

## Food Composition and Preference of Captive Javan Langur (*Trachypithecus auratus*) in Gembira Loka Zoo, Yogyakarta

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### Abstract

Javan langur (*Trachypithecus auratus*) is one of the endemic primate species of Indonesia. Its populations were exposed to extinction risk caused by human activities. Thus, conservation efforts such as ex-situ conservation were needed to preserve this species. One of the javan langur ex-situ conservation in Yogyakarta is the Gembira Loka Zoo. In captivity, animals must be guaranteed to be free from hunger and stay nourished. One aspect to support this welfare is food supply. Therefore, this study aimed to identify the food composition and analyze the correlation between food preference and feeding duration of each food item group. We used scan animal sampling method with five minutes intervals to observe the behavior of seven individuals of captive javan langurs. The result showed that there are three groups of food (fruit, vegetable, and leaf) provided daily to javan langurs in Gembira Loka Zoo. All the individuals spent most their time to consumed food from vegetable group, except for infant female who had the highest duration in the leaf group. In addition, based on which food they consumed first every feeding time (preference food), javan langurs preferred vegetable over fruit and leaf. Based on the Spearman correlation test, there are positive correlations of duration and preference of feeding except for leaf groups. This result was different from the natural food composition of javan langurs which mostly consisted of leaves. This study might help the zoo to consider the food items provided for the animals to increase animal welfare

**Keywords:** Ex-situ conservation, Food composition, Food preference, Gembira Loka Zoo, *Trachypithecus auratus*



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### INTRODUCTION

Indonesia has many primate species including the endemic species the javan langur (*Trachypithecus auratus*). Javan langurs included in the CITES Appendix II category and listed as vulnerable in IUCN red list due to the decreased wild population (Nijman, 2023). Javan langurs are threatened with extinction due to human activities such as illegal

animal trade, a decrease in natural habitat area due to land conversion, and an increase in poaching (Leca et al., 2013). The effort to protect the population of javan langur from declining is ex-situ conservation in captivity. In captive environment, the animals are consistently having access to food compared to the wild population. However, the provided foods usually are less in seasonal variation and containing highly digestible components such as starch or sugar (Hoshino et al., 2021).

Javan langur belongs to subfamily Colobinae that predominantly eat leaves. Their stomach are adapted to this feeding ecology which is complex and multichambered forestomach (Langer, 2017). The diet of the wild javan langur consisted of leaves (young leaves 69.9%, mature leaves 0.8%) and supplemented with fruits and flowers (Tsuji et al., 2019). The complexity of the stomach which support foregut fermentation in this subfamily, the consumption of high sugar or high starch food might lead to acidosis (Lambert, 1998). However, in the zoo, colobines in the zoo fed by a mixed diet of fresh leaves, vegetables, and commercial pellets (Hoshino et al., 2021). Our preliminary study found that fed for primates in the Gembira Loka Zoo consisted of fresh leaves, vegetables, and fruits. Thus, to support the animal welfare in captive colobines, we analyzed the preference food and feeding duration of captive javan langurs in Gembira Loka Zoo, Yogyakarta.

## METHOD

This study was carried out from Maret until May of 2023 with total observation time is 250-300 hours at the Gembira Loka Zoo, Yogyakarta. Tools used in this study were camera, stationery, and timer. The object researched is Javan Langur. Before starting the research, habituation is carried out which is useful as an adjustment period between humans and animals. Habituation is used to prevent bias when observing behavior. Habituation period can be filled with activities to identify individual Javan langurs. Observation method uses behavioral sampling rules is scan animal sampling. Scan animal sampling is observation who monitors the behavior of certain individuals or individuals who are first seen in a group (Martin & Bateson, 1993). Scan animal sampling is used to collect data on feeding activities carried out by certain individuals during time intervals, for example five or ten minutes, so that behavior duration behaviors that appear during observations are obtained. Observations will start and finish according to the opening hours and closing hours of visitors.

This research will observe several aspects such as the type of feed, duration of feeding, and feed preferences. Feed preferences in this study were aimed to feed eaten for the first time from all types of feed given by the keepers and duration of eating from the time the feed entered the Javan Langur's mouth until it was finished chewing. After feed preference and feeding duration were obtained, both data were analyzed. Feed preference will be analyzed using the feed preference percentage,

$$\text{preference (\%)} = \frac{\text{Daily feed preference}}{\text{Total number of preferences}} \times 100\%$$

then percentage of duration of feeding was analyzed using the formula

$$\text{duration of feeding (\%)} = \frac{\text{Daily meal duration}}{\text{Total meal durations}} \times 100\%$$

Correlation between preference for type of feed and eating duration of Javan langurs was tested using Spearman rank correlation implemented in R.4.3.1.

