The Effect of Fermented Dragon Fruit Peel Juice on the Performance and Carcass Production of Quails

Gusti Ayu Mayani Kristina Dewi[1]; Made Wirapartha[2]; Ni Luh Putu Sriyani[3]; Apni Tristia Umiarti[4]; Ni Made Ari Kusuma Dewi[5]; Ni Pande Made Suartiningsih[6*]

Faculty of Animal Husbandry, Udayana University, Indonesia
*Corresponding Author

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Abstract— *This research aims to determine the performance and carcass production of quails that have been given fermented dragon fruit peel juice. The experiment was arranged in a completely randomized design (CRD) using 180 male quails aged 6 to 16 weeks, divided into 3 treatment with 6 replications per treatment and 10 birds per replication unit. The treatments consisted of drinking water without fermented dragon fruit peel juice (FDFJ0), and drinking water supplemented with 4% (FDFJ4) and 6% (FDFJ6) fermented dragon fruit peel juice. The variable observed in this study are growth performance and carcass characteristics. Data were analyzed statistically using analysis of variance (ANOVA) with SPSS for Windows version 23. If significant differences were observed at P<0.05, Duncan's multiple range test was performed for further comparison. The results showed that supplementation with 4% and 6% FDFJ in drinking water significantly increased body weight gain, carcass weight, carcass percentage, breast meat weight, and breast meat percentage, while significantly reducing feed conversion ratio (FCR) compared to the control group (FDFJ0). However, there was no significant effect on feed intake, water intake, final body weight, and slaughter weight. In male quails aged 6-16 weeks, it has been determined that adding 4% and 6% fermented dragon fruit peel juice to drinking water enhances growth performance and carcass quality, especially with regard to breast meat production and FCR.*

Keywords— Carcass Characteristic, Dragron Fruit Peel Juice Fermented, Performance, Quails.

I. INTRODUCTION

Quails are a poultry commodity for meat and egg production that is gaining popularity among the Balinese community. However, raising quail can provide resource for poor families with meet and eggs. The females are very prolific because they begin laying eggs on average at six weeks and in raising male quails, only females are selected to be kept as egg producers, the will selling the male quail to the market to be raised as breeders and marketed in carcass form, as fried quail, roasted quail, quail soup at restaurants and street vendors/Lapak-Lapak.

The widespread use of oral medication in chickens has resulted in the emergence of drug resistance. The application of antibiotics in livestock leads to the risk of transmitting drug-resistant genes to human pathogens (Gould, 2008). The World Health Organization (WHO, 2018) states that the use of antimicrobials in food-producing animals is an important public health risk. To provide an alternative to growth-promoting antibiotics (AGPs), probiotics have been created and added to poultry feed or their drinking water as a promising means of limiting intestinal colonization by disease-causing bacteria. Lately, there's been increasing interest in phytochemicals from dragon fruit peel as a natural substitute for antibiotic growth promoters (AGPs). Numerous plant-based extracts have shown antimicrobial properties and are commonly used in poultry farming to boost productivity (Dewi et al., 2022). Dragon fruit (Hylocereus polyrhizus), which was introduced and cultivated in Indonesia around 2000 (Dewi et al., 2016), produces a peel that is mostly discarded as agricultural waste. In spite of this, the peel's concentration of antioxidants helps shield cells from harm brought on by free radicals and can lessen oxidative stress in fowl that are subjected to environmental stress. According to Daniel et al. (2014), the peel of dragon fruit contains a large amount of crude fiber (23.39%), which limits its direct inclusion in poultry feed. Bidura (2020) recommended utilizing fibrous herbal materials in the form of water extracts or juices, since fiber is insoluble in water. Pamungkas (2011) also noted that the high fiber and low protein content in local agricultural by-products can hinder their use in animal diets. However, fermentation has

been suggested as a solution, as it can break down complex organic compounds into simpler, more digestible forms, and improve the taste and aroma, making them more acceptable to animals.

