



## DIET, FEED PREFERENCES, AND NUTRITIONAL INTAKE OF *Hylobates albibarbis* IN TRANSIT CAGE BKSDA KALIMANTAN TENGAH

### DIET, PREFERENSI PAKAN, DAN ASUPAN GIZI *Hylobates albibarbis* DI KANDANG TRANSIT BKSDA KALIMANTAN TENGAH

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#### Abstract

*Hylobates albibarbis* is a type of small primate that lives on the island of Borneo with a characteristic black face and white hair on the eyebrows, cheeks, and chin that resembles a beard. *H. albibarbis* feeding management is important in conservation efforts on ex-situ conservation because of animal welfare. This study aims to determine the composition of the diet, feed preferences and nutritional intake of feed given to *H. albibarbis* in transit cage at the Palangka Raya-Central Kalimantan Office for Conservation of Natural Resources (named Balai Konservasi Sumber Daya Alam-BKSDA) under the Directorate of Conservation of Natural Resources and Ecosystems of the Ministry of Environment & Forestry of the Republic of Indonesia. The methods used are focal animal sampling and restricted feeding observed in individual male adult and infant of *H. albibarbis*. The observations show that the feed preferred by adult *H. albibarbis* was the Ambon banana (98.21%) and the least preferred was the Kepok banana (74.26%). Otherwise, in infants *H. albibarbis* the most preferred feed was papaya (93.43%), and the least preferred feed was Ambon banana (58.10%). The average daily feed intake for adult *H. albibarbis* was 658.52 g, and for infant was 378.16 g. *H. albibarbis* in transit cage at the Palangka Raya BKSDA office, Central Kalimantan had good growth and healthy physical condition assumed from their body weight and length.

**Keywords:** Diet; Feed preferences; *Hylobates albibarbis*; Nutritional intake

#### Abstrak

*Hylobates albibarbis* merupakan kera kecil yang hidup di Pulau Kalimantan dengan ciri khas wajah berwarna hitam dan rambut berwarna putih pada alis, pipi, dan dagu yang menyerupai janggut. Pengelolaan pakan *H. albibarbis* penting dalam upaya konservasi dengan konservasi ex-situ untuk kesejahteraan hewan. Penelitian ini bertujuan untuk mengetahui komposisi pakan, preferensi pakan, dan asupan nutrisi pakan yang diberikan pada *H. albibarbis* di kandang transit kantor BKSDA Palangka Raya Kalimantan Tengah. Metode yang digunakan adalah focal animal sampling dan restricted feeding pada individu jantan dewasa dan jantan bayi *H. albibarbis*. Observasi dilakukan dalam durasi 12 jam selama 31 hari. Hasil pengamatan menunjukkan bahwa pakan yang disukai *H. albibarbis* dewasa adalah pisang Ambon (98,21%) dan yang tidak disukai adalah pisang Kepok (74,26%). Pakan yang disukai bayi *H. albibarbis* adalah pepaya (93,43%) dan yang tidak disukai adalah pisang Ambon (58,10%). Total asupan pakan harian untuk *H. albibarbis* dewasa adalah 658,52 g. Total asupan pakan harian untuk *H. albibarbis* bayi adalah 378,16 g. *H. albibarbis* di kandang transit kantor BKSDA Palangka Raya Kalimantan Tengah memiliki pertumbuhan yang baik dan kondisi fisik yang sehat berdasarkan berat badan dan panjang tubuhnya.

**Kata Kunci:** Asupan nutrisi; Diet; *Hylobates albibarbis*; Preferensi pakan

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## INTRODUCTION

*Hylobates albibarbis* or white-bearded gibbon, is a primate species living on the island of Borneo. The habitat of *H. albibarbis* is in primary and secondary forests in Central and West Kalimantan. The main diet of *H. albibarbis* is fruits which makes them suitable as seed dispersers and helps regenerate natural forests (Dillis et al., 2015). Male individuals of *H. albibarbis* have a body length ranging from 46.5–47.5 cm and a body weight of 4.9–6.5 kg. Whereas in female individuals, body length ranges from 46.5–49.7 cm, and body weight of 5.8–6.9 (Wiratno, 2019). The whole body is covered by brown hair. The face is black and has white hair on the eyebrows, cheeks, and chin that resembles a beard. The legs, arms, and lower body are dark brown in color. The toes and fingers are darker in color (Lyon, 1911).

