UNIVERSITI PUTRA MALAYSIA

FEEDING PREFERENCE OF FREE-RANGING LONG-TAILED MACAQUE BETWEEN SOLID AND LIQUID FORM OF FOOD AT UNIVERSITI PUTRA MALAYSIA

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DEDICATION

My parents, Mr. Sehgar Kandasamy and Mrs. Yasotha Devi Sehgar, for the encouragement to chase my dreams and the courage to accept my limitations.

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Matha, pitha, guru, deivam.

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ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD 4999-Projek Tahun Akhir.

PILIHAN MAKANAN KERA LIAR DI ANTARA MAKANAN PEPEJAL ATAU CECAIR DI SEKITAR UNIVERSITI PUTRA MALAYSIA

oleh

KAVVIN A/L SEHGAR

2022

Supervisor: Assoc. Prof. Dr. Hafandi Ahmad

Co-supervisor: Assoc. Prof. Dr. Hasliza Abu Hassim

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Secara progresif, insiden konflik manusia-hidupan liar telah dikaitkan dengan haiwan kera yang menjadi sumber kebimbangan pada skala global. Beberapa strategi yang sering digunakan untuk menghentikan pembiakkan berlebihan dalam populasi hidupan liar termasuk pembunuhan, pemindahan dan keracunan. Walau bagaimanapun, prosedur ini biasanya berjangka masa pendek dan membawa akibat yang tidak beretika. Menariknya, kajian di luar negara telah menunjukkan keberkesanan alat kontraseptif untuk mengawal populasi kera. Oleh itu, ini merupakan kajian terdahulu untuk memahami pilihan kera liar di antara makanan dalam bentuk pepejal atau cecair di Universiti Putra Malaysia. Kuadran bahan makanan disediakan di lokasi kera ditemui

dan perangkap kamera dipasang untuk merakam tingkah laku pemakanan mereka. Dalam kajian ini, makanan seperti roti dengan jem mentega kacang dan buah-buahan (contoh: epal dan pir) digunakan sebagai makanan pepejal, manakala jus oren dan minuman berkarbonat (contoh: minuman 100 *plus*) digunakan sebagai makanan cecair. Keputusan menunjukkan bahawa 81.37% daripada kera liar memilih makanan pepejal, 18.18% daripada kera liar telah memilih kedua-dua makanan pepejal dan cecair, manakala hanya 0.45% daripada kera liar telah memilih bentuk makanan cecair. Dapat disimpulkan bahawa kera liar mempunyai kesukaan yang lebih tinggi terhadap makanan pepejal berbanding makanan bentuk cecair. Beberapa faktor yang mungkin boleh menjejaskan keutamaan adalah banyaknya bahan makanan yang terdapat di lokasi tertentu dan rangsangan deria oleh sesebuah makanan. Selain itu, cabaran yang dihadapi ketika pengumpulan data termasuk cuaca tidak menentu, kesilapan teknikal semasa mengendalikan perangkap kamera dan juga bahaya pekerjaan seperti kecederaan.

Kata kunci: Kera liar, makanan pepejal, makanan cecair, Universiti Putra Malaysia

ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine in partial fulfillment of the course VPD 4999-Final Year Project.

FEEDING PREFERENCE OF FREE-RANGING LONG-TAILED MACAQUE BETWEEN SOLID AND LIQUID FORM OF FOOD AT UNIVERSITI PUTRA MALAYSIA

by

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2022

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Progressively, incidences of human-wildlife conflict have been linked to macaques which are a source of concern on a global scale. The few typical strategies used to stop an excessive expansion in wildlife population include culling, translocation and poisoning. However, these procedures usually are brief and carry unethical consequences. Interestingly, studies in foreign countries have shown the effectiveness of contraceptives to control the population of macaques. Therefore,

this is a preliminary study to understand the feeding preference of long-tailed macaques (LTM) between solid and liquid form of food in Universiti Putra Malaysia. Quadrants of food material were prepared in the location where LTM are found and camera traps were set-up to record their feeding behavior. In this study, bread with peanut butter jam and fruits (e.g apple and pear) were used as solid food, while orange juice and carbonated drink (e.g 100 plus) were used as liquid food. Results showed that at 81.37% of the wild LTM preferred solid food, at 18.18% of wild LTM have chosen both solid and liquid food, while only 0.45% of wild LTM have chosen liquid form of food. It can be concluded that wild LTM have higher preference towards solid food over liquid form of food. Some factors that could possibly affect the preference are abundance of food material available in a particular location and sensory stimulation by a particular food. In addition, a challenge faced during the research includes unpredictable weather, technical errors when handling the camera traps and also occupational hazard such as injuries.

