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Research Article

Technical Aspects of Timorese Pony Husbandry Practices in Amfoang Region, East Nusa Tenggara Province, Indonesia

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Abstract | Timorese pony is among the local genetic resources in Indonesia, and the population is experiencing a decline due to traditional husbandry management challenges. Therefore, this study aimed to evaluate the technical aspects of breeding Timorese pony at the smallholder farm level in the Amfoang Region, East Nusa Tenggara (NTT) Province. The main focus included five technical farming aspects: breeding, feeding, stable, health, and maintenance. The experiment was conducted in South Amfoang and Central Amfoang Sub-districts, including 96 Timorese pony breeders determined based on the Lemeshow method. Data were obtained using a questionnaire guide that passed validity and reliability tests. The results showed that the characteristics of breeders were productive age, low education level, more than 10 years of farming experience, and less than five livestock ownership. Approximately 77.08% of breeders selected breeds based on physical appearance, and 8.33% considered pedigree. Furthermore, 90.62% of the main feed was grass, concentrate feed was only 7.29%, and breeders did not have stables (93.75%). Regarding health, only 10.42% of breeders ensured vaccination, and 96.87% did not quarantine sick animals. Intensive maintenance of Timorese ponies was only carried out by 4.17% of breeders, and the majority kept horses as a side business (78.13%). This study identified a low adoption of technology, and most breeders applied traditional practices when raising Timorese ponies. Consequently, farmers needed technical training, research-based policies, and budget support to improve livestock welfare and maintain the ecological sustainability of Timorese ponies. The results provided practical guidance for Timorese pony conservation and the empowerment of local breeders in remote regions.

Keywords | East Nusa Tenggara, Husbandry, Local resources, Sustainability, Technical aspects, Timorese pony

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INTRODUCTION

Horse development in various countries is providing economic benefits and supporting the agriculture, livestock, tourism, and sports sectors (Kolstrup *et al.*, 2013; Jęczmyk *et al.*, 2021). In Indonesia, horse has a strategic position due to their use for sports, agriculture, livestock, transport, tourism, and sociocultural attractions (Turangan, 2017; Randu and Hartono, 2020; Zannah *et al.*, 2022; Astati *et al.*, 2024). However, the development of horse population has experienced a negative growth of -1.84% (Ditjennak, 2021). Novianty and Andrie (2021)

and Lestari *et al.* (2023) reported several factors causing the decline in livestock populations, namely less than optimal maintenance systems, reproductive problems, limited availability and continuity of feed, and health management that breeders consider less (Wenda *et al.*, 2020).

Timorese pony is a local horse genetic resource of Timor Island in Indonesia whose breed is decreasing. According to the Provincial Statistics Bureau of East Nusa Tenggara (NTT) Province (2017, 2024), horse population in 2022 has decreased by 72.28% compared to 2016. In Amfoang Region of Kupang Regency, breeders keep Timorese pony due to easy access to pastures, hereditary livestock-keeping habits, economic benefits, and local traditions. This horse is also used by local breeders to transport agricultural products after harvest, as gifts in marriage (*Tess*), and death (*Kosu Luke*) ceremonies. However, its current development faces challenges of limited access to feed, low knowledge of horse management, conventional husbandry, and modernized development. Randu and Hartono (2020) and Randu and Wera (2021) recommended policy and budget interventions for improved horse management.

Husbandry practices of Timorese pony in Amfoang Region are of great interest, showing the customs of local breeders. Understanding the five technical aspects of animal husbandry (breeding, feeding, stable, health, and maintenance) can help breeders and stakeholders make improvements; and policies, conserve local livestock, and increase the sustainability of development. According to Fraser *et al.* (2013), the underlying theory of animal welfare emphasizes the importance of meeting the physical and psychological needs of animals (Akanksha *et al.*, 2024). This theory supports the comprehension of the interaction among genetic factors, the environment, and the management practices that affect animal welfare (Li *et al.*, 2023). Although mainly developed in an industrial context, animal welfare theory can be applied in local farms and stimulate scientific discussion on sustainable livestock development pathways in areas where traditional livestock farming is being deployed (Buller *et al.*, 2018; Martinez and Nolting, 2023).

