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THE RELATIONSHIP BETWEEN LOCAL FEED TYPES AND THE PRODUCTIVITY AND FEASIBILITY OF KACANG GOAT FARMING IN TOLITOLI REGENCY, INDONESIA

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ABSTRACT

Kacang goats have a lesser body weight than other goats and are widely distributed throughout Indonesia. Their main feed comes from green fodder in the form of grass, legumes, or agricultural/plantation waste. This feed is used for growth and production (meat and milk) and reproductive metabolism. This study aimed to determine the relationship between local feed types and the productivity and feasibility of Kacang goat livestock in the Tolitoli Regency. This study, conducted from May to August 2023, used a survey method by distributing questionnaires to 174 Kacang goat farmers. The results showed that the local feed often consumed by Kacang goats was Gamal green fodder (Gliricidia maculata). Other types of green fodder such as Kayu Jawa (Linnea coromandalica), Lamtoro (Leucaena leucocephala), Turi (Sesbania grandiflora), and Teki (Cyperus rotundus Linn) were only used as substitute feed if gamal green fodder was not obtained. The productivity of Kacang goats, in general, is still relatively low. The income from the Kacang goat business is Rp.1,728,178/year. The R/C Ratio of the Kacang goat business is 1.9675, indicating that the Kacang goat business provides an income of 0.9675 (96.75%).

Keywords: Type of Feed, Productivity, Feasibility, Kacang Goats.

1. INTRODUCTION

Population growth accompanied by economic changes and increasing awareness of nutrition and public health will have implications for our increasing demand for needs, especially protein needs. This includes animal protein such as goats. In 2021, the goat population in the Central Sulawesi province increased by 588,009 compared to 2020, when it was 555,399 (BPS, 2022). The Tolitoli Regency is one of the regencies contributing to this increase in the goat population. Currently, the goat population in Tolitoli Regency is 77,546 (Dinas Perkebunan dan Peternakan Kabupaten Tolitoli, 2021).

Kacang goats are one of Indonesia's livestock that play an important role in meeting the animal protein needs of the community, especially in rural areas such as the Tolitoli Regency, Central Sulawesi. The advantages of Kacang goats lie in their high adaptability to tropical environments and ability to utilize low-quality feed. However, the productivity of this livestock often remains low due to the limited quality and quantity of feed available.

Feed is an important factor in supporting livestock productivity. Providing sufficient feed with the nutrients livestock needs is expected to produce high productivity. Generally, the community carries out goat farming in Indonesia as a side job; thus, the maintenance system is still

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traditional. Moreover, the feed provided is minimal, so high productivity is difficult to achieve (Purbowati et al., 2015).

Productivity is the ability of goats to produce production during each period, including litter size, weaning weight, service per conception, age at first mating, kidding interval, and empty period (Nafiu et al., 2020). Birth weight and daily weight gain are the main factors in achieving optimal meat production. According to Susanti et al. (2015), the rate of weight gain is influenced by age, environment, and genetics, where the initial body weight of the fattening phase is related to adult weight. Specifically, if growth at the beginning of fattening is good, then the growth to the peak will also be good. Suparman and Hafid (2016) stated that the nutritional content of feed affects body weight and the percentage of carcass and non-carcass.

Local feed, consisting of green fodder and agricultural waste, is the primary source of nutrition for Kacang goats in Tolitoli. The optimal utilization of local feed can increase livestock productivity, such as daily bodyweight gain (DGB) and reproduction rate. Research by Syadik et al. (2021) showed that the DGB of Kacang goats in Tolitoli ranged from 80 g/day for goats aged under 3 months and 83 g/day for ages 3-6 months, with a birth rate reaching 198% per year.

In addition, the economic feasibility of Kacang goat farming is greatly influenced by the inefficiency of local feed usage. Feed costs are a significant component of the operational cost structure of livestock farming. Therefore, the efficient use of local feed can reduce production costs and increase the profitability of livestock businesses. Analyses of the feasibility of goat farming businesses in various regions show that using appropriate local feed can increase farmer income and make livestock businesses more financially viable (Julpanijar et al., 2016; Puspita et al., 2024).