Saccharomyces cerevisiae it has been demonstrated that yeast acts as a probiotic in chickens and improves the digestion of fibrous foods (Bidura et al., 2021; Dewi et al., 2022). The crude fiber content of the feed can be decreased during the yeast fermentation process, improving the birds' ability to use it. According to Tanaka et al. (1992) and cited in Bidura (2020), fermentation products also have the advantage of inhibiting the liver enzyme 3-hydroxy-3-methylglutaryl-CoA reductase, which is involved in the synthesis of cholesterol. There is a lot of potential in using premium Saccharomyces cerevisiae yeast as a supplement. There is currently little research on using dragon fruit peel as animal feed. Dragon fruit peel can be safely added to the diet at levels of up to 1% (Ningsih et al., 2017) or even up to 4% without having a negative impact on the health of the livestock, according to Wardani et al. (2023) and Ningsih et al. (2017). Additionally, it has been demonstrated that supplementing 5-week-old broiler chickens with 4% fermented dragon fruit peel using Saccharomyces cerevisiae enhances their performance. The performance of quails aged 1 to 6 weeks was not considerably improved by fermenting dragon fruit peel with Saccharomyces cerevisiae in drinking water, according to research by Stradivari (2021).

Several studies (Bidura, 2020; Bidura et al., 2021; Dewi et al., 2022; Ningsih et al., 2017; Stradivari, 2021) have reported that adding herbal juices to poultry drinking water can significantly improve performance and egg production, as well as reduce feed conversion ratio. Additionally, such supplementation has been shown to significantly lower cholesterol and fat levels in the body. Based on these findings, the present study investigates the effect of administering either non-fermented or fermented dragon fruit peel juice (FDPJ) through drinking water on the performance and carcass characteristics of quails aged 6 to 16 weeks.

II. MATERIALS AND METHODS

In this study, 160 male quail of the Coturnix coturnix japonica species, all 6 weeks old, and homogeneous body weight had been used. The ration used in the study was the commercial ration QQ 504 S produced by PT Sreeya Sewu Indonesia. The nutrient contents of the ration were: 4% water; Metabolizable energy 2800 Kcal/kg; 14% crude protein; 7% crude fat ;7% crude fiber; 14% ash; 2.5% calcium; 0,6% phosphor; 0,4% methionine and 0,60 methionine +cystine. The equipment used consisted of 18 colony cages, each measuring 70 cm in length, 20 cm in height, and 50 cm in width, along with feed and water containers, and a digital scale.

The research design used a Completely Randomized Design (CRD) which consists of 3 treatments and 6 repetitions. The treatments were based on the tape yeast Saccharomyces cerevisiae for fermented dragon fruit peels juice. The treatments given were: FDFJ0 = Drinking water without fermentation of dragon fruit peels juice; FDFJ4= Drinking water with 4% of fermentation dragon fruit peels juice and FDFJ6= Drinking water with 6% of fermented dragon fruit peels juice. In this study, tape yeast was used to ferment the peel of red dragon fruit (Hylocereus polyrhizus). The dragon fruit peel (DFP) was cut into small pieces, combined with yeast, and kept anaerobically for five days in order to complete the fermentation. Following three days of fermentation, one kilogram of DFP was mixed with one liter of water (1:1 ratio, g/g) until it was smooth, and then it was filtered through double-layer gauze. According to the treatment procedures, the resultant fermented dragon fruit peel juice (FDPJ) was added to drinking water at concentrations of 4 to 6 cc per 100 cc of water (Dewi et al., 2022). FDPJ was added to drinking water continuously for the duration of the study.

Laboratory analysis by Dewi et al. (2022) showed that the phytochemical content of the fermented dragon fruit peel juice included 16.62 mg/100 g flavonoids, antioxidant activity measured at 22.99 mg LGAEAC, and a total population of lactic acid bacteria of 8.1 × 105 in the gut tract. The research was conducted in Megati District, Tabanan, Bali, Indonesia, over a 14-week period, divided into 2 weeks of preparation, 10 weeks of data collection, and 2 weeks of data analysis. The preparation phase involved internal coordination, setting up the research site, preparing infrastructure, livestock conditioning, and feed adaptation. Drinking water, sourced from PDAM, was provided ad libitum. Feed was also given ad libitum from morning until evening. The drinking water treatments consisted of water mixed with either 4% or 6% fermented dragon fruit peel juice.

Performance measures, including feed and water consumption, final body weight, body weight gain, and feed conversion ratio (FCR), as well as carcass weight and percentage, including the weights of the breast, back, thighs, and wings, were among the variables that were observed. Feed intake and individual body weight were recorded weekly. Slaughter weight was determined by weighing live quails at the end of the study after a 12-hour fasting period. Carcass weight was obtained by slaughtering the quails and removing non -carcass components such as feathers, head, neck, internal organs, and both legs. Carcass percentage was then calculated using the following formula:

Carcass percentage = (Carcass weight / Slaughter weight) × 100% (1)

Analysis of variance (ANOVA) was used to examine research data using the Statistical Package for the Social Sciences (SPSS) version 2021. Duncan's Multiple Range Test was used for additional comparison if significant differences between treatments were discovered ($P<0.05$).

