Birth weight, milk production, and milk quality of Ettawah grade goat at first kidding period supplemented with concentrate contained *katuk* (*Sauropus androgynous*) leaf flour and Zn bio complex

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**Abstract.** The purpose of this study was to determine the performance of Ettawah goat at the kidding period, which supplemented concentrate containing katuk leaf flour and bio complex Zn flour. 16 goats were being used in the study with an average body weight of 38.19±2.4 kg. The study used a completely randomized design with 4 treatments and 4 replicates. The treatments were: T₀=breeder pattern feed (forage of lamtoro + 0.5 kg concentrate); T₁=feed pattern breeder + *katuk* leaf flour 77.5g; T₂=T₁+Zn bio complex 1.03 g/kg concentrate; and T₃=T₁+Zn bio complex 2.06 g/kg concentrate. Variables measured included milk production, milk quality, birth weight of the kid. The results showed that treatments had a highly significant effect (**p**<0.01) on the birth weight of kid and milk production, but it was not significant (**p**>0.05) on milk quality. Average birth weight of the kid, T₀: 2.54±0.08kg; T₁: 3.09±0.39kg; T₂: 3.10±0.21kg and T₃: 3.39±0.61kg. Average does milk production T₀: 618.99±5.96; T₁: 961.38±38.09; T₂: 1016.49±17.35 and T₃: 1144.00±92.67ml/head/day. concluded that supplementation of *katuk* flour and Zn bio complex in feed concentrate for elderly pregnant does of Ettawah goat breeders could increase milk production and birth weight of kid during kidding period.

1. **Introduction**

Goats mainly kept for meat production, and their milk consumed. However, nowadays, there is increasing consumption of goat milk due to its better-quality, such as lower cholesterol, higher vitamin, and valuable amino acid than cow milk also can be used as infant food [1,2]. Goat milk has also been used several medicinal values as therapeutic virtues for dietetic and ulcers problems or people allergic to cow milk and inflammatory diseases which led to an increased interest in goats milk as a functional food, and it now forms a part of the current trend to healthy eating [1].

Composition comparison of goat milk with other ruminants (cow, sheep, and horse) and human milk is presented in Table 1 [3]. Goat milk has been well-known as useful human consumption due to its nutrition content and medical for many diseases. To improve the productivity of dairy goats is through crossbreeding between local breed and adapted exotic breed [4].
Table 1. Composition comparison of goat milk with other ruminants (cow, sheep, and horse) and human milk [4]

| Component       | Value       | Goat       | Cow       | Sheep      | Mare       | Human      |
|-----------------|-------------|------------|-----------|------------|------------|------------|
| Fat (g/kg)      | Mean        | 41.00.00   | 36.01.00  | 75.00.00   | 12.01      | 36.04.00   |
|                 | (Min-Max)   | (30-60)    | (33-54)   | (50-90)    | (5-20)     | (35-40)    |
| Crude protein (g/kg) | Mean       | 34.00.00   | 32.05.00  | 54.05.00   | 21.04      | 14.02      |
| Lactose (g/kg)  | Mean        | 47.00.00   | 48.08.00  | 49.00.00   | 63.07.00   | 67.00.00   |
| Ash (g/kg)      | Mean        | 07.07      | 07.06     | 08.05      | 04.02      | 02.02      |
| Gross energy (kcal/kg) | Mean   | 670        | 674       | -          | 480        | 677        |
|                 | (Min-Max)   | (660-690)  | (650-712) | -          | (390-550)  | (650-700)  |

Ettawah grade (PE), a local goat breed, is one of the dairy goat breeds in Indonesia. They have been well-known for their adaptability in the harsh environment. Thus, smallholder farmers like to raise them. However, their milk production is still low ranged 0.2-1.2 liter/head/day [5]. The Ettawah grade is one of the tropical dairy goats that have the potential to produce milk, which exists in East Nusa Tenggara (ENT) Province, especially on the island of Timor, which is still new. The presence of Ettawah grade is expected to overcome the gap in milk consumption as a result of the uneven distribution of dairy cows due to climate as the main limiting factor. Studies on the performance of Ettawah grade goat production on the island of Timor directed at the performance of the parent and child are also still limited.