*Hylobates albibarbis* are threatened due to various factors, such as habitat loss caused by land expansion, illegal logging further exacerbated by forest fires, and illegal hunting (Nijman & Menken, 2005). The conservation status of this animal based on the International Union for Conservation of Nature (IUCN) is endangered (Marshall et al., 2020). Considering that this species has a high conservation status, the Natural Resources Conservation Agency (BKSDA) of Palangka Raya, Central Kalimantan, participates in conservation, namely providing transit cages that function for temporary care for confiscated, handed over or evacuated animals, continued in the rescue and rehabilitation process, or before being released into their natural habitat in the wild. Thus, this species may feed differently from the type of feed it provides in the wild.

Feed is an important aspect that must always be considered, especially in temporary animal conservation areas. The feed given to animals must be food that can meet the nutrients that affect animal development, development during the embryonic period, result during pregnancy, and growth of young individuals (Manansang et al., 2016). The aspect of feed selection is also essential because the feed needed by primates is feed that contains carbohydrates, proteins, fats, minerals, and vitamins (Karyawati, 2012).

The size of the body owned by primates affects their diet. Primates tend to choose leaves and insects to meet their protein needs. This is because the leaves and insects contain about 20% of the dry weight of protein. Arboreal primates, which spend more time in the forest canopy, such as *H. albibarbis*, prefer to feed in the form of fruits with a higher percentage than leaves and insects. However, gibbons can also eat flowers and leaves field under certain conditions, such as a long Summerfield (Nurvianto et al., 2022).

*Hylobates albibarbis* was more dominant in frugivorous although it consumed feed from other sources besides fruit. *H. albibarbis* is characterized as a fruit eater, especially figs from the family *Moraceae*. Species from the *Hylobatidae* family consume a lot of small fruits that are ripe, unobtrusive, and have a high sugar content (Singh et al., 2018). In periods of low abundance of ripe fruit, this species will consume other food sources such as insects, leaves, and fruits still in a raw state (Coiner et al., 2016). The choice of feed derived from the fruit is also influenced by the activity of this species, an arboreal primate. Primates that spend much time with brachiation activities need nutrients that are rich in fiber. They are easier to digest and do not inhibit brachial activity because they have light body weight. For this reason, this research needs to be carried out to determine feed management in the form of diet composition, feed preferences, and nutritional intake of feed given to *H. albibarbis* in ex-situ conservation areas related to animal welfare in its conservation efforts.

For this reason, this research needs to be carried out to determine feed management in the form of diet composition, feed preferences, and nutritional intake of feed given to *H. albibarbis* in ex-situ conservation areas related to energy and nutrient requirements.

## MATERIALS AND METHODS

The research was carried out along 31 days in January until February 2022 at the transit cage, Central Kalimantan BKSDA Office, Palangka Raya City, Central Kalimantan, located at coordinates 2°12'33" South latitude, 113°54'51" East longitude. The total area of the transit cages and the orchid demonstration plots is 40 x 35 m. The subjects in this study were an individual male

adult *H. albibarbis* at the age of  $\pm 7$  and an individual male infant *H. albibarbis* at the age of  $\pm 2$  (Table 1).

This study uses non-experimental methods. The method used for observing feeding activities and types of feed is focal animal sampling. The feed given in the transit cage used the restricted feeding method. Observations were carried out for 12 hours for 31 days. Feed data collection includes various types of feed given per day when feeding activity is in progress and the amount of daily feed consumption.

**Table 1.** Profile of the *Hylobates albibarbis* in the transit cage of the Palangka Raya BKSDA office, Central Kalimantan

Sex	Age (years)	Height (cm)	Weight (kg)	Health condition	Historical
♂ Adult	$\pm 7$	72	$\pm 7$	Healthy	Illegal pet
♂ Infant	$\pm 2$	50	$\pm 2$	Healthy	Wild

The observation of feed was carried out for 31 repetitions and was carried out while eating activities were in progress. Feed observations focused on aspects of the type of feed given, which was an indicator of nutrient consumption of *H. albibarbis*. The feed given at mealtime is weighed first for each type. Then, the remaining feed is weighed again per type. The amount of feed consumed is calculated by subtracting the weight of the feed given from the remaining feed.