III. RESULTS AND DISCUSSION

3.1 Quail Performance:

The results showed that quails gave treatment FDFJ0, FDFJ4 and FDFJ6 in drinking water give to body weight gain significantly and decreased FCR ($p<0.05$) (Table 1). The result showed that quail that giving treatment dragon fruit peel juice was able to increase final body weight and body weight gain FDFJ0 were 304.18g/e and 130.80 g/e (Table 1.). Treatment FDFJ4 was 2.6%higher and 2.90% lower no significant different ($p>0.05$) than FDFJ0 and FDFJ6. But Treatment FDFJ6 was higher 5.48 % significantly different ($p<0.05$) than treatment FDFJ0. Similar with body weight giant treatment FDFJ6 was 10.80% significantly different ($p<0.05$) than treatment FDFJ0.

The amount of feed ingested and the nutrients absorbed by the body affect the final body weight and body weight gain of male quails. Higher final body weight is the result of greater tissue development (Ningsih et al., 2022; Stradivari, 2021). Although feed and water consumption were not significantly affected, a significant decrease in feed conversion ratio (FCR) ($p<0.05$) was observed in male quails treated with 6% fermented dragon fruit peel juice (FDFJ6). Lactic acid bacteria (LAB), a type of gram-positive bacteria that live in quails' digestive tracts and help with nutritional absorption, are responsible for this action. LAB converts carbohydrates into lactic acid (Dewi et al., 2016; Ningsih et al., 2022; Wardani et al., 2023). The average LAB population in the intestines of quails, as described in the Materials and Methods section, was 1.8×10^5 CFU/g. According to Suartiningsih et al. (2018), factors that influence body weight gain include the quantity of feed intake, physical form of the feed, feed composition, and the balance of nutrient content. Numerically, an increase in average body weight gain was observed in quails receiving FDFJ. This improvement is likely due to the antioxidant content of dragon fruit peel juice, which helps neutralize free radicals. Dewi et al. (2022) and Suartiningsih et al. (2018) stated that dragon fruit peel has antioxidant properties and potential as a free radical scavenger. Supplementing livestock diets with antioxidant-rich materials can mitigate the effects of free radicals, which are known to cause oxidative stress (Fig. 1).

TABLE 1
MALE QUAIL CARCASSES AND PERFORMANCE AGED 6-16 WEEKS WERE FED DRINKING WATER CONTAINING FERMENTED DRAGON FRUIT PEEL JUICE (FDFJ)

Variable	Treatment 1			
	FDFJ0	FDFJ4	FDFJ6	SEM[3)]
Animal Performance Initial body wight (g)	173.38	176.68	175.20	0.53
Final body weight (g)	304.18[b]	312.5[ab]	321.83[a,2)]	4.20
Body weight gain (g/10 weeks)	130.80[b]	135.32[ab]	146.63[a]	6.33
Feed Consumption (g/10 week)	1,274.00	1,260.00	1,134.00	34.05
Water consumption (ml)	2,675.40[a]	2,646.00[a]	2,268.60[a]	60.85
FCR	9.74[a]	9.32[a]	7.73[b]	1.12
Carcass Yield Slaughter weight(g)	204.17	206,30	221.83	5.53
Carcass weight (g)	116.88[b]	124.33[a]	135.58[a]	1.98
% carcass	57.25	60.27	61.12	1.45
A Part of Carcass Breast (%)	39.90[b]	40.49[ab]	43.51[a]	1.153
Wing (%)	9.25	10.54	8.97	0.067
Tight (%)	20.98	22.40	28.65	0.42
Back (%)	27.21	26.39	26.39	0.67

Note:

1) ***FDFJ0 = Drinking water without fermented dragon fruit peel juice,***
   FDFJ4 = Drinking water with 4% of dragon fruit peels juice and
   FDFJ6= Drinking water with 6% of fermented dragon fruit peel juice.
2) ***The values of the different superscript on the same row show the non-significant differences (P<0.05).***
3) ***SEM: Standard Error of The Treatment Means***

Based on research related to total phenolic content, antioxidant activity, and antiproliferative effects, dragon fruit peel has shown stronger potential in inhibiting cancer cell growth compared to its non-toxic flesh. Extracts of super red dragon fruit peel (Hylocereus costaricensis) using water as a solvent contain anthocyanins at a concentration of 1.1 mg/100 ml (Bidura, 2020; Ningsih et al., 2022).

