The Effectiveness of Cumin as Natural Antioxidant to Improve Rumen Ecology of Mastitis Dairy Cow's

(Efektifitas Kumin sebagai Antioksidan Alami untuk Meningkatkan Ekologi Rumen pada Sapi Perah yang Menderita Mastitis)

E Nurdin* and Arief

Dept. of Animal Production, Faculty of Animal Husbandry, Andalas University
Kampus Unand – Limau Manis, Padang 25163, Indonesia
***Correspondence author email: ellyza_n@yahoo.com**

Abstract. The research was on the effect of supplementation of natural antioxidant (*Cuminum cyminum*) to improve rumen ecology of Mastitis Dairy Cow's and improved milk production. This research was in-vitro treatments and using rumen fluids of Holstein dairy cows with mastitis condition. They were fed diets supplemented with various levels of a natural antioxidant (A; 0 ppm; B: 500 ppm; C: 1000 ppm and D: 1500 ppm). Total of Rumen Bactery, pH, NH_3, acetate acid, propionate acid and butirate acid were determined. The design of this experiment was used Randomized Design. The collected data were analyzed by Multiple Analysis of Variance. While the difference between the treatment effects was tested using Duncan's Multiple Range Test. The results showed that supplementation of 1 000 ppm of *Cuminum cyminum* caused increase of population bactery, Acetic acid and Propionic acid and decrease of NH_3 concentration ($P<0.05$). They are not effect for milk acidity ($P>0.05$). Our conclusion, the level 1 000 ppm of *Cuminum cyminum* improve to good condition of rumen ecology. It showed to increase bactery rumen (66.02%), decrease NH_3 concentration (7.58%), increase asetic acid (49.91%) and propionic acid (29.94 %). Condition of pH rumen is showed in normal condition.

Key Words: *Cumminum cyminum,* anti-oxidant, rumen ecology, mastitis, dairy cows

Introduction

Milk production in Indonesia is low, This problem population of dairy cows, production ability and milk quality) were not optimum level. Some researchers reported that problems caused feeding and farm management in Indonesia were potentialities in a lower milk yield.

Data of National Socio Economic Survey in BPS (2008) showed that consumption per capita Indonesian for milk is 0.51 gr/capita/day and population of dairy cows in Indonesia is 368.470 cows with 577.5 ton/year milk product and average production is 6.5 - 8.5 liter/cow/day. Ideal of milk production for Indonesia is 14 – 16 litre/cow/day .

Usually medical treatment for mastitis is injection of antibiotics from intra-mammae. In an effort to reach of maximum production. It is natural that if lactating cows are administered antibiotics, the antibiotics are secreted in raw milk. The problem is how long the antibiotics continue to be secreted once administration has stopped. Through the withdrawal time varies depending on the kind of antibiotic, administration method and individual differences of cows, it has been recognized that 72 hours after the final administration is enough. Recently, however, the effect of antibiotics has improved and some of them are retained in the cow's body for a long time and at higher concentration. Frequently, using antibiotics are not to act as the rule. Besides that, the control of milk, which contain antibiotic residues is very difficult. This effort has increasing the opportunity there is antibiotic residues in livestock products and will produce a metabolit in the body. It endangered the inhabitant's health (Barton, 2000; Barton and Hart, 2001).

The more an animal is stressed in its environment, the less efficient its immune system is. That is demonstrated that stress to integrity of the change of microbial rumen. The stress cow have decreased rumen acidity and that is increased the pathogen microbial (Martin and Nisbet, 1992; Leslie, 2000; Shem *et al*., 2000;

Nurdin, 2004; and Nurdin, 2007). The other alternative to increase immune system is supplementation of anti-oxidant and anti-inflamation herbal in fed. They have profit to increase immune system, not expensive, and safely for human and cows (Bendich, 1992).

The use of antibiotics can be replaced with the use of local materials which is safe for humans and can improve the health of livestock. Herbal plants have been used by many people especially in Indonesia and generally in Asia, there are Sun Flower (Helianthus annuus L.), turmeric (Curcumin sp.), Cumin (Cuminum cyminum), tamarind (Tamarindus), Caisim (Brassica campestris), etc. The herbals have been used in a long time by many people to overcome the inflammation that occurs in humans (DNP, 1992; IIRR, 1994; Nurfina, 1995; Moorjati, 2000)