The calculation of the nutritional content of feed uses the food composition list also because of the entire feed given is commercial feed so that the nutritional content is listed in the Indonesian food composition (Table 2). The calculating of the nutritional content of feed are:  $B_j$ , is the weight of feed  $j$  given to *H. albibarbis* in a day.  $B_j$  is obtained by adding up the weight of the feed given minus the weight of the remaining feed.  $G_{ij}$  is the nutrient content contained in feed  $j$  (g) in an amount of 100 g. The nutritional content of this  $j$  feed includes protein, fat and energy content. Figures for nutrient content in feed  $j$  are listed in the Indonesian Food Composition Table (Table 2).

**Table 2.** Nutritional value of *Hylobates albibarbis* feed in transit cages per 100 g

Common name	Protein (g)	Fat (g)	Calories (cal)
Kepok banana	0.8	0.5	109
Ambon banana	1.0	0.8	72.9
Red dragon fruit	1.7	3.1	71
Cucumber	0.2	0.3	8
Papaya	0.5	12.0	46
Watermelon	0.5	0.2	28

Source: Table of Indonesian food composition in 2017 ( Ministry of Health of the Republic of Indonesia, 2018)

## RESULTS

During the 31 days of observation about diet of *H. albibarbis* in transit cage could be seen in Table 2. All of the feed that given to *H. albibarbis* in transit cage BKSDA Central Kalimantan are agricultural product, consist of Kepok bananas, Ambon bananas, red dragon fruits, cucumber, papayas, watermelon as shown in the Table 3 and Figure 1.

**Table 3.** Types of diet given to *Hylobates albibarbis* in transit cages

Common name	Scientific name	Information
Kepok banana	<i>Musa acuminata x Musa balbisana</i>	AP
Ambon banana	<i>M. acuminata</i> Colla	AP
Red dragon fruit	<i>Hylocereus polyrhizus</i>	AP
Cucumber	<i>Cucumis sativus</i>	AP
Papaya	<i>Carica papaya</i>	AP
Watermelon	<i>Citrullus vulgaris</i>	AP

Note: AP= Commercial feed/agricultural products



**Figure 1.** The fruit that consumed by the *H. albibarbis* in the transit cage

Both adult and infant *H. albibarbis* consumed Kepok bananas, Ambon bananas, and watermelons on the flesh and seeds, while the skin was ignored. Red dragon fruit and cucumber feed, the parts consumed by *H. albibarbis* are flesh, seeds, and skin. Red dragon fruit has a hard skin, so *H. albibarbis* peel and remove the hard skin while the thin skin is not peeled. The flesh and skin are parts of papayas that are eaten by *H. albibarbis*. Table 4. illustrated types of feed that consumed by *H. albibarbis* and diet preferences of each *H. albibarbis* could be seen on Table 5.

**Table 4.** Types and parts of feed consumed by *Hylobates albibarbis* in transit cages

Common name	Part of eaten		
	Flesh	Seed	Rind
Kepok bananas	✓	✓	-
Ambon bananas	✓	✓	-
Red dragon fruits	✓	✓	✓
Cucumbers	✓	✓	✓
Papayas	✓	-	✓
Watermelons	✓	✓	-