## RESULTS AND DISCUSSION

### Food Composition

Main feed is given by the keeper in the morning and additional feed is given in the afternoon. Not only eating leaves, fruit, and vegetables (**Table 1**), Javan Langurs are given vitamins once every 3 months as an addition. Feed were categorized into three categories: fruit, vegetable, and leaves based on the study of food preferences and nutritional composition of bonobos (*Pan paniscus*) in captivity (Verspeek & Stevens, 2020). In addition, supplemented food as primate biscuits was also provided and given to the langurs in Gembira Loka Zoo, Yogyakarta.

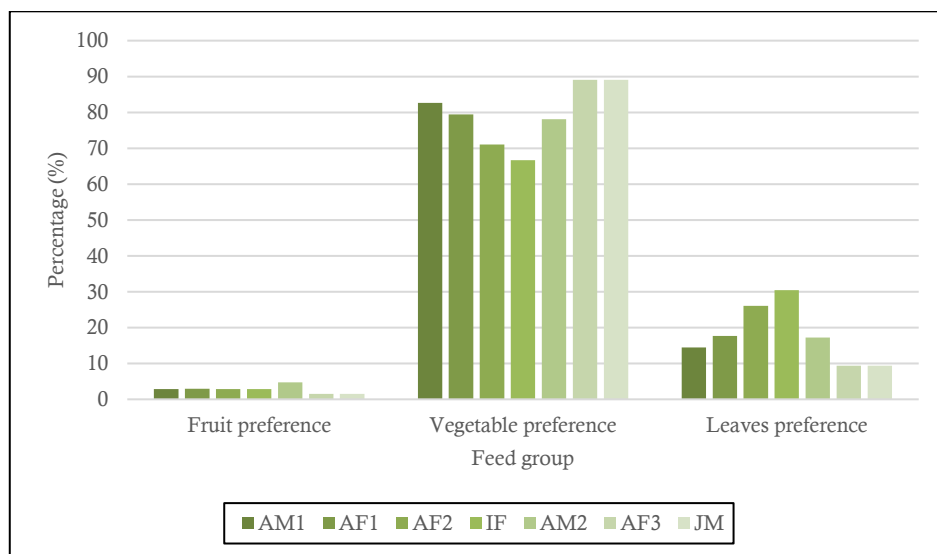
**Tabel 1.** Foods consumed by the Javan Langur in Gembira Loka Zoo

No	Local name	Scientific name	Edible plant parts	Feed category
1	Apple	<i>Malus domestica</i>	Fruit	Fruit
2	Common bean	<i>Phaseolus vulgaris L</i>	Fruit	Vegetable
3	Papaya	<i>Carica papaya L</i>	Fruit	Fruit
			Leaves	Vegetable
4	Gendola	<i>Basella rubra Linn</i>	Leaves	Leaves
5	Banyan	<i>Ficus benjamina</i>	Leaves	Leaves
6	Jamaica cherry	<i>Muntingia calabura</i>	Leaves	Leaves
7	Watery rose apple	<i>Syzygium aqueum</i>	Fruit	Fruit
8	Orange	<i>Citrus aurantium</i>	Fruit	Fruit
9	Corn	<i>Zea mays</i>	Fruit	Vegetable
10	Water spinach	<i>Ipomoea aquatica</i>	Fruit	Vegetable
11	Cowpea	<i>Vigna unguiculata</i>	Fruit	Vegetable
12	Chayote	<i>Sechium edule</i>	Fruit	Vegetable
13	Pear	<i>Pyrus communis</i>	Fruit	Fruit
14	Banana	<i>Musa acuminata</i>	Fruit	Fruit
15	Chinese mustard	<i>Brassica juncea L</i>	Fruit	Vegetable
16	Cucumber	<i>Cucumis sativus</i>	Fruit	Vegetable
17	Tomato	<i>Solanum lycopersicum</i>	Fruit	Vegetable
18	Sweet potato	<i>Ipomoea batatas</i>	Tuber	Vegetable
19	Carrot	<i>Daucus carota</i>	Tuber	Vegetable
20	Caladium	<i>Caladium sp.</i>	Leaves	Leaves

### Food Preferences of Javan Langur at the Gembira Loka Zoo

Javan Langurs live in groups. The number of Javan Langur individuals in one colony can vary. Gembira Loka Zoo has two colonies of Javan Langurs. The first cage contained one adult male (AM1), two adult females (AF1 and AF2), and one female baby (IF). The second cage contains one adult male individual (AM2), one adult female individual (AF3), and one male juvenile individual (JM). There are several stages in the behavior of the Javan Langur in obtaining food, namely monitoring the food when the

keeper approaches the cage, then approaches the feed container. After monitoring food, then take food by putting food in the mouth. Javan Langurs tend to eat in trees since Javan langurs are arboreal animals that carry out all their activities in trees (Ihsanu & Setiawan, 2013; Leca et al., 2013). The main feed is given by the keeper in the morning and additional feed is given in the afternoon. Not only do they feed on leaves, fruit, and vegetables, but once every 3 months the Javan Langur is given additional vitamins. Feed preferences in this study were aimed at the first food taken by every individual during the first and second feedings. The following is the preference percentage and duration of feeding time for Javan Langurs at the Gembira Loka Zoo, which is described in Figure 1.



