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Research Article

Feed Consumption and Preferences of Male Anoas (Bubalus Spp.) at Anoa Breeding Center in Manado

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Abstract: This study aims to measure the consumption level and analyze the feed preferences of male anoa (*Bubalus* spp.) kept at the Anoa Breeding Center Manado. The study was conducted for 15 days using two adult male anoa aged 7 and 11 years as research objects. The type of feed provided consisted of green fodder in the form of Pennisetum purpureum and Paspalum dilatatum and additional feed in the form of bananas, sweet potatoes, carrots and long beans with a cafeteria feeding system. Consumption data was obtained from the difference between the feed provided and the remaining feed each day, then analyzed descriptively to determine fresh consumption, dry matter consumption and organic matter consumption, while feed preferences were analyzed using *Neu's Index* based on dry matter consumption. The results showed that the average fresh consumption was 8729,00 and 9962,27 g/day/head, with dry matter consumption of 1293.61 and 1549.43 g/day/head, respectively, and organic matter consumption of 1188,03 and 1402,87 g/day/head. *Pennisetum purpureum* was the forage with the highest consumption level, although nutritionally *Paspalum dilatatum* had a higher dry matter content. *Neu's Index* value showed that supplementary feed had the highest preference (1.00), followed by *Pennisetum purpureum* (0.74–0.83) and *Paspalum dilatatum* (0.50–0.65), which was supported by the order of consumption where male anoa first chose *Pennisetum purpureum in* forage and hibiscus banana in supplementary feed as the most preferred feed. The results of the study showed that the physiological needs of male anoa were met with Pennisetum purpureum being preferred over *Paspalum dilatatum* and bananas as the most preferred supplemental feed.

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INTRODUCTION

The biodiversity of Sulawesi Island is reflected in its rich endemic flora and fauna, including unique animals like the anoa (Bubalus spp.), an important symbol of the Wallacea ecosystem. Anoa is a dwarf buffalo found only on Sulawesi and several small surrounding islands and is the largest wild land mammal living in the region (Sulo, 2023). The anoa has evolved alongside the geological history of Sulawesi and has been classified as endangered by the IUCN (International Union for Conservation of Nature) Red List since 1986 and is included in Appendix I of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). It is an internationally protected species. Its population is estimated at fewer than 2,500 mature individuals, with a population decline of 20% in the wild over the past 14-18 years (Arini et al., 2020). This population decline is caused by poaching and habitat loss due to forest conversion, which has led to the fragmentation and isolation of anoa populations, necessitating conservation efforts. Anoa conservation aims to protect a species, maintain ecosystem balance, biodiversity, and natural heritage (Arini et al., 2020). One form of ex-situ anoa conservation effort is the establishment of the Anoa Breeding Center (ABC) in Manado, which was inaugurated in 2015. This facility is under the auspices of the Manado Environmental and Forestry Instrument Standards Implementation Center (BPSILHK) and focuses on planned captive breeding to increase the anoa population and also serves as an education and research center in collaboration with the North Sulawesi Natural Resources Conservation Center (BKSDA).

Proper feed management can improve anoa health and support successful reproduction and ex-situ conservation. The primary feed for anoa at the ABC breeding site consists of fresh greens, including elephant grass (Pennisetum purpureum) and Australian grass (Paspalum dilatatum), to meet nutritional and fiber needs and adapt to their natural ruminant nature. Anoa are also provided with supplementary feed such as hibiscus bananas, sweet potatoes, carrots, and long beans, which complement their nutritional needs and serve as enrichment to maintain feed variety and reduce stress caused by a monotonous diet. This feed variation aims to facilitate a species' adaptation to the conditions of its habitat (Meot, 2024).

