



The Effectiveness of Red Ginger and Brotowali Extract on Broiler Productivity and Carcass Quality

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Abstract | The purpose of this study was to analyze the using red ginger and brotowali extract both single or in combined application in drinking water on the productivity and carcass quality in broiler. One hundred unsexed broilers were reared for 28 days. This study used a completely randomized design (CRD) with 4 treatments and 5 replications, each replication consist of 5 broilers placed randomly in each treatment. The treatment were P0 = giving drinking water without adding red ginger and brotowali extract (control), P1 = giving 1% red ginger extract in drinking water, P2 = giving 5.12 g/kg body weight of brotowali extract in drinking water, P3 = giving the red ginger and brotowali extract in drinking water. All broilers were observed for productivity variables including feed consumption, body weight gain, feed conversion ratio, and mortality. Twenty samples were used to measure the observed variables in carcass quality including carcass percentage, abdominal fat, cholesterol, and cooking losses. The results showed that the addition of red ginger and brotowali extracts in drinking water both single or in combined application improved on body weight gain, conversion ratio, mortality, carcass percentage, abdominal fat, and cooking loss significantly ($p < 0.05$). Administration of a combination of red ginger and brotowali extract in drinking water resulted in the best body weight gain (1100.28 g/head), Feed conversion ratio (1.37), carcass percentage (83.58%), abdominal fat percentage (0.56%) and cooking loss (8.56%).

Keywords | Brotowali, Carcass quality, Productivity, Red ginger.

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INTRODUCTION

Broiler is one of the livestock consumed by the public because its meat is a potential source of protein to be developed (Priyanti et al., 2018). In commercial broilers, growth promoter antibiotics have historically been commonly used in feeds to increase growth capacity and maintain broiler health (Sugiharto, 2016). According to (Kurniawan, 2021) the use of this synthetic feed additive can result in residue from the remaining chemicals contained in the livestock. The alternative that can be taken to over-

come these problems is to use herbal ingredients (Kuralkar et al., 2021).

Red ginger (*Zingiber officinale*) is a medicinal plant that contains active compounds such as phenolic and terpene. The phenolic compounds in ginger are mainly such as oleoresin, flavonoids, tannins, essential oils, and gingerols which function to help optimize organ function (Febriani et al., 2018; Mao et al., 2019). The total phenolic compounds of red ginger (*Zingiber officinale*) extract was 21.90 mgGAE/g extract using the Folin-Ciocalteu method

(Amalia et al., 2021). The red ginger has antibacterial and antioxidant properties (Mao et al., 2019) whose activity stimulates the digestive system (Kuralkar et al., 2021). Haroen et al. (2018) reported that ginger supplementation improved carcass quality and reduced abdominal fat in broiler. Red ginger extract in 1% concentration on feed increased antibody titer of Newcastle Disease (Andityas, 2013).

Brotowali (*Tinospora sp.*) contains active compounds found in the stems and roots of plants. The active compounds in brotowali stems and roots are alkaloids, resin, starch, glycosides, picroretocides, picroretin bitter substances, tinocrisposid, berberine, palmatine, columbine, and kaokulin or pikrotoksi (Yesi et al., 2019; Warsinah et al., 2020). Brotowali contains flavonoids equivalent to 33 g in 100 g dry weight of ethanol (Harwoko et al., 2016). Flavonoids are well known as antibacterial agents against a wide range of pathogenic microorganisms (Xie et al., 2015) and can act as immunostimulants which increase the immune response (Sharma et al., 2012). Antibacterial activity of flavonoids can enhance livestock productivity by improving digestibility, nutrient absorption and destructing pathogens present in the animal gut are called phytogetic feed additives (PFA) (Kuralkar et al., 2021). Pradiningsih et al. (2018) stated that brotowali extract was effective in weight gain for white rats. The results of the research by (Sami et al., 2019) also show that this plant has the ability to improve broiler performance. Tasminatun et al. (2007) reported that 5.12 g/kg body weight brotowali extract in drinking water was effective in increasing the body weight of broilers.

Red ginger and brotowali work with different mechanisms to improve productivity and carcass quality in broiler. The pharmacological effects of active herbal compounds can support each other (synergy) but can also oppose (contradiction) (Ganiswara, 2016), in affecting productivity and carcass quality of broilers. So it is necessary to conduct research about giving a combination of red ginger and brotowali on productivity and carcass quality in broiler. The purpose of this study was to analyze the effectiveness of using red ginger and brotowali either singly or in combination in drinking water on the productivity and carcass quality of broilers.

