

# **The Effect of the Gambir (*Uncaria gambir* (Hunt.) Roxb.) Leaves Waste and White Turmeric (*Curcuma zedoaria*) for The Productivity, Antioxidant Content and Mastitis Condition of The Fries Holland Dairy Cows**

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## **Abstract**

The aim of this research was to evaluate the effect of the gambir leaves waste and white turmeric on the productivity, antioxidant content and mastitis condition of dairy cows. The treatments were A. 0% gambir waste + 0.02% white turmeric; B. 20% of gambir waste + 0.02% white turmeric; C. 30% gambir waste + 0.02% white turmeric; D. 40% gambir waste + 0.02% white turmeric; and E. 50% gambir waste + 0.02% white turmeric. The results of *in vitro* experiment showed that the optimum ecological conditions rumen pH were ranging from 6.66 to 7.59, NH<sub>3</sub> concentrations were ranging from 23.42 to 31.54 nM and VFA concentrations were ranging from 66.15 to 119.82 mM. All treatments gave a real impact on the rumen ecology of dairy cows FH. *In-vivo* experiment for the best treatment from *in-vitro* experiment (30% gambir waste + 0.02% white turmeric) showed that similarly, the effect of administration of gambir leaves waste and white turmeric on dairy cattle FH, antioxidant activity affect the increase of milk production ( $P<0.05$ ) from 9.75 liters to 11.52 liters (18.15%), increase the antioxidant content of milk ( $P<0.05$ ) from 10.98 to 13.89 (26.50%) and a decline of the mastitis ( $P<0.05$ ) from positive two to positive one. Gambir leaves decoction waste at the amount of 30% combined with white turmeric gave the optimal condition of rumen ecology. It was also increased milk production by 18.15%, the antioxidant content of milk by 26.50%, and decline mastitis.

## **1. Introduction**

Maximum productivity is determined by the feed. Alternative way to balance the rumen ecology for optimal durability and animal productivity is using plants that contain antioxidants. Antioxidants work in a system to support each other. Therefore, the administration of combination of antioxidants will provide the better results. Antioxidants are commonly found in plants such as sunflower, curcuma, cumin [1,2,3,4] and gambir [5]. The numbers are very large and untapped, while white turmeric has an advantage in reducing cases of subclinical mastitis was 72.73 - 86.37% [3]

Gambir (*Uncaria gambir* (Hunt.) Roxb.) is a commodity of West Sumatra and contribute to gambir export in Indonesia by 80%. According to gambir crop area in West Sumatra is 21.412 hectares with a production of 14,220 tons / year, 6% of them is the yield of gambier exported and 94% or 168 087.67 tons left is gambir extraction waste [6]. It means that 168 087.67 tons of waste is not utilized and being wasted, whereas gambir waste such as leaves contains antioxidants and good nutrition if it is fed to livestock. Besides, the number of gambir processing units in West Sumatra is as



much as 3571 units by 6908 workers. Therefore, the utilization of gambir substitution on livestock will improve the community economy.

Gambir has been used by the public as wound healing drug, anti-nematode, autonomic nerve stimulator, and an antioxidant. Gambir contains catechins which is a substance to be antioxidants<sup>5</sup>. Phytochemical content of flavonoids includes catechins, 50%, pyrocatechol 20% -30%, gambirin 1% -3%, red catechu 3% -5%, quersetin 2% -4%, wax 1% -2% and alkaloids 2% -5%. The content of catechins in the leaves are 40% -50% [7]. Based on the results of qualitative analysis showed that gambir contains quinone, terpenoids, alkaloid, tannins, flavonoids and saponins [8] and antioxidant activity of extract gambir leaf are 172.62 ppm [21]. While the results of proximate analysis conducted by [9] on gambir extraction waste contains dry materials 56.43%, crude protein 10.66%, crude fat 4.90%, crude fiber 29.35%, BETN 35.73%, and tannin 5%.

The objective to be achieved was to obtain a formulation which is a combination of gambir leaf decoction waste and white turmeric in the feed of dairy cattle that can optimize rumen ecological conditions and will eventually be a parameter of dairy cattle productivity and produce antioxidant milk, so that it can utilize the available natural resources which are not utilized.

