chickens given fermented soursop (*Annona muricata*) leaf aqueous extract through drinking water showed significantly different results ( $P < 0.05$ ). The higher the level of administration of fermented soursop leaf water extract through drinking water, the lower the TPC (CFU/gr). Joper chickens treated with P0, P1, P2, P3 and P4 were 1.6; 1.9; 3.0; 4.7 and 5.7x10<sup>5</sup> CFU/gr (Table 2). P0 treatment without fermented soursop leaf water extract gave the lowest total bacteria followed by the highest *Escherichia coli* and coliform bacteria (Table 2), so it was identified that the total bacteria had increased due to the growth of lactic acid bacteria and decreased growth of *Escherichia coli* and coliforms bacteria. This is because the administration of fermented soursop leaf water extract has phytochemical compounds in the form of alkaloids, saponins, steroids, phenols, flavonoids and tannins which act as antibacterials so that lactic acid bacteria experience increased growth and function as probiotics (Aruan et al., 2017; Selvanathan et al., 2022). Mariana & Susanti (2012), stated that probiotics are food ingredients that can stimulate the growth of probiotic bacteria because they have specific properties that are not absorbed and hydrolyzed in the digestive system, can stimulate the growth of beneficial bacteria and inhibit the growth of pathogenic bacteria.

Total *Escherichia coli* and coliform bacteria in male joper chickens given fermented soursop (*Annona muricata*) leaf aqueous extract through drinking water showed significantly different results ( $P < 0.05$ ). The higher the level of fermented soursop leaf water extract, the lower the number of *Escherichia coli* and coliform bacteria (Table 2). Giving fermented soursop leaf water extract which has active phytochemical compounds in the form of flavonoids which act as antibacterial, can interfere with growth and even kill some bacteria by interfering with the metabolic processes of harmful bacteria. Khera & Bhargava (2013) stated that flavonoids are secondary metabolites from plants that have antibacterial, antifungal, and anti-inflammatory properties. Plants that contain phytochemicals as natural antibiotics with the ability to suppress pathogenic microbes, provide immunity and endurance and increase production performance (Natsir & Widodo, 2016). This indicated that the levels of fermented soursop leaf water extract were able to inhibit the growth of pathogenic bacteria. Gunawijaya et al. (2021), stated that the growth of bacterial colonies could not be reduced the amount of growth, due to the level of administration of active compounds that had not been fulfilled, so they were not able to inhibit the growth of bacteria in the digestive tract of chickens.

## 4 Conclusion

Based on the results of the study it can be concluded that administration of fermented soursop (*Annona muricata*) leaf water extract at a level of 2% administration through drinking water gave the best results on performance variables and microbes in the digestive tract of joper male chickens.