Thus, it is important to research the relationship between local feed types and productivity and the economic feasibility of Kacang goat farming in the Tolitoli Regency. The results of this study will provide practical recommendations for farmers to utilize local feed resources optimally, thereby increasing livestock productivity and farmer welfare in the area.

2. MATERIAL AND METHODS

The location of the study was determined using a purposive sampling method. This study was conducted from May to August 2023 in the Tolitoli Regency of Indonesia. 174 respondents were selected for this study. The respondents were required to have at least 2 years of goat farming experience, at least five goats, and a pen. Data collection was via a questionnaire distributed to the 174 farmers. The questionnaire included questions regarding the types of green fodder used to feed the goats at the research location. In addition, there were also questions regarding the feasibility and productivity of goats, such as Weight Gain, Body Condition Score, Litter Size, Birth Weight, Mortality, Childbirth Distance, and Weaning Weight.

Weight Gain

The calculation of weight gain used the formula:

$$\text{DWG (g head}^{-1}\text{ day}^{-1}) = = \frac{W2-W1}{T2-T1}$$

Description:

DWG: Daily weight gain

W_1: Initial weighing weight

W_2: Final weighing weight

T_1: Initial weighing time (day)

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T_2: Final weighing time (day)
Goat weighing was done every two weeks before the livestock was fed.

Body Condition Score (BSC)
A scale of 1.0 - 5.0 was used to score the goats. The BSC was determined by touching and feeling their bodies. The first body area that needed to be observed and felt in determining the BSC was the lumbar area, which is the area behind the ribs in the form of the waist. The assessor used hand palpations above this area and tried to feel this area with their fingertips and hands. The second body area that needed to be felt was the fat that covers the sternum (breastbone). The third was the ribs and the fat-covering tissue on the ribs and intercostals (between the bones).

Litter Size
The litter size data was obtained from secondary data by calculating the number of offspring born divided by the number of mothers giving birth.

$$Litter\ size = \frac{Number\ of\ calves\ born}{Number\ of\ mothers\ giving\ birth}$$

Birth weight
The birth weight data was obtained by farmers within 24 hours after the calf was born.

Mortality
The mortality rate was determined by calculating the number of calves that died divided by the number of calves who were alive and weaned.

$$\text{Mortality} = = \frac{\text{number of calves that died after birth until weaned}}{\text{number of calves born until weaned}}$$

Childbirth Interval
The birth interval is the time between one birth and the next. The data on birth intervals were obtained from interviews with the farmers.

Weaning Weight
The weaning weight was obtained by weighing calves around 90 days after they were weaned from their mothers.

Income and Feasibility
The income obtained by the farmers was the total livestock sales minus the costs incurred during the production period with the formula $\pi = TR - TC$.
Description: π = Income
TR = Total Revenue
TC = Total Cost
The feasibility was calculated using the R/C ratio formula.
R/C Ratio = (T R)/(T C)
If the R/C value obtained was > 1, a business was declared profitable; if R/C < 1, the company declared a loss. Furthermore, if the R/C Ratio value = 1, the business was at the breakeven point (Break Event Point).

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3. RESULTS AND DISCUSSION

The Tolitoli Regency is one of the regencies in the Central Sulawesi Province, stretching from east to west, located north of the equator at the coordinates 0.35° – 1.20° north latitude, 120° – 122.09° east longitude. It has the following boundaries:

a. North: Sulawesi Sea
b. East: Buol Regency
c. South: Parigi Moutong Regency
d. West: Donggala Regency and Makassar Strait

Geographically, the Tolitoli Regency is marked by mountain ranges and stretches of sea. It is located at 0 – 2,500 M above sea level, with flat topography to moderate mountains. The lowlands are generally spread around the coast, and their locations vary.

Figure 1. Research location

3.1 Types of Feed

The following are the types of green fodder found in the research location. The Kacang goats predominantly consume this fodder.

