p-ISSN: 1907-8056
e-ISSN: 2527-5410
AGROINTEK
Jurnal Teknologi Industri Pertanian
journal homepage: journal.trunojoyo.ac.id/agrointek

Carcass yield of cross-bred native chicken with fed dietary contain prebiotic from dahlia (*Dahlia variabilis*) and probiotic

Zakaria Husein Abdurrahman [1*], Yoyok Budi Pramono[2], Nyoman Suthama[3]

[1]*Department of Animal Science, University of Boyolali, Boyolali, Indonesia*
[2]*Department of food technology, Diponegoro University, Semarang, Indonesia*
[3]*Department of animal science, Dipenogoro University, Semarang, Indonesia*

Article history
Received:
28 March 2022
Revised:
16 May 2022
Accepted:
24 May 2022

Keyword
Native chicken;
Inulin;
Dahlia;
Carcass;
Lactobacillus sp

ABSTRACT

The use of probiotics and prebiotics together produces more beneficial effect to the microflora ecosystem in the intestine of chicken. The primary objective was to determine the carcass yield of the cross-bred native chicken fed diet containing dahlia (Dahlia variabilis) tuber powder as a resource of inulin combined with Lactobacillus sp. Animals used in this study were 168 birds of 21 days old cross-bred native chickens randomly allocated into six treatments with four replications. Data were analyzed as a completely randomized design in a 2×3 factorial of 2 levels of prebiotics and three levels of probiotics as the main effects. The treatments were 0.8% of dahlia tuber powder without Lactobacillus sp. (E1O0); 0.8% dahlia tuber powder combined with 1.2 mL of Lactobacillus sp. (10^8 CFU/mL) (E1O1); 0.8% dahlia tuber powder combined with 2.4 mL of Lactobacillus sp. (10^8 CFU/mL) (E1O2); 1.2% dahlia tuber powder without Lactobacillus sp. (E2O0); 1.2% dahlia tuber powder combined with 1.2 mL of Lactobacillus sp. (10^8 CFU/mL) (E2O1); 1.2% dahlia tuber powder combined with 2.4 mL of Lactobacillus sp. (10^8 CFU/mL) (E2O2). The feeding of dahlia tuber powder combined with Lactobacillus sp. showed no significant effect (P>0.01) on the percentage of carcass weight, meat-bone ratio, and percentage of carcass cut weight on cross-bred native chicken. In conclusion, a feeding diet containing inulin derived from dahlia tuber combined with Lactobacillus sp. was not affected on carcass yield of cross-bred native chicken, although in previous studies, the same treatment could improve the meat quality of cross-bred native chicken.

[*] Corresponding Author
Email: zhabdurrahman@gmail.com
DOI 10.21107/agrointek.v16i4.14175

INTRODUCTION

Based on data from BPS (2020), the native chicken population from 2018 to 2020 continued to increase. The population increased to 2.4% in 2020 compared to 2018. The increase in population was also followed by consumption in 2015, which amounted to 0.626 kg per capita per year to 0.782 kg per capita per year in 2020, but this was not sufficient to meet the demands of the market. Indonesian prefer to consume native chicken meat over broiler chicken because of the flavor. Crosses between native chickens and laying breed chickens have been carried out in Indonesia and are known as cross-bred native chickens. Cross-bred native chickens can produce meat whose aroma and taste are similar to young free-range chickens at the same age, but their growth is faster to reach slaughter weight. The productivity of cross-bred native chickens can be increased by using antibiotics. However, antibiotics have been banned as growth promoters in livestock because they have negative effects on long-term use. According to Alloui et al. (2013), the use of antibiotics as growth promoters can cause resistance to pathogenic bacteria. Thus, the use of prebiotics and probiotics is needed as an alternative to antibiotics.

