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The effect of white turmeric extract (*Curcuma zedoaria*) and *Lactobacillus sp* herbal mixture as feed additive on animal productivity

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ABSTRACT

This study was conducted to determine the effect of herbal white turmeric extract (Curcuma zedoaria) with Lactobaccilus sp on the productivity of livestock. The test subjects within this study are 50 broiler chickens aged 0 days which were divided equally into two observation groups, namely the control group (A) and the treated group (B). The treatments are carried out as follows: A = no animal herbal mixture was added into the drinking water; B = drinking water was added with herbal mixture. Average body weight of the chickens were (A) 460 g and (B) 484 g, the feed conversion ratio values for chicken aged 6 and 13 days respectively are 0.696 (A); 0.644 (B) and 1.25 (A); 1.18 (B), while the performance index value (IP) of broiler chickens aged 6 and 13 days were 335 (A); 390 (B) and 272 (A); 315 (B), consecutively. In this study the addition of herbal mixture as feed additives into broiler chicken drinking water can increase the average body weight of the treatment group compared to the control group, the treatment group has a lower FCR value indicating good feed efficiency and IP values above 300 implying good breeding process.

Keywords: *animal herbal mixture, Curcuma zedoaria, feed conversion ratio, Lactobaccilus sp., Turmeric*

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1. Introduction

Livestock mortality is a problem that many farmers face in their effort to expand business. Factors causing the death of livestock include poisoning, stress, poor maintainance along with disease as its biggest factor. In an effort to overcome these problems the farmers then provide additional feed ingredients in the form of antibiotics that are expected to reduce the population of pathogenic microorganisms in the digestive tract, so that livestocks are healthier and can take most out of the feed given for growth or production (Walton, 1977; Meyer *et al.*, 2018; Rasyid *et al.*, 2019; Hu *et al*., 2010). In addition, livestock will not be easily affected by disease and its mortality rates can be reduced. However, the administrations of this antibiotics are feared to cause microorganisms that are resistant to antibiotics such *Escherichia coli*, *Salmonella spp,* and *Campylobacter spp,* present in the digestive tract of livestock, to transfer to or infect humans through physical contact or through consumption of food (Bogaard & Stobberingh, 1999; Mehdi *et al.*, 2018; Kumar & Pal, 2018).

Accordingly, debates about the use of antibiotics as feed additives arise frequently and policies on the prohibition of the addition of antibiotics to animal feed supplements exist in some countries.

The ratification of prohibition policy on the use of antibiotics with no concrete solution accompanying it would be an injudicious undertaking. The worst impact that the prohibition of giving antibiotics without a proposed alternative can have is the potential of a greater outbreak of disease that can further detriment farmers. Therefore, efforts are being made to find alternative substitutes for antibiotics as feed additives such as the use of bioactive substances from plants.

One of the medicinal plants appraised to be used to increase the immune system of livestock is white turmeric (*Curcuma zedoaria*). White tumeric contains essential oils consisting of flavonoid compound along with sesquiterpenes consisting of: zedoarone, kurdiona, epicurkumenol, kurzerena, kurkumol and isokurkumenol. These substances function as anti-inflammatory, analgesic hepatoprotector and antioxidants (Windono *et al*., 2002).

In a previous study (Pratikno, 2010), it was explained that the effect of dose of turmeric extract was significant on the average body weight of chicken in addition to the negative impact of its observation time. Seen from the benefits, white turmeric can be used as an alternative ingredient for feed additives instead of antibiotics. Besides having the ability to increase livestock immune and growth, white turmeric is also a medicinal plant that is easy to find and relatively safe to use since it is a herbaceous plant.

Still, other problems arise when demands for supply and quality of livestock increases with increasing population. It is because, on hindsight, the use of herbaceous plants as feed additives cannot provide an immidiate and significant effect on the quality of livestock. The role of technology is needed to realize these demands. Technology in the form of microorganisms application in the production of animal feed has been introduced in Indonesia. The practices can come in manners of 'probiotics' (bacteria, fungi, yeast), 'fermented products' or 'extracted products from a fermentation process' (usually "enzymes"). Probiotics provide great benefits for the health and physiology of the body. Research from (Johnson *et al.*, 1986; Lokapirnasari *et al*., 2019; Aalaei *et al*., 2018) shows probiotic bacteria Lactobacillus sp has a positive impact on chicken growth, egg production and efficiency of feed use.

Based on these problems, an innovation is needed in developing the potential of certain materials to increase its uses in order to fulfill public needs of livestock. The addition of combination of herbal plants and probiotics in animal feed is expected to be excercised as one of the safer feed supplement alternatives in increasing the productivity of livestock. Given that the benefits of both herbal plants and probiotics are very large, a scheme is developed to combine the two into a "feed additive".