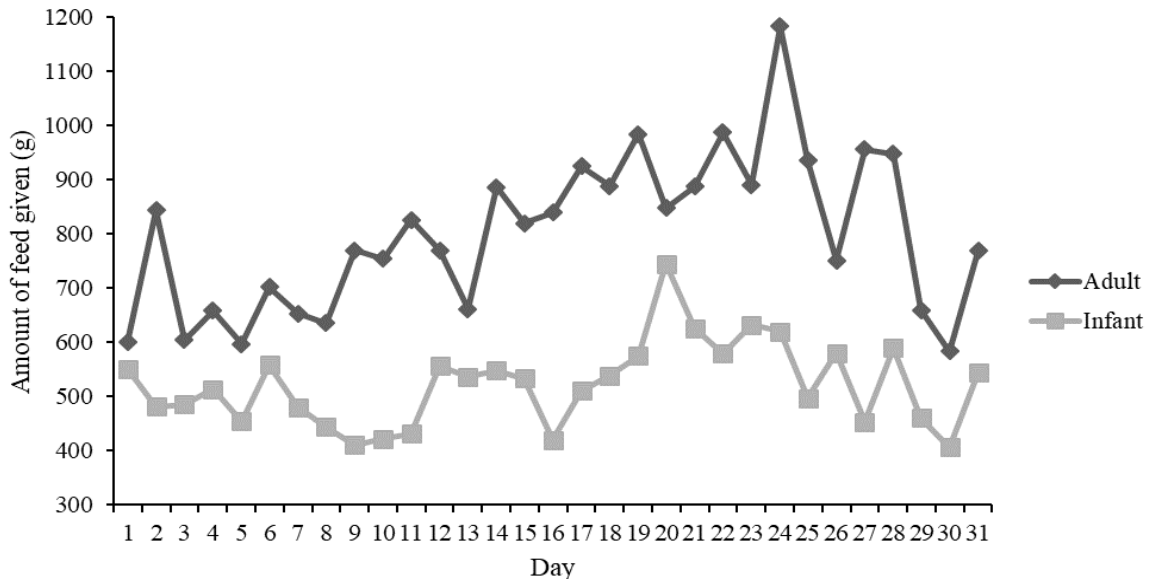
**Table 5.** Diet preferences of each type of *H. albibarbis* feed in transit cages

Individual	Common name	Average given (g)	Average eaten (g)	Residual average (g)	Percentage eaten (%)	Residual percentage (%)
Male adult	Kepok banana	350.67	260.42	90.26	74.26	25.74
	Ambon banana	279	274	5	98.21	1.79
	Red dragon fruit	245.95	223.68	24.26	90.21	9.79
	Cucumber	194.29	163.86	30.43	84.34	15.66
	Papaya	210.15	195.4	14.75	93	7
	Watermelon	253.5	201.88	51.63	79.64	20.36
Male infant	Kepok banana	223.09	132.73	88.37	60.39	39.61
	Ambon banana	105	61	44	58.10	41.90
	Red dragon fruit	162.29	126	36,30	77.64	22.36
	Cucumber	129	116.84	12.21	90.54	9.46
	Papaya	139.44	130.28	9.17	93.43	6.57
	Watermelon	184.33	122.33	62	66.37	33.64

In Table 5, the feed preference of *H. albibarbis* can be seen from the percentage of consumption of each type. In adult male *H. albibarbis*, the most preferred feed was Ambon bananas, with a consumption percentage of 98.21%, followed by 93% papaya, red dragon fruit, 90.21%, cucumber 83.34%, watermelon 79.64%, and Kepok bananas 74.26%. Meanwhile, the most preferred feed for male infants *H. albibarbis* was papaya, 93.43%. Then, cucumber was 90.54%,

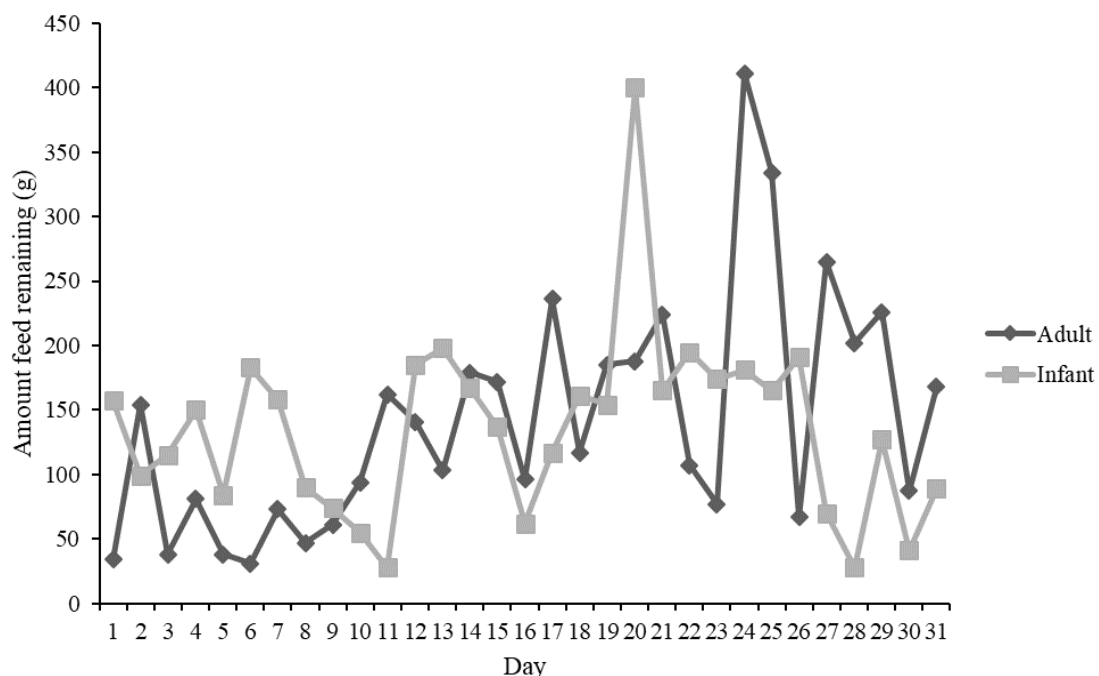
red dragon fruit was 77.64%, watermelon 66.37%, Kepok banana 60.39%, and Ambon banana 58.10%. The average daily feed consumption for adult males *H. albibarbis* is 658.52 g, and for male infants *H. albibarbis* is 378.16 g.