Probiotics are living microorganisms in sufficient quantities that can affect the composition and ecosystem of the microflora in the digestion, which provides health benefits for the host (Hill et al., 2014). Research by Awad et al. (2009) showed that the use of *Lactobacillus* sp. as a probiotic could improve the performance of broiler chicken. The performance of probiotics and endogenous bacteria in the gastrointestinal tract can be improved by adding prebiotics to the feed. The current definition of a prebiotic is a selective substance that can produce certain changes in the composition and activity of the microflora of the gastrointestinal tract, which provides benefits to the health of the host (Valcheva and Levinus, 2016). Inulin is a very potential source of prebiotics. Wong et al. (2013) found that inulin is a prebiotic source of the oligosaccharide group, which is superior to other oligosaccharides in improving the performance of *Lactobacillus* sp. World commercial inulin production has so far been obtained from Jerusalem artichoke and chicory root, while in Indonesia, inulin can be obtained from a dahlia, gembili, banana weevil, and turubuk tubers (Haryati, 2011; Mangunwidjaja et al., 2014). *Dahlia variabilis* is a potential source of inulin in Indonesia (Suthama et al., 2019). Based on Singh et al. (2019), the dahlia tuber contained 14-20% inulin.

The use of probiotics and prebiotics together produces a more beneficial effect than partial use (Fallah et al., 2013). The use of probiotics and prebiotics together is expected to affect the microflora ecosystem in the intestine, namely increasing the number of beneficial bacteria, which results in an increase in nutrient absorption followed by the quality of the chicken carcass. The aim of this work was, therefore, to determine the carcass yield of the cross-bred native chicken fed diet containing dahlia tuber powder as a resource of inulin combined with *Lactobacillus* sp.

METHODS

This research was conducted simultaneously with Abdurrahman et al. (2016a, 2016b). The detailed materials and methods used were:

The 168 cross-bred native chickens were fostered in the brooding area and fed commercial feed from 1-20 days old. At the 21 days old (164.45 ± 2.97g), birds were placed in the experimental cage divided into 168 cages and given treatment feed. The feed composition was in accordance with Abdurrahman et al. (2016), as shown in Table 1.

The experiment had the following 6 treatments in a factorial arrangement:

1. E1O0: 0.8% dahlia tuber powder without *Lactobacillus* sp.;
2. E1O1: 0.8% dahlia powder and 1.2 mL *Lactobacillus* sp. (10^8 cfu / mL);
3. E1O2: 0.8% dahlia tuber powder and 2.4 mL *Lactobacillus* sp. (10^8 cfu / mL) ;
4. E2O0: 1.2% dahlia tuber powder without *Lactobacillus* sp.;
5. E2O1: 1.2% dahlia tuber powder and 1.2 mL *Lactobacillus* sp. (10^8 cfu / mL);
6. E2O2: 1.2% dahlia tuber powder and 2.4 mL *Lactobacillus* sp. (10^8 cfu / mL).

Table 1 Ingredients and nutrient compositions of the experimental basal diet)

Diet ingredient	Starter	Finisher
	.....(%).....	
Yellow corn	53.30	54.50
Rice brand	16.00	20.00
Soybean meal	19.50	15.00
Fish meal	10.00	9.30
$CaCO_3$	0.70	0.70
Vitamin and mineral	0.50	0.50
Total	100.00	100.00
Nutrient Composition (*%*)		
Metabolizable energy (*kcal/kg*)*	2.879.55	2.879.16
*Crude protein***	19.67	17.73
*Ether extract***	6.42	6.35
*Crude fiber***	6.38	6.60
*Methionine**	0.42	0.40
*Lysine**	1.95	1.06
*Calcium****	1.17	1.10
*Phospor****	0.68	0.68

*Based on Table of Badan Standarisasi Nasional (2006) and National Research Council (1994); **Result of chemical analysis at The Laboratory of Animal Feed Science, Faculty of Animal Science, Hasanuddin University (2014);*** result of chemical analysis at the Laboratory of Animal Nutrition and Feed Science, Faculty of Animal and Agriculture Science, Diponegoro University (2013).

The feed was given two times a day, at 06.00 AM and 04.00 PM. Feed containing dahlia tuber powder and *Lactobacillus* sp. is given every evening. Each treatment had four replicates of 7 cross-bred native chickens each and lasted for 11 weeks. At the end of 11 weeks, birds were weighed and slaughtered. The carcass weight was obtained by removing the head, legs, and visceras. The carcass is then cut into two drumsticks (right and left), two wings (right and left), a breast, and a back. The parameters observed were the percentage of the carcass, percentage of the carcass weight cut, and the meat to bone ratio.