Studies on maintenance in multiple breeds of horses have been performed for a variety of reasons. Several investigations have also been carried out in various regions, such as Japan (Senokuchi *et al.*, 2018), Sakha Republic (Pak *et al.*, 2024), Italy (Raspa *et al.*, 2020), and Indonesia (Hau and Sirappa, 2024; Neri, 2022). These include inbreeding prevention, conservation, export of organic horse commodities, stable density, optimal racehorse performance, and business feasibility analysis. Some reports focus on animal husbandry management for improved animal welfare (Brunner *et al.*, 2015; Popescu *et al.*, 2019; Watters *et al.*, 2021; Hacan *et al.*, 2023). Although previous studies have addressed equine livestock husbandry in general, there are gaps in integrating the five technical aspects of equine husbandry across different regions, environments, characteristics, and behavior of breeders, specifically in remote regions. This is supported by limited information on the development of Timorese pony in the World Domestic Animal Diversity Information System (FAO, 2024).

One aspect of Indonesian pony husbandry practices that has not been adequately discussed in recent literature is Timorese pony. There are only a few broad studies available that need further investigation to create an appropriate local standard of Timorese pony husbandry affordable to breeders. Technical feasibility assessment of these practices in Amfoang Region has provided knowledge and recommendations for practice that can help breeders carry out management efficiently and sustainably. The novelty of this study is the lack of previous related reports in Amfoang Region. The results were expected to (a) contribute to the scientific documentation of Timorese pony and husbandry in Indonesia, (b) produce evidence-based policy recommendations, as well as (c) conserve and empower local breeders to promote Timorese pony based on regional potential.

MATERIALS AND METHODS

Study area and duration

This study was conducted in four villages in the South Amfoang sub-district and four villages in the Central Amfoang sub-district, which are recognized for Timorese pony breeding. Both Amfoang districts are located in Kupang Regency, East Nusa Tenggara Province, Indonesia. We conducted the research for 5 months, from May to September 2024.

Sampling and respondents

As the sub-district government office did not possess statistical data on pony breeders, the number of 96 respondents was determined using the Lemeshow method. As the sub-district government office did not possess statistical data on pony breeders, the number of 96 respondents was determined using the Lemeshow method. According to Ahmed (2024), Lemeshow's method is used in probability sampling in survey research or field research to determine the minimum sample size when the size of a population is not known precisely (Wardana and Nugroho, 2023).

Purposive sampling was used to select respondents, considering their experience in breeding Timorese ponies for a minimum of 1 year, practicing during the study, and

willingness to be interviewed. The intent was to ensure that the Timor pony breeders selected as the sample had adequate knowledge and practical skills, which was in line with this study's objectives. This study employs a margin of error of 10%, which is deemed acceptable for this type of research, given the lack of information regarding the number of Timorese pony breeders in the study area and the study's limitations, including time and resources. This selected margin aligned with established social research protocols. The Formula for determining the number of respondents based on the Lemeshow method, according to Khanitaturrahmah *et al*. (2022), is expressed as follows:

$$n = \rho.(1-\rho)\left(\frac{Z\propto}{e}\right)$$

$$n = 0.5.(1-0.5)\left(\frac{1.960}{0.10}\right)^2$$

$$n=0.5.(0.5)(19.60)^2$$

$$n=0.5.(0.5)(384.16)$$

$$n= 96.04 \text{ rounded to } 96$$

Where; n= minimum sample size, Z∝ = score on the standard curve for 95% deviation, which is 1.960, ρ = the expected proportion of the population, but the population is not known, so an approach of ρ = q = 0.5, *e* = error limits, 10%.

Data collection

The study method used was a survey by Astati *et al*. (2024) and Aziza (2023). Primary data was obtained through direct observation and structured interviews using a questionnaire guide that had been tested for validity and reliability. The interviews were conducted to gain a deeper understanding of farmers' current breeding practices for Timorese ponies. Meanwhile, secondary data supporting this research is in the form of a literature review, including books, previous research, and journal articles relevant to the research objectives.

Variables and analysis

The variables observed in this study focused on (1) breeding, (2) feeding, (3) stable, (4) animal health, and (5) maintenance aspects. Data analysis of these variables used descriptive statistical methods. Data tabulation was conducted on all respondents' answers to obtain a clear picture of the technical aspects of current Timorese pony husbandry practices in South Amfoang and Central Amfoang sub-districts. All respondents' answers were visualized in the form of percentage distribution tables and graphs. To facilitate the analysis of the research data, we used SPSS version 25.