Keywords: Long-tailed macaque (LTM), solid food, liquid food, Universiti Putra Malaysia.

1.0 INTRODUCTION

Due to widespread human operations like farming, commerce, or rapid urbanisation activities, human-wildlife conflict (HWC) has become an increasing global concern (Siljander et al., 2020). According to Priston & McLennan (2013), macaques are increasingly involved in human-wildlife conflicts as a result of their propensity to cohabit with humans and survive in urban settings. According to Moroccan authorities, Barbary macaques *(Macaca sylvanus)* have harmed the forest by peeling the bark off of cedar trees in Morocco. However, according to Camperio Ciani et al. (2001), the excessive logging and agriculture operations were to blame for the poor water availability, that led to the bark stripping behaviour. As a result of human-rhesus macaque *(Macaca mulatta)* conflict in Himachal Pradesh, India, the local government has started a culling operation and categorised the macaques as pests (Anand & Radhakrishna, 2020).

In Malaysia, the long-tailed macaques, *Macaca fascicularis*, are among the fauna that come into conflict with people most frequently. In Malaysia, several state such as Selangor, Kedah, and Johor accounted for the majority of the 37,822 complaints about long-tailed macaques that the Department of Wildlife and National Parks Peninsular Malaysia (PERHILITAN) received between 2006 and 2010 (Karuppannan et al., 2014). Moreover, long-tailed macaques are the second-most common species to be involved in collisions with motor vehicles, according to research (Kasmuri et al., 2020). Culling as

well as other population-control measures have been implemented in response to complaints made to the authorities. As part of its efforts to regulate conflicts between people and long-tailed macaques, PERHILITAN has reportedly culled 53,687 of the animals (Department of Wildlife and National Parks Peninsular Malaysia (PERHILITAN, 2018).

The few conventional techniques used to combat unchecked wildlife population growth include culling, translocation, poisoning, and permitting natural deaths (Barfield et al., 2006). These techniques typically only have short-term benefits on population control, and they might not be morally permissible in light of the welfare of the animals involved (Shimizu, 2012). Contraceptive technique offers a feasible solution to the conflict between humans and macaques without the social and economic costs associated with the direct extermination and relocation of surplus animals (Barfield et al., 2006; Priston & McLennan, 2013).

Contraceptive has been studied as a way to manage the macaque population. Male and female macaques in Hong Kong have undergone sterilisation and contraceptive procedures, which has led to a 5% and 30% drop in the overall population and the average annual birth rate, respectively (Shek, 2011). Similar to this, the Thai government undertook a scheme to restrict the population of long-tailed macaques by administering orchidectomy to males and levonorgestrel implants to females (Malaivijitnond et al., 2011). In Kuala Lumpur, Karupannan K. (2015) carried out a pilot study on non-surgical castration of male long-tailed macaques. Chemical castration

turned found to be an efficient sterilisation technique that didn't affect the animal's sociological or physiological functions.

Successful combat of population overgrowth through contraceptive involves multiple steps. The initial step will be to understand the feeding preference of the macaques. Effective management of these urbanised, free-ranging non-human primate species requires on both an understanding of their population dynamics and their modified feeding behaviours (Dishari et al., 2021). Therefore, this study focusses on establishing the feeding preference of free-ranging long-tailed macaques around Universiti Putra Malaysia.

Objective

The objective of this study was to identify the food preference of long-tailed macaque between solid and liquid food forms.

Hypothesis

A similar study conducted by Roshid et al. in the year 2021 at Mbah Agung Karangbanar Recreational Forest, Banyumas, Central Java, Indonesia reports that macaques showed keen interest to provisional foods such as rice, bread and peanuts and beverages such as soda drinks, tea drinks and coffee. However, the same research reports that only 10% has shown interest in drinks. Hence, the hypothesis for this research is that free ranging long-tailed macaque in an urban settlement would have a preference for solid form of food over liquid form.

H1: Free ranging long-tailed macaque in an urban settlement would have a preference for solid form of food over liquid form.

H0: Free ranging long-tailed macaque in an urban settlement would not have a preference for solid form of food.