The average production of Ettawah grade goat's milk is amounting to 487.67 ± 294.45ml/head/day with a birth weight of 2.406 ± 0.426kg [6]. To meet the demand for goat milk, consequently, the milk production of Ettawah grade (PE) has to increase through improving management and genetic. Many crossbreeding programs in dairy goat has been done to increase goat productivity in producing milk [7]. One of the factors causing low productivity is still weak feed management, which is aimed at improving the performance of the PE goat.

Goats consume forage as their main feed, but sometimes forage conditions do not meet the needs of livestock both in quantity and quality [6]. *Saurus androgynus* or known as *katuk* in Indonesia (Fig. 1) has leaves are commonly known as sweet leaves due to its nutritional components (Table 1) and sweet taste of the leaves after cooking [8,9]. *Katuk* is believed to increase lactation in women in Indonesia [8]. Therefore, the current experiment aimed to know the performance of pregnant PE goats were fed katuk leave flour and Zn bio complex as supplements.

Figure 1. Katuk and its distribution in Southeast Asian countries [8,9]
Table 2. Nutritional composition of katuk leaves [8]

| Component      | Value       | Goat (g/kg) | Cow (g/kg) | Sheep (g/kg) | Mare (g/kg) | Human (g/kg) |
|----------------|-------------|-------------|------------|--------------|-------------|--------------|
| Fat            | Mean (Min-Max) | 41.00-00 | 36.01-00 | 75.00-00 | 12.01 | 36.04-00 |
| Crude protein  | Mean (Min-Max) | 34.00-00 | 32.05-00 | 54.05-00 | 21.04 | 14.02 |
| Lactose        | Mean (Min-Max) | 47.00-00 | 48.08-00 | 49.00-00 | 63.07 | 67.00-00 |
| Ash            | Mean (Min-Max) | 07.07-07 | 07.06-06 | 08.05-06 | 04.02 | 02.02 |
| Gross energy   | Mean (Min-Max) | 670-690 | 674-710 | - | 480 | 677 |

2. Materials and methods

2.1. Experimental location
The research has been carried out in the Sumlili Village, West Kupang Sub-district, East Nusa Tenggara Province in the Goat Breeding Installation, and forage production of Animal Feed, NTT Province Regional Technical Implementation Unit from 1 August to 5 December 2018.

2.2. Experimental animals and management
16 months does PE used in this study with an average body weight of 38.19±2.4 kg. The equipment used in the form of a 75kg capacity digital hanging scales with a sensitivity of 1g, a 5kg capacity digital sitting scales with a sensitivity of 1g, a concentrate feed container, and a drinking water container. Feed ingredients such as forage lamtoro and concentrate (60:40). The concentrate consists of ground corn (88% DM), rice bran (89% DM), 1:3, katuk leaf flour (91.49% DM), and Zn complex. The amount of katuk flour that give 10% of the portion of the dry forage matter and the need for dry matter is 3% body weight. The study used a completely randomized design with 4 treatments and 4 replicates. The four treatments were (1) \( T_0 = \) breeder pattern feed (forage of lamtoro + 0.5 kg concentrate); (2) \( T_1 = \) feed pattern breeder + katuk leaf flour 77.5g; (3) \( T_2 = T_1 + Zn \) bio complex 1.03g/kg concentrate; and (4) \( T_3 = T_1 + Zn \) bio complex 2.06g/kg concentrate. Clean water was available ad libitum. Does were milked twice a day (morning and afternoon) by hands.

2.3. Data analysis
Variables measured included milk production, milk quality, birth weight of the kid. The collected data is processed by analysis of variance and followed by [10].

3. Results and discussion

3.1. Birth weight
The results in Table 3 showed a significant effect (\( p < 0.05 \)) on the birth weight of the kid. There was an increase in the birth weight of kid in pregnant goat mothers who received concentrated supplements containing katuk leaf flour as well as those containingkatuk leaf flour and bio complex Zn. Supplementation of katuk flour and bio complex Zn in older pregnant goat mothers can increase the weight of the born kid. This increase in birth weight is not only due to the additional intake of nutrients sourced from katuk flour but also has to do with the availability of adequate nutrition from rumen microbial activity, where the nutrients can be directed to the growth and final development of the fetus during the period of late pregnancy. It has been reported by [8] that Zn, with its catalytic function, activates enzymes involved in metabolism. Kid birth weight in this study was higher than
that kid birth weight in the rainy season 2.45 ± 0.39kg and the dry season 2.17 ± 0.45kg in rural areas.