MATERIALS AND METHODS

PREPARATION OF RED GINGER AND BROTOWALI EXTRACT

The extraction of red ginger and brotowali was carried out using the maceration method. Red ginger and fresh brotowali that have been collected and cleaned of adhering impurities were then washed using running water until clean and then drained. Clean red ginger and brotowali

then sliced thin and then dried by drying in the sun for 2-7 days or using an oven with a temperature of 49-55 °C for 2 days and then pounded and sifted with a 50 mesh sieve then stored in a container.

The powdered (50 mesh) of red ginger and brotowali were weighed (50 g), then macerated with 96% ethanol with a ratio of 1:5 for 2x24 hours, the resulting macerate was filtered and evaporated with a rotary evaporator, to obtain a thick extract (Sa'diah et al., 2019). Then the thick extract was put into the mortar and lactose (1:2) was added little by little while grinding until evenly distributed and a dry mass was obtained. Then it was weighed and the yield and characteristics were determined (Zulharmitta et al., 2017).

FEEDING TRIAL

A hundred broilers unsexed were reared for 28 days and given feed and water ad libitum. The feed to be used was GM1C commercial feed from PT. Cheil Jedang. The chemical composition of GM1C commercial feed is Moisture content (Max 13%), Protein (Min 20%), Fat (Min 5%), Crude Fiber (Max 5%), Ash (Max 8%), Calcium (0.8-1.1%), Phosphorus (0.5%), Aflatoxin (50 µg/kg) and Metabolic energy (3000 kcal/kg). The technique for administering red ginger and brotowali extract in drinking water is presented in (Table 1). This study was a field experiment designed using a completely randomized design (CRD) with 4 treatments and 5 replications, each replication consisting of 5 broilers placed randomly in each treatment. The treatments were: P0 = giving drinking water without the addition of red ginger and brotowali extract (control), P1 = giving 1% red ginger extract in drinking water, P2 = giving 5.12 g/kg body weight of brotowali extract in drinking water and P3 = giving red ginger and brotowali extract in drinking water. The dosage of red ginger 1% refers to previous studies by (Andityas, 2013), and the brotowali extract dosage of 5.12 g/kg body weight refers to (Tasminatun et al., 2007).

Table 1: Technical administration of red ginger and brotowali extract in drinking water

Days to-	Drinking water type
1 – 6	Broilers were given water ad libitum without the addition of red ginger and brotowali extracts.
7 – 28	P0 giving drinking water ad libitum without the addition of red ginger and brotowali extract. P1 giving 1% red ginger extract in drinking water P2 giving 5.12 g/kg body weight of brotowali extract in drinking water. P3 giving the red ginger and brotowali extract in drinking water with a ratio of 1:1

Table 2: The level of feed consumption, body weight gain, feed conversion ratio, and mortality of broiler treated with red ginger and brotowali extract in drinking water.

Variable	P0	P1	P2	P3
Feed consumption (g/head)	1505.53a	1509.45a	1508.53a	1509.65a
Body weight gain (g/head)	1000.42a	1048.80b	1076.52b	1100.28c
Feed conversion ratio	1.51a	1.44b	1.40b	1.37c
Mortality (%)	0	0	0	0

P0 = drinking water without the addition of red ginger and brotowali extracts (control), P1 = drinking water + 1% red ginger extract, P2 = drinking water + 5.12 g/kg body weight of brotowali extract, P3 = drinking water + red ginger and brotowali extract .

Table 3: Percentage of carcass, abdominal fat, cholesterol and cooking loss of broiler given red ginger and brotowali extract, either singly or in combination.

Variable	P0	P1	P2	P3
Carcass Percentage (%)	77.76a	81.87b	80.29b	83.58c
Abdominal Fat (%)	0.79a	0.62b	0.61b	0.56c
Cholesterol (mg/dL)	251.80a	243.80a	242.80a	240.80a
Cooking Loss (%)	13.78a	9.89b	9.01b	8.56c

P0 =Drinking water without the addition of red ginger and brotowali extract (control), P1 = drinking water + 1% red ginger extract, P2 = drinking water + 5.12 g/kg body weight of brotowali extract, P3 = drinking water + red ginger and brotowali extract.

During the study, the broilers were kept in cages with rice husk bedding. Provision of red ginger and brotowali extract put into drinking water every day from the 8th day until harvest.