2.0 LITERATURE REVIEW

2.1.1 Species

Macaca Fascicularis, is commonly known as the long-tailed macaque or crab-eating macaque. The majority of Peninsular Malaysia, Sabah, and Sarawak, as well as all of Southern Asia, are home to *M. fascicularis*, the most widespread and biologically diversified species of nonhuman monkey in the world (Fooden, 1995; Wheatly, 1999). In Peninsular Malaysia, Sabah, and Sarawak, the long-tailed macaque can be found almost anywhere, especially in lowland areas and near the coasts. These days, they are also commonly seen in urban areas (Perhilitan, 2006).

2.1.2 Food preference of *M. fascicularis*

The food and feeding ecology of long-tailed macaques are poorly understood (Yeager 1996). Initial studies on their eating habits over a short period of time revealed that they are omnivorous (Hock and Sasekumar 1979; Kurland 1973). However, research done subsequently reveals that they consistently prefer fruits to other food kinds as their main dietary source. Long-tailed macaques are frugivorous, and on

Borneo in Kalimantan, they consume ripe, meaty fruits for 66.7% of their diets, whereas on Sumatra, they consume fruit for an even larger percentage of their diets (82%) (Yeager 1996; Wich et al. 2002). Some studies categorize them as frugivorous since they seek out alternative food sources when fruit isn't available (Berenstain et al.,1986). Long-tailed macaques concentrate on alternative food items such as insects, stems, young and mature leaves, flowers, seeds, grass, mushrooms, invertebrates, bird eggs, clay, and bark during seasons of the year when fruit is scarce, such as the dry season into the early rainy season (Wheatley, 1980).

2.1.3 Conservation status

Recently, *M. Fascicularis* has been classified under the IUCN red list as endangered. The three species that the IUCN Red List now recognises as being endangered, including the infamous long-tailed macaque (*Macaca nemestrina*), the stump-tailed macaque (*Macaca arctoides*), and (*Macaca fascicularis*). Conservationists are horrified because it reflects the complete failure of the current predicament when even the most versatile and opportunistic generalist primates, like long-tailed macaques, are now listed as endangered (Sinan, 2022). Threats to the species listed as vulnerable and endangered are mostly caused by habitat loss (Choong et al., 2021). The natural habitats of macaques must be preserved immediately, and the public must be made aware of the plight of these animals. The emphasis should be on confrontations between people and animals in order to refute the myth that macaques are abundant and live on an even playing field (Choong et al., 2021)

2.1.4 Long-tailed macaques – human conflict

Long-tailed macaques are reportedly a problem in a number of locations, including farms, tourist accommodations, reserves, roadsides, temples, and cities (Lee & Priston, 2005). In Peninsular Malaysia, *M. fascicularis* has become a significant issue in several areas, especially in those with rapid population growth, such Selangor and Johor (PERHILITAN Annual Report, 2004). Long-tailed macaques have become used to humans and have even developed around urban communities where they dwell on the open rooftops of flats and steal food from nearby trash cans (Perhilitan, 2006). The biggest factor of long-tailed macaque-caused conflicts between humans and wildlife is typically food motive. In contrast, most of these pest behaviours were brought on by human activity, including feeding of animals, improper garbage disposal that allowed animals to rummage through trash, encroachment of human settlement into forested areas, and destruction of natural habitats due to deforestation and agricultural activities (Choong et al., 2021).

2.1.5 Contraception in monkeys

Different types of contraception can stop ovulation, fertilisation, implantation, the success of a pregnancy, or the termination of the foetus (Gray & Cameron 2010). According to Kirkpatrick et al. (2011), choosing contraception with proven potency in captive animals, assuring the safety of these products, establishing methods to administer contraceptive agents to free-ranging wildlife, and demonstrating actual population control results are the main barriers to wildlife contraception. Oral bait

distribution provides the possibility to reach greater numbers of free-ranging animals at a lower cost (Fagerstone et al., 2006).

3.0 MATERIALS AND METHODS

3.1 Experimental design

The first step was to locate the colony of long-tailed macaque to be studied. Camera traps were used in places filled with resources that may attract macaques. Furthermore, active surveillance by driving around UPM to locate macaques were done (Figure 1.1). After successfully locating the colony to be studied, camera traps were placed to observe their natural behaviors and activities which includes feeding time and feeding frequency. Then, an empty space in that location is chose to set-up quadrants. Each quadrant was set-up in the measurement of 1metre x 1metre (Figure 1.2). The number of quadrants to set-up for the study depends on the availability of camera traps. In this study, 3 quadrants were used to study. Following setting up of quadrants, solid food and liquid food were placed in random manner (Figure 1.3). The solid food used in this study are bread with peanut butter jam, apples and pears while the liquid food used in this study are 100 plus isotonic drink and orange juice. Then, camera traps were fixed with video recording mode facing the quadrants to record the macaques and observe their feeding behaviors (Figure 1.4). Then, after a day, camera traps were collected and video footages were analyzed. Lastly, the steps were repeated at another location within UPM.