Table 3. Mean birth weight of kid, amount and quality of does’ milk

| Variable                        | Treatments |
|---------------------------------|------------|
|                                 | T₀         | T₁         | T₂         | T₃         |
| Birth weight (kg/head)          | 2.72±0.37  | 3.09±0.39  | 3.09±0.19  | 3.39±0.61  |
| Milk production (ml/head/day)   | 618.99±5.96| 961.38±38.09| 1016.49±17.35| 1144.00±92.67 |

-Milk quality:
- Water (%): 84.61 ± 2.22a; 82.39 ± 2.61a; 82.59 ± 2.55a; 82.73 ± 0.85a
- Protein (%): 5.02 ± 1.32a; 5.92 ± 1.42a; 5.53 ± 1.08a; 5.41 ± 1.01a
- Fat (%): 5.53 ± 0.86a; 6.85 ± 1.54a; 6.49 ± 1.49a; 6.08 ± 0.98a
- Lactose (%): 4.20 ± 0.13a; 4.40 ± 0.35a; 4.27 ± 0.28a; 4.26 ± 0.18a

Note: a, b, c superscripts of different column in the same row were significantly different (P<0.01)

3.2. Milk production
Analysis of variance showed a significant effect (p <0.01) on the amount of milk produced by the goat. This means that the supplementation of katuk flour and bio complex Zn in older does can improve the performance of parent milk production at lactation where milk production is highest in T₃. In general, many factors affect milk production, including the quantity and quality of feed, the availability of drinking water, the level of animal health and the quantity and quality of the udder [12]. Low milk production is closely related to feeding quality and less than optimal rumen metabolism [8]. Increased milk production in T₁, T₂, and T₃ related to the content of certain steroid compounds such as saponins and flavonoids on katuk leaves, which play a role in stimulating the proliferation of alveolar epithelium so that new alveoli will form, thereby increasing the number of alveoli.

The presence of Zn minerals is also known to activate rumen microbes in the metabolic process so as to enable the availability of adequate nutrients for milk synthesis. Some minerals play an important role in increasing rumen microbial activity, one of which is Zn accelerates protein synthesis by microbes by activating microbial enzymes. Zn was absorbed through the mucosal surface of the rumen tissue and stimulated the growth of rumen ciliate [12]. Overall the amount of milk obtained in this study was higher than 501.71± 168.05 ml/head/day in Kulon Progo and 419.71 ± 197.84 ml/ head/day in Bantul [13].

3.3 Milk quality
Analysis of variance showed no significant effect of treatment (P > 0.05) on milk quality, which included water content, protein, fat, and lactose. This means that the supplementation of katuk flour and bio complex Zn in older pregnant goat mothers does not change the chemical composition of the milk produced.

Table 4. Results of analysis of feed concentrate proximates used in the study

| Treatments | DM (%) | Water (%) | Ash (%) | OM (%) | Crude Protein (%) | Crude Fat (%) | Crude Fibre (%) |
|------------|--------|-----------|---------|--------|-------------------|---------------|-----------------|
| T₀         | 93     | 7         | 8.04    | 84.97  | 17.95             | 3.08          | 18.56           |
| T₁         | 92.98  | 7.02      | 7.86    | 85.12  | 18                | 3.59          | 18.16           |
| T₂         | 92.37  | 7.63      | 7.82    | 84.55  | 18.38             | 3.16          | 17.87           |

Source: Laboratorium Politani Kupang, 2017
The quality of milk obtained in this study is different from that obtained by [13] that water 85.10 ± 0.93%; protein 3.94 ± 0.52%; fat 4.29 ± 0.13% and lactose 5.21 ± 0.46% in single-birth does while in does who gave birth to twins: water 86.08 ± 1.12%; protein 3.78 ± 0.65%; fat 4.39 ± 0.65% and lactose 5.08 ± 0.71%. This condition is presumed because the nutrient composition of the concentrated feed ingredients used is almost the same, as shown in Table 4.