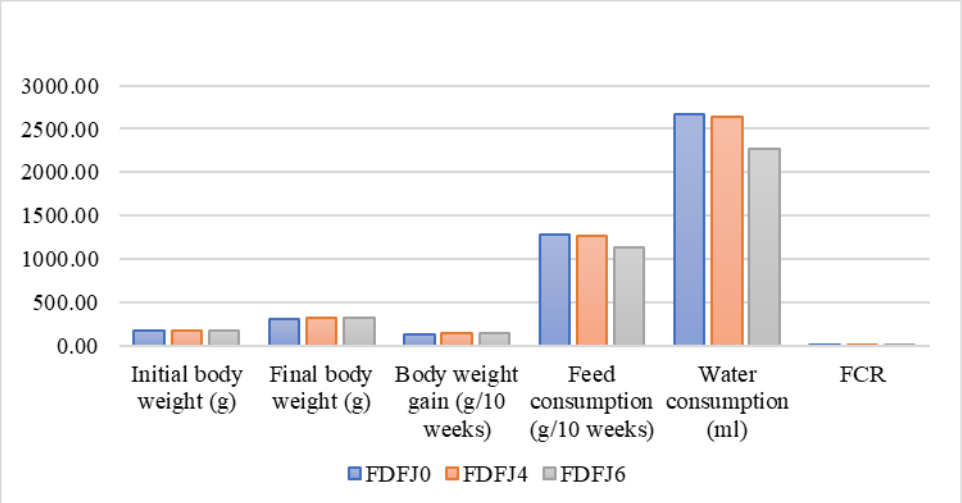

FIGURE 1: The effect of treatment for animal performance

3.2 Cascass Yield:

The results obtained are the addition of with FDFJ4 and FDFJ6 in drinking water give to, carcass weight, carcass and breast percentage, increased significantly (P<0,05) than FDFJ0 treatment. Carcass weight is influenced by the size of external body parts such as the head, neck, thighs, feathers, and blood. The increased carcass weight in male quails receiving the FDFJ6 treatment is likely due to the relatively high antioxidant content found in dragon fruit peel. Studies on total phenolic content, antioxidant activity, and antiproliferative effects have shown that dragon fruit peel is a more potent cancer cell growth inhibitor compared to its non-toxic flesh. Extracts of super red dragon fruit peel (*Hylocereus costaricensis*) using water as a solvent contain anthocyanins at a concentration of 1.1 mg/100 ml (Ningsih et al., 2022; Pamungkas, 2011). The results of this study indicated that carcass weights in the FDFJ0, FDFJ4, and FDFJ6 treatments showed significantly different results (P > 0.05) as presented in Fig. 2.