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## References

- Aenih, N., Pagala, M. A., & Tasse, A. M. (2016). Hematologi ayam kampung super yang diberi minyak kelapa-sawit terproteksi dalam ransum. *Jurnal Ilmu dan Teknologi Peter-nakan Tropis*, 3(1), 15-20.
- Alabi, O. J., Malik, A. D., Ng'Ambi, J. W., Obaje, P., & Ojo, B. K. (2017). Effect of aqueous Moringa oleifera (Lam) leaf extracts on growth performance and carcass characteristics of hubbard broiler chicken. *Brazilian Journal of Poultry Science*, 19, 273-280.
- Artika, I. M., Julistiono, H., Bermawie, N., Riyanti, E. I., & Hasan, A. E. Z. (2017). Anticancer activity test of ethyl acetate extract of endophytic fungi isolated from soursop leaf (*Annona muricata* L.). *Asian Pacific journal of tropical medicine*, 10(6), 566-571. <https://doi.org/10.1016/j.apjtm.2017.06.004>
- Aruan, N. M., Sriyanti, I., Edikresna, D., Suciati, T., & Munir, M. M. (2017). Polyvinyl alcohol/soursop leaves extract composite nanofibers synthesized using electrospinning technique and their potential as antibacterial wound dressing. *Procedia Engineering*, 170, 31-35. <https://doi.org/10.1016/j.proeng.2017.03.006>
- Badrie, N., & Schauss, A. G. (2010). Soursop (*Annona muricata* L.): composition, nutritional value, medicinal uses, and toxicology. In *Bioactive foods in promoting health* (pp. 621-643). Academic Press. <https://doi.org/10.1016/B978-0-12-374628-3.00039-6>
- Campbell-Platt, G. (1994). Fermented foods—a world perspective. *Food research international*, 27(3), 253-257. [https://doi.org/10.1016/0963-9969\(94\)90093-0](https://doi.org/10.1016/0963-9969(94)90093-0)
- Dharmawati, S., Firahmi, N., & Parwanto, P. (2013). Penambahan tepung bawang putih (*Allium Sativum* L) sebagai feed additif dalam ransum terhadap penampilan ayam pedaging. *Ziraa'ah Majalah Ilmiah Pertanian*, 38(3), 17-22.
- Durrani, F. R., Sultan, A., Jan, M., Chand, N., & Durrani, Z. (2008). Immunomodulatory and growth promoting effects of Neem (*Azadirachta indica*) leaves infusion in broiler chicks. *Sarhad J. Agric*, 24(4), 655-659.
- Fullerton, R. R., & McWatters, C. S. (2001). The production performance benefits from JIT implementation. *Journal of operations management*, 19(1), 81-96. [https://doi.org/10.1016/S0272-6963\(00\)00051-6](https://doi.org/10.1016/S0272-6963(00)00051-6)
- Ghazalah, A. A., & Ali, A. M. (2008). Rosemary leaves as a dietary supplement for growth in broiler chickens. *International Journal of Poultry Science*, 7(3), 234-239.
- Gunawijaya, G. P., Nuriyasa, I. M., & Siti, N. W. (2021). Performance and Blood Lipide Profile of Cockerel Aged 0-7 Weeks That Were Given Sambiloto Leaf Water Extract (*Andrographis Paniculata* Ness) Through Drinking Water. *International Journal of Life Sciences*, 5(3), 179-190. <https://doi.org/10.53730/ijls.v5n3.2209>
- Je, J. Y., Park, P. J., Jung, W. K., & Kim, S. K. (2005). Amino acid changes in fermented oyster (*Crassostrea gigas*) sauce with different fermentation periods. *Food chemistry*, 91(1), 15-18. <https://doi.org/10.1016/j.foodchem.2004.05.061>
- Kaleka, N. (2015). Panen Ayam Kampung Super. *Arcita. Solo*.
- Khera, N. E. H. A., & Bhargava, S. A. N. G. E. E. T. A. (2013). Phytochemical and pharmacological evaluation of *Tectona grandis* Linn. *Int J Pharm Pharm Sci*, 5(3), 923-927.
- Kogoya, D., Mandey, J. S., Rumokoy, L. J., & Regar, M. N. (2019). Penambahan Daun Gedi (*Abelmoschus Manihot* (L) Medik) Sebagai "Additive" Dalam Air Minum Dan Pengaruhnya Terhadap Performans Ayam Kampung Super. *Zootec*, 39(1), 82-92.
- Li, P., Piao, X., Ru, Y., Han, X., Xue, L., & Zhang, H. (2012). Effects of adding essential oil to the diet of weaned pigs on performance, nutrient utilization, immune response and intestinal health. *Asian-Australasian Journal of Animal Sciences*, 25(11), 1617.
- Londok, J. J., & Mandey, J. S. (2014). Potensi Fitokimia dan Aktivitas Antimikroba Daun Sirsak (*Annona muricata* Linn.) Sebagai Kandidat Bahan Pakan Ayam Pedaging. *Jurnal LPPM Bidang Sains dan Teknologi*, 1(1), 30-36.
- Mariana, E., & Susanti, H. (2012). Pengaruh Suplementasi Tepung Terigu terhadap Pertumbuhan dan Laju Pengasaman Probiotik *Lactobacillus acidophilus*. *Jurnal Teknologi dan Industri Pertanian Indonesia*, 4(3).
- Mohammadi Gheisar, M., & Kim, I. H. (2018). Phytobiotics in poultry and swine nutrition—a review. *Italian journal of animal science*, 17(1), 92-99.