Feed consumption and preference are important aspects of anoa feed management. The amount of feed consumed will influence the anoa's nutritional needs, which support their health and growth. The weight of feed consumed is calculated by weighing any remaining feed (Indriyani, 2017). Feed preference is the tendency of an animal to choose a particular type of feed over other available feeds. Feed preferences are determined based on feed consumption levels (Suryawan et al., 2023). Feed consumption was observed based on fresh, dry, and organic matter intake, while feed preferences were analyzed using the Neu's Index calculation. The purpose of this study was to measure the feed consumption levels of male anoa (Bubalus spp.) and analyze feed preferences for various types of feed provided at the Anoa Breeding Center in Manado.

RESEARCH METHODS

Research Location and Timeline

This research was conducted at the Anoa Breeding Center (ABC) Manado, an endemic wildlife breeding facility under the auspices of the Manado BPSILHK, located in Kima Atas Village, Manado City. The research was conducted from August to November 2024.

Research Sample

The study used two adults of male anoa: a 7-year-old Maesa and an 11-year-old Rocky, weighing approximately 120 kg and in good health. The feed provided consisted of forage

and supplementary feed. The forage used included Pennisetum purpureum and Paspalum dilatatum, while supplementary feed included plantain, sweet potato, carrot, and long bean. The nutrient composition of the male anoa feed can be seen in Table 1.

Table 1. Nutrient composition of male Anoa feed

Types of feed	BK (%)	PK (%)	SK (%)
Pennisetum purpureum	19,90	10,20	34,20
Paspalum dilatatum	12,18	11,68	32,49
Banana (*Musa paradisiaca*)	-	0,80	-
Sweet potato (*Ipomoea batatas*)	-	0,89	2,79
carrot (*Daucus carota*)	10,11	1,00	0,06
Long bean (*Vigna sinensin* L.)	-	17,30	-

Sources: Harahap (2024); BPTU-HPT PATAS (2024); TKPI (2019); Raudah *et al.* (2024); Rohman (2022); Mulianti *et al*. (2024).

Research Methods

The adaptation period was conducted through observation for 7 days before data collection for 15 days. Feed was provided using a cafeteria system: forage (Pennisetum purpureum and Paspalum dilatatum, totaling 12 kg/day/head or ±10% of body weight) twice daily (7:00 AM and 6:00 PM WITA, each 6 kg), and 500 g of supplementary feed (200 g sweet potato, 200 g carrot, 50 g long bean, 50 g banana) once daily (9:00 AM WITA).

Research Variables

1. Fresh Consumption

Fresh consumption was calculated based on the difference between the weight of the feed provided and the weight of the remaining feed using the formula:

$$K = M - S$$
$$\% K = x\ 100\%$$

Where:
K = consumption (kg/day)
M = feed provided
S = remaining feed

2. Dry Matter Consumption

Dry matter consumption was calculated by converting fresh feed consumption to the weight of the remaining feed. The formula for dry matter consumption is as follows (Chintia, 2017):

$$\text{DM Consumption} = \text{Fresh Consumption} \times \% \text{ DM}$$

3. Organic Matter Consumption

Organic matter consumption is calculated by calculating the total feed consumption provided in the form of organic matter. OM consumption can be measured using the following formula (Osuji et al., 1993):

$$\text{MO Consumption} = (\text{Feed Given x (MO)}) - (\text{Remaining Feed (MO)})$$

4. Feed Preference

Feed preference was analyzed using Neu's Index (Bibly et al., 1998 in Arini and

Kafiar, 2014):

$$w = r/a$$

Where:
w = selection index
r = proportion consumed
a = proportion available
Interpretation:
w ≥ 1 = preferred
w < 1 = less preferred
The order of feed consumption was also observed as supporting data to provide an overview of feeding behavior trends throughout the study.

Data Analysis

Data were analyzed descriptively and quantitatively by calculating average fresh food consumption, dry matter, organic matter, and preference scores.