RESULTS AND DISCUSSION

Overview of timorese pony

Timorese pony is one of the five local horse breeds of NTT found on Timor Island. Other local breeds are the sandalwood horse (inhabiting Sumba Island), Flores on Flores Island, Sabu (Sabu Island), and Rote horse (limited to Rote Island). Timorese pony has shown great adaptability and endurance in the environmental conditions of Timor Island. The origin of Timorese pony remains largely unrecorded, although literature suggests that Arab traders and European explorers, particularly the Portuguese and Dutch, brought pony by sea in the 16th and 18th centuries. Based on morphology, Timorese pony has a strong and agile short back, well-developed muscles in the neck region, a prominent hip structure, an elongated body shape, as well as a calm and obedient disposition. This horse is generally 40-48 inches tall, or ± 102-122 cm, with coat colors generally brown, black, and reddish brown, but some are grey (Fröhlich *et al*., 2024; Linton, 2014). Figure 1 shows Timorese pony in the study region.

Figure 1: Timorese ponies in (A) South Amfoang and (B) Central Amfoang Sub-districts.
Source: Personal documentation (2024).

Timorese pony breeder characteristics

Breeder characteristics show the condition and background of the study respondents regarding their behavior and daily activities of keeping Timorese pony in South Amfoang and Central Amfoang Sub-districts. Knowledge of breeder characteristics is important to create practical solutions to optimize breeding business at breeder level. Based on Efu and Simamora (2021), these characteristics include traits or qualities that should be possessed by breeders in their business. Table 1 presents the characteristics of Timorese pony breeders in South Amfoang and Central Amfoang Sub-districts.

This study showed that the average age of Timorese pony breeders was 53.41 years, ranging from 28 to 68 years. The results showed that breeders from Central Amfoang, and South Amfoang Sub-districts were in the productive age demographic. Table 1 categorized 87 breeders (90.63%) as productive age, while the remaining nine (9.37%) are non-productive (± 0.882). According to Randu and Hartono (2018), horse breeders at a productive age have physical and psychological abilities that are still strong enough to optimally manage their breeding activities, and decide on a management model considered appropriate to support

the increase in business and productivity. According to Walalayo *et al*. (2023), the productive age group is between 15 and 64 years. This category is excluded from the non-productive age group, comprising under 15 and over 64 years.

The average formal education of Timorese pony breeders in South Amfoang and Central Amfoang Sub-districts is completed primary school, 31.25%. Only 5.21% of breeders graduated from university (± 2.234) (Table 1). According to Randu and Hartono (2018), low education affects the ability to adopt innovations and technologies (Hasan *et al*., 2022). This condition makes breeders rely more on their personal and community experiences in managing livestock businesses (Indey *et al*., 2022; Rohani *et al*., 2020). The results in Table 1 showed that 64.58% of breeders had rearing experience of more than 10 years (± 0.725). Warman *et al*. (2024) determined that breeding experience in Central Lombok Regency extended to 50 years. This discovery suggests that livestock is essential to the livelihood of local breeders. According to Hau et al. (2024), experience in animal husbandry has been positively associated with improved management skills, although perseverance and consistency greatly influence breeders in growing their business (Tulle *et al*., 2021).

The number of livestock owned is one indicator of the success of breeders in developing Timorese pony in South Amfoang and Central Amfoang Sub-districts. The results showed that the average ownership of Timorese pony was 4.91 heads, ranging from 1 to 13 heads. Based on Table 1, most breeders owned less than 5 Timorese ponies (48.96%), and only 5.21% had more than 10 Timorese ponies (± 0.595). These results show that breeding Timorese pony in Amfoang Region is a small-scale farming business. Alam *et al*. (2014) categorized livestock ownership into three distinct scales, comprising small, moderate, and large-scale for individuals possessing 1-5, 6-10, and more than 10 heads, respectively. Efforts are needed to increase the number of horse owners because it impacts breeders' income contribution due to the efficient use of production facilities (Randu and Hartono, 2018).

Table 1: Characteristics of timorese pony breeders.