Cumin seeds was not just for taste alone, they have made it into the stellar ranks of Indian, Middle Eastern and Mexican cooking. This ordinary looking seed is anything but ordinary when it comes to health benefits. Cumin seeds, whose scientific name is *Cuminum cyminum*, are a very good source of iron a mineral that plays many vital roles in the body. Iron is an integral component of hemoglobin, which transports oxygen from the lungs to all body cells, and is also part of key enzyme systems for energy production and metabolism. Additionally, iron is instrumental in keeping your immune system healthy. Iron is particularly important for menstruating women, who lose iron each month during menses. Additionally, growing children and adolescents have increased needs for iron, as do women who are pregnant or lactating. Cumin seeds have traditionally been noted to be of benefit to the digestive system, and scientific research is beginning to bear out cumin's age-old reputation. Research has shown that cumin may stimulate the secretion of pancreatic enzymes, compounds necessary for proper digestion and nutrient assimilation. Cumin seeds may also have anti-carcinogenic properties. In one study, cumin was shown to protect laboratory animals from developing stomach or liver tumors. This cancer-protective effect may be due to cumin's potent free radical scavenging abilities as well as the ability it has shown to enhance the liver's detoxification enzymes. Since free radical scavenging and detoxification are important considerations for the general maintenance of wellness, cumin's contribution to wellness may be even more farther reaching (Martinez *et al*., 2001, and Lacobellis *et al.,* 2005). Kay *et al*. (2005) said that supplement tocopherol ussually contents in natural antioxidant, to improved milk fat percentage about 6%.

Good ruminant nutrition depends on two factors: Vollatile Fatty Acid and a large microorganism population in the rumen. A large microorganism population is responsible for increased VFA production (acetic acid and propionic acid). Acetic acid is function to milk fat precursor and propionic acid is function for glucosa syntesis (Mc.Namee, 1996; Kalscheur *et al*., 2006 and Wang *et al*., 2006)).

This research was to investigate for anti-oxidant supplement on rumen ecology of Holstein dairy cows could improve to increase quality and quantity of milk.

Research Methods

This research use *in-vitro* technique in laboratory with pressure transducer technique (Theodoreu dan Brooks, 1990). Material used liquid rumen from mastitis dairy cow, and cumin. Nutritional content and analyzed fitochemistry of cumin showed in Table 1 and Table 2.

This research used experiment methode and the design is Compete Randomized Design . The treatments in this research is by giving Cuminum cyminum with four dosis: A. Control; B. 500 ppm ; C. 1 000 ppm ; D. 1 500 ppm. Each treatment was replicated 12 times. The data gathered is analyzed with analysis of variance (ANOVA) and effects test from all treatments using Duncan Multiple Range Test (DMRT) (Gaspersz, 1995). The variable is Total of Rumen Bactery (CFU/ml), pH, NH_3 (mg/ml), acetic acid (mg/100l) and propionic acid (mg/100ml).

Table 1. Nutritional content of cumin

Nutritional content*	%
Dry Matter	90.37
Crude Protein	15.49
Crude Fiber	8.37
TDN	45.15
Metabolism Energy (Kkal/kg)	4233

* Laboratory Analysis (2009)

Table 2. Fitochemistry of cumin

Content*	Positif/Negatif
Alkaloid	-
Polifenolat	+
Tanin	-
Flavanoid	+
Steroid	-
Kuinon	+
Saponin	+

*Laboratory Analysis (2009)

Result and Discussion

Ethnoveterinary medicine refers to people's beliefs, knowledge, skills and practices relating to care of their animals (McCorkle, 1986; Li and Ziang, 2004). Several books have been written on ethnoveterinary medicine (Mathias-Mundy & McCorkle, 1989; Bizimana, 1994; Martin, McCorkle & Mathias, 2001). However, in most of these sources, there is only a brief description of the plants used, and the purported conditions that they treat, and often no validation of the effect against these conditions is provided. Most of the research on testing of ethnoveterinary medicine preparations has so far been carried out in Asia. Conversely, a number of publications has been produced that relate to diseases that affect humans and livestock (Bizimana, 1994; and Lacobellis *et al.,* 2005).

With the development of the organic movement aiming for more sustainable ways of farming, the search for alternatives has become necessary. The movement has developed principles for organic animal husbandry that include high levels of animal welfare. This is being achieved through keeping animals as close as possible to their natural habitat (e.g. access to grass and rangelands for maximum periods), reducing housing times and intensities, and a reducing reliance on chemo-therapy (Thamsborg and Roepstorff, 2003).

Good ruminant nutrition depends on two factors are Vollatile Fatty Acid (VFA) and a large population in the rumen. A large microorganism population is responsible for increased VFA production, as well as for the digestible protein available to the animal. When this population is increase, it results in the presence of a greater amount of digestible protein further along the ruminant's digestive tract (Kalscheur *et al*., 2006 and Wang *et al*., 2006). The other hand, the condition of rumen ecology would be effect of quality and quantity dairy cows production (Charmley and Nicholson, 1994; Kay *et al*., 2005; Wu and Satter, 2000).