Sampling for Feed consumption is calculated every day by counting the difference between the feed given and the remaining feed. Sampling for body weight gain measured every week by counting the difference between broiler body weight at the end of maintenance and broiler body weight at the beginning of maintenance, and Feed conversion ratio calculated by the formula:

$$\frac{\text{feed consumption}}{\text{body weight gain}}$$

Twenty samples were used to measure for carcass quality variables at the end of rearing to observe carcass percentage, abdominal fat percentage, cholesterol, and cooking loss. Carcass percentage was obtained from the comparison between carcass weight and live weight multiplied by 100%. Abdominal fat percentage calculated by the formula:

$$\frac{\text{abdomen fat weight}}{\text{live weight}} \times 100\%$$

Cooking loss percentage is calculated by the formula :

$$\frac{\text{initial weight before steaming} - \text{final weight after steaming}}{\text{initial weight before steaming}} \times 100\%$$

STATISTIC ANALYSIS

The data obtained were analyzed by analysis of variance

(ANOVA). If the treatment has a significant effect, it is continued with Duncan's test (Gaspersz, 1994).

RESULTS

The data on Broiler productivity is presented in Table 2. Table 2 showed that feed consumption in all broiler groups showed no significant difference ($p>0.05$). The broiler group that was not given red ginger and brotowali showed significant differences ($p<0.05$) in body weight gain and Feed Conversion Ratio from the group given red ginger and brotowali as a single or combined application. The body weight gain and Feed Conversion Ratio of the broilers group that given red ginger showed no significant differences ($p>0.05$) from the group given brotowali. These groups (given red ginger or brotowali) have significant differences ($p<0.05$) from group that given red ginger and brotowali as a combined application. The broiler given a combine application of red ginger and brotowali showed the highest body weight gain from the others group, and the Feed Conversion Ratio of the group given combined application of red ginger and brotowali showed the lowest Feed Conversion Ratio from others.

The data on broiler carcass quality are presented in Table 3. Based on the results showed that all groups had no significant effect ($p>0.05$) on broiler cholesterol value. The carcass percentage, abdominal fat, and cooking loss showed that the broiler group that was not given red ginger and brotowali extract was significantly different ($p<0.05$) from the group were given red ginger and brotowali extract as single or combination application. Furthermore, the broiler group given red ginger extract was not significantly dif-

ferent ($p > 0.05$) from the group of broilers given brotowali extract. The group was given red ginger and brotowali as combined application showed a significant difference ($p < 0.05$) from the broilers that are given red ginger or brotowali as a single application. Broilers that were given the combination application of red ginger and brotowali extract showed the highest percentage of carcass compared to the other groups and the percentage values of cooking loss and abdominal fat in this group showed the lowest.

DISCUSSION

PRODUCTIVITY

The effectiveness of red ginger and brotowali extracts on broiler productivity can be measured by calculating feed consumption, body weight gain, Feed Conversion Ratio, and mortality. Feed consumption is not only influenced by the palatability of the feed but also influenced by the smell, taste, texture, and color of the feed and the balance of the nutritional content (Yahya, 2017). Based on the results showed that, the feed consumption value of broilers that neither given nor given red ginger and brotowali extract either singly or in combination relatively the same. This showed that the giving of red ginger and brotowali extract in drinking water of the broiler did not affect feed consumption. Pratikno (2010) reported that the use of herbal namely turmeric in drinking water, resulted no significantly different in feed consumption. This result is in line with research by (Alifian et al., 2018) who stated that the administration of herbal medicine temulawak (*Curcuma xanthorrhiza Roxb*) and turmeric (*Curcuma longa*) did not significantly affect for feed consumption of broilers.

The body weight gain is one of the productivity parameters of broiler, and is the main goal in broiler industries. The administration of red ginger and brotowali extract has a positive effect for body weight gain of broiler. Based on this result shows that there are compounds in red ginger and brotowali that work to increase body weight. Red ginger and brotowali have flavonoids as secondary metabolites of these plants which have antioxidant and antibacterial activity (Warsinah et al., 2020). The antibacterial activity of the herb works by inhibit bacterial growth so that they can increase the absorption of nutrients. The chemical compounds contained in brotowali work by destroying the bacterial wall by breaking the peptidoglycan bond of the bacterial cell so that the cell layer does not form completely (Asis, 2016). According to (Yadnya et al., 2014) who revealed that the content of essential oils in herbal ingredients, namely bay leaf (*Syzygium polyanthum*), which have antibacterial properties can inhibit the growth of pathogenic bacteria in the digestive tract so that there is an increase in absorption of feed substances in the body of livestock and the process of forming meat better. Ac-

cording to (Javed et al., 2009) stated that ginger extracts in broiler drinking water significantly increased body weight. Ginger is efficacious for increasing appetite, strengthening the stomach, and improving digestion, increasing the performance of enzymes that can help the digestive process in processing feed (Cahyono et al., 2012).