Category	Frequency (People)	Percentage (%)	Standard deviation (SD)
Age (Years)			
15 - 24	0	0.00	
25 - 34	2	2.08	
35 - 44	10	10.42	± 0.882
45 - 54	34	35.42	
55 - 64	41	42.71	
> 64	9	9.37	
Education			
Illiteracy (Unable to read or Write)	17	17.70	
Did not complete primary school	8	8.33	
Completed primary school	30	31.25	
Did not completed junior high school	5	5.21	
Completed junior high school education	16	16.67	± 2.234
Did not complete secondary education	3	3.13	
Completed high school education	12	12.50	
Did not complete university degree	0	0.00	
Graduated from university	5	5.21	
Livestock rearing experience (Years)			
1 - 5	13	13.54	
6-10	21	21.88	± 0.725
> 10	62	64.58	
Number of Horse Ownership (Horses)			
< 5	47	48.96	
5 - 10	44	45.83	± 0.595
> 10	5	5.21	

Source: Primary data processed, 2024.

Aspects of Timorese Pony Breeding

Breeding is the key to sustainable horse farming because it improves breeders' genetic quality, growth, and economic benefits in the future. According to Amam and Harsita (2019); Anggraeni and Mariana (2016), breeding influences the success of livestock development, including horses. Improving the seed aspect is necessary to increase livestock productivity. Livestock breeding strategically produces seeds based on good guidelines (Ministry of Agriculture, 2014). Figure 2 shows how Timorese pony breeders in South Amfoang and Central Amfoang Sub-districts apply breeding aspects in their activities.

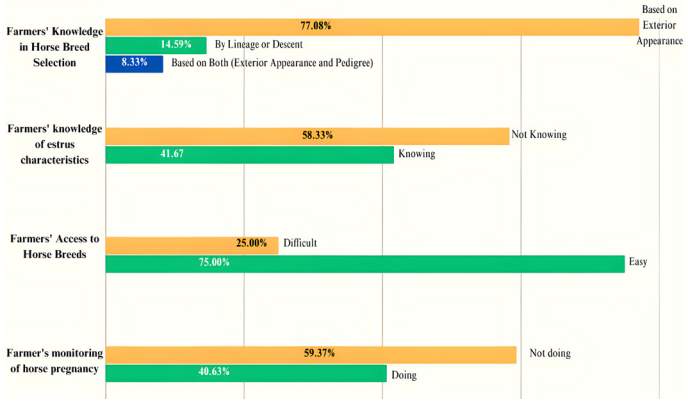

Figure 2: Implementation of Technical Aspects of Timorese Pony Breeding.
Source: Primary Data Processed, 2024.

Based on the results (Figure 2), 74 breeders (77.08%) selected Timorese pony breeds due to physical appearance (external body shape), while only eight breeders (8.33%) made selections regarding physical appearance and pedigree. Breeders select the Timorese pony breed based on physical appearance, considering the descendants of individuals who have consecutively won horse races. The goal is to pass on these superior traits to their offspring. Putra and Simanjuntak (2023) believed that selecting breeds based on external appearance is a suitable, practical, and efficient method in traditional farming systems. However, farmers are discouraged from selecting livestock that overemphasize certain physical traits in the long term, as this practice risks reducing genetic diversity, increasing disease susceptibility, causing reproductive problems, and making it difficult for livestock to adapt to environmental changes (Bilyaro *et al*., 2023; Biscarini *et al*., 2015; Van Marle-Köster and Visser, 2021). The results in Figure 2 showed that 58.33% of breeders did not know the characteristics of Timorese mares in heat. This shows that the lack of education, training, and information among breeders should be improved to increase their skills. Breeders must understand the characteristics of horses in heat to improve reproductive quality, quantity, and mating success (Lohmiller et al., 2020).

Timorese pony breeders in South Amfoang and Central Amfoang Sub-districts can easily obtain horse breeding stock (75,00%). This condition differs from the results of Randu and Hartono (2018) that 37.97% of Sandalwood horse breeders in Southwest Sumba Regency experience difficulty in obtaining seeds. The results showed that 59.37% of breeders did not doing monitoring the pregnancy of Timorese pony, while 40.63% engaged in monitoring (Figure 2). The pregnancy and development of Timorese mares are ineffectively monitored because breeders conduct surveillance only once every 5-7 days. Putra and Simanjuntak (2023) stated that breeding could be used to ensure the growth, development, and regeneration of livestock. Determining good breeding practices in South Amfoang and Central Amfoang Sub-districts is essential to obtaining quality offspring and selecting desirable traits, particularly for the next generation. These results are relevant for remote regions such as Amfoang, which have limited genetic diversity.