The percentage of carcass weight (%) is calculated from carcass weight (weight of chicken without feathers, blood, head, neck, legs, and visceras) divided by live weight and then multiplied by 100%. The percentage of carcass pieces weight (%) was calculated from the weight of each carcass piece (breast, drumstick, back, and wings) divided by total carcass weight and then multiplied by 100%. The ratio of bone meat (%) is calculated by dividing the weight of the bones by the weight of carcass meat, then multiplied by 100%.

The data were examined in a 2x3 factorial with two levels of prebiotics and three levels of probiotics as the primary effects in a completely randomized design. Significant effects were further analyzed, and means were compared using Duncan's multiple range test to see the difference between each treatment. Statistical significance was determined at P ≤0.01.

$$Y_{ijk} = \mu + \alpha_i + \beta_j + (A\beta)_{ij} + \varepsilon_{ijk}$$

where:

Y_{ijk} = The results of observations in the i treatment, and in the j repetition, General mean;

α_i =The effect of dahlia tuber powder on the i-level;

β_j=The effect of Lactobacillus sp. in the j-level,

(Aβ)ij= The interaction of the *i*-level dahlia tuber powder and *j*-level *Lactobacillus* sp., *ijk*= Error effect on the experimental of *i*-level dahlia tuber powder, *j*-level *Lactobacillus* sp., *k*-level repetition.

RESULTS AND DISCUSSION

The results showed that the addition of feed containing dahlia tuber powder as a source of inulin combined with *Lactobacillus* sp. showed no significant effect (P> 0.01) on the percentage of carcass weight (Table 2). The combination of dahlia tuber powder and *Lactobacillus* sp. can increase the number of beneficial bacteria in the intestine in the form of lactic acid bacteria, which can produce metabolite products in the form of short-chain fatty acids (SCFA), thereby lowering intestinal pH and increasing nutrient absorption. The mechanism is compatible with Teymouri et al. (2021) found that giving a combination of prebiotics and probiotics increased the population of beneficial microorganisms in the intestines of broiler chickens. Mookiah et al. (2014) also found that the balance of the microorganism ecosystem in the digestive tract of poultry can increase nutrient absorption and livestock health. Based on this, the improvement of intestinal health and nutrient absorption due to the addition of dahlia tuber powder as an inulin source in combination with the bacteria *Lactobacillus* sp. should be followed by an increase in carcass percentage. According to Abdel-Raheem and Abd-Allah (2011), feed containing a combination of prebiotics and probiotics can increase carcass weight because it maintains the beneficial microbial population in the digestive tract, thereby increasing nutrient digestibility in the digestive tract, which in turn has an impact on improving livestock health and performance. However, this did not happen in this study because it may be due to differences in probiotic sources, prebiotics, and types of livestock. According to Mookiah et al. (2014), differences in results can be due to differences in strains of probiotics, prebiotics, environmental conditions, and types of livestock. This finding is supported by Abdel-Hafeez et al. (2017), who found that feed containing probiotics and prebiotics could not increase the percentage of the chicken carcass.

According to Baéza et al. (2021) and Hidayat and Iskandar (2017), carcass percentage is influenced by sex, age, and live weight. The higher live weight and age are followed by the increase in carcass weight. Research by Abdel-Hafeez et al. (2017) also showed that the results of feed intake are consistent with final body weight, body weight gain, and carcass weight percentage. In fact, the findings in this study indicate that the percentage of carcass weight is not influenced by the combination of dahlia tuber powder and *Lactobacillus* sp., so it is inconsistent with Yunus et al. (2016) who show that the combination of inulin from dahlia tuber powder and *Lactobacillus* sp. can increase body weight and daily weight gain. The findings in this study were possible because the increase in nutrient uptake was distributed to the increase in nutrient content in the meat. Abdurrahman et al. (2016) reported that giving a combination of inulin from dahlia tuber powder and *Lactobacillus* sp. causes an increase in antioxidant activity and protein mass of cross-breed native chicken. In addition, it is possible to increase body weight and gain daily body weight to be distributed to non-carcass parts such as the neck, legs, and internal organs. The mean percentage of carcass produced in this study was still in the normal range even though it was cut at 11 weeks of age. According to Suwitari et al. (2019), the mean percentage of cross-country chicken carcasses aged 14 weeks was 59-61%.