Figure 2. shows trends in total of feed given to adult and infant *H. albibarbis* in transit cage during 31 days. The most feed given to the adult *H. albibarbis* were 1183 g on the 24<sup>th</sup> day, while the greatest feed that infant *H. albibarbis* got were 745 g on the 20<sup>th</sup> day, namely. Meanwhile, the least amount of feed that adult and infant *H. albibarbis* received were on the 30<sup>th</sup> day, which is 583 g for adult *H. albibarbis* and 407 g for infant *H. albibarbis*. The amount of feed given per day to the two individuals were different due to the difference in the ages of the two gibbons.



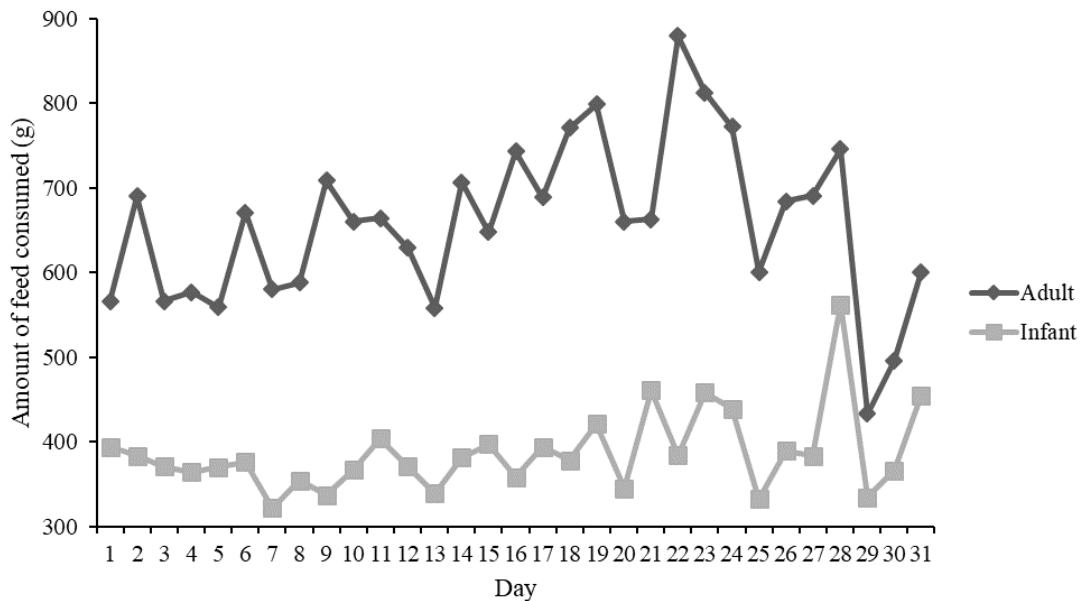
**Figure 2.** Total of feed given to adult and infant *H. albibarbis* for 31 days

The differences of the amount of feed leftover by adult and infant *H. albibarbis* could be seen in Figure 3. The most remaining feed was 411 g for adult *H. albibarbis* on the 24<sup>th</sup> day, when the most remaining feed on infant the 20<sup>th</sup> day in which 400 g of feed leftover. At the moment when a lot of feed uneaten, the gibbons provide more feed than usual so that there was also more food left. Another cause, the infant was still 2 years old in which canine teeth have not fully grown so he is not optimal when using his teeth to peel fruit skin.