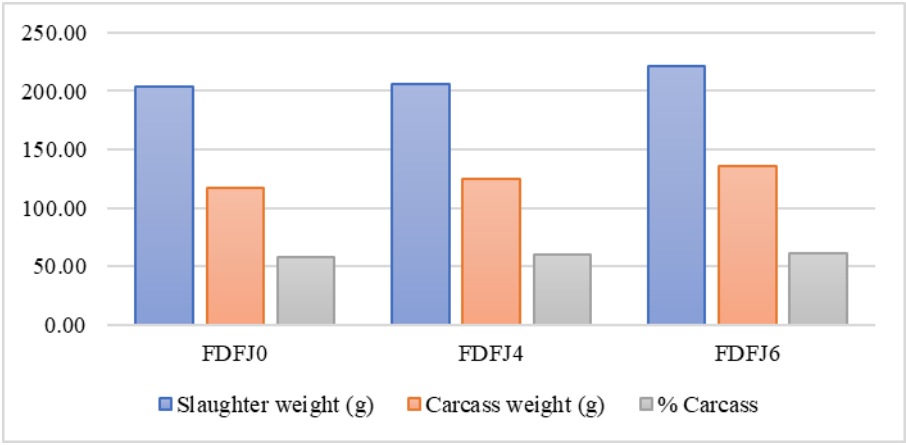

FIGURE 2: The effect of treatment for male quail carcass yield

Based on the results of statistical analysis, administering 6% FDFJ through drinking water can increase the carcass weight of quails. This is attributed to the presence of *Saccharomyces cerevisiae* yeast in the fermented dragon fruit peel juice, which promotes the growth of lactic acid bacteria (LAB) that function as probiotics. These probiotics aid the digestive process, protect, and maintain the health of the digestive tract, thereby contributing to an increase in final body weight and carcass weight. According to Bidura (2020), supplementation of *Saccharomyces cerevisiae* in the diet can significantly enhance growth and improve nutrient digestibility. The addition of lactic acid bacteria to feed through the use of Saccharomyces cerevisiae as a

probiotic source has been shown to improve fat absorption and other digestive processes (Bidura, 2020; Dewi et al., 2022; Wardani et al., 2023).

The results indicated that breast meat yield increased with the addition of FDFJ in the drinking water. This improvement is attributed to the antioxidant content in dragon fruit peel, which helps reduce the effects of free radicals, thereby enhancing the animals' immunity and improving hormonal functions. This aligns with the findings of Wardani et al. (2023), who reported that antioxidants support hormonal processes in livestock. Furthermore, dragon fruit is known for its strong anti-radical properties and high antioxidant activity (Dewi et al., 2022; Suartiningsih et al., 2018). Phytochemical analysis of fermented dragon fruit peel juice (as presented in the Materials and Methods section) showed antioxidant activity of 22.9876 mg/L GAEAC. According to Ningsih et al. (2022), Stradivari (2021), and Wardani et al. (2023), antioxidant content in the diet can help maintain carcass quality by preserving mineral levels in the body, as illustrated in Figure 3.

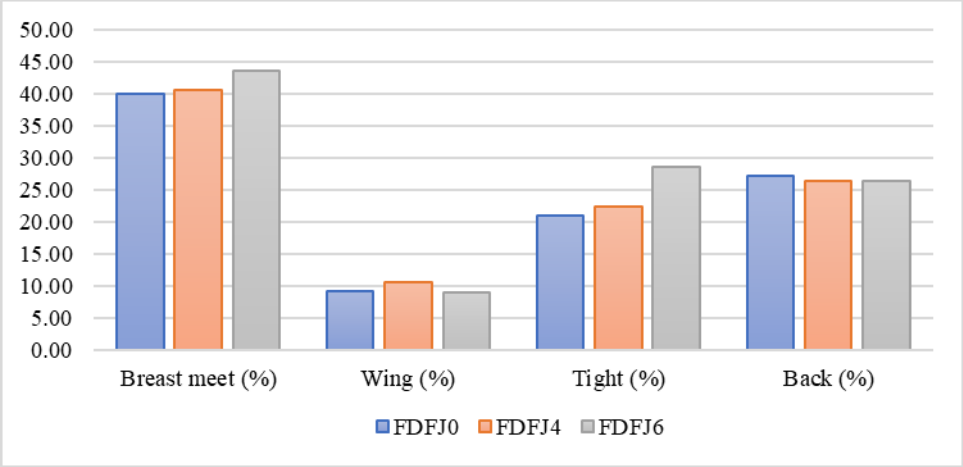

FIGURE 3: The effect of treatment for a part of carcass male quails

The fermentation process, aided by Saccharomyces cerevisiae yeast found in tape yeast, can enhance the population of lactic acid bacteria (LAB) in the digestive tract of quail. According to Dewi et al. (2022) and Stradivari (2021), Saccharomyces cerevisiae acts as a probiotic source in poultry feed, increasing LAB numbers. This increase in LAB through fermentation supports better nutrient absorption and improves the overall health of the animals. Furthermore, Ningsih et al. (2022) and Widodo et al. (2015) reported that the higher carcass portion in quails receiving FDFJ4 and FDFJ6 treatments is attributed to the relatively high antioxidant content in dragon fruit peel.

In conclusion, male quails aged 6 to 16 weeks can benefit from increased body weight gain, carcass weight, carcass and breast meat percentage, and decreased feed conversion ratio (FCR) when given 4% and 6% fermented dragon fruit peel juice through drinking water.