RESULTS AND DISCUSSION

Fresh feed Consumption

Fresh feed consumption is the total amount of feed consumed by anoa. For endemic species like the anoa (Bubalus spp.), feed consumption is crucial because it directly contributes to nutritional needs that support health, growth, and survival, both in their natural habitat and in captivity. As ruminants, anoa utilize the fermentation process in their rumen to digest high-fiber feed, enabling them to meet their nutritional needs even when consuming only low-quality natural feed (Sangadji, 2024).

The average fresh feed consumption of male Rocky Anoa was 8,729.00 g/day/head and that of male Maesa Anoa was 9,962.27 g/day/head (Table 2), indicating that this consumption meets the ideal ruminant requirement of 10% of body weight. This consumption range aligns with the research of Suryawan et al. (2023), which reported that captive anoa feed requirements range from 8.34% to 11.54% of body weight. The amount of feed consumed by the forage group is influenced by the nutritional content and preference of each feed ingredient. Pennisetum purpureum has a crude fiber content of 34.2%, while Paspalum dilatatum has a crude fiber content of 32.49% (Table 1). Rustiyana (2016) stated that the higher the crude fiber content, the lower the digestibility of feed in ruminants. The crude fiber content of Paspalum dilatatum is lower, which is theoretically easier to digest, but in this study, the highest consumption of male anoa was actually found in Pennisetum purpureum.

Table 2. Average food consumption of male Anoa

Anoa's name	Type of feed	Fresh consumption (g/day/head)	DM consumption (g/day/head)	OM consumption (g/day/head)
Rocky	*Pennisetum purpureum*	4689,33	606,78	528,91
	Paspalum dilatatum	3539,67	596,95	575,06
	Supplementary feed	500,00	89,88	84,06
	Total	8729,00	1293,61	1188,03

Maesa	*Pennisetum purpureum*	5165,27	677,23	597,11
	Paspalum dilatatum	4297,00	782,31	721,70
	Supplementary feed	500,00	89,88	84,06
	Total	9962,27	1549,43	1402,87

Crude protein content also affects feed consumption because it provides nitrogen for rumen microbes in the fermentation process. Hidayat et al. (2025) stated that anoa require a relatively high protein intake to support the formation and maintenance of muscle mass. Paspalum dilatatum has a crude protein content of 11.68% higher than Pennisetum purpureum at 10.2%. Nutritionally, this condition should support higher Paspalum dilatatum consumption. The results showed that Pennisetum purpureum consumption was higher than Paspalum dilatatum, namely in rocky at 4,689.33 g/day/head and maesa at 5,165.27 g/day/head, while Paspalum dilatatum consumption in rocky was 3,539.67 g/day/head and maesa at 4,297.00 g/day/head (Table 2). This indicates that consumption is influenced not only by nutritional content but also by the anoa's preference for the food. The difference in consumption levels between the two anoa indicates that the Maesa has a higher consumption rate than the Rocky, which is likely influenced by variations in age, activity level, and physiological condition of each individual.

Additional feed (500 g/day/head) included hibiscus banana (5.7% CF, 0.8% CP), sweet potato (2.79% CF, 0.89% CP), carrot (0.06% CF, 1.0% CP), and long beans (17.30% CP) (Table 1). Supplemental feed consumption is influenced by the characteristics of the feed, which generally has low crude fiber and a soft, easily digestible texture. This condition allows supplemental feed to be fermented more quickly by rumen microbes than fiber-rich forages. This supplemental feed is provided in limited quantities as enrichment and nutritional supplements, so the level of consumption is influenced not only by nutritional content and preference, but also by the amount given.