The purpose of this study is to determine the effect of the combination of white turmeric extract *(Curcuma Zedoaria)* and *Lactobacillus sp.* on the productivity of livestock.

2. Materials and Methods

2.1 Research Materials

The study was conducted in January–February 2017 in the Ungaran area, Semarang Regency, Central Java. The materials used in the study were 50 broiler chickens aged 0 days. Mixtures of

herbal mixture were given to drinking water from day 1. Herbal mixture composing the drinking water were made from water, white turmeric extract, *Lactobaccilus sp.* and formulated molasses that were then incubated for ± 3 days to optimize bacterial performance in the mixture. The equipment used in this study include test tube, analytic balance, drop pipette, volume pipette, stirring rod, aluminum foil, mortar and pestle, measuring cup, alarm cup, vial, knife and water drums.

2.2 Research Procedure

The study was carried out by observing the control group and treatment group for 14 days or until the chickens reach the age of 13 days. The control group was not given herbal mixture into the drinking water while the treatment group was given herbal mixture into their drinking water. The parameters observed were increases in body weight along with the value of feed conversion ratio (FCR) and performance index (IP). Supporting parameters examined were consumption of feed and drinking water. The study was conducted in several stages, namely the field survey stage (1 week), preparation stage (1 week), and treatment stage (2 weeks).

Animal herbal mixture was made by mixing 500 ml of water with 30 ml of a solution containing lactobaccilus sp. and was later added withmolasses. White turmeric was added in the form of extract obtained from process of blending and filtering. The herbal mixture formula was then applied to drinking water for treated broiler group. The formula for herbal mixture made is presented in Table 1.

Table 1. Herbal mixture.

No	Day	Herbal mixture (ml)	Water (ml)
1	1–6	2	1000
2	7–13	3	1000

3. Results and Discussion

3.1 Formulation of Herbal Mixture

Application of herbal mixture to the treatment group was carried from morning until evening after which drinking water is replaced with plain water without the addition of animal herbal mixture. The provision of drinking water was intended so that the herbal mixture could be immediately distributed properly so that the impact on the performance of broiler chickens would be prompt. As stated in a research conducted by Rizal (2006), water consumption of chicken is usually two times more than its consumption of food. Chicken will be able to live longer without food than without water. Thus, the impact of implanting herbal mixture to drinking water, as opposed to food, is expected to be more quickly observed since consumption of drinking water is far more than consumption of food.

3.2 Effect of Treatment on Food and Water Consumptions as well as Chicken Mortality

To find out the effect of the treatment on the consumption of food and drink of broiler chicken, data on the food consumptions of broiler chicken are presented in Table 2. It can be seen in Table 2 that the food consumption of the control group is more than the treated group. It is likely that the addition of herbal mixture left an opposing effect in the attempt to increase appetite.

Consequently, food consumptions of the treated group turned out to be lower than the control group. Water consumptions of broiler chicken are presented in Table 2.

Tabel 2. Food consumption of broiler chicken.

Age (Days)	Control (A)			Treated (B)		
	Amount of Food (g)	Left Over (g)	Consumption (g)	Amount of Food (g)	Left Over (g)	Consumption (g)
1	120	-	120	120	-	120
2	300	120	180	300	120	180
3	400	100	300	400	100	300
4	500	70	430	500	70	430
5	600	-	600	600	-	600
6	800	-	800	800	-	800
7	1300	200	1100	1300	150	1150
8	1500	-	1500	1500	-	1500
9	1800	250	1550	1800	230	1570
10	2100	500	1600	2100	400	1700
11	2100	190	1910	2100	210	1890
12	2300	230	2070	2300	370	1930
13	2300	80	2220	2300	290	2010
	Total		14380	**Total**		14180

As seen in Table 3, water consumptions of the two groups are almost equal. Water consumption in the treated group was 100 mL more than the control group. This can be an indication that the addition of animal herbal mixture does not significantly affect the affinity and taste of drinking water seeing as the chickens still consume normal amounts of drinking water.

Tabel 3. Water consumption of broiler chicken.

Age (days)	Control (A)			Treated (B)		
	Amount of water (ml)	Left over (ml)	Consumption (ml)	Amount of water (ml)	Left over (ml)	Consumption (ml)
1	2000	1500	500	2000	1500	500
2	2000	1400	600	2000	1300	700
3	2000	1400	600	2000	1300	700
4	2000	600	1400	2000	600	1400
5	2000	200	1800	2000	300	1700
6	2500	500	2000	2500	500	2000
7	3000	700	2300	3000	700	2300
8	3000	600	2400	3000	800	2200
9	3000	600	2400	3000	700	2300
10	3000	500	2500	3000	500	2500
11	4000	1000	3000	4000	900	3100
12	4000	900	3100	4000	800	3200
13	4000	700	3300	4000	600	3400
	Total		25900	**Total**		26000

Up to the last day of observation, chicken mortality only occurred in the control group, which was as much as 1 chicken, while the mortality rate in the treatment group was 0. Mortality in this case

is the number indicating the amount of chickens that died during observation process. Mortality can be influenced by several factors including body weight, type of chicken, climate, environmental cleanliness, sanitation of equipment and cages as well as diseases (North & Bell, 1990; Berg *et al.*, 2020; Hogan *et al.*, 2018).

