

Effect of Addition of Moringa (*Moringa oleifera*) in the Feed on Conception Rate, Litter Size and Survival Rate of local Rabbits in Indonesia

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Abstract

Moringa leaves contain galactagogues that can enhance milk production in local rabbits through the stimulation of oxytocin and prolactin hormones. This study aimed to assess the effects of moringa leaves on pregnancy, litter size, and survival rate of local rabbits. Twenty female rabbits and three male rabbits were used as experimental animals. The study comprised two treatments: R0 (control) and R1 (feed supplemented with moringa leaves). Treatments were administered during pregnancy until the offspring reached 30 days of age. Data analysis was performed using a simple t-test. Study indicated that had a non-significant effect on pregnancy rates, with a percentage of 90% for rabbits fed moringa leaf flour and 80% for those without it. Furthermore, the provision of moringa leaf flour did not significantly affect litter size, with 46 offspring born to rabbits given moringa leaf flour and 41 born to those not given it. However, the provision of moringa leaf flour significantly improved the survival rate, with 100% survival among rabbits given moringa leaves compared to 75% among those not given them.

Keywords: Agricultural Innovation, Conception rate, Moringa Leaves, Survival rate, Rabbit

Rabbits are livestock with significant potential as farm and ornamental animals (Gidenne *et al.*, 2019). The development of rabbit farming in Indonesia has been increasingly embraced by communities due to the animals' easy husbandry practices, minimal capital requirements, rapid business cycles, versatility in product yield, utilization of limited land, and ability to utilize agricultural waste as feed (Petracci *et al.*, 2018). Environmental factors contribute significantly to rabbit productivity, with approximately 70% attributed to environmental factors and the remainder to genetic or hereditary factors. Among environmental factors, feed stands out as the most crucial aspect in rabbit farming, accounting for approximately 60-70% of success (Habeeb *et al.*, 2018).

High-quality feed positively impacts rabbit survival, meeting their basic life needs, promoting tissue growth and development, and enhancing livestock productivity (Kumar *et al.*, 2023). According to Marhaeniyanto and Susanti (2017), moringa (*Moringa oleifera*) is a leguminous plant classified as a perennial. Moringa's advantages include its status as a readily available local material, with crude protein content ranging from 26-36%, and a complete set of essential amino acids. The bioactive compounds in moringa leaves, such as phytosterol and isoflavone, influence metabolism and reproduction, as these substances possess estrogenic properties (Setiasih *et al.*, 2021). Moringa leaves contain galactagogues, compounds that enhance milk production. This stimulation augments casein production and lactose synthetase enzyme activity in mammary gland epithelial cells,

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thereby affecting digestibility, milk production, quality, and quantity (Brar *et al.*, 2022). Galactagogues have the potential to stimulate oxytocin and prolactin hormones, comprising alkaloids, polyphenols, steroids, flavonoids, and other substances (Thakur *et al.*, 2023). Prolactin hormone functions to increase milk production and plays a role in sperm production, while oxytocin facilitates milk secretion or milk letdown (Mota-Rojas *et al.*, 2023). Galactagogues are used to increase or supplement breast milk, and moringa leaves hold promise as galactagogues (Singh *et al.*, 2018). The phytohormones present in oleifera leaves contribute to increased milk production (Tabares *et al.*, 2014).

Increased milk production in rabbit mothers positively correlates with the survival rate, as newborn rabbits rely solely on maternal milk for the first 21 days of life, after which they begin to forage for other sources of food (Szendrő *et al.*, 2019). Therefore, maternal milk serves as the primary source of initial immune protection through the digestive tract. Rabbit kitten mortality within the first 21 days is linked to maternal milk production in terms of both quality and quantity (Nolan *et al.*, 2019). This research aims to investigate the effects of bioactive compounds present in moringa leaf extracts on enhancing pregnancy success, litter size, and survival rate in local rabbits.

Materials and Methods

The sample animals for this study were 20 female and 3 male local rabbits sourced from Akbar Zoo Banyuwangi, situated at Jalan Raya Lijen, Sukosari, Paspan, Glagah, Banyuwangi. The research comprised two phases, employing female rabbits that had already given birth 1-2 times. In the first phase, 10 female rabbits aged more than 4 months were utilized. In the second phase, 10 female rabbits and 3 male rabbits were used to determine the number of offspring. A total of 20 rabbits were utilized for the study divided into R0 and R1, each consisting of 10 rabbits.

The preparation of moringa leaf flour commenced by harvesting young leaves from the first to the seventh leaf stalk (below the apex) of fresh and green moringa trees. The

processing involved spreading the leaves evenly on wire mesh trays and drying them in a drying oven at 45°C for 24 hours. Subsequently, the dried moringa leaves were pulverized using a blender and sieved. The sieved flour was stored in airtight plastic containers under clean, dry, and light-protected conditions, with humidity maintained below 24°C to ensure storage stability for up to 6 months (Narhi *et al.*, 2022). These specify the level of inclusion of moringa leaf flour to the feed, pre-weighed according to the feed formula to prevent rancidity. Throughout the 4-week treatment period, rabbits were provided with pellet feed according to the treatment regimen, administered twice daily at 07:00 AM and 02:00 PM. In the afternoon, additional green feed was provided to boost the rabbits' immune system.

Female rabbit in estrus was introduced into the male rabbit's cage and allowed to mate naturally. After mating, the female rabbit was returned to its cage, and pregnancy was assessed by palpation technique after 2 weeks of mating (Jiménez *et al.*, 2021).