Dry Matter Consumption

Dry matter is the weight of feed after water is removed and reflects all nutrient components, including carbohydrates, protein, fat, fiber, minerals, and vitamins. Dry matter consumption in ruminants ranges from approximately 2% of body weight. The average dry matter consumption of the Rocky Anoa reached 1293.61 g/day/head. The Maesa Anoa showed a higher consumption of 1549.43 g/day/head (Table 1). These values indicate that the dry matter consumption of male Anoa is close to the normal range of requirements. These results also align with previous research Basri et al. (2008) of 1557 g/day/head, or 1.5-2% of body weight, and are consistent with Flores-Miyamoto et al. (2005) of 1767 g/day/head in the lowland Anoa. This value is also similar to that of Timor deer, at 1440–1570 g/day/head (Garsetiasih, 2006). Differences in values can be influenced by feed type, individual characteristics, and rearing conditions.

Table 3. Dry matter and organic matter content of research feed

Types of feed	Dry matter (%)	Organic matter (%)
Feed given		
Pennisetum purpureum	13,63	85,57
Paspalum dilatatum	19,93	89,15
Supplementary feed	15,68	92,44
Leftover feed		
Pennisetum purpureum (Anoa Rocky)	16,10	80,98
Pennisetum purpureum (Anoa Maesa)	16,84	73,05
Paspalum dilatatum (Anoa Rocky)	24,34	81,99

Paspalum dilatatum (Anoa Maesa)	24,28	83,28

The dry matter contribution between forage types reflects the nutritional characteristic of the feed, with Pennisetum purpureum and Paspalum dilatatum being the primary sources of energy, fiber, and nutrients for male anoa. Dry matter consumption is influenced by individual factors and the capacity of the reticulo-rumen to accommodate and digest feed (Tahuk et al., 2021), and is an indicator of biological response to feed (Basri, 2009). The results showed a difference between fresh and dry matter consumption for both forage types. In terms of fresh quantity, Pennisetum purpureum consumed more than Paspalum dilatatum. However, in terms of dry matter quality, Paspalum dilatatum consumed higher. This is due to differences in the initial dry matter content of the two feeds (Table 3). Paspalum dilatatum has a higher dry matter content (19.93%) than Pennisetum purpureum (13.63%). The high water content of Pennisetum purpureum results in a higher feed volume but lower nutrient density. Conversely, the more nutrient-dense Paspalum dilatatum allows anoa to obtain a higher dry matter intake despite consuming a lower fresh volume.

Leftover feed data shows that the dry matter content of the remaining forage increased compared to when it was fed. This increase indicates that anoa tend to consume the more succulent (high-moisture) parts of the feed, leaving behind the drier, more fibrous, or mineral-rich parts, such as stems. Preference is the primary factor explaining the differences in dry matter consumption between feeds (Sulfiani, 2019). The contribution of dry matter consumption from supplemental feed was relatively small compared to forage, at 89.88 g/day/animal for both anoa (Table 2). This value was influenced by the limited amount of supplemental feed provided, at only 500 g/day/animal, resulting in a low quantitative contribution to total dry matter consumption. Nevertheless, all supplemental feed was consumed without any waste, indicating a very high preference.

Organic Matter Consumption

Organic matter is the portion of dry matter that has been reduced by ash (inorganic minerals). This includes carbohydrates, protein, fat, fiber, and vitamins, the main components that provide energy for rumen fermentation (Naytili et al., 2022). Organic matter consumption reflects the amount of organic nutrients consumed and is directly proportional to dry matter consumption. This is evident in the Rocky Anoa, with a dry matter consumption of 1,293.61 g/day/animal and an organic matter consumption of 1,188.03 g/day/animal, and the Maesa Anoa, with a dry matter consumption of 1,549.43 g/day/animal and an organic matter consumption of 1,402.87 g/day/animal (Table 2).