**Figure 3.** Total of feed remaining of adult and infant *H. albibarbis* for 31 days

Figure 4. depicts total of feed consumed by an adult *H. albibarbis* during 31 days of observation. The highest amount of feed consumed by adult *H. albibarbis* was 772 g, and the lowest was 443 g, with an average consumption of 658.52 g. Based on the percentage of feed consumed, the highest was 95.58%, and the lowest was 64.28%. Meanwhile, the average percentage of feed consumed was 83.15% and the remaining feed was 16.85%. The percentage of feed consumed is pretty high considering that during the observation, the feed provided was accompanied by fruit skin.



**Figure 4.** Total of feed consumed by adult and infant *H. albibarbis* for 31 days

The in Figure 4. displays total of feed consumed by an infant *H. albibarbis* during 31 days of observation. The highest amount of feed consumed was 562 g and the lowest was 322 g with an average consumption amount of 378.16 g and the average remaining amount was 135.39 g. Based on the percentage of feed consumed, the highest was 95.25% and the lowest was 46.31%. Meanwhile, the average percentage of feed consumed was 75% and the remaining feed was 25%. The percentage of the remaining feed is relatively high because of the primate still in the infant phase, so the ability to peel and eat feed has not been maximized and there is still a lot of fruit flesh left in the skin of the fruit.

The consumption of nutrients and energy per day for the two individuals of the *H. albibarbis* could be seen in Table 6. There were differences intake calories between two *H. albibarbis* who live in transit cage. The adult ones need 339.29 cal/ind/d while the infant need 177.34 cal/ind/d. Estimated nutritional consumption of adult male of *H. albibarbis* were 16.24 g for protein, 47.83 g for fat, and energy 645.78 cal for the average amount feed consumed in one day. Meanwhile, in infant male *H. albibarbis* the average amount of total protein in the feed consumed in one day was 9.27 g, fat 30.39 g, and energy 164.77 cal for the average amount feed consumed in one day.

**Table 6.** Estimated nutritional consumption of *H. albibarbis* in transit cages

Individual	Consumption of nutrients			Calories
	Protein (g/ind/d)	Fat (g/ind/d)	(cal/ind/d)	
♂ Adult	8.08	28.89	339.29	48.47
♂ Infant	4.22	15.51	177.34	88.67

## DISCUSSION

The estimated age of adult *Hylobates albibarbis* male is about seven years, while the estimated for individual male infant *H. albibarbis* is about two years. The adult phase in the family

*Hylobatidae* is characterized by sexual maturity in individuals and body size reaching its maximum. Meanwhile, the infant phase is the phase from when the individual is born to 2 years (Winarno & Sugeng, 2018). *H. albibarbis* in the transit cage has a different background. The male adult one is a *H. albibarbis* found by residents in 2015 and has been kept since 2015. Finally, on 15 January, 2021, the resident who kept this *H. albibarbis* was handed over to the Central Kalimantan BKSDA. Meanwhile, infant *H. albibarbis* after being found by residents, was immediately handed over to the Central Kalimantan BKSDA on 16 June, 2021.

Regarding body length and body weight, adult male individuals have a body length of 72 cm and a body weight of 7 kg. Based on the literature, adult males of the *H. albibarbis* in the wild have a body length in the range of 46.5–47.5 cm with a body weight of 4.9–6.5 kg (Wiratno, 2019). This is thought to be due to the provision of different types of feed and the limited range of motion during rearing by humans before being transferred to transit cages, so that the nutrition obtained and energy expended is different from that of the *H. albibarbis* in the wild. Feeding management in the transit cage was carried out three times a day for the *H. albibarbis* (morning, afternoon, and evening). The feed given is fruit from agriculture such as bananas, dragon fruit, papaya, cucumber, and watermelon. Meanwhile, drinking is offered two times a day in the morning and evening when the cage is cleaned. Feeding was given in the morning (09.00 WIB), in the afternoon (12.00 WIB), and the afternoon (15.00 WIB).

