Wijayakusuma National Conference (WiNCo) 2022 e-ISSN: 2809-7785
Cilacap, Indonesia, 19 November 2022
pp.35-39

Is *Macaca fascicularis* Contribute to *Salmonella* Infection in Human?

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Abstrak - Dua individu monyet ekor panjang (LTM) ditemukan secara ilegal untuk kasus penangkaran, salah satu monyet yang terancam punah, dengan kondisi kandang penuh tunggal. Pengamatan pertama menemukan bahwa keduanya sepenuhnya ditampung dengan ruang terbatas, pengayaan lingkungan yang tidak memadai, dan kondisi yang buruk, serta perilaku yang lebih agresif. Kasus ini ditemukan di area pendidikan. Masyarakat dapat dengan mudah mengakses kandang mereka, dan membeberkannya secara gratis, serta terkadang menunjukkan tingkah laku agresif. Tim kami telah melakukan audiensi dengan pemilik kedua individu, tetapi masih perlu perhatian untuk pengayaan lingkungan, kesejahteraan, tingkah laku, pilihan makanan, serta alasan hewan peliharaan. Kami membutuhkan lebih banyak saran karena perhatiannya pada tingkat kondisi berkelanjutan mereka setelah melaporkan dua orang yang terinfeksi beberapa penyakit, yang merupakan satu penyakit *Salmonella*. Ada kemungkinan penularan penyakit antara dua LTM dan manusia, serta potensi infeksi penyakit. Studi lebih lanjut diperlukan karena untuk memastikan skema transmisi terjadi.

Kata kunci: monyet ekor panjang, lompatan spesies, pengayaan lingkungan, penyakit *Salmonella*, transmisi penyakit.

Abstract - Two individuals of the long-tailed macaque (LTM) were found illegally for captivity cases, one of the endangered monkeys, with single-full-cage conditions. The first observation found that both are fully housed with limited space, insufficient environmental enrichment, and poor conditions, as well as more aggressive behaviour. This case was found in the education area. The public can easily access their cage, and free provisioned them, as well as sometimes exhibit aggressive behaviour. Our team has been in an audience with the owner of both individuals, but it still needs attention for environmental enrichment, welfare, behaviour, food choices, as well as the reason for the pet. We need more suggestions due to its attention to their sustainable condition rate after reporting two people who were infected with some disease, which is one *Salmonella* disease. There is a possibility for disease transmission between two LTMs and humans, as well as the potential for disease infection. Further study is needed due to make sure the transmission scheme occurred.

Keywords: disease transmission, environmental enrichment, long-tailed macaque, salmonella disease, species jumping.

1. INTRODUCTION

Primates used as a pet, as well as private possession, might influence disease transmission to humans [1]. Besides, pet primate was reported to have infected humans with the deadly B-virus that caused meningoencephalitis [2] and human herpesvirus 1 [3]. In addition, pet primates also contributed to the bacillary dysentery outbreak in humans [4]. Most primate species acquired private possession, such as *Macaca fascicularis* or long-tailed macaque (LTM) [1], [5].

LTM is commonly used as an animal model because of its biological characteristics similar to humans [6], [7]. Besides, LTM is also used as a traditional monkey entertainment exhibition called *Topeng Monyet* or dancing monkey [8]. LTM was generally habitat lives [9], [10], as well as would be living in the captive or zoo, in semi-wild conditions, and in wild such as forest [11]. One way to pet acquisition is to adopt from the wild for any reason to catch them.

We found the pet's monkey private possession for *Macaca fascicularis* (LTM) in some unusual place. The first investigation would determine the physical condition, environmental enrichment check, food-water resources, and behaviour. It is unavailable for veterinary medical monitoring for its health condition. We also collected the interview with the nearest people and got information about potential contact with the subjects.

2. METHOD

This study reported the case report of fully-housed two individuals of endangered macaque species, long-tailed macaque (LTM) (*Macaca fascicularis*), potentially the origin of communicable diseases exposure which needs attention to human spread, based on our investigation. We referred to [12] with several modifications for this study after reporting some communicable diseases that infected humans (research flowchart can be seen in Figure 1).

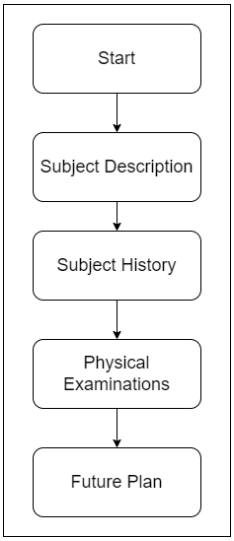

Figure 1. Research flowchart.

2.1 Subject Description

First, we adopted the information about the two monkeys as pets with fully-housed and limited space conditions. This information is based on an anonymous reporter taking morning running activities and passing those subjects. The reporter also feels sympathy for their caged condition, behaviour, and daily resources (water and food). The reporter also told us their subjects were always provisioned with other people who visited or passed them. Based on this report, we decided to field an immediate investigation to ensure the report's credibility.