In the terms of the economic condition of the society, the utilization of gambir waste will increase farmers' income by utilizing the waste generated from gambir processing, become new business opportunities by producing a product to be given to livestock and will ultimately increase the productivity of dairy cattle. Besides, it can increase the income of dairy farmers because it can produce antioxidant milk which have a higher price than the normal one.

## 2. Materials and Method

### 2.1. Phase I. is the phase of in-vitro studies.

Materials: Materials was rumen fluid was taken from Fries Holland (FH) dairy cows of 4 years old, The waste decoction of the leaves of gambier (*Uncaria gambir* (Hunt.) Roxb.) come from home industry of gambir at Payakumbuh-West Sumatera and white turmeric (*Curcuma zedoaria*) come from herbal market at Bandung-West Java. This research was carried out at Balai Penelitian Ternak, Ciawi-Bogor, West Java, and Chemical Research Laboratory of the University of Padjadjaran in Bandung, West Java.

Research design: The design used was complete randomized design with 5 treatments and 8 replications. Treatments were several levels of combination of gambir waste and white turmeric by body weight. The treatments are A. 0% gambir waste + 0.02% white turmeric; B. 20% of gambir waste + 0.02% white turmeric; C. 30% gambir waste + 0.02% white turmeric; D. 40% gambir waste + 0.02% white turmeric; and E. 50% gambir waste + 0.02% white turmeric.

Sampling and analysis: The variables are rumen pH, rumen NH<sub>3</sub> concentration, total VFA, and they were used as a parameter of the dairy cattle productivity before it was being given to cattle and the potential as an antioxidant. This research was carried out *in vitro* in the laboratory by a *pressure transducer* technique (Theodoreu and Brooks, 1990)

Statistical Analysis: The collected data was analyzed by Analysis of Variance. After a significant F test ( $P < 0.05$ ), Duncan's Multiple Range Test was used to inspect differences among treatments [10].

### 2.2. Phase II is the phase of in-vivo studies.

The experiment was done in smallholder dairy farm in Padang Panjang, West Sumatera; Faculty of Animal Science and laboratory of Agricultural Technology, Andalas University, Padang, West Sumatra for three months. The cow were kept in individual cage equipped with feeder and waterer.

Animals: Twenty Fries Holland lactating cows suspected with in mastitis subclinical (++) and positive contained bacterial pathogens (*Staphylococcus*, *Streptococcus*, *E.coli*, and *Corynebacterium*)

were used in the experiment. These cattle were in 2<sup>nd</sup> - 4<sup>rd</sup> lactation period, with body weight of 350 kg and milk production of 10 – 12 liters/head/day.

Feeding: They were fed 40 kg/head/day of King grass and 6 kg/head/day of concentrate feed produce. The feed contained 87.07% dry matter, 12.42% crude protein and 68.00% TDN. Before being given treatment, all animals in the given worm medicine and materials adapted to the treatment (gambir and white turmeric) for 1 week. The waste decoction of the leaves of gambier (*Uncaria gambir* (Hunt.) Roxb.) come from home industry of gambir at Payakumbuh-West Sumatera and white turmeric (*Curcuma zedoaria*) come from herbal market at Bandung-West Java.

Research design: used was complete randomized design with 2 treatments and 10 replications. The treatments using the best treatment of *in-vitro* studies (Phase I) are A. non antioxidant; and B. 30% of gambir waste + 0.02% white turmeric.

Sampling and analysis: The parameters measured were the production of milk (4% FCM), milk antioxidant content (HPLC) and the condition of mastitis (CMT reagen).

Statistical Analysis: The collected data was analyzed by Analysis of Variance. After a significant F test ( $P < 0.05$ ), Duncan's Multiple Range Test was used to inspect differences among treatments [10].

### 3. Results and Discussion

The effect of substitution treatment of gambir leaf decoction waste in the forage on ruminal pH, NH<sub>3</sub> concentration, total gas and Total VFA was shown in Table 1.