Figure 1.1: The macaques spotted during tracking of macaque colony

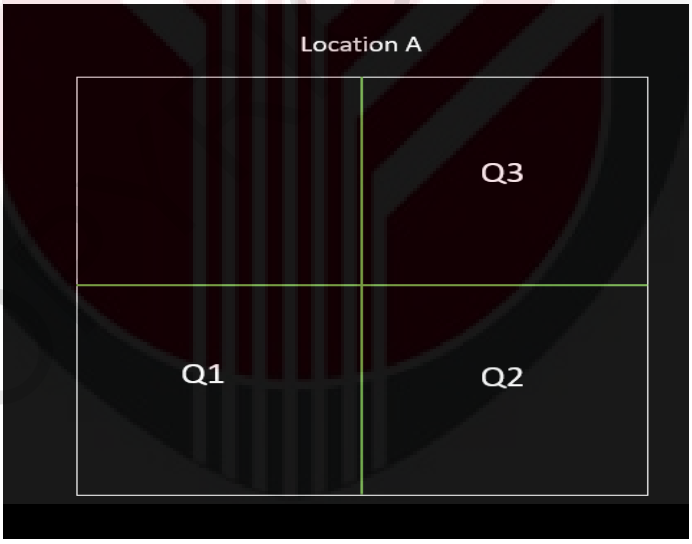

Figure 1. 2: The four quadrant of data collection

Figure 1.3: The solid and liquid food at the quadrant area

Figure 1.4: The camera trap located at the quadrant area

3.2 Study location

This study focusses on free-ranging long-tailed macaque around UPM. So, locating macaques were focused around UPM. Long-tailed macaques were first successfully tracked and located near Institute of Tropical Agriculture (ITAFOS) (Lat. 2.98 º, Long. 101.73 º). Macaques were located near the dumpster of this unit (Figure 2.1). Then, upon completion of study at the first location, macaque colony were tracked and located at Comparative Medicine and Technology unit (COMeT) (Lat. 2.98 º, Long. 101.72 º). Macaques here were located next to the animal research facility (Figure 2.2)