The meat bone ratio in cross-bred native chickens fed a combination of dahlia tuber powder as a source of inulin combined with *Lactobacillus* sp. showed no significant effect (P> 0.01) (Table 2). The meat bone ratio is the ratio of meat to the bone in the carcass. The higher the ratio of meat to bones followed by the greater proportion of carcass that can be consumed. The results of the research by Malik et al. (2016) on chickens fed probiotics and acidifiers showed different results with the influence on the meat-bone ratio. According to Marcu et al. (2012), a good quality carcass is characterized by a high proportion of meat and a low proportion of bone and fat. The way to determine the quality of carcass and meat after deboning is to calculate the meat-bone ratio for all carcasses. The average meat-bone ratio in this study was assumed to be closely related to the carcass percentage, which was not significantly different.

Table 2 Percentage of carcass weight, meat-bone ratio, and percentage of carcass cut weight)

variable	*Level of dahlia tuber powder* (%)	*level of Lactobacillus* sp. (*mL*)			*mean*
		O0	O1	O2	
P*ercentage of carcass weight* (%)	E1	54.20	55.07	58.22	55.83
	E2	57.60	52.28	57.50	55.79
	Mean	55.90	53.68	57.86	55.81
M*eat-bone ratio* (%)	E1	2.11	1.85	2.23	2.06
	E2	2.63	2.69	2.03	2.45
	Mean	2.37	2.27	2.13	2.26
percentage of breast (%)	E1	18.84	22,47	23,47	21,59
	E2	24.44	21,97	22,29	22,90
	Mean	21.64	22,22	22,88	22,25
percentage of wings (%)	E1	18.32	16.82	15,80	16,98
	E2	16.71	18.70	16,68	17,36
	Mean	17.51	17.76	16,24	17,17
percentage of back (%)	E1	26.22	25.75	22.61	24.86
	E2	26.31	25.65	24.05	25.34
	Mean	26.27	25.70	23.33	25.10
percentage of drumstick (%)	E1	36.62	34.97	38.13	36.57
	E2	32.54	33.68	36.98	34.40
	Mean	34.58	34.33	37.56	35.49

Means in the same row and column with no superscript show no significant result (P>0.05). E1=supplementation of dahlia tuber powder at 0.8%; E2=supplementation of dahlia tuber powder at 1.2%; O0=no supplementation of *Lactobacillus* sp.; O1=supplementation of *Lactobacillus* sp. at 1.2 mL (10^8 cfu/mL); O2=supplementation of *Lactobacillus* sp. at 2.4 mL (10^8 cfu/mL).

The results of the analysis of the percentage of carcass weight pieces can also be related to the percentage of carcass weight which has no significant effect. The combination of dahlia tuber powder and *Lactobacillus* sp. did not have a significant effect (P> 0.01) (Table 2) on the percentage of carcass cut weight. This result was possible because of the relationship between the percentage of carcass weight and the percentage of cut carcass weight. These results were consistent with research conducted by Aristides et al. (2012); Narasimha et al. (2013); Sarangi et al. (2016), who found that treatment of feed containing prebiotics, probiotics, and a combination of both did not show an increase in the percentage of carcass weight pieces compared to untreated chicken. Research by Iskandar *et al*. (1999) stated that there is a close relationship between body weight, whole carcass weight, and carcass weight. In contrast, the body weights in Yunus et al. (2016) are significant. This is possible because of differences in chicken species with the research of Iskandar et al. (1999). This assumption is in accordance with the opinion of Iskandar (2005) that the development of carcass and carcass pieces is mostly influenced by the type of chicken.

CONCLUSION

The addition of prebiotic inulin sourced from dahlia tuber combined with probiotic *Lactobacillus* sp. in feed did not affect the carcass quality of cross-bred native chickens, although, in previous studies, the same treatment could improve the meat quality of cross-bred native chicken.

ACKNOWLEDGEMENT

Thanks to Anindya P. K. for her support and assistance in the experiments

REFERENCES

Abdel-Raheem, S. M. and S. M. Abd-Allah. 2011. The effect of single or combined dietary supplementation of mannan oligosacharide and probiotics on performance and slaughter characteristics of broilers. Int. J. Poult. Sci. 10: 854-862.

