Increasing milk production and milk chemical composition in dairy cows by a supplementation of *Moringa oleifera* leaf (mol) powder block

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**Abstract.** Lower milk productivity of dairy cows might be correlated with the low milk consumption in Indonesia. This problem might be adversely affected by low quality and quantity of food intake. Therefore, the purpose of this study was to evaluate the milk production of dairy cows supplemented with “*Moringa oleifera* leaf (MOL) powder block”. There were 20 suckling Friesh Holland dairy cows used in this study. All animals were fed with roughage of natural elephant grasses and rice bran. They were divided into two groups of treatments. The first group supplemented with MOL powder block 500 g/head/day for 21 days and the second group has remained without a supplementation. Hand milking was performed twice a day. Daily milk production and milk concentrations of fat, protein, lactose, calcium and phosphorus were recorded. The data were compared, between the two treatments by using student’s t-test. The supplementation of MOL powder block significantly (p<0.05) increased milk production compared to that without supplementation (14.25 vs 11.51 litre/head/day). Protein in milk was significantly (p<0.05) higher in the treated group in compared to that in control group (3.89 vs 3.43 %, respectively). This study concluded that milk production and protein concentration in milk could be increased by supplementation of MOL powder block.

1. Introduction
Milk production in Indonesia is still very low so it has not been able to fulfil the demand of national milk consumption [1]. Bappenas [2], reported that the normal standard for dairy cow milk production is 12 litres/cow/day. However, Nurhayu et al. [3], showed that the productivity of dairy cattle in South Sulawesi was only 4-7 litres/cow/day. Low national milk production caused the increase of import of fresh milk and milk products. Indonesia imported 60-70% of national milk consumption [1].

Hartutik [4], stated that feeding contributes about 70% to milk production. Other factors that affect milk production are breeding and management. To produce high quantity and quality milk, the dairy cows should consume a sustainability high quantity and quality food. Ambo Ako et al. [5] added that by providing complete feed silage, the quality and productivity of dairy cows could be improved. In general, high-quality feeds are relatively expensive. Therefore, it will be important to find high-quality food, low cost and available all year round.
One excellent alternative that meets the above criteria is MOL. This feedstuff has been recommended as a feed supplement for livestock because it is rich in nutrients, such as high-protein [6]. According to Gopalakrishnan et al. [7] Moringa oleifera leaves powder contains protein of 29.4% with the crude fibre of 12.5% and rich in vitamins and minerals.

Zakaria et al. [8] showed that the supplementation of MOL powder to nursing mothers could increase the volume of breast milk. The average volume of breast milk increased significantly. Moringa oleifera plant is a local food that has a potential to be developed in the culinary of nursing mothers because it contains phytosterol compounds that can stimulate the prolactin hormone (lactagogum effect) which can increase milk production [9].

The purpose of this study was to evaluate the effect of MOL powder block on milk production in dairy cows.

### 2. Materials and methods

#### 2.1 Animals
There were 20 Friesh Holland dairy cows, 5-7 years old, 1-4 months lactating, used in this study. The animals were kept intensively under small holder farms (4-10 heads/farm). They were fed with elephant grass (*Pennisetum purpureum*) 30 kg/head/day and rice bran 7 kg/head/day. They were milked twice a day by hand milking.

#### 2.2. Methods of study
The animals were divided into two groups, Group 1, as a control (n=10) were fed regularly with elephant grass, rice bran, salt and minerals. Group 2, as a treatment group (n=10) were fed regularly with elephant grass, rice bran, salt and minerals and supplemented with MOL powder block 500 g/cow/day. The MOL powder block consists of *Moringa oleifera* leaf powder 250 g, Molasses 175 g, salt 20 g, urea 20 g, mineral mix 20 and cement 15 g. Milk production were measured daily. At the end study, milk samples were collected and chemical concentrations of protein, fat, lactose, calcium and phosphorous were analysed. The different means of the data between the two groups were analyzed by student t-test.

### 3. Results and discussion

#### 3.1. Milk Production
Milk production in cows with and without supplementation of MOL powder block are shown in figure 1.

![Figure 1. Milk production (litre) in cows with (Group 1) and without (Group 2) supplementation of MOL powder block.](image)

Milk production in the treatment group was significantly (p<0.05) in compared to that in the control group (14.25 ± 2.0 vs. 11.51 ± 2.9 liter/head/day). This indicated that the supplementation of MOL powder block could increase milk production of dairy cows under the smallholder farms.

The increase in milk production in the treatment group found in this study was similar to that reported in goat [10]. He reported that supplementation of fresh *Moringa oleifera* leaves to goats 0.5-1.5
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kg/head/day could increase milk production 0.5 litres/head/day. Similar results were also detected in dairy cows. Moringa leaf supplementation could be increased milk production by 15% [11]. Therefore, Sarwatt et al. [6] stated that Moringa oleifera leaves have the potential to be used as a feed supplement in ruminants.

The mechanisms by which MOL powder block could increase milk production of dairy cows were not yet well clarified. But it seems that lactagogum and phytosterols including campesterol, stigmasterol and B-sisterol could stimulate the prolactin and increase milk production [9]. Kristina [12] reported that phytosterol compounds in Moringa leave increased milk production for women who are breastfeeding.

3.2. Chemical compounds of milk

Milk chemical compounds in cows with and without supplementation of Moringa oleifera leaf powder block are shown in table 1.

| Chemical Compound (%) | Group 1 (control) | Group 2 (treatment) |
|-----------------------|-------------------|---------------------|
| Protein               | 3.43a             | 3.89b               |
| Fat                   | 4.17              | 4.05                |
| Lactose               | 2.84              | 3.2                 |
| Calcium               | 0.048             | 0.053               |
| Phosphor              | 0.081             | 0.085               |

The protein level in the treatment group was significantly (p<0.05) higher compared to that in the control group. Levels of fat, lactose, calcium and phosphor were not significantly (p>0.05) different between the two groups. This indicated that MOL powder block could increase the quality of milk through the increase of protein level.

The milk Protein concentration of 3.89 % found in this study was higher than 3.5% that reported by Abu el al. [13] 3.2% reported by Young et al. [14] and 2.8% by National standard 2011. Milk concentrations of protein and fat found in this study were also higher in compared to those reported by Looper [15] in the pure breed of Holstein (3.16 and 3.64%, respectively). An additional of Moringa leaf to the in vitro research significantly increased protein synthesis of microbes [11]. The higher amino acid in blood resulted from degradation of feed protein the higher milk protein [16]. Utari et al. [17] stated that the digested amino acids absorbed from the intestine by blood circulation and transported to alveoli in the mammary gland. In the mammary gland, the amino acids were synthesized to milk protein. Moringa oleifera leaf contains several amino acids so it can be used as a protein resource feed [7]. Moringa oleifera leaf powder contains 27.4% of protein. In the future, the high protein level might be considered this plant as a main feedstuff for cattle [18].

Reasons for the significant increase of protein and a tendency of fat decrease in the MOL powder block were not yet well known. These might be affected by feeding management practices which have a potential impact on milk fat and protein concentrations [15]. He showed that feeding the animals with high NFC (>45%) and low fiber (<26% NDF) caused a decrease of fat and an increase of protein in milk.
4. Conclusion
It can be concluded that the supplementation of Moringa leaf powder block could increase milk production and protein concentration in the milk of FH dairy cows.

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