Mortality is one of the important parameters for the successful maintenance of chickens. Chicken mortality in the control group is thought to be closely related to the microbial composition in the chicken intestine. Lactobacillus bacteria added to drinking chicken in the treatment group gave positive results. Conceivably, with the increasing number of Lactobacillus in the intestine, Lactobacillus bacteria work more optimally to overhaul simple carbohydrates into lactic acid. As lactic acid increases, the pH of the environment becomes low causing other microbes not to grow. When colonization occurs on the surface of the digestive tract, Lactobacillus prevents fungal growth and suppresses growth of *E. coli* and pathogenic bacteria in the small intestine (Astuti *et al.*, 2015). *Lactobacillus* bacteria can maintain the balance of other bacterial populations in the small intestine and this condition does not occur in the control group causing death in chicken.

From the results obtained, it can be resolved that addition of probiotics in broiler chicken drinking water can reduce the mortality of broiler chicken. In this examination, the probiotic appears to function the same as antibiotics which is to increase immunity. However, the difference is that antibiotics are chemically synthesised and when absorbed in the intestine can leave residues in the tissue and can cause mutations of microorganisms. In contrast, probiotics are living microorganisms, and their presence in the animal's body does not cause residues and mutations because it only forces pathogenic microorganisms out of the body. This is also reinforced by a research from Tillman *et al.* (1998), Hasan *et al.* (2019), and Anadon *et al.* (2019) stating that probiotics are "good bacteria" that can produce natural antibiotics and help the integrity of the intestinal mucosa, metabolic processes and enhance immunity.

3.3 Effect of Treatment on Body Weight

Observations of body weight in the treated group were carried out on chickens aged 6 days to 13 days and the results showed significant increase. Increase in chicken weights during observations are shown in Figures 1 and 2.

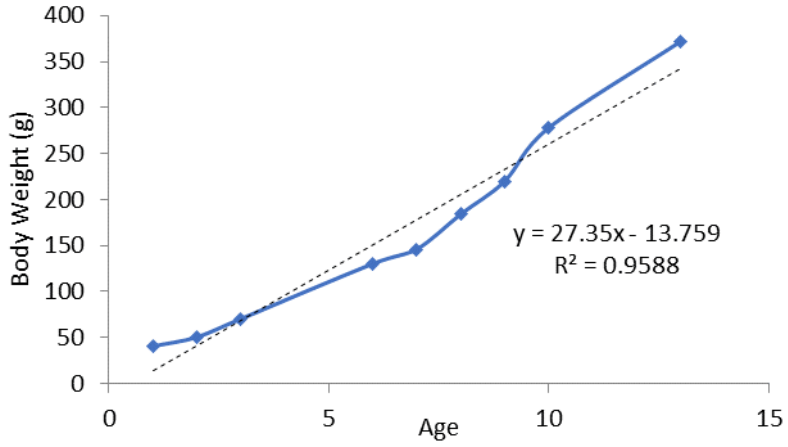

Figure 1. Average body weight of control group (day).

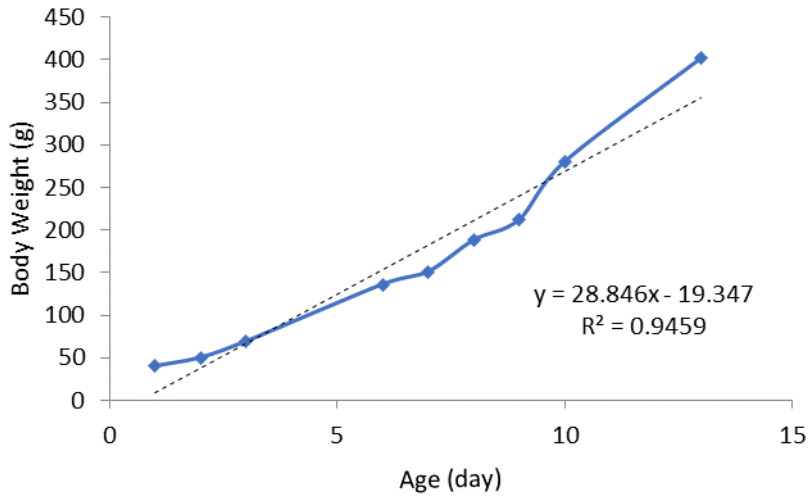

Figure 2. Average body weight of treated group.