The way of feeding begins with determining the feed to be given and weighing per type. Then, the feed was washed, cut into pieces, and given to the *H. albibarbis*. For the kind of feed in the form of fruits with skins such as bananas, no cutting and peeling of the skin is carried out, so that it can be seen which parts of the fruit are consumed. Bananas were the type of feed that is given the most amount (Manansang et al., 2016). The feed that gibbons tend to prefer is fruit feed containing ripe fruit flesh (Rahma, 2011). In line with previous research, at the transit cage the most preferred feed of *H. albibarbis* is bananas. It is also known that the *Hylobatidae* family in ex-situ conservation areas most likely bananas.

Nevertheless, the hard rind is removed and cut into pieces for red dragon fruit. Cucumber feed is given in pieces with skin (no peeling). Papaya is provided by removing the seeds first, then cut into pieces and giving them along with the rind. Whereas, in the wild family *Hylobatidae* was consumed several types of fruits with the seeds. Thus related to gibbons as a seed dispersal animals in the forest, so they were helpful for natural forest regeneration (Manshur et al., 2008). In contrast with papaya, watermelon was given by cutting it and with the rind and seed (no peeling).

*Hylobates albibarbis* is a frugivorous primate, so it predominantly eats fruit but can also eat leaves in the wild during periods of low ripe fruit abundance (Coiner et al., 2016). In the research location, leaves from the *H. albibarbis* feeding tree were not given in the wild because the site of the transit cage which is just temporary was not in the natural habitat of the *H. albibarbis* but in the city forest. So, the whole feed given is commercial feed (AP). Even so, feeding is carried out regularly and varied so that it is hoped that the nutrients needed by the *H. albibarbis* can be fulfilled. Also, the parts of the feed consumed differ depending on the type.

Protein is an essential nutrient for the body. This is because if energy consumption from other nutrients has not been met, protein will be used to meet the unmet energy needs as for the type of feed that can increase daily protein consumption in the form of leaves, such as young leaves that have high protein content (Auliah, 2018). In addition, the leaves also contain fiber, which can facilitate the digestive system of *H. albibarbis*, an arboreal primate, so it can maintain its body weight for brachiation (swinging) activities. In Rahma's research (2011), an infant Javan gibbon with the same age and body weight as the infant individual at transit cage BKSDA Kalimantan Tengah consumed feed with a protein content of 9.98 g per day, showing a relatively low number. Thus, the protein consumption rate of infant male *H. albibarbis* (4.22 g per day) and adult male *H. albibarbis* (8.08 g per day) individuals at the study site needs to be increased per day.

In addition to protein, fat is also an essential nutrient for the body because it is a reserve for the body when carbohydrates have been exhausted. Based on the literature, the type of feed with a fat content that is not too high is not a problem in primates. This is because fat levels that are not

too high can be filled with other fat content in different types of feed (Auliah, 2018). Although, the level of daily protein consumption in the two individuals of the *H. albibarbis* at the study site was relatively low, both individuals had good growth and development and healthy physical conditions. It can be seen from the movement of the two very agile individuals and the body weight and body length are by the literature of the *H. albibarbis* in the wild.

## CONCLUSION AND SUGGESTIONS

Diet comes from agricultural produce, including Kepok bananas, Ambon bananas, red dragon fruits, cucumbers, papayas, and watermelons. The most preferred feed for adult male *H. albibarbis* was Ambon bananas (98.21%) and the least preferred food was Kepok bananas (74.26%). The most preferred feed for infant male *H. albibarbis* was papayas (93.43%) and the least preferred feed was Ambon bananas (58.10%). The average daily feed intake for adult male *H. albibarbis* was 658.52 g and for infant male *H. albibarbis* was 378.16 g. The daily nutrient consumption for adult male *H. albibarbis* is 8.08 g/ind/d protein, 28.89 g/ind/d fat, and 339.29 cal/ind/d energy. Consumption of nutrients in infant male *H. albibarbis* for protein 4.22 g/ind/d, fat 15.51 g/ind/d, and energy 177.34 cal/ind/d. Additional feed variations such as leaves are needed to increase fiber consumption and high protein feeds. However, *H. albibarbis* at transit cage BKSDA in Central Kalimantan have good growth and healthy physical condition, it is evident based on their body weight and length that statistically are similar with primates in the wild.