**Table 1.** The Effect of Treatments to Average Rumen pH, NH<sub>3</sub> Concentration and VFA

| Treatments | Parameters        |                           |                     |
|------------|-------------------|---------------------------|---------------------|
|            | pH                | NH <sub>3</sub><br>(mg/l) | VFA<br>(mg/100ml)   |
| A          | 6,66 <sup>a</sup> | 23,42 <sup>a</sup>        | 113,38 <sup>a</sup> |
| B          | 6,94 <sup>a</sup> | 28,12 <sup>b</sup>        | 112,31 <sup>a</sup> |
| C          | 6,81 <sup>a</sup> | 31,54 <sup>c</sup>        | 119,82 <sup>c</sup> |
| D          | 7,08 <sup>b</sup> | 27,85 <sup>b</sup>        | 87,62 <sup>b</sup>  |
| E          | 7,59 <sup>b</sup> | 21,35 <sup>a</sup>        | 66,15 <sup>b</sup>  |

Description: A. 0% gambir waste + white turmeric; B. 20% gambir waste + white turmeric; C. 30% gambir waste + white turmeric; D. 40% gambir waste + white turmeric; and E. 50% gambir waste + white turmeric.

The results showed that the optimum ecological conditions are rumen pH ranging from 6.66 to 7.59, NH<sub>3</sub> ranging from 23.42 to 31.54 nM and VFA ranging from 66.15 to 119.82 mM. All treatments give a real impact on the rumen ecology of dairy cows FH. It means that the administration of gambir substitution with a concentration of 20%, 30%, 40% and 50% affect the ecology of the rumen ( $P < 0.05$ ). Gambir waste is an antioxidant ingredients that substitution of gambir waste can be used to 30% as an antioxidant. Because of its nature as an antioxidant, it will provide the antioxidant benefits at a certain level and in excessive doses will act as bactericidal agent [11,12]. As a result, rumen pH will increase at the dose above 30% gambir waste + white turmeric. VFA as a parameter of productivity also showed the highest production at a dose of 30% gambir waste + white turmeric and decreased at a dose above 30% gambir waste + white turmeric. Gambir leaves decoction waste also contains good nutritional value for dairy cattle. It does not contain ingredients that are malnourished and hazardous materials (Table 2 and Table 3). This is due to fast protein degradation of feed

compared with microbial protein synthesis due to insufficient availability of carbon skeletons, so  $\text{NH}_3$  will accumulate and exceed the optimum level.

**Table 2.** Proximat Analysis and Antioxidant of Gambir Leaf Decoction Waste

| Sample   | Content (%) <sup>1)</sup> |       |       |       |       | Antioxidant (ppm)    |
|----------|---------------------------|-------|-------|-------|-------|----------------------|
|          | Water                     | BK    | PK    | SK    | BETN  |                      |
| Fresh    | 13,97                     | 86,03 | 10,62 | 18,28 | 67,06 | 172.62 <sup>2)</sup> |
| Decocted | 8,99                      | 91,01 | 13,26 | 26.82 | 53,92 | 34.99 <sup>3)</sup>  |

Source:

1) PUPT research result at Laboratory of Livestock Nutrition and Food, Faculty of Animal Husbandry, Padjadjaran University (2017).

2) Rahmawati et al. (2013)<sup>21</sup>

3) PUPT research result at Analysis result in Laboratory of Research and Services, Department of Chemistry, Faculty of Science, Padjadjaran University (2017)

Buffering fuction of gambir as antioxidant was able to maintain rumen pH remains in normal conditions to the level of 30%. pH range in the results showed that the treatment in the manufacturing process of gambir did not affect the active ingredients contained in the leaf decoction waste of gambir, so that pH conditions stayed in optimum state that have an impact on the condition of  $\text{NH}_3$  and total VFA as a final product. Budinuryanto et al. (1999) stated that the saponins and tannins on gambir as the active ingredient have a function as a pH buffering [13]. Gambir processing will increase the active substance of antioxidants, tannins and polyphenols. Analysis result in Laboratory of Research and Services, Department of Chemistry, Faculty of Science, Padjadjaran University (2017) showed that the decoction waste of gambir leaves has a potential antioxidant activity by 17.22 - 34.99 ppm, while white turmeric itself has antioxidant content of 0.881 ppm [14,15].

It showed that the quantity of the active ingredient after processing is higher in gambir waste, where the decoction waste has a potential antioxidant activity by  $6.56 \pm 0.04$  ppm accordance with the opinion of Nurdin et al. that conducting research on the effects of antioxidants and antioxidant ingredients processing, that the handling of antioxidant ingredients can increase or decrease the activity depending on the type of antioxidant. Some of them are heat resistant while the others are not [3,11,12,16].