Aspects of Timorese Pony Feeding

Feed is an important component in developing Timorese pony to support their productivity. It contributes the most (60-75%) to the total cost of livestock production. Figure 3 presents the indicators of the feed aspect applied by breeders in South Amfoang and Central Amfoang Sub-districts in breeding Timorese pony.

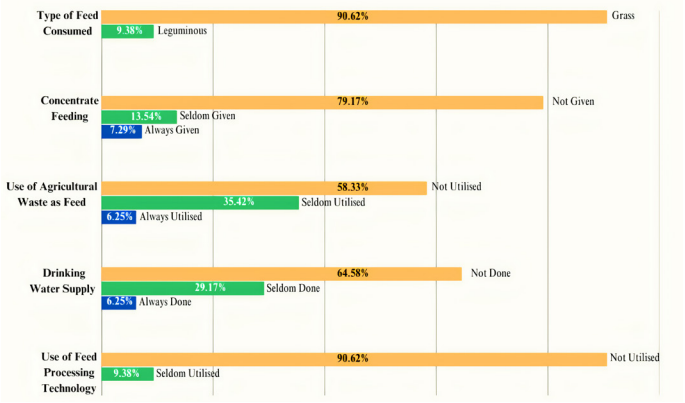

Figure 3: Implementation of technical aspects of timorese pony feeding.
Source: Primary Data Processed, 2024.

The results in Figure 3 show that some of the constraints of Timorese pony breeders in South Amfoang and Central Amfoang Sub-districts are related to the type of feed consumed, which is only grass (90.62%). Breeders also do not given concentrate feed (79.17%). Agricultural waste as feed is only routinely used by 6.25% of breeders through rice straw, banana stalks, bamboo leaves, sweet potato leaves, and corn leaves. The majority of breeders did not provide drinking water for Timorese pony (64.58%). Livestock search for their water source in breeding regions. Furthermore, 90.62% of breeders do not use feed

processing technology as an alternative solution to improve feed quality, cost efficiency, and agricultural waste.

According to Ermers *et al.* (2023), equines require forage as their primary food to meet fiber needs and maintain optimal digestive health. In addition to fiber, horses require other nutrients, such as water, fat, protein, carbohydrates, vitamins, and minerals, to maintain their overall physiological condition (Ralston, 2021). Substandard and unbalanced feeding has been shown to harm horses intestinal health, behavior, and physical performance (Freedom Health, 2014). Lestari *et al.* (2023) state that farmers in Gantarang Village, Jeneponto Regency, routinely provide fresh and dry feed consisting of nuts and grass, as well as other ingredients, such as grass, rice straw, corn, vegetables, peanuts, green beans, and sweet potatoes. Quality forages increase the nutritional value important to support livestock growth and health (Talla *et al.*, 2023). The results of this study differed when compared to Mastellar *et al.* (2018), who discovered that 71% of ranchers in South Dakota provided concentrates to horse to fulfill vitamin and mineral requirements. Lindinger (2022) stated that horse lost large amounts of water and electrolytes during exercise or heat stress. Therefore, water is essential to prevent dehydration and maintain physical performance.

Farmers can process fermented feed using a technological approach to ensure feed continuity for Timor pony horses in the Amfoang region, which is primarily affected by the dry season. Supplementation of vitamins, minerals, amino acids, and proteins in Timor pony horse feed is also very important. Management of grazing fields through a rotation system is also very important to support feed sustainability. This feed-processing technology can utilize agricultural waste that farmers already own and is available in the Amfoang area.

Aspects of timorese pony stable

Effective stable management is crucial for guaranteeing the comfort, safety, and optimal growth of Timorese pony. According to HM and Khairil (2020), pen management includes ensuring that pen function as a place to live and livestock activities, both individual, group, stud, calf, and quarantine pens. Failure to fulfill technical requirements through poor stabling management will compromise the productivity, safety, and comfort of the livestock. Figure 4 shows how breeders in South Amfoang and Central Amfoang Sub-districts manage stable aspects.