The Feed Conversion Ratio is useful for calculating amount of feed spent to produce each kilogram of body weight gain (Kartasudjana et al., 2010). The feed conversion ratio in the broilers that given red ginger extract was not significantly different from the broilers given brotowali extract. This result indicated that the active compound of both herbs in certain doses have the same activity to induce feed efficiency. The feed conversion ratio in the broilers that given a combination of red ginger and brotowali extract resulted in the lowest feed conversion. This shows that the active compound of both herbs can support each other (synergy) in affecting the productivity of broiler. Lower FCR value indicates more efficient the animal in converting feed into meat (Fahrudin et al., 2016).

Mortality is a measure of the number of deaths in a population (Nurmi et al., 2019). Mortality is the death rate of broilers in maintenance for one period which is usually calculated as a percentage. Based on the results of the study, it was shown that the total mortality for all groups of broilers treated with red ginger and brotowali and the group of broilers that were not given any treatment was 0% or there were no deaths during the rearing period. This shows that the administration of red ginger and brotowali extracts either singly or in combination in this study did not cause toxic effects for broilers.

CARCASS QUALITY

The administration of red ginger and brotowali extract has a positive effect for carcass quality by increase the percentage of carcasses and decrease the percentage of abdominal fat and cooking losses. The first parameter measured in carcass quality was carcass percentage. The carcass is closely related with body weight. (Tama et al., 2017) stated that the factors that affect carcass percentage are body weight gain, feed consumption, and the nutrition in the feed. The carcass weight increases in line with body weight. Syam (2015) reported that the positive effect of adding a several herbs including turmeric on carcass weight. Giving herbs or medicinal plants mixed in both feed and drinking water for broilers can increase bodyweight and appetite so it can have an impact for increasing the percentage of carcass (Zumbrotun, 2012).

Abdominal fat is fat that lies between the gizzard, intestines, and around the cloaca (Pratiwi, 2016). The result of this study showed that the addition of red ginger and

CONFLICT OF INTEREST

The authors declare that they have no conflict of interests.

NOVELTY STATEMENT

Red ginger (1%) and brotowali (5.12 g/kg body weight) extract as feed additive candidate for broiler.

AUTHOR'S CONTRIBUTION

DDP and N design the research; N supervise the experiment in field and DDP supervise the experiment in the lab; MRS conducted experiment and drafted the manuscript, DDP and N revised the manuscript.

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brotowali extract either singly or in combination in drinking water can reduce abdominal fat levels in broilers. This result is in line with (Tahalele et al., 2018), the administration of herbs in drinking water decreased the percentage of abdominal fat. Decreased levels of abdominal fat because red ginger can increase fat metabolism. Herawati (2007) also stated that red ginger is useful for reducing belly fat, where the addition of 0.5–2% red ginger probiotics in feed resulted decrease in abdominal fat percentage.

Based on the results of this study showed that red ginger and brotowali extract did not effect to cholesterol levels. This result is in line with research by (Sulistyoningsih et al., 2018) which stated that the administration of herbal ingredients had no significant effect on broiler blood cholesterol levels. Ginger powder and cinnamon flour 1.0%, 0.2%, and 0.3% in feed has not been able to reduce cholesterol levels (Gaiwad et al., 2020).

The addition of red ginger and brotowali extract either alone or in combination with drinking water had a significantly different effect ($p < 0.05$) on cooking losses compared to the broiler group which was not given red ginger and brotowali extract. The lower the percentage of cooking loss, the less water is lost and the nutrients are dissolved in the water. Vice versa, the greater the percentage of cooking losses, the more water is lost and nutrients are dissolved in water (Soeparno, 2009). According to (Dewayani et al., 2015) added that the value of cooking losses ranged from 1.5–54.5% so the nutrients lost were relatively small. The addition of red ginger and brotowali either alone or in combination with drinking water can reduce the value of cooking losses in broiler. According to (Kartikasari et al., 2018), cooking losses are strongly influenced by the amount of water lost during cooking, one of the contributing factors is the meat protein which can bind water, so the more water retained by the less meat protein. Water is released and results in lower cooking losses.

CONCLUSION

Administration of a combination of red ginger (1%) and brotowali (5.12 g/kg body weight) extract in broiler drinking water resulted in the best body weight gain, feed conversion ratio, carcass percentage, abdominal fat percentage, and cooking loss percentage.

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