Gamal Plant (*Gliricidia maculata*)

The Gamal plant is a shrub in the Leguminosae. This plant also functions as a controller of erosion and weeds, especially cogon grass. Gamal leaves, seeds, and bark, except ruminants, contain substances that are toxic to humans and livestock. Good livestock feed must meet certain requirements, namely having a high nutritional value, being economical, easy to obtain, and having maintained availability. Gamal leaves are one of the leguminous livestock feeds in the form of shrubs that farmers often use. Gamal trees can grow in dry areas and adapt to the dry season (Kabi and Lutakome, 2013).

A laboratory analysis of animal feed nutrition at Brawijaya University showed that Gamal leaves contain 26.91% crude protein, 21.09% dry matter, 20.98% crude fiber, and 3.97% crude fat. The high protein content in Gamal can be used to fulfill the crude protein needs of goats.

Kayu Jawa (*Linnea coromandalica*)

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Kayu Jawa (Linnea coromandalica) is a plant widely distributed in several tropical countries, including Indonesia. It is often found on the side of the road or in yards as a hedge. An analysis of feed nutrition at the Faculty of Animal Husbandry and Fisheries, Tadulako University, showed that Kayu Jawa leaf flour has 15.06% crude protein, 16.5% crude fiber, and 67.45% TDN.

Lamtoro (*Leucaena leucocephala*)

Lamtoro (Leucaena leucocephala) is a legume tree that can be cultivated as a producer of green fodder for livestock year-round. A laboratory analysis of animal feed nutrition at Brawijaya University showed that Lamtoro leaves contain 27.85% crude protein, 24.71% dry matter, 21.51% crude fiber, and 4.22% crude fat.

Turi (*Sesbania grandiflora*)

Turi (Sesbania grandiflora) is a plant native to Indonesia that belongs to the Papilionaceae legume family. Turi beans are one type of legume from the Turi tree, which is round, brownish yellow, and has a distinctive taste and aroma typical of this type of legume. An analysis by the Faculty of Animal Husbandry, Nusa Cendana University, Kupang, showed that Turi contains 27.87% dry matter, 27.37 crude protein, 3.93% crude fat, and 7.30% crude fiber.

Rumput Teki (*Cyperus rotundus* Linn)

Rumput Teki is a perennial weed that grows in tropical and subtropical areas. This plant can grow wild in agricultural land, open fields, gardens, and roadsides, so the community often destroys it (Muthoharoh and Hikmah, 2019). Rumput Teki has a stem that is 25 cm long, triangular, and overlaps the leaves. The leaves are 5-20 cm long, grooved, dark green, and grow from the base of the plant (Hana and Hifzul, 2018). A study conducted by Wahyono et al. (2019) determined that the crude protein contents of nine species of field grass were in the range of 3.48-7.60%, with the highest value produced by bad nutgrass at 7.60%, with a dry matter of 22.99%.

3.2 Productivity of Kacang Goats

Table 1 shows the results obtained from the research on the productivity of Kacang goats in the Tolitoli Regency.

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Table 1. Productivity of Kacang Goats in the Tolitoli Regency

Variabel Penelitian	Rataan
Birth weight (kg)	
♂	1,76 ± 0,15
♀	1,59 ± 0,21
Weaning weight (kg)	
♂	8,29 ± 0,50
♀	7,57 ± 0,48
PBBH (kg)	
♂	0,071 ± 0,005
♀	0,066 ± 0,004
Litter Size (ekor)	2,07 ± 0,26
Kidding Interval	10,84 ± 0,71
Pre-weaning mortality (ekor)	10,8%
Body Condition Score	
♂	2,6 ± 0,49
♀	2,37 ± 0,49

Birth Weight of Kacang Goats

The results show the average birth weight of male Kacang goats was 1.76 ± 0.15, while the birth weight of female goats was 1.59 ± 0.21. The results of this study are lower compared to the results of the study by Elieser et al. (2016), in which the average birth rate of males was 2.21 ± 0.51 kg and that of females was 2.01 ± 0.52 kg. The low birth weight in this study is suspected to have been caused by an undirected mating system, which is most likely the result of inbreeding.