Based on Figure 4, 93.75% of Timorese pony breeders in South Amfoang and Central Amfoang Sub-districts did not own a stable. Although 6.25% had a stable, breeders did not clean the stable (92.71%). Observations in the study showed that breeders built very simple stables made from pieces of wood with leaf roofs, and some even had no roofs. The location of the stables is mostly more than 500 meters from the breeders' residence (90.62%). This condition impacts the maintenance, supervision, and health of breeding Timorese Ponies.

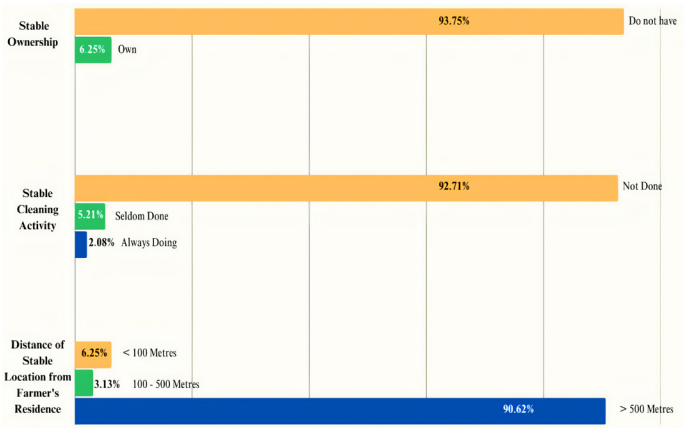

Figure 4: Implementation of technical aspects of timorese pony stable.
Source: Primary Data Processed, 2024.

Wenda *et al.* (2020) stated that stable must be sturdy, easy to clean, and have adequate drainage, serving as a place to feed and drink, with good air circulation. Stable should also have sufficient distance from settlements of at least 10 meters and manure storage at a minimum of 25 meters. Breeders should make pens easy to maintain, durable, and environmentally friendly, and facilitate the process of feeding, cleaning, as well as health care (HM and Khairil, 2020). The attainment of optimal livestock health care can be facilitated through the implementation of proficient stall management practices, as substandard environments engender conditions conducive to the proliferation of parasites and diseases (Zuroida and Azizah, 2018). Maintaining livestock without a pen heightens their susceptibility to environmental stressors, including severe weather, predators, theft, and exposure to infections such as parasites (e.g., worms), bacteria (e.g., tetanus and leptospirosis), and other microbes. These circumstances can compromise physiological health, resulting in abnormalities of thermoregulation, development, reproduction, and performance. Psychological effects may sometimes present as atypical behavior, including anger or lethargy (Dwinata *et al.*, 2018; Niyas *et al.*, 2015; Rinca *et al.*, 2022).

Aspects of timorese pony health

Disease prevention, treatment, and management, as aspects of Timorese pony health, are important elements in the cultivation and development. It is part of the main activities of livestock health management. Figure 5 shows several indicators of the health aspects of Timorese pony managed by breeders in South Amfoang and Central Amfoang Sub-districts.

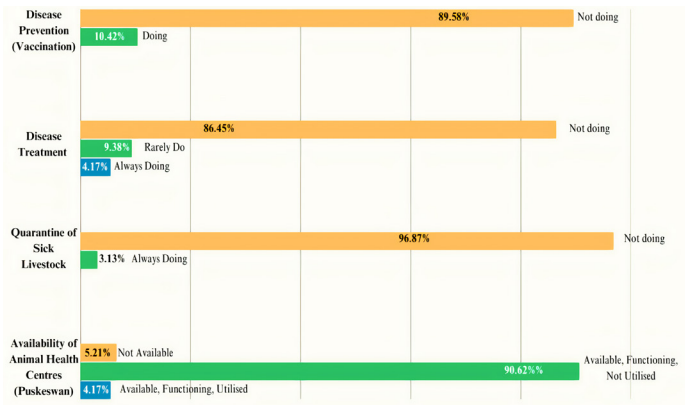

Figure 5: Implementation of Technical Aspects of Timorese Pony Health.
Source: Primary Data Processed, 2024.