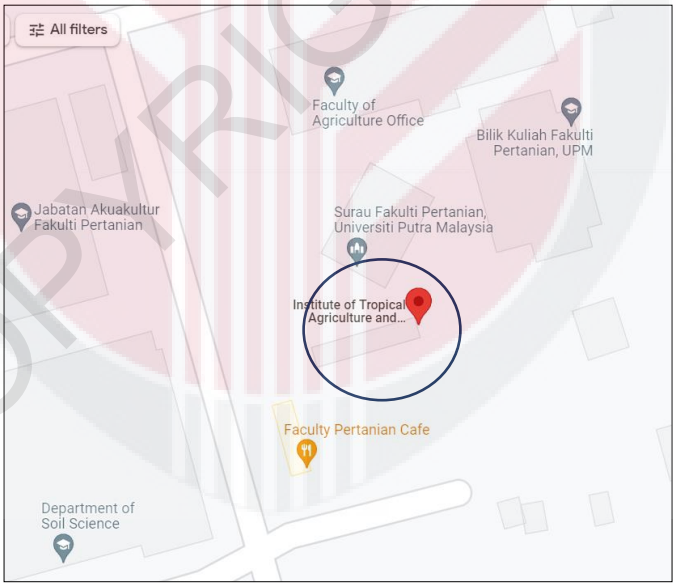

Figure 2.1: The location of ITAFOS, UPM

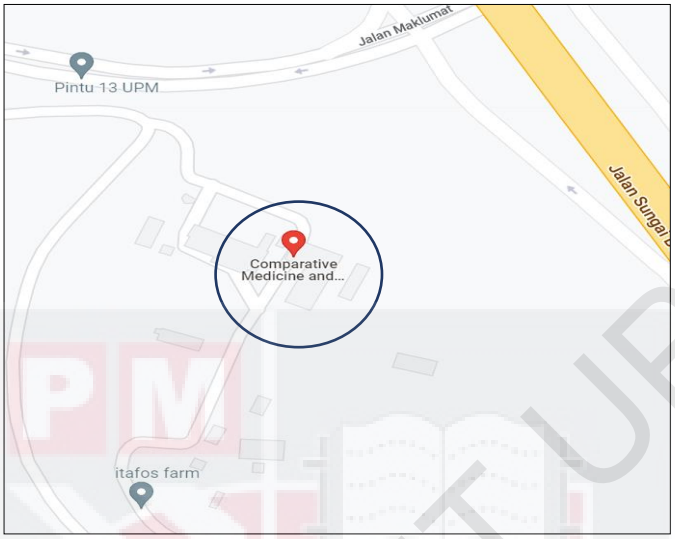

Figure 2.2: The location of COMeT, UPM

4.0 RESULTS

Footages received from the cameras were analyzed and results were recorded. According to the observation made on natural feeding behavior, macaques had two feeding times which are 7am to 10 am and then 4pm to 6pm. The data collected from the study showed that, in ITAFOS in between 7am-10am, 35 macaques chose solid food while 7 chose the drinks offered. Meanwhile, in the same location but at 4pm to 6pm, 45 macaques chose solid food and 12 macaques chose the drinks. On the other hand, at COMeT at 7am to 10am, 40 macaques chose solid food and 8 chose drinks while in between 4pm to 6pm, 46 macaques chose solid food and 11 chose the drinks offered. Chart 1.1 and Chart 1.2 presents the results gathered in both locations. As overall

summary, 81.37% of the macaques chose solid food, 18.18% chose both solid and liquid form of food while only 0.45 % chose drinks alone.