The result of the experiment is about rumen ecology (Total of Rumen Bactery, pH, NH_3, acetic acid and propionic acid) showed in Table 3.

The treatment is highly significant for total bactery, NH_3 concentration and partial VFA concentration ($P<0.01$), and not significant for pH of rumen ($P>0.05$) but pH of rumen is showed in normal condition after they had given *Cuminum cyminum*, pH rumen increase 6,89 – 7,03. These improvements indicate that is the effect of antioxidant in *Cuminum cyminum* (Nurdin, 2007).

Total bactery rumen in treatment of 1000 ppm cumin seeds is 2,5650 x 10^9 CFU/ml, highly significant to increase bactery rumen at control (1,5450 x 10^9 CFU/ml), treatment of 500 ppm cumin seeds (1,9850 x 10^9 CFU/ml) and treatment of 1500 ppm cumin seeds (2,3850 x 10^9 CFU/ml). Total bactery rumen decrease again in level treatment of 1 000 ppm *Cuminum cyminum*, because *Cuminum cyminum* as for as the natural antioxidant. Li and Jiang (2004) and Lacobellis *et al.* (2005) give his statement about when the nature antioxidant give in higly level, they are a bacterisidal.

The greater increase was with the level of *Cuminum cyminum* in 1 000 ppm, because ecology rumen is very nice to growth the bactery. That resulted in proportionately greater increase in total bactery, decrease NH_3 concentration (261.0950 mg/liter), increase acetic acid (252.9075 mg/100ml) and propionic acid (97.4825 mg/100ml). Content of *Cuminum cyminum* in fitokimia analysis (Table 2) and Nutritional content (Table 3.) contribute to increase of rumen ecology. The supplement tocopherol ussually contents in natural antioxidant (Kay *et al*., 2005), this condition to improved asetic acid rumen and improve to milk fat percentage (Lee *et al*., 2001).

They will increase the bactery and decrease NH_3 concentration (Davidson *et al*., 2003; Olmos and Broderick, 2003; Hriston *et al*., 2004). The other hand, the antioxidant of *Cuminum cyminum* can stoped a free radical action (Lacobellis *et al.,* 2005).

Table 3. The effect of the treatments to total bactery (CFU/ml), pH, concentration of NH_3 (mg/l), concentration of acetate acid (mg/100ml) and concentration of propionate acid (mg/100ml)

Treatment	Total bacteria (x 10^9)	pH	NH3	Acetic acid	Propionic acid
A (control)	1.5450 a	6.89	283.4225 [a]	126.6725[b]	68.2925[c]
B (500 ppm of *Cuminum cyminum)*	1.9850 [ab]	6.95	311.1325 [b]	104.0350[d]	68.1700[c]
C(500 ppm of *Cuminum cyminum)*	2.5650 [b]	6.95	261.0950 [a]	252.9075[a]	97.4825[a]
D(500 ppm of *Cuminum cyminum)*	2.3850 [b]	7.03	364.4925 [c]	112.9675c	78.1075[b]

Different superskrip in the same column showed significantly difference (P<0.05)

A large microorganism population is responsible for increased VFA production. When this population increased, it results in the presence of a greater production milk or meat (Pinares-Patino *et al*., 2001, Kalscheur *et al*., 2006, and Wang *et al*., 2006).

The final proces of fermentation is Volatille Fatty Acid, they are acetic acid and propionic acid, and used for energi and carbon sources Acetic acid is a milk fat precursor, body fat and energy (Mc.Namee, 1996). Propionic acid is one's factor for glucose syntesis. Propionic acid concentration will increase if they had consumtion a lot of starch and sugar. The level treatment of 1000 ppm cumin seeds, concentration of propionic acid is higher (97.4825 mg/100ml), because content of BETN of *Cuminum cyminum* is so higher too about 54.85% (analisa proksimat of cumine). In Lactation cows, acetic acid and propionic acid *ratio* is very important to increase and decrease milk fat (Mc.Namee, 1996 and Mc. Dowell, 2000; Hristov *et al*., 2005, Kalscheur *et al*., 2006 and Wang *et al*., 2006).

Conclusions

The level 1 000 ppm of *Cuminum cyminum* improve to good condition of rumen ecology . It showed to increase bactery rumen (66.02%), decrease NH_3 concentration (7.58%), increase asetic acid (49.91%) and propionic acid (29.94%). Condition of pH rumen is showed in normal condition.

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