- Montoya-Weiss, M. M., & Calantone, R. (1994). Determinants of new product performance: A review and meta-analysis. *Journal of product innovation management*, 11(5), 397-417. [https://doi.org/10.1016/0737-6782\(94\)90029-9](https://doi.org/10.1016/0737-6782(94)90029-9)
- Munandar, A., & Pramono, V. J. (2015). Production Of Crude Aspergillus Fermentation Extract To Enhance The Quality Of Feed As A Productivity Booster Of Super Chicken. *Jurnal Sain Veteriner*, 32(2).
- Nagai, T., Inoue, R., Inoue, H., & Suzuki, N. (2003). Preparation and antioxidant properties of water extract of propolis. *Food chemistry*, 80(1), 29-33. [https://doi.org/10.1016/S0308-8146\(02\)00231-5](https://doi.org/10.1016/S0308-8146(02)00231-5)
- Natsir, H. M., & Widodo, E. (2016). Use of curcuma (*Curcuma domestica*) and ginger (*Zingiber officinale*) meal combination with encapsulation and non-encapsulation on intestinal characteristic, and intestinal microfloras in broiler. *Buletin Peternakan*, 40, 1-10.
- Novita, H., Novitaningrum, A. D., Madusari, B. D., Nugraha, M. F. I., Rajamuddin, M. A., Yunita, R., & Enggarini, W. (2020). Antibacterial activity of *Anadendrum microstachyum* and *Selaginella plana* against two pathogenic bacteria (*Edwardsiella ictaluri* and *Streptococcus agalactiae*) causing freshwater fish diseases. In *IOP Conference Series: Earth and Environmental Science* (Vol. 535, No. 1, p. 012025). IOP Publishing.
- Permatasari, G.A.A.A., Besung, I.N.K., & Mahatmi, A. (2013). Inhibition of soursop leaf juice on the growth of *Escherichia coli* bacteria. *Indonesia Medicus Veterinus*. 2(2), 162-169.
- Portugaliza, H. P., & Fernandez Jr, T. J. (2012). Growth performance of Cobb broilers given varying concentrations of Malunggay (*Moringa oleifera* Lam.) aqueous leaf extract. *Online Journal of Animal and Feed Research (OJAFR)*, 2(6), 465-469.
- Qurniawan, A., Arief, I. I., & Afnan, R. (2016). Performans produksi ayam pedaging pada lingkungan pemeliharaan dengan ketinggian yang berbeda di Sulawesi Selatan. *Jurnal Veteriner*, 17(4), 622-633.
- Rahayu, N. And Frasiska, N. (2019). Slaughter weight and carcass percentage of broiler chickens fed drinking water containing a combination of bitter leaf extract (*Andrographis paniculata*) and soursop leaf (*Annona muricata*). *Bulletin of Applied Animal Research*, 1(1), 31-34.
- Salombre, V. J., Najoran, M., Sompie, F. N., & Imbar, M. R. (2018). The effect of using Kepok banana peel silage (*Musa paradisiaca formatypica*) as a partial substitute for corn on broiler carcasses and viscera. *Zootech Journal*. 38(1), 27-36.
- Scott, M. L., Nesheim, M. C., & Young, R. J. (1982). Nutrient of The Chicken. *Publ. By ML Scott, Itacha, New York*.
- Sejati, G. C. S., Arifin, H. D., & Mudawaroch, R. E. (2019). Produktivitas Ayam Kampung Super (Joper) Pengaruh Rasio Lisin dan Metionin. *Jurnal Riset Agribisnis dan Peternakan*, 4(1), 41-52.
- Selvanathan, V., Aminuzzaman, M., Tan, L. X., Win, Y. F., Cheah, E. S. G., Heng, M. H., ... & Aktharuzzaman, M. (2022). Synthesis, characterization, and preliminary in vitro antibacterial evaluation of ZnO nanoparticles derived from soursop (*Annona muricata* L.) leaf extract as a green reducing agent. *Journal of Materials Research and Technology*, 20, 2931-2941. <https://doi.org/10.1016/j.jmrt.2022.08.028>
- Teixeira, E. M. B., Carvalho, M. R. B., Neves, V. A., Silva, M. A., & Arantes-Pereira, L. (2014). Chemical characteristics and fractionation of proteins from *Moringa oleifera* Lam. leaves. *Food chemistry*, 147, 51-54. <https://doi.org/10.1016/j.foodchem.2013.09.135>
- Widodo, T.S., Sulistyanto, B. & Utama, C.S. (2015). The number of lactic acid bacteria (LAB) in the digesta of the small intestine and cecum of broiler chickens that were fed spilled feed from fermented feed factories. *Agripet*, 15(2), 98-103.
- Widyanjaya, A. A. G. F., & Jayawardhita, A. A. G. (2021). Antibacterial Effect and Potency of Jamaican Cherry Leaves (*Muntingia calabura* L.) as Feed Additive for Antibiotic Growth Promoter Alternative in Animals. *WARTAZOA. Indonesian Bulletin of Animal and Veterinary Sciences*, 31(3), 129-136.

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