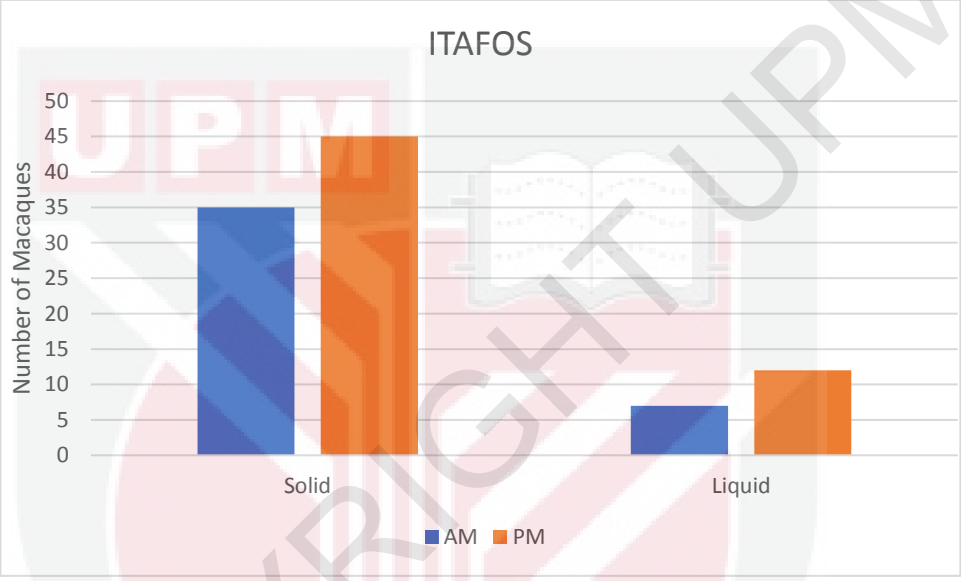

Figure 3.1 : Choice of food by long-tailed macaques in ITAFOS

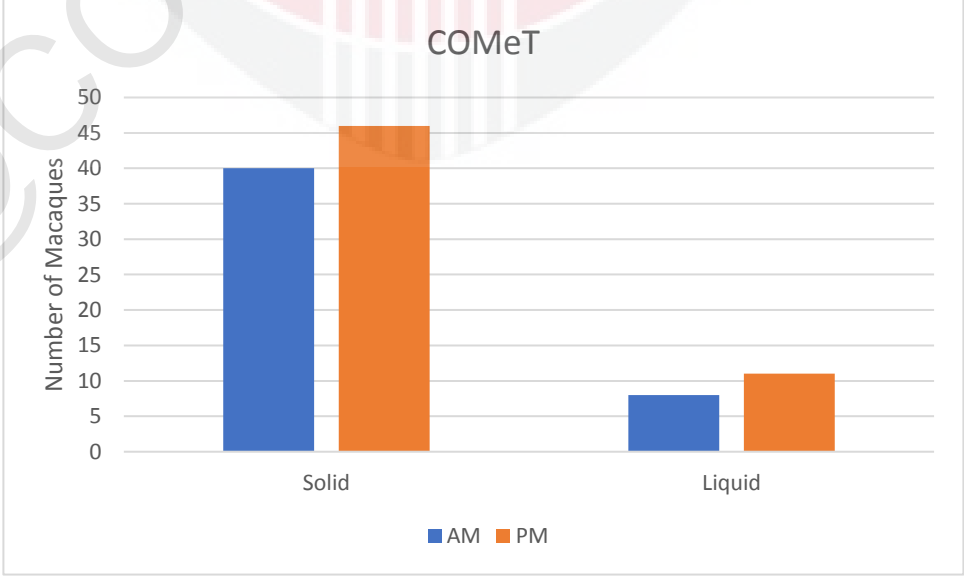

Figure 3.2 : Choice of food by long-tailed macaques in COMeT

Figure 4.1 : Long-tailed macaque choosing bread with peanut butter jam

Figure 4.2 : Long-tailed macaque choosing apple

Figure 4.3: Long-tailed macaque choosing apple and orange juice

5.0 DISCUSSION

5.1 Long-tailed macaques' natural diet

Because fruits make up 57–67% of their diet, long-tailed macaques who dwell in forests with little human contact are more likely to be frugivorous (Ungar 1994; Yeager 1996). In Kalimantan, it has been documented that they eat fruit from 17 (Wheatly 1980) to 24 (Yeager 1996) different species of fruiting plants. Fruits were the most favored food item in the teak forest at Cepu (Java Island), according to Hasanbahri et al., 1996, to obtain food; they split into small groups that may cover a wide area. They frequently travelled between 100 and 600 meters each day, and the availability of food affected their ranging habits (Kamarul et al., 2014).

5.2 Altered feeding behaviour

Due to habitat disruption and frequent human contact, long-tailed macaques vary their dietary habits. They use every source of food that is accessible to them to evolve increasingly omnivorous (Wheatley 1989). Due to the abundance and widespread distribution of food, the research group appears to inhabit locations adjacent to residential areas (Kamarul et al., 2014). Macaques not only grown to be hardy animals to thrive through lack of natural food available, but also grew interest towards human novel food and can readily thrive on human wastes which are widely available near human settlements. The multinomial logit model exposes the choice-based judgments made by these wild grey langurs in West Bengal, India, where they have not only come to understand processed foods provided by humans as an alternative food source but have also demonstrated a significant interest in them (Dasgupta et al., 2021). With this arises an important doubt which is, when abundance of food source is available, which food would be highly likely to be chosen by the macaques? This brings us to the next discussion which would be sensory stimulation.

5.3 Sensory stimulation

Sensory stimulation plays a crucial role when it comes to choosing a food source (Cunningham et al., 2019). Primate brains are said to rely mostly on their highly evolved visual systems (Kaplan et al., 1979). A study by Laska et al., in 2007 concluded that non-human primates evaluate unfamiliar food using olfactory, gustatory, and tactile signals in addition to visual information, but they mostly visually analyze familiar food

before intake. This suggests that, despite macaques using their various sends to evaluate a food, they also tend to choose familiar food prior to inspecting a new food. This could be a factor influencing the choice of food selected by the macaques in this study.

6.0 CONCLUSION

In this preliminary study to identify the preference of free-ranging long-tailed macaques in UPM between solid or liquid form of food, it can be concluded that the macaques had higher preference towards solid food over liquid form of food.

7.0 RECOMMENDATION

This study should be continued with the testing of drug efficacy when incorporated with solid food, macaques' reaction towards "drug+food" offered and finally the effectiveness of the contraceptive through food. While trial challenges are taking place, a buffer zone should be established around UPM to keep human-wildlife conflict under control.

8.0 STUDY LIMITATIONS AND CHALLENGES

Throughout this study, weather has been a challenging element. Sunny weather is beneficial from preparing the quadrant to capturing quality footages. Next, technical

errors when handling camera traps. Ensuring the camera traps are set-up for desired video length and video quality is important. At the same time when fixing a camera trap, making sure it is fixed at the right angle and at the right distant is also crucial as camera traps detect motion. Furthermore, occupational hazard was a challenge as dealing with sharp equipment and wild macaques can get dangerous. Lastly, the presence of alpha male that dictates the availability and choice of food offered to the colony. Response of every macaque from the colony is important to determine the food preference and presence of alpha male can reduce the availability and choices left for other members of the colony to choose.

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