As presented in Figures 1 and 2, the same trend is obtained where both the treated and the control groups experience a dynamic increase in body weight every day. This indicates that the process of adding herbal mixture into drinking water has an effect on increasing the digestion process of broiler chicken resulting in an increase in body weight.

The improved performance of broiler chicken digestive organs is certainly inseparable from the biological activity of compounds contained in the ingredients added. This is also in accordance with the study conducted by Erniasih & Saraswati (2006) stating that curcumin is a compound that plays a major role in helping the digestion process of livestock in which curcumin is a compound that is contained in white turmeric. Therefore, the increase in body weight of the treated group is inherent with the presence of curcumin compound contained in regular and white turmeric. Curcumin can stimulate the gallbladder wall to excrete bile and essential oils that function to regulate the release of stomach acid so as not to overdo the work of the intestine. Increased digestion process due to the presence of curcumin will result in the absorbed metabolic substrate to become more numerous (Erniasih & Saraswati, 2006).

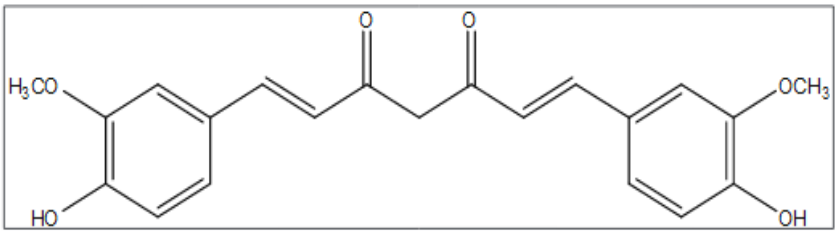

Figure 3. Curcumin Chemical Structure (Wilson *et al.,* 2005).

The structure of the curcumin compound contained in white turmeric is shown in Figure 3. There are O-H groups and conjugated double bonds on each benzene ring which are constituent units identical to the phenolic compounds (Rorong and Suryanto, 2010). Therefore, it can be said that curcumin has properties that are similar to the class of phenolic compounds based on the similarities of the structure they have. Phenolic compounds have antioxidant properties that can maintain the body's metabolic system (Astuti, 2011). This means that curcumin compounds also have the ability to maintain the body's metabolic system, specifically in this case, of broiler chicken.

3.4 Feed Conversion and Perfomance Index

3.4.1 Feed Conversion

To determine how effective the food eaten by chickens are being converted into the desired output as the weight of chickens increase, feed conversion ratio (FCR) was calculated using the following equation:

$$FCR = \frac{Total\ consumption\ (kg)}{Body\ weight\ in\ day}$$

If after the calculation small FCR value is obtained, it means that there is a high feed efficiency. This is so since there will be less feed needed by the chicken to produce one kilogram of body weight. On the other hand, high feed conversion ratio indicates that more feed is needed to increase weight.

3.4.2 Performance Index (IP)

Success of broiler breeding process is indicated by Performance Index determined through the following equation:

$$IP = \frac{(100 - D)x\ BB\ x\ 100}{FCR\ x(\frac{A}{U})}$$

where

IP : Performance Index
D : Presentage of Depletion (%)
BB : Average body weight (kg)
FCR : Feed Conversion Ratio
A/U : Average harvesting age (day)

To determine the accomplishment of this study FCR and IP were calculated and are presented in Table 4.

Table 4. FCR and IP for broiler chicken.

Data	FCR		IP	
	A	B	A	B
Aged 6 Days	0.696	0.644	335	390
Aged 13 Days	1.25	1.18	272	315

Table 4 shows the FCR and IP values calculated when the chickens were 6 and 13 days old. The FCR values of the control group (A) for ages 6 and 13 days are far greater than the FCR value of the treated group (B). A higher FCR value in the control group indicates that the feed efficiency is not optimal. The results obtained are in accordance along with a research by Kompiang (2009) which explains that probiotics increase enzymatic activity in the digestive system so that the absorption of food becomes more comprehensive. As a result, the amount of nutrients such as fats, proteins, and carbohydrates which are normally unused and excreted as faecal waste will be reduced (Jin *et al.*, 1997; Gong *et al.*, 2018; Yadav *et al*., 2019). Thus, feed efficiency is quite high in the treated group compared to the control group.

As for the IP value, the treated group has higher IP values than the control group. The IP value is said to be good if it is above 300. From the results of IP calculations shown in Table 4, it can be said that the breeding process of the treated group provided with feed additive in the form of animal herbal mixture from white turmeric and *Lactobacillus sp*. is far more successful compared to the control group with no herbal treatment being given.

4. Conclusion

The addition of animal herbal mixture made from white turmeric extract and *Lactobacilus sp* to drinking water can reduce feed conversion ratio value and mortality in addition to increasing body weight of broiler chickens.

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