IV. CONCLUSION

The administration of fermented dragon fruit peel juice (FDFJ) in drinking water at concentrations of 4% and 6% significantly improved the growth performance and carcass quality of male quails aged 6 to 16 weeks. The supplementation enhanced final body weight, body weight gain, carcass weight, carcass percentage, and breast meat yield, while also reducing the feed conversion ratio (FCR). However, it did not significantly affect feed and water intake. These improvements are attributed to the antioxidant and probiotic properties of the fermented juice, particularly the presence of *Saccharomyces cerevisiae* and lactic acid bacteria, which enhance gut health and nutrient absorption efficiency.

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REFERENCES

[1] Bidura I G N G, 2020. Alternatif Pengganti Antibiotik Growth Promotor (AGPS) pada Ternak. Swasta Nulus. Denpasar.

[2] Bidura I G N G, Siti N W, Wibawa A A P P, Ariana I N T and Puspani E, 2021. The effect of carot leaves meal fermented in diets on egg production, yolk cholesterol and beta-carotene in yolk of hens. Annals of R.S.C.B. 25(6): 18705–18711. http://annalsofrscb.ro

[3] Daniel R S, Osfar S and Irfan H D, 2014. Optimalisasi Peningkatan Produksi Ternak Unggas dengan Pemanfaatan Limbah Kulit Buah naga (Hylocereus sp) Terfermentasi. Fakultas Peternakan Universitas Brawijaya, Malang.

[4] Dewi G A M K, Ningsih N W A and Wardani N P K, 2022. Limbah Buah Naga (Hylocereus sp.) untuk Ternak Unggas. Udayana University Press. Denpasar.

[5] Dewi G A M K, Nuriyasa I M and Wijana I W, 2016. Optimalisasi Peningkatan Produksi Ternak Unggas dengan Pemanfaatan Limbah Kulit Buah Naga (Hylocereus Sp) Terfermentasi. Research Report LPPM. Udayana University. Denpasar.

[6] Dewi G A M K, Umiarti A T and Wirapartha M, 2022. Impact of fermented dragon fruit peel (Hylocereus Sp.) juice in drinking water on the performance and quality of japanese quail eggs. KnE Life Sciences 7: 240–250.

[7] Gould I M, 2008. Antibiotic policies to control hospital-acquired infection. Journal of Antimicrobial Chemotherapy 61(4): 763–765. https://doi.org/10.1093/jac/dkn039

[8] Ningsih N W A, Dewi G A M K, Puspani E, Siti N W and Bidura I G N G. 2022. Effect of fermented dragon fruit peel juice through drinking water on quail egg production. World Journal of Pharmaceutical and Life Sciences 81(2): 1–5.

[9] Ningsih U W, Hartono B and Nugroho E. 2017. Analisis pemasaran sapi potong melalui analisis marjin, transmisi harga, struktur pemasaran, perilaku pemasaran dan kinerja pemasaran. Jurnal Ilmu-Ilmu Peternakan 27(1): 1–11.
https://doi.org/10.21776/ub.jiip.2017.027.01.01

[10] Pamungkas W. 2011. Teknologi fermentasi alternative solusi dalam upaya pemanfaatan bahan pakan lokal. Media Akuakultur 6(1): 43–48.

[11] Stradivari M P F. 2021. The effect of fermented dragon fruit peels juice provision in drinking water on weight of 6–14-week-old quail's carcass. International Journal of Food Science and Agriculture 5(3): 389–392. https://doi.org/10.26855/ijfsa.2021.09.008

[12] Suartiningsih N P M, Dewi G A M K and Nuriyasa I M. 2018. The effect of level dragon fruit peels (Hylocerus polyrhizus) fermentation in against productivity of "Kampung" chicken 2-10 weeks old. International Journal of Multidisciplinary Approach and Studies 5(2): 93–99.

[13] Wardani N P K, Dewi G A M K and Puspani E. 2023. The effect performance and percentage carcass kampung chicken given fermented dragon fruit peel (Hylocereus polyrhizus) on drinking water. International Journal of Life Sciences 7(2).

[14] WHO. 2018. Antimicrobial resistance. Word Health Organization Media Centre.

[15] Widodo T S, Sulistiyanto B and Utama C S. 2015. Jumlah Bakteri Asam Laktat (BAL) dalam digesta usus halus dan sekum ayam broiler yang diberi pakan ceceran pabrik pakan yang difermentasi. Agripet 15(2): 98–103. https://doi.org/10.17969/agripet.v15i2.2376.