The pattern of organic matter consumption follows the dry matter consumption after the ash fraction is reduced, as evidenced by the lower organic matter consumption compared to the dry matter consumption. Based on the research results, the organic matter content of male anoa feed ranged from 85.57–92.44% of the dry matter (Table 3). This value indicates that male anoa organic matter consumption is within the normal ruminant range, which is approximately 85%–90% of total dry matter consumption. This is consistent with Flores-Miyamoto et al. (2005), who reported that organic matter in anoa feed reached 92–93% of the dry matter

The organic matter content of the forage provided was higher than that of the remaining forage, with Pennisetum purpureum at 85.57% and Paspalum dilatatum at 89.15%, while the remaining forage content decreased to 73.05–80.98% and 81.99–83.28%, respectively (Table 3). This indicates anoa selective feeding, with a tendency to consume more easily digestible and nutrient-rich forages. The organic matter consumption of male anoa, at 1188.02–1402.86 g/day/head, is lower than that of sambar deer (2.15 kg/day/head)

(Afzalani et al., 2008) and male Bali cattle (91 g/kg BW^0.75/day) (Tahuk et al., 2021), influenced by differences in body weight and rumen capacity.

Feed Preference

Feed preference is the degree to which an animal prefers a particular type of food. The feed preference values for male anoa can be seen in Table 2. The supplementary feed for both the rocky anoa and the maesa anoa had the highest value of 1.00, meaning all the feed given was consumed without any waste. The higher the preference index value, the higher the anoa's preference for that type of feed.

Table 4. Feed preferences based on dry matter consumption

Types of feed	Average DM consumption (r) (g)	Dry matter feeding (a) (g)	Preference (r/a)
Anoa Rocky			
Pennisetum purpureum	606,78	817,80	0,74
Paspalum dilatatum	596,95	1195,80	0,50
Supplementary feed	89,88	89,88	1,00
Anoa Maesa			
Pennisetum purpureum	677,23	817,80	0,83
Paspalum dilatatum	782,31	1195,80	0,65
Supplementary feed	89,88	89,88	1,00

The maesa anoa showed a higher preference value for Pennisetum purpureum (0.83) than the rocky anoa (0.74). Meanwhile, although Paspalum dilatatum contributed significantly to dry matter, both the rocky and the maesa showed lower preference values for this grass, at 0.50 and 0.65, respectively. This indicates that the anoa's preference for feed does not always align with its dry matter contribution or nutrient density.

The forage group showed that elephant grass ranked first with the highest consumption, while Australian grass ranked second (Table 5). Anoa tended to prioritize elephant grass before Australian grass, even though both types of forage were available in relatively equal quantities in the enclosure. This indicates that elephant grass has a higher level of palatability, supported by its morphological characteristics such as wider leaves, a relatively smooth leaf surface, and softer stems (Baharuddin, 2022).

Table 5. Feed order consumed by male Anoa

Feed group	Types of feed	Consumption order
Green fodder	*Pennisetum purpureum*	1
	Paspalum dilatatum	2
Supplementary feed	Banana (*Musa paradisiaca*)	1
	Sweet potato (*Ipomoea batatas*)	2
	Carrot (*Daucus carota*)	3
	Long bean (*Vigna sinensin* L.)	4

The supplementary feed group showed that hibiscus bananas were consistently the first choice and were consumed immediately after being offered, even though forage was still available. The next most consumed food items were sweet potatoes, carrots, and long beans. The tendency of male anoa to choose hibiscus bananas as the first choice is thought to

be related to the physical properties of the food. This is in line with Mustari et al. (2015), who stated that hibiscus bananas have a soft texture, sufficient water content, and a strong aroma that stimulates the animals to consume them immediately. Furthermore, bananas are rich in non-structural carbohydrates such as glucose, fructose, and sucrose (Pakhahan et al., 2024), which are easily digested and provide a natural sweetness, further increasing the animal's preference for the feed. Arini and Kafiar (2014) stated that the implementation of a cafeteria system showed that feeds with high preference tended to be selected and consumed first. Therefore, consumption behavior can be a clear indicator of animal preference for certain types of feed, as well as reflecting the animal's preference for the available feed.

CONCLUSION

The physiological needs of male anoa were met based on food consumption and preferences. Pennisetum purpureum had a higher preference than Paspalum dilatatum, and bananas were the preferred supplementary food.

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