Litter size is greatly influenced by the number of ova ovulated by the doe. Rabbit ovulation rates correlate with body weight. The number of ova ovulated, fertilized by sperm, and developing intrauterine are determining factors of litter size (Peiró *et al.*, 2021). The number of live births in a litter reflects the fertility of the doe and serves as an indicator of offspring care (Elkomy *et al.*, 2021). Stillbirth rates increased in rabbits with low feed consumption during pregnancy (Manal *et al.*, 2010).

Survival rate was determined by observing the number of healthy offspring born capable of survival. The data obtained were analyzed using a simple t-test, a statistical test utilized to determine whether there is a significant difference between two sample means (two variables compared).

Results and Discussion

Based on the research data, the number of rabbits that became pregnant when provided with moringa leaf flour (*Moringa oleifera*) was higher than those not given moringa leaf flour (*Moringa oleifera*). On average, out of 10 rabbits

Table I. Average pregnancy success in local rabbits after moringa leaf flour supplementation (*Moringa oleifera*).

No	Treatment	N	Pregnant	Not Pregnant	Conception rate
1	H0 (Without Moringa)	10	8	2	80%
2	H1 (With Moringa)	10	9	1	90%

in the control group (without moringa), 8 rabbits became pregnant while 2 did not, whereas in the treatment group (with moringa leaf flour), out of 10 rabbits, 9 became pregnant and 1 did not.

The provision of moringa leaf flour did not significantly influence pregnancy rates in this study, likely due to the insufficient concentration provided, which may require further supplementation. This finding aligns with previous research by Olusegun *et al.* (2018), who found that feeding dried moringa leaves (*Moringa oleifera*) at a concentration of 10% could increase the conception rate to 100%. Similar reports have been observed in cattle, where supplementation with moringa leaves in Urea Molasses Multi-nutrient Moringa Blocks (UM3B) for lactating cows increased the pregnancy rate (Sahu *et al.*, 2023). Additionally, the provision of moringa leaf feed has been shown to enhance libido. Low libido can affect pregnancy rates, and one of the nutrients known to increase libido is the mineral zinc (Zn). Moringa leaves contain zinc (Zn) mineral, which can enhance libido. Moringa leaves contain approximately 31.03 mg/kg (Syarifuddin *et al.*, 2017).

The results of litter size in this study did not show significant differences, which is consistent with the findings of Prastiya *et al.* (2019), who reported no significant differences in reproductive performance indicators such as gestation length, litter size at birth and weaning, birth and weaning litter weights, parturition weight, total milk production, and pre-weaning body weight gain of offspring after supplementing moringa leaf flour. Similar results were found by Alemede *et al.* (2014), where the administration of 4.8% moringa leaf flour did not influence the

reproductive performance indicators such as litter size, offspring mortality until weaning, birth weight, and weaning weight. In contrast, Olla *et al.* (2012) reported that the administration of moringa leaves had a better effect on fertility and litter size in rabbits compared to those fed with *Cajanus cajan* or *Centrosema pubescens*. Mutwedu *et al.* (2022) stated that the constituents of moringa leaves had no effect on rabbit litter size, possibly due to the absence of stimulatory effects of moringa leaf phytosterols or isoflavones on FSH or LH, which are protein hormones and related to ovulation rates and litter size.

The results of survival rates in local rabbit kits/does in group H0, with a mean of 3.0 ± 1.82 , showed a significant difference compared to group H1, with a mean of 4.6 ± 2.54 . From the kit/does survival data, it was found that the survival rate for H0 was 73%, while for H1, it was 100%. Group H0 kit survival showed a significant difference compared to group H1 kit survival. This finding is consistent with the research conducted by Olusegun *et al.* (2018), which showed that administering 10% moringa leaf flour resulted in a survival rate of 86%, higher than that of 5% administration. Ayodele *et al.* (2014) reported that supplementing rabbit feed with 20% moringa leaf flour had the best effect on milk production, as interpreted from weaning weight and offspring mortality. Similar results were supported by Wahyuningsih *et al.* (2019), indicating that administering ethanol extract of moringa leaves at a rate of 0.54%, equivalent to 10% moringa leaf flour in concentrate, increased milk production, weaning weight, and reduced offspring mortality, with no significant difference in litter size.

Table II. Average litter size and survival rate in local rabbits supplemented with moringa leaf flour (*Moringa oleifera*).

No	Treatment	N	Number of Offspring	Offspring per Doe	Survival Kit per Doe	Survival Rate
1	H0 (Without Moringa)	10	$41^a \pm 2.92$	$4.1^a \pm 2.92$	$3.0^a \pm 1.82$	73%
2	H1 (With Moringa)	10	$46^a \pm 2.54$	$4.6^a \pm 2.54$	$4.6^b \pm 2.54$	100%

Based on the results of this study, the success of the survival rate is attributed to meeting the lactation needs of rabbit kits, thereby ensuring their immune status and preventing milk shortage. Ethanol extract of moringa leaves containing phytosterols and isoflavones at 0.54%, equivalent to 10% moringa leaf flour in concentrate, is more potent as galactogogues in rabbit mothers compared to hexane solvent or a mixture of hexane and ethanol (50:50). The increase in milk production in rabbit mothers given ethanol extract at 0.54%, equivalent to 10% moringa leaf flour in concentrate, is also accompanied by an increase in milk epithelial cells by up to 300%, active alveoli by 63%, and alveolar diameter by 50% (Wahyuningsih *et al.*, 2019).

Conclusion

Based on the findings of this study, it can be concluded that the provision of moringa leaf flour (*Moringa oleifera*) in feed does not affect the success of pregnancy and litter size in local rabbits. However, the inclusion of moringa leaf flour (*Moringa oleifera*) in the diet of rabbit mothers has a positive effect on the survival rate of local rabbit offspring.

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