Abdurrahman, Z. H., Y. B. Pramono, and N. Suthama. 2016. Feeding effect of inulin derived from dahlia tuber combined with *Lactobacillus* sp. on meat protein mass of cross-bred kampong chicken. J. Indonesian. Trop. Anim. Agric. 41: 37-44.

Abdurrahman, Z. H., Y. B. Pramono, and N. Suthama. 2016. Meat characteristic of cross-bred local chicken fed inulin of dahlia tuber and *Lactobacillus* sp. Med. Pet. 39: 112-118.

Alloui, M. N., W. Szczurek, and S. Swiatkiewicz. 2013. The usefulness of prebiotics and probiotics in modern poultry nutrition: a review. Ann. Anim. Sci. 13: 17-32.

Aristides, L. G. A., F. G. Paiao, L. S. Murate, A. Oba, and M. Shimokomaki. 2012. The effects of biotic additives on growth performance and meat qualities in broiler chickens. Int. J. Poult. Sci. 11: 599-604

Awad, W. A., K. Ghareeb, S. Abdel-Raheem, and J. Bohm. 2009. Effects of dietary inclusion of probiotic and synbiotic on growth performance, organ weights, and intestinal histomorphology of broiler chickens. Poult. Sci. 88: 49-56.

Baéza, E., L. Guillier, M. Petracci. 2021. Production factors affecting poultry carcass and meat quality attributes. Anim. 100331.

[BSN] Badan Standarisasi Nasional. 2006. Pakan anak ayam ras pedaging (ayam broiler starter). Standar Nasional Indonesia (SNI) 01-3930-2006.

[BPS] Badan Pusat Statistik-Statistics Indonesia. 2020. Populasi ayam buras menurut provinsi (ekor), 2018-2020.https://www.bps.go.id/indicator/24/476/1/populasi-ayam-buras-menurut-provinsi-.html.

Direktorat Jenderal Peternakan dan Kesehatan Hewan. 2020. Livestock and animal health statistics 2020. Direktorat Jenderal Peternakan dan Kesehatan Hewan Kementerian Pertanian RI, Jakarta.

Fallah, R., A. Kiani, and A. Azarfar. 2013. A review of the role of five kinds of alternatives to in-feed antibiotics in broiler production. J. Vet. Med. Anim. Health 5: 317-321.

Gray, T. C., D. Robinson, and J. M. Jones. 1982. Effect of age and sex on the eviscerated yield, muscle and edible offal of a commercial broiler strain. Br. Poult. Sci. 23: 289-298.

Haryati, T. dan Supriyati. 2010. Pemanfaatan senyawa oligosakarida dari bungkil kedelai dan ubi jalar pada ransum ayam pedaging. J. I. Ternak Vet. 15(4):252-260

Hidayat, C. and S. Iskandar. 2017. Weight estimation of empty carcass and carcass cuts weight of female SenSi-1 Agrinak chicken. Jurnal Ilmu Ternak dan Veteriner, 22(1): 24-29.

Hill, C., F. Guarner, G. Reid, G. R. Gibson, D. J. Merenstein, B. Pot, L. Morelli, R. B. Canani, H. J. Flint, S. Salminen, P. C. Calder and M. E. Sanders. 2014. Expert consensus document: The International Scientific Association for probiotics and prebiotics consensus statement on the scope and appropriate use of the term probiotic. Nat. Rev. Gastroenterol. Hepatol. 11: 506–514.

Iskandar, S., H. Resnawati, dan D. Zainuddin. 1999. Karkas dan potongan bagian karkas ayam F1 silangan pelung-kampung, yang diberi ransum berbeda protein. J. Ilmu Ternak Vet. 4: 28-34.

Iskandar, S. 2005. Pertumbuhan dan perkembangan karkas ayam silangan kedu x arab pada dua sistem pemberian ransum. J. Ilmu Ternak Vet. 10: 253-259.

Jung, S. J., R. Houde, B. Baurhoo, X. Zhan, and B. H. Lee. 2008. Effects of galacto-oligosaccharides and a Bifidobacteria lactis-based probiotic strain on the growth performance and fecal microflora of broiler chickens. Poultry Sci. 87: 1694–1699.