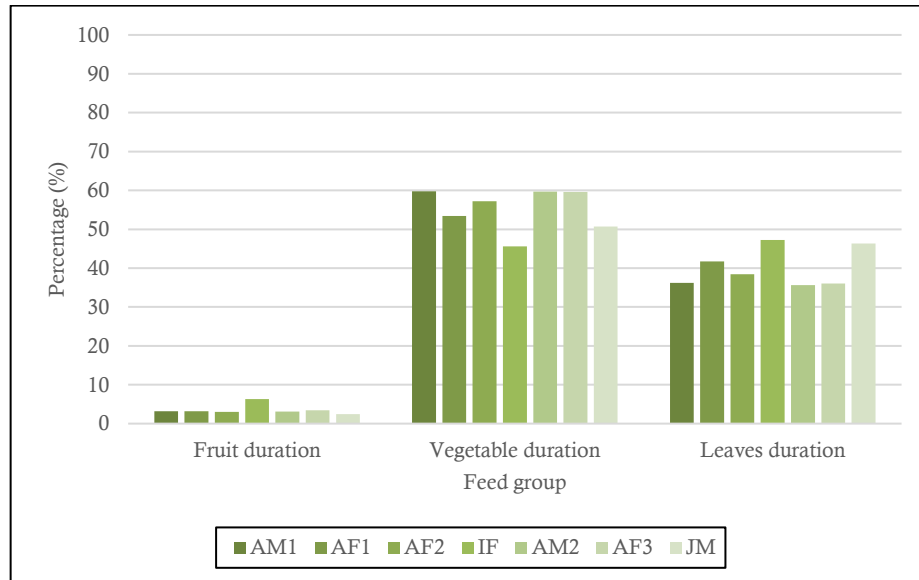
**Figure 1.** Feed preferences based on the feed group of Javan Langur at the Gembira Loka Zoo in Yogyakarta 2023.

All individuals of javan langur preferred feed items from vegetable feed group, this is different from the feed preferences of wild population. However, in nature, fresh young leaves of Banyan (*F. benjamina*) that were fed to javan langurs in Gembira Loka Zoo, Yogyakarta also consumed by the wild javan langurs (Tsuji et al., 2019). Other *Ficus* species were found as the food items consumed by wild javan langurs (Karyanto et al., 2022; Wardhana et al., 2022). The composition of the feed for Javan Langurs in nature is different from the composition of the feed for Javan Langurs at the Gembira Loka Zoo, which consisted of fruits, vegetables, and leaves. This is due to the limited availability of fresh young leaves in captivity. The fruit group feed in this study was consumed less compared to vegetables and leaves. Usually, fruits that consumed by wild population are figs species since the availability throughout the year (Tran et al., 2019). Furthermore, populations of javan langur inhabited inland forest are much less folivorous (Kool, 1993).

### Feeding duration of Javan Langur at the Gembira Loka Zoo

Every Javan Langur has the highest eating duration in the vegetable feed group (Figure 2), except for IF individuals who had the highest feeding duration in the leaves group. This is because the first cage contains adult AM1, AF1, and AF2 individuals who

are more dominant in consuming large amounts of vegetables so that IF individuals do not have competition to consume large amounts of leaves and during the study period, IF individuals do not only eat the feed that has been given keeper, the IF individual is still being breastfed by its mother, namely the AF2 individual.