4. Conclusions and suggestion

4.1. Conclusions
Supplementation of *katuk* leaf flour and bio complex Zn results in a significant increase in does milk production and kid birth weight. Supplementation of *katuk* leaf flour and bio complex Zn does not cause changes in the content milk components such as fat, protein, lactose, and water. Supplementation of *katuk* leaf flour as much 10% needs forage dry matter and bio complex Zn as 2.06g/kg concentrate. Giving the best results with the highest average milk production (1144.00 ± 92.67ml/head/day) and highest birth weight of kid (3.39 ± 0.91kg).

4.2. Suggestion
It is recommended in order to get good milk production and birth weight of the kid, does need to be given additional supplements in the form of *katuk* leaf flour and bio complex Zn mixed with pure concentrates consisting of ground corn and fine bran.

References

[1] Abbas H M F, Hassan A M, El Gawad M A M and Enab A K 2014 Physicochemical Characteristics of Goat’s Milk Life Science Journal 11 pp 307-17
[2] Asresie A and Adugna M 2014 Bioactive properties of goat milk: It is Hypoallergenic, nutritional and therapeutic significance: A global review Journal of Animal Scientific Research 2 (4) pp 315-20
[3] Potocnik K, Gantner V, Kuterova K and Cividini A 2011 Mare’s milk: Composition and protein fraction in comparison with different milk species Miškarstvo 61 pp 107-13
[4] Praharani L, Supryati and Krisnan R 2015 Milk quality of Anglo Nubian X Etawah Grade Goats and Saanen X Etawah Grade Goats at first kidding period The 6th International Seminar on Tropical Animal Production Integrated Approach in Developing Sustainable Tropical Animal Production Yogyakarta Indonesia pp 401–05
[5] Sutama I K 2014 Dairy Goat Production on Smallholder Agriculture in Indonesia Proceeding the 2nd Asian-Australian Dairy Goat Conference IPB ICC Bogor pp 8-20
[6] Noach Y R and Handayani H T 2017 Kinerja Induk Kambing Peranakan Ettawa di Desa SumliliKabupaten Kupang [The performance of Ettawah Grade Goat in the Village of Sumlili, Kupang Regency] Prosiding Seminar Nasional Peternakan III Hilirisasi Teknologi dalam Sistem Peternakan Lahan Kering Mendukung Swasembada Daging Nasional, pp 183-6
[7] Assan N 2013 Crossbreeding as a strategy to increase productivity in resource-poor goat keepers in the rural areas of Zimbabwe International Journal of Science and Knowledge 2 (1) pp 52-6
[8] Bunawan H, Bunawan S N, Baharum S N, and Noor N M 2015 Review Article: Sauropus androgynous (L.) Merr. Induced Bronchiolitis Obliterans: From Botanical Studies to Toxicology Evidence-Based Complementary and Alternative Medicine: 7 pages
[9] Khoo H E, Azlan A, and Ismail A 2015 Sauropus androgy nous leaves for health benefits: hype and the science The Natural Products Journal 5 pp115–23
[10] Steel R G D and Torrie J H 1995 Principles and Procedures of Statistics 2nd Edition (London: McGraw-Hill International Book Company)
[11] Rumentor S D 2008 Suplementasi Daun Bangun-Bangun (Coleus amboinicus Lour) dan Zink Vitamin E dalam Ransum untuk Memperbaiki Metabolisme dan Produksi Susu Kambing Peranakan Etawah [Supplementation of Bangun-Bangun Leaf (Coleus amboinicus Lour) and
Zinc-Vitamin E in the Ration to Improve Metabolism and Production of Etawah Peranakan Goat Milk] Doctoral Thesis Sekolah Pascasarjana Institut Pertanian Bogor, Bogor

[12] Sulaksana I 2008 Pertumbuhan anak kambing Peranakan Ettawa (PE) sampai umur 6 bulan di Pedesaan [Growth of Ettawa Peranakan (PE) goats up to 6 months in the countryside] Jurnal Ilmu-Ilmu Peternakan 11 (3) pp 112–7

[13] Budiarsana I G M and Sutama I K 2001 Efisiensi Produksi Susu Kambing Peranakan Etawah [Efficiency of milk production of Etawah grade goat] Seminar Nasional Teknologi Peternakan dan Veteriner Balai Penelitian Ternak, Ciawi-Bogor