Malik, H. E. E., R. H. H. Hafzalla, O. H. A. Ali, M. Elhassan, B. Dousa, A. M., Ali, and K. H. Elamin, K.M., 2016. Effect of probiotics and acidifiers on carcass yield, internal organs, cuts and meat to bone ratio of broiler chicken. IOSR J. Agr. Vet. Sci. 9(12):18-23.

Mangunwidjaja, D., M. Rahayuningsih, R. Suparwati. 2014. Pengaruh konsentrasi

enzim dan waktu hidrolisis enzimatis terhadap mutu frukto-oligosakarida dari inulin umbi dahlia (*Dahlia pinnata*). E-Jurnal Agroindustri Ind. 3(1):190-199.

Marcu, A., I. Vacaru-Opris, A. Marcu, M. Nicula, D. Dronca, and B. Kelciov. 2012. The influence of feed energy and protein level on meat quality at "Hubbard F15" broiler chickens. Sci. Pap. Anim. Sci. biotechnol. 45: 432-439.

Midilli, M., M. Alp, N. Kocabach, O. H. Muglah, N. Turan, H. Yilmaz, and S. Cakir. 2008. Effects of dietary probiotic and prebiotic supplementation on growth performance and serum IgG concentration of broilers. S. Afri. J. Anim. Sci. 38: 21-27.

Mookiah, S., C. C. Sieo, K. Ramasamy, N. Abdullah, and Y. W. Ho. 2014. Effects of dietary prebiotics, probiotic and synbiotics on performance, caecal bacterial populations and caecal fermentation concentrations of broiler chickens. J. Sci. Food Agric. 94: 341-348.

Narasimha, J., D. Nagalakshmi, Y. R. Reddy, and S. V. Rao. 2013. Synergistic effect of non starch polysaccharide enzymes, synbiotics and phytase on performance, nutrient utilization and gut health in broilers fed with sub-optimal energy diets. Vet. World. 6: 754-760.

[NRC] National Research Council. 1994. Nutrient Requirements of Poultry. 9th Revised Edition. Washington DC (USA): National Academy Press.

Sarangi, N. R., L. K. Babu, A. Kumar, C. R. Pradhan, P. K. Pati, and J. P. Mishra. 2016. Effect of dietary supplementation of prebiotic, probiotic, and synbiotic on growth performance and carcass characteristics of broiler chickens. Vet. World 9: 313-319.

Shahin, K. A. and F. Abd Elazeem. 2005. Effects of breed, sex and diet and their interactions on carcass composition and tissue weight distribution of broiler chickens. Arch. Tierz. 48: 612-626.

Singh, R. S., T. Singh, and C. Larroche. 2019. Biotechnological applications of inulin-rich feedstocks. Bior. Tech. 273:641-653.

Suthama, N., B. Sukamto, and I. Mangisah. 2019. Healthy meat production of broiler fed microparticle-protein diet with inclusion of inulin derived from dahlia tuber extract. IOP Conference Series: Earth and Environmental Science. 292(1):112-118.

Suwitari, N. K. E., L. Suariani, N. M. Yudiastari, N. Kaca, Y. Tonga. 2019. Performance of 0-14 weeks-aged super free-range hens that are fed by fermented coconut pulp powder-contained ration. J. Physic. Conf. Ser. 1402(5): 055027.

Valcheva, R. and L. A. Dieleman. 2016. Prebiotics: definition and protective mechanisms. Best Pract. Res. Clin. Gastroenterol. 30: 27-37.

Wong, L. L., C. C. Sieo, K. Ramasamy, and Y. W. Ho. 2013. Effects of commercial oligosaccharides on growth of selected beneficial and non-beneficial gut bacteria of broilers. Proceedings of World's Poultry Science Association and World Veterinary Poultry Association, Malaysia. pp.56-58.

Yunus, M., N. Suthama, H. I. Wahyuni. 2016. Kombinasi penambahan sumber inulin dan *Lactobacillus* sp. terhadap aktivitas fosfatase alkalis dan ketersediaan energi pada ayam kampung persilangan. Jurnal Pengembangan Penyuluhan Pertanian. 13(23):30-38.