After the first investigation, we started a literature study based on nearest people interviews, people who visited routine to provisioning food, and photo documentation. The subjects were *Macaca fascicularis* (long-tailed macaque, LTM), also named SY (♂) and SM (♀), all habituated. All subjects were fully-housed, restricted, and had poor environmental enrichment, as well as limited food-drink resources. The location of this case is in the institutional education environment called X Institution. The second interview was conducted to collect the subject's history.

2.2 Subject History

Based on the interview, the origin of those subjects was estimated in 2012, with first age class about three infants orphaned from the rescue (one subject was unknown if died or relocated). Also, at least once for medical examination by a veterinarian in their life. The cage condition is single, fully, and limited housed without any environmental enrichment, as well as never joined both. People who run in the morning or institution staff (students or staff) are very accessible to them. We also collected important information about disease spread from the subjects. The staff institution owned the subjects and sometimes fed and cleaned their cages.

2.3 Physical Examinations

We investigated their physical examinations, such as body condition, behaviour, as well as stereotype test. We have not collected any biological samples, as well as potentially hazardous and limited time for an ethical agreement permit. SY was a juvenile, and SM was a pre-adult. SY was stuck with the wrong neck collar size, as well as probably their infant accessories, and it might be challenging to swallow, drink, or any other eating mechanisms. Based on that condition, SY is also spindly. SM is located in front of SY's cage. The cage size is more extensive than SY but still unsuited. SM has never breastfed as well as a parental care history. SM was accessible to people who visited or were provisioned with food. The first environmental assessment was un-hygiene, high volume of waste, as well as sometimes waste incineration, overall is polluted. Both subjects exhibited at least stereotyped behaviours, such as locomotion, appetitive behaviour, and self-harm. Sometimes, aggressive behaviour, such as grimacing, bluffing, and clawing, was exhibited. SY once exhibited the masturbation process.

2.4 Future Plan

The future plan includes meeting with the owner, planning to maintain the cages, and providing daily resources. We also remark on any feedback to support the subjects' welfare, environmental enrichment, as well as monitoring. Besides, building some community or volunteering is essential for supporting all future plans and considering the subjects' sustainability.

3. RESULT AND DISCUSSION

Our investigations found that at least two diseases probable that infected humans also occurred after contact with subjects. First, a man (a student in the institution, aged about twenty years) shows some clinical signs such as fever, myalgia, and nausea. Then, he must be hospitalised after diagnosing with typhoid fever. Second, a girl kid (visitor, aged about 10-15 years) shows some clinical signs of fever and diarrhoea but is not hospitalised (unknown condition after the case reported).

The monkey would not spread or origin of typhoid fever (*Salmonella typhi*) as well as typhoidal serovars, which only occurred in humans [13]. However, the non-human primate was reported as an animal model for typhoid fever infection [14], [15], as well as the *Salmonella* enteritis infection model [16]. The cases are probably caused by species jumping or transmitted from food or water that monkeys consume. The transmission probability for typhoid fever such as water, food, or other resources consumed by humans, as well as blood transmission [17]; it might happen to people who come into contact with subjects and not prevent such as washing hands.

The non-human primate also reported transmitting diarrhoea to humans, as well as its pets [4]. Besides, other studies reported caused gastrointestinal parasitic while consumed as bushmeat [18]. In rare extreme cases, it is also caused by non-zoonitic *Salmonella* osteomyelitis in the rhesus monkey, one of the macaque species (*Macaca mulatta*) [19]. In addition, in the wild condition, non-human primates are associated with typhoid monkeys (apes) [20], monkey fever [21], malaria [22], [23], monkeypox [24]–[26], and yellow fever [27]. Besides, most zoonotic diseases spread to humans by the monkey, such as Herpesvirus B, are associated with LTM species [28].

Figure 2. SY (left) and SM (right) documentation.

Non-human primates, as well as LTM species like this case report, are not suitable for pets or private possession. The disease transmission would be influenced by the pet primate's age, species, health and nutritional state, and behaviour [1]. According to [28], a person who has been bitten, scratched, or exposed to monkey bodily fluids should adequately wash the bite, scratch, or flush vulnerable membranes, such as the eye. To avoid B virus infection, contact a health care professional or public health authority as soon as feasible for treatment and potential usage of antiviral medicine.

4. CONCLUSION

Our investigation in this paper report that the potential of disease transmission occurred in humans as well as in cases after contact with the pet's primate. This study only explains recent arguments about human-primate disease transmission and other factors that might influence disease transmission. Further study is needed to ensure the pet's primate contributes to human disease, in this case, *Salmonella* disease, by collecting biological samples from the pet and human contact. Any reason for pet acquisitions and private possession due to decreased primate sustainability in their wild habitat is prohibited instead to support the SDGs as well as one health concept.

ACKNOWLEDGEMENT

The author would thank all volunteers of AIPOM (Mr. AM, Ms. DP, UKML), Animal Friends Jogja (AFJ), and all people who support the fight against primates, not pets. This study does not require ethical clearance, and all hospitalised are anonymous, but further study is needed for ethical clearance and study agreement.

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