According to Hidayati et al. (2015), the birth weight of baby goats has a positive correlation with the mother's body weight. With every increase in the mother's weight, there will be an increase in the birth weight of the child. Other factors that affect the birth weight of kids are the type of birth, gender, age of the mother, the breed of the mother, the breed of the father, and the season of birth. Birth weight is also closely related to the number of kids (litter size) born; it is suspected that the more babies produced per birth, the lower the birth weight obtained. This is possibly due to the availability of milk from the mother, where twins will get less milk intake, causing them to be weaker.

Weaning Weight

Table 1 shows that the weaning weight of Kacang goats in the Tolitoli Regency averages 8.29 ± 0.50 kg for male goats and 7.57 ± 0.48 kg for female goats. The low weaning weight of the goats in this study is likely due to environmental factors. Hamdan et al. (2020) reported a positive correlation between weaning weight and birth weight. The higher the birth weight, the higher the weaning weight. Environmental factors are directly related to livestock, mainly feed. In general,

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livestock are only given a single feed in the form of greens without ever being given additional feed as a strengthener to help accelerate the rate of bodyweight gain. Ultimately, feeding on high nutritional content will cause livestock to obtain maximum weaning weight.

The weaning weight of male goats is higher than that of female goats because the birth weight of male goats is higher than female goats. In general, weaning weight is more influenced by the availability of milk from the mother. Elieser (2016) stated that weaning weight is highly dependent on the amount of milk consumed by the kid.

The ideal weaning age is 90 days because, until this time, they get more nutrition from their mother's milk (Ashari et al., 2015). Elieser et al. (2016) stated that weaning at 90 days is the best time to apply livestock selection criteria.

Daily Weight Gain (DWG)

The average daily weight gain obtained in this study was 0.071 ± 0.005 kg for male goats and 0.066 ± 0.004 kg for female goats.

Environmental factors, mainly feed, significantly affect DWG; the higher the quality of the feed consumed, the higher the livestock growth rate. Syawal et al. (2013) stated that feed factors are very important in meeting growth needs; a lack of feed is a significant obstacle in the growth process. This means that feed availability is important in ensuring basic living needs, production needs, and livestock reproduction. Daily weight gain can occur after basic living needs are met if livestock can convert the feed substances consumed into livestock products, such as fat and meat.

Litter Size

Data from the research results show that the average litter size obtained is 2.07 ± 0.26 heads/birth. This shows that the number of children born simultaneously in the Tolitoli Regency is quite high, even with low birth weights.

Sodiq (2012) stated that the parity and body size of the mother greatly influence goat litter sizes. The mother's body posture will affect her ability to give birth to some children. Mothers with large body postures will produce more significant children simultaneously.

Litter size is essential in determining livestock productivity in breeding and rearing. Sudewo et al. (2012) reported that litter size tends to increase from the first to the sixth parity, with a peak at the sixth litter size of 1.96 ± 0.32 heads. Subsequently, the number of kids born decreases at the seventh parity. The number of children born tends to increase as the mother ages; this is thought to be related to body hormones because the more mature the mother, the more perfect her hormonal mechanisms. This is in accordance with Sodiq (2012), who reported that the average number of children born at one birth continued to increase until the sixth parity.

Pre-Weaning Mortality

Pre-weaning mortality is the percentage of kids that die in the pre-weaning period in relation to the total number of kids born in one lambing period. Many factors can cause pre-weaning kid deaths, including difficulty during labor (dystocia), climate conditions, litter size, disease, and predators. Our data showed that the number of pre-weaning goat deaths in the Tolitoli Regency was 37 out of 361 kid births, around 10.8%. This high number of kid deaths was influenced by the farmers' lack of understanding farmers about handling livestock after they were born, handling and treating diseases, and nutrition for kids.