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## REFERENCES

- Auliah, N. L. (2018). Analisis jenis pohon pakan dan kandungan nutrisi buah sumber pakan orangutan Sumatera (*Pongo abelii*) di Kawasan Taman Nasional Gunung Leuser (Skripsi sarjana). Universitas Sumatera Utara, Medan, Indonesia.
- Coiner-Collier, S., Scott, R. S., Chalk-Wilayto, J., Cheyne, S. M., Constantino, P., Dominy, N. J., & Ossi-Lupo, K. (2016). Primate dietary ecology in the context of food mechanical properties. *Journal of Human Evolution*, 98, 103-118. doi: 10.1016/j.jhevol.2016.07.005.
- Dillis, C., Beaudrot, L., Feilen, K. L., Clink, D. J., Wittmer, H. U., & Marshall, A. J. (2015). Modeling the ecological and phenological predictors of fruit consumption by gibbons (*Hylobates albibarbis*). *Biotropica*, 47(1), 85-93. doi: 10.1111/btp.12176.
- Karyawati, A. T. (2012). Tinjauan umum tingkah laku makan pada hewan primata. *Jurnal Penelitian Sains*, 15(1), 44-47. doi: 10.26554/jps.v15i1.94.
- Kementerian Kesehatan Republik Indonesia. (2018). *Tabel komposisi pangan Indonesia tahun 2017*. Jakarta: Direktorat Jenderal Kesehatan Masyarakat.
- Lyon, Jr, M. W. (1911). Mammals collected by Dr. WL Abbott on Borneo and some of the small adjacent islands. *Proceedings of the United States National Museum*, 40, 12.
- Manansang, J., Dondin, S., Joko, P., Entang, I., Yohana, T. H., & Imam, P. (2016). Penangkaran ex-situ Owa Jawa (*Hylobates moloch*) di fasilitas Penangkaran PSSP LPPM-IPB dan Taman Safari Indonesia. Bogor: Institut Pertanian Bogor.
- Manshur, A., Saputra, M. Y. A., & Mansyur, F. I. (2008). *Owa kelawat (Hylobates muelleri) sebagai obyek wisata primata di Taman Nasional Bukit Baka-Bukit Raya*. Bogor: Institut Pertanian Bogor.
- Marshall, A. J., Nijman, V., & Cheyne, S. (2020). *Hylobates albibarbis*. The IUCN red list of threatened species. Retrieved from <https://www.iucnredlist.org/species/39879/17967053>
- Nijman, V., & Menken, S. B. J. (2005). Assessment of census techniques for estimating density and biomass of gibbons (*Primates: Hylobatidae*). *The Raffles Bulletin of Zoology*, 53(1), 201-211.
- Nurvianto, S., Adriyanti, D. W. I. T., Hamdan, F., Triyanto, J., & Darmanto, A. (2022). Population density survey of white-bearded gibbons (*Hylobates albibarbis*) in high conservation value forest area of palm oil plantation company, Central Kalimantan, Indonesia. *Biodiversitas*



*Journal of Biological Diversity*, 23(5), 2245-2254. doi: 10.13057/biodiv/d230501.

- Rahma, D. A. (2011). Studi perilaku dan pakan owa Jawa (*Hylobates moloch*) di Pusat Studi Satwa Primata IPB dan Taman Nasional Gunung Gede Pangrango: Penyiapan Pelepasliaran (Tesis master). Bogor: Institut Pertanian Bogor.
- Singh, M., Cheyne, S. M., & Smith, D. A. E. (2018). How conspecific primates use their habitats: Surviving in an anthropogenically-disturbed forest in Central Kalimantan, Indonesia. *Ecological Indicators*, 87, 167-177. doi: 10.1016/j.ecolind.2017.12.041.
- Winarno, G. D., & Sugeng, P. H. (2018). *Perilaku satwa liar (Ethology)*. Bandar Lampung: Anugrah Utama Raharja.
- Wiratno. (2019). *Panduan identifikasi jenis satwa liar dilindungi : Mamalia*. Jakarta: Kementerian Lingkungan Hidup dan Kehutanan serta Lembaga Ilmu Pengetahuan Indonesia.