The results Figure 5 showed that Timorese pony breeders in South Amfoang and Central Amfoang Sub-districts did not implement good animal health management. The majority of breeders did not vaccinate Timorese pony (89.58%), provided no treatment (86.45%), and did not quarantine sick animals (96.87%). Only 4.17% of breeders used the local animal health center's services. Interview results showed that worm infection, diarrhea, colic, and tick infestation are common diseases that attack Timor Pony horses in the Amfoang region. On the other hand, the government's vaccination program mainly focused on cattle, pigs, and goats. Breeders treat Timor Pony diseases using effective traditional medicine based on their experience. Semi-intensive breeders often contact veterinary paramedics when their livestock shows disease symptoms, including implementing quarantine strategies. In comparison, some other breeders rarely use the services of the Animal Health Centre due to the distance from their residences and financial constraints.

The results are in line with those reported by Putra and Simanjuntak (2023) in Dogiyai Sub-district and Syadik *et al.* (2021) in Toli-Toli Sub-district. However, Wenda *et al.* (2020) in Pinabetengan Village, Tompaso Sub-district, Minahasa Regency, reported that 71.43% of horse breeders vaccinated newborn calves and 54.55% controlled worm parasites. According to Nururrozi *et al.* (2020), vaccination is a disease prevention program that provides immunity to the body of livestock. Vaccines are disease seeds that are weakened or killed by specific procedures to stimulate the formation of immune substances and withstand attacks. A low vaccination coverage and weak quarantine systems can increase the risk of rapid disease spread, potentially leading to endemic conditions that threaten livestock populations. For this reason, effective vaccination and quarantine policies are essential to reduce disease transmission rates and protect the sustainability of livestock businesses (Alam and Sugiarto, 2022).

Efforts to increase the adoption of vaccinations and quarantine practices for Timor ponies, especially in remote and hard-to-reach areas, can be achieved through several integrated strategies. First, continuous extension is essential to raise farmers' awareness of the importance of vaccination and isolation of sick animals, with support from veterinary paramedics, veterinarians, and higher education institutions. Second, technical training for local farmers to become community animal health workers must be developed to overcome the limited number of veterinarians in the Amfoang area. Third, the government needs to provide mobile vaccination services in the form of mobile clinics or mobile animal health units equipped with medical equipment and medicines to reach remote areas on a scheduled basis.

In addition, optimizing digital technology is very important to monitor the health of Timor ponies through a system that provides information on vaccination schedules, symptoms of disease, and guidelines for handling sick animals. These efforts must be supported by cross-sectoral collaboration between breeders, the government, local communities, and educational institutions to ensure the sustainability of the Timor Pony population in the Amfoang area. Finally, providing incentives or rewards to farmers who consistently implement the vaccination program can be a positive stimulus to encourage active community participation.

Aspects of Timorese Pony Maintenance

Good horse maintenance will improve genetic quality, reproductive health, and overall health quality, increase economic value, and optimize competitiveness. Figure 6 shows breeders' activities in implementing aspects of Timorese pony maintenance in South Amfoang and Central Amfoang Sub-districts.

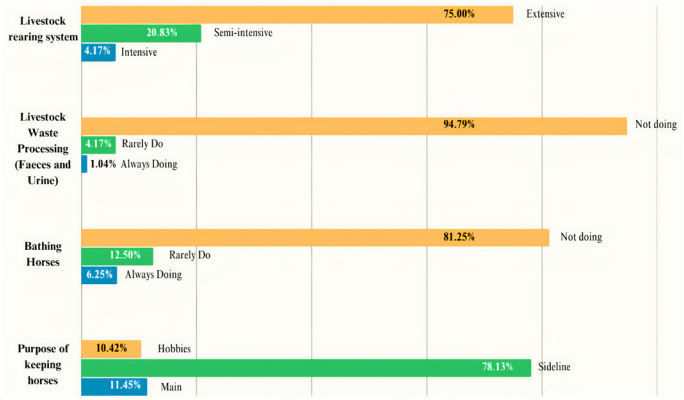

Figure 6: Implementation of technical aspects of timorese pony maintenance.
Source: Primary data processed, 2024.