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Calving Interval

The calving interval is the period between one birth and the next. This is the most important characteristic for assessing productivity and the best index for evaluating reproductive efficiency in livestock (Parasmawati et al., 2013). According to Wijanarko (2010), the length of the calving interval is influenced by the interval between the first estrus and pregnancy, the duration of the pregnancy, mating failure, embryonic death, and days open. Generally, goats give birth three times in two years with a gestation period of 150-154 days. Mating in goats is not seasonal; goat estrus occurs every 18-21 days and lasts 24-36 hours.

Our data showed that the average kidding interval of the Kacang goats in the Tolitoli Regency was 10.84 ± 0.71 months. This explains why Kacang goat mothers give birth only once a year. The longer birth interval in Kacang goats is thought to be caused by breeders not understanding and paying enough attention to the estrus cycle in livestock, resulting in uncontrolled mating processes that take longer.

Goat Body Condition Score

Body condition score (BSC) is an assessment that assigns a score to the body condition of livestock based on visual estimation and palpation of body fat deposits under the skin, around the backbone, base of the tail, and hips. BSC is one of the benchmarks for high and low body fat content. The higher the BSC number, the greater the fat content in the body of a livestock, and vice versa. High and low BSC values are greatly influenced by several factors, including feed consumption, environment, lactation period, and genetic factors from the mother in the form of linear body members (Aziz et al., 2019).

The BSC we obtained in the Tolitoli Regency were 2.6 ± 0.49 for male goats and 2.37 ± 0.49 for females. These goats' BSC values are in the score two or skinny category. When visualizing goats with little fat, the backbone is still visible. The ribs are still visible, although some are covered by fat.

3.3 Feasibility of Kacang Goat Farming

The average income of the Kacang goat farming respondents in the Tolitoli Regency is IDR 3,258,620/year with an average price/head of IDR 1,629,310. The Kacang goat farming business consists of fixed costs and variable costs. Fixed costs consist of depreciation costs for cages and equipment; for these farmers, this worked out to IDR 408,132/year.

Variable costs incurred by farmers in livestock businesses are for items used up in one production period. The variable cost components used in the Kacang goat farming business are green fodder, medicines, and labor; for these farmers, this worked out to IDR 1,085,422/year.

The total costs of the Kacang goat farming business are listed in Table 2.

Table 2. Total Production Costs of Kacang Goat Farming Business in the Tolitoli Regency

No	Type of Fee	Value (IDR)
1	Fixed cost	**408,132**
E 2	Variable cost	**1,085,422**
Amount		**1,493,554**

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This total cost is borne by business actors who seek various inputs and other factors needed for their production interests.

The income of the Kacang goat farming business is listed in Table 3.

Table 3. Income of Kacang Goat Farming Business in the Tolitoli Regency /Year

No	Description	Value (IDR)
1	Revenue	**3,258,620**
2	Total cost	**1,493,554**
Income		**1,765,066**

An R/C Ratio analysis compares the level of profit or income obtained with the total costs that must be incurred to make these profits. A business is said to be feasible and beneficial if R/C > 1. The R/C ratio value of goat breeders in the Tolitoli Regency is listed in Table 4.

Table 4. R/C Ratio Value of Goat Breeders in Tolitoli Regency

No	Description	Value (IDR)
1	Revenue	1,765,066
2	Total cost	1,493,554
R/C Ratio		**1.9675**

Table 4 explains that the income of goat farmers in the Tolitoli Regency is Rp. 1,765,066, while the total cost that farmers must spend is Rp. 1,493,554. The R/C Ratio value of 1.9675 indicates that the Kacang goat farming business is feasible in the Tolitoli Regency.

4. CONCLUSION

Forage in the research location, both legumes and Gramineae, are sufficiently available for livestock businesses, especially ruminant livestock. These consist of Gamal greens (Gliricidia maculata), Kayu Jawa (Linnea coromandalica), Lamtoro (Leucaena leucocephala), Turi (Sesbania grandiflora), and teki (Cyperus rotundus Linn). The dominant feed is Gamal greens. The productivity of Kacang goat livestock is relatively low but can be developed in the Tolitoli Regency. It is also financially profitable and feasible to cultivate.

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