*In-vivo* experiment for the best treatment from *in-vitro* experiment (30% gambir waste + 0.02% white turmeric) showed that similarly, the effect of administration of gambir leaves waste and white turmeric on dairy cattle FH, antioxidant activity affect the increase of milk production from 9.75 liters to 11.52 liters (18.15%), increase the antioxidant content of milk from 10.98 to 13.89 (26.50%) and a decline of the mastitis from positive two to positive one (Table 3).

**Table 3.** The Effect of Treatments to Milk Production, Antioxidant Content of Milk, and Mastitis Condition

| Treatments | Parameters         |                  |                    |
|------------|--------------------|------------------|--------------------|
|            | Milk production    | Milk antioxidant | Mastitis condition |
| A          | 9.75 <sup>a</sup>  | 10.98            | Positive2          |
| B          | 11.52 <sup>b</sup> | 13.89            | Positive 1         |

Description: A. 0% gambir + 0.02% white turmeric; B. 30% gambir + 0.02% white turmeric.

The optimum ecology of rumen would increased produced VFA (acetic acid and propionic acid). Acetic acid is function to milk fat precursor and propionic acid is function for glucosa syntesis [22]. The other hand, the condition of rumen ecology would be effect of quality and quantity dairy

cows production [2, 23, 24]. Gambir leaves waste and white turmeric by virtue of its antioxidant compound and anti-inflammation potential can increase alveolar cell permeability and can assist in rumen ecological balance.

The greater the value of mastitis status showed good condition because the more healthy dairy cows (rating the status of mastitis: negatif = 4; + = 3; ++ = 2; +++ = 1; and ++++ = 0). Mastitis condition in this research showed a decrease in the level of mastitis compared with control (76.92%). Test of mastitis condition with CMT reagen's mastitis conducted at the beginning and end of research showed that treatment B were negative ( $P < 0.01$ ). This is possible because the cow's used in this research detected positif mastitis (++) and supported of microbiologik test found pathogenic bacteria in milk. But supplementation of herbs resulted in the decrease mastitis.

Provision of natural antioxidants of *Curcuma* sps. group, such as white turmeric and turmeric mango given to dairy cows, is significantly increase the productivity, endurance, and the levels of antioxidants of milk in different rate depending on dairy cows [3, 4, 12, 15, 17, 18]. White turmeric has advantages in reducing mastitis condition and gambir waste has higher antioxidant content, which can increase the antioxidant content of milk. Because feed contents consumed by livestock will be accumulated in the body and milk by 5-20%.

The administration of antioxidants in combination will give a good effect because each antioxidant will complement the lack of other antioxidant ingredients. The treatments increased antioxidant milk about 26.50%. It is caused by the work mechanism of antioxidants that usually work within a system (antioxidant networking).

Supplementation of 30% of gambir waste + 0.02% white turmeric until 4 weeks showed improvement on mastitis status. The treatment of mastitis by using antibiotic, the new *Staph. aureus* infection occurred again and new intramammary infections occurring after treatment and bacteria become resistant [25]. The effect of antibiotics has improved and some of them are retained in the cow's body for along time and at higher concentration [26]. Antibiotic residues in livestock product was harmful to consumer health, In addition, this treatment improves milk yield and milk quality , decrease condition of mastitis in dairy cattle and cured mastitis.

The study discover that doses of combination natural antioxidant (Waste decoction of the leaves of gambier (*Uncaria gambir* (Hunt.) Roxb.) and white turmeric (*Curcuma zedoaria*)) that can be beneficial for increase the productivity and healthy of dairy cattle, produce antioxidant milk and increase the economic condition of the society. The utilization of gambir waste will increase farmers' income by utilizing the waste generated from gambir processing, become new business opportunities by producing a product to be given to livestock and will ultimately increase the productivity of dairy cattle. Besides, it can increase the income of dairy farmers because it can produce antioxidant milk which have a higher price than the normal one. This study will help the researcher to uncover the critical areas of productivity and health of dairy cows especially of mastitis problem by using the combination of natural antioxidant.

#### 4. Conclusion

Gambir leaves decoction waste at the amount of 30% combined with white turmeric gave the optimal condition of rumen ecology. It was also increased milk production by 18.15%, the antioxidant content of milk by 26.50%, and decline mastitis.

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