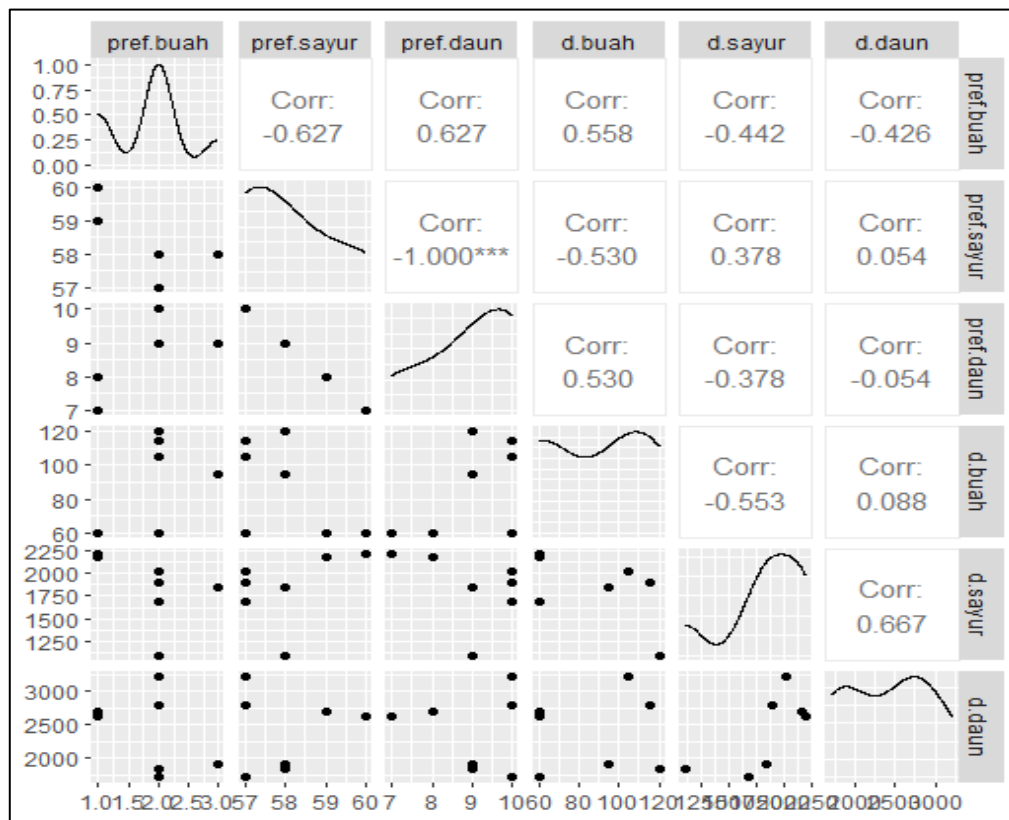
**Figure 2.** Feed duration based on the javan langur feed group at the Gembira Loka Zoo in Yogyakarta 2023.

The feeding duration of the fruit feed group was relatively low compared to the vegetables and leaves group (< 20%). In the nature, *Trachypithecus* showed no significant differences of time spent consuming various food items (Tran et al., 2019). There is limited number of studies about feeding duration for each food items performed in javan langurs.

### Correlation between feed preference and feed duration

The correlation between fruit group feed preferences and fruit group feeding duration was positive (Spearman correlation,  $r = 0.558$ ) (Figure 3). When the Javan Langur's food preference for the fruit group is high, the duration of the Javan Langur feeding on the fruit group increases. The same was found for the correlation between preference and duration of eating for the vegetable feed group (Spearman correlation,  $r = 0.378$ ). If feed preference the javan langur for the vegetable group increased then feeding duration for vegetable group will increases. The preference and duration correlations were stronger in the fruit group compared to the vegetable group. The correlation between the feed preferences of the vegetable group and the duration of eating for the vegetable group is positive, this indicates that if the Javan Langur feed preference is high, the duration of the feed increases. On the other hand, the correlation between feed preferences and the duration of feeding for the leaf group is negative (Spearman correlation,  $r = -0.054$ ), it means if the Javan Langur's feeding preference for high leaves, eats the duration of the Javan Langurs for the low leaves food group, this is because leaf food is given earlier before morning feeding hours and the amount of leaf feeding is very abundant compared

to fruit and vegetable feed.



**Figure 3.** Correlation between preferences and duration of feeding of javan langur at the Gembira Loka Zoo, Yogyakarta

Preference data and duration of eating Javan langurs in captivity are expected to provide an overview of the preferences for feed and duration for feeding on Javan Langurs in the wild. Food preference data can provide an overview of the diversity of primate food preferences and the tendency of animals to choose food options (Huskisson et al., 2021) The feed components for the Javan Langurs at the Gembira Loka Zoo are currently not in accordance with the feed components in their habitat, because the Javan Langurs feed in their habitat are leaves. The availability of leaves food components, such as in the native habitat of the Javan Langur, can support the Javan Langur's needs to survive and reproduce (Hoshino et al., 2021)

### CONCLUSION

Based on the research that has been done, it can be concluded that all Javan Langur individuals has preference for feed in the vegetable feed group and have the highest feeding duration in the vegetable feed group, except for IF individuals who have the highest duration in the leaf group. The results of the Spearman correlation test showed that the preferences and duration of eating in the fruit and vegetable group were positive so that the higher the preference, the higher the duration of eating.

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