The results Figure 6 show that 75.00% of breeders in South Amfoang and Central Amfoang sub-districts

maintain Timorese pony extensively. According to Gading *et al.* (2020), extensive breeding is a system where breeders allow livestock to graze freely daily to find their feed independently without using pens or providing additional feed. This system is a traditional breeding pattern (Lase *et al.*, 2021). Approximately 94.79% of breeders in the interviews admitted that the lack of practicing fecal and urine waste management because there was no training from the government/ local agricultural extension officers. Similarly, due to the dominance of the extensive breeding system, breeders pay very little attention to bathing their animals (81.25%). According to Alegbeleye and Sant'Ana (2020) and Vaysi *et al.* (2024), poorly managed waste and urine can pollute water and soil, increase greenhouse gas emissions, and spread pathogens that endanger human and animal health. Therefore, farmers need to adopt simple, cheap, and practical waste management technologies, such as bokashi, liquid organic fertilizers, biogas, and energy briquettes (Heriyanti *et al.*, 2020; Purwanta and Daniel, 2018; Randu *et al.*, 2020, 2024).

Figure 6 shows that 78.13% of breeders kept Timorese pony as a side business. Meanwhile, 11.45% kept Timorese Pony as a leading business that contributed to income. Income contribution from Timorese pony businesses can be increased by providing capital subsidies, health services, and rewards for breeders who consistently vaccinate and produce quality horses. Other strategies include training in maintenance and business management, institutional strengthening, and market development through local branding, horse riding tours, cultural promotion, horse contests, product diversification (meat, milk, leather), and extensive digital promotion to introduce the Timorese pony more widely, especially in the Amfoang area.

According to Widiati (2014), subsidies can encourage increased productivity in livestock farming, but this must be balanced with institutional arrangements so that farmers can respond effectively to policies and technological innovations. Marketing support also plays a key role in increasing competitiveness, which can be strengthened through digital strategies, e-commerce, and branding (Longgy and Widianingrum, 2024). Additionally, results-based incentives such as subsidies and insurance have increased income and provided economic protection, allowing farmers to focus more on developing their businesses (Syafitri and Sari, 2023). This support is crucial in maintaining the sustainability of livestock farming, mainly when dealing with price fluctuations, production risks, and market uncertainties (Ristianti *et al.*, 2022).

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, this study showed that the practice of breeding Timorese pony in Amfoang Region, NTT, was carried out by breeders traditionally. Breeders did not apply five technical aspects properly, as 77.08% focused on breed selection based on physical appearance. Timorese pony was dominantly dependent on single feed in the form of grass (90.62%) and did not optimize the use of feed sourced from agricultural waste (58.33%). Breeders did not use feed processing technology (90.62%), neither owned a stable (93.75%). Furthermore, breeders rarely applied equine health aspects such as vaccination, treatment, and quarantine of sick animals. The results showed that Timorese pony served only as a side business for breeders, making little contribution to increasing income or the economy in Amfoang Region. This could be due to limited access to education, training, and supporting infrastructure.

This study identifies significant opportunities to improve the welfare and sustainability of Timorese ponies through policy incentives that emphasize both technical and financial support, including livestock insurance, provision of incentives for farmers, formation of farmer cooperatives, business capital subsidies, enhancement of the socio-cultural role of Timorese pony commodities, education, and advanced training on the use of genomic technology, development of selected pony certification, utilization of feed and waste processing technologies, product diversification, improvement of branding and promotion of tourism-based Timorese ponies, and implementation of digital marketing strategies. These measures would enable local farmers in the Amfoang Region to transition from traditional small-scale practices to more professional, sustainable, and profitable enterprises.

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NOVELTY STATEMENT

This study breaks significant new ground by

comprehensively examining Timorese pony husbandry practices in Amfoang Region of NTT, an area that has not been studied by scholars. The focus is on the integration of five technical aspects, namely breeding, feeding, stable, health, and maintenance, in a unique local context. The perspectives of breeders who adhere to traditional husbandry practices are also included. Another novelty is the comprehensive assessment of factors affecting the productivity and welfare of Timorese pony in remote areas, which has received little attention in the scientific literature on local livestock breeding. Therefore, this study identifies key challenges in managing Timorese pony and provides recommendations for policy improvement as well as sustainable livestock development.

AUTHOR'S CONTRIBUTION

The authors contributed equally to the drafting of this manuscript.

Conflict of interest

The authors declare no conflict of interest.

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