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IMPROVEMENT OF LEMURS CAPTIVITY CONDITIONS IN AN NGO IN MADAGASCAR

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Abstract

The paper presents a study on the behaviour of lemurs in captivity and in preparation for release back into the wild. The study was conducted within the RENIALA NGO in Madagascar, and assessments were made of stereotypical behavioural deviations in correlation with shelter and feeding conditions. Health assessments and copro-parasitological analyses were performed to identify the degree of parasite contamination, the types of parasites in correlation with behavioural characteristics and the type of food administered. The lemurs' diet was analysed, as well as the impact of quality and quantity on their behaviour. Some foods were identified that should be avoided and others that should be administered in limited quantities, compared to beneficial foods. It was recommended that the diet of underweight specimens be supplemented with certain nutritional supplements to rebalance the overall status of the organism. The parasitological evaluation allowed conclusions to be drawn regarding the effectiveness of the preventive measures applied, resulting in recommendations for improvement.

Key words*: lemurs' behaviour, captivity conditions, prophylaxis, lemurs' parasitology.*

INTRODUCTION

Lemurs are endemic primates of Madagascar, currently classified as "endangered". The worrying decline in their population is caused by humans, who destroy their natural habitat and hunt them for food and pets. In Madagascar, many local associations are working to protect them. The study was conducted in the NGO Reniala, in Madagascar, which is dedicated to rescuing endangered lemurs with the ultimate aim of releasing them back into the wild. They work with *Lemur catta*, a species of Lemur recognized as "endangered" by the IUCN *(International Union for Conservation of Nature, 2018*) (Figure 1).

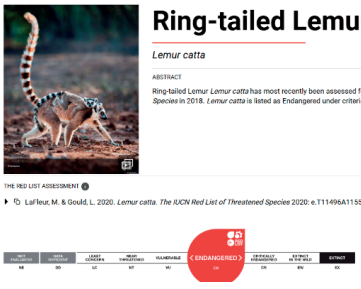

Figure 1. *Lemur catta*, endangered species (IUCN, 2018)

Ring-tailed lemurs are recognizable by their grey fur, white belly, long pointed snout, black and white ringed tail, and black-rimmed eyes. Unlike other lemur species, there is no difference in coat colour between the two sexes. They are arboreal, meaning they live in trees. As such, they are highly agile, able to leap from branch to branch over distances of up to 10 meters. Behaviourally, they are very social animals that live in hierarchical groups of 5 to 25 individuals. These groups are usually made up of the family, extended to include a few other individuals. The social organization is multi-female/multi-male. The female is always dominant. Members of a group groom each other, search for food together, and sleep in the same tree at night. Males have brachial glands on their forelegs. He rubs his forearms with his tail and then shakes his tail to disperse the pheromones. They communicate with each other via a characteristic gathering call and via odours left by their urogenital and brachial glands.

Individuals less than one year old are considered infants and must remain in the group for normal social development. After this period, they are either expelled from the group or remain and become an integral part of it (Rafalinirina,

2015). This information highlights the complexity for NGOs in creating new groups of individuals who do not know each other beforehand. In terms of diet, they are mainly frugivorous and phyllophagous, meaning that they feed mainly on fruit -particularly tamarind - and leaves (Mowry, 2014). Occasionally, they may also eat flowers, mushrooms, small insects, or eggs if they find them in the wild. In the wild, their diet is low in fat, protein, and carbohydrates, but high in fibres. The fruits they eat are often unripe and therefore low in sugar. A diet that is too low in fibres and too high in carbohydrates can lead to loosen stools or diarrhoea.

The objective of the study was to answer the question: how could the conditions of the lemurs in captivity at Reniala be improved? During the study, the focus was on three main areas: behaviour, diet and prophylaxis. The work was carried out in three stages. The first stage involved researching the specific characteristics of this species. The second stage was field analysis, through Observation (the entire organization surrounding the lemurs, their natural behaviour, as well as any stereotypical behaviours, the layout of the enclosures, the distribution of meals, the enrichment of the environment, and the care provided to sick animals). The final step was to propose an improvement project to the NGO, based on the observations and knowledge and tailored to the resources available on site.

MATERIALS AND METHODS

The study was conducted within the RENIALA NGO in Madagascar. The NGO Reniala currently have more than 70 lemurs on site: 50 animals were in cages and around 20 had already been released into the forest.

Our study was focused on the animals still in captivity. The cages are located in the Mangily forest, a few minutes' walk from the houses.

There are 15 cages of different sizes:

- 8 small cages measuring approximately 8 m³, each housing one to three individuals, allowing them to interact with each other;
- 2 small aviaries of 16 m³ with about 5-6 individuals each;
- 1 medium aviary measuring 480 m³ housing 3 individuals;
- 1 large aviary measuring 1,200 m³ with approximately 15 individuals;
- 3 quarantine boxes adjacent to the treatment room;
- Some facilities are dedicated to animal care: a food preparation room and a treatment room, which also serves as a pharmacy and analysis laboratory. Food comes from a vegetable garden used exclusively for feeding the lemurs.

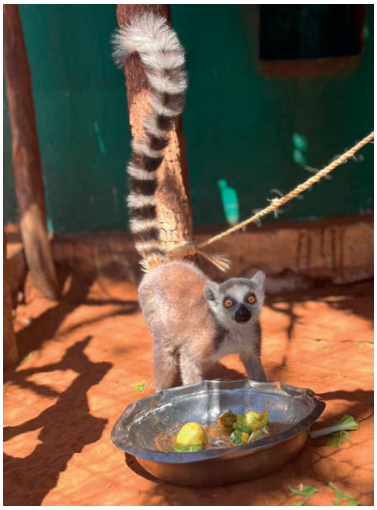

Figure 2- Lemur in cage - NGO Reniala- Madagascar

Their project aims to rescue lemurs kept in captivity by the local population, care for the animals, set up groups with an appropriate hierarchy, and eventually release them back into the wild.

The problem is dealing with the consequences of captivity, as these lemurs have lost vital behaviours such as foraging and fleeing from predators due to unsuitable conditions.

Before they can be released, these animals are kept in captivity for several months to form groups with a stable hierarchy, enabling them to survive in the wild.

When a new animal arrives on site, it goes through several stages. First, it is quarantined for a minimum period of 15 days. During this period, it is examined by a veterinarian to determine its state of health and is given a worming treatment. Once this stage is complete, the animal is transferred to the reception unit. The aim of this phase is to recreate groups of lemurs with a suitable hierarchy, as close as

possible to what is found in the wild. To do this, the animals are placed in adjacent cages so that they can get used to having visual and olfactory contact with each other. Then they are brought into physical contact: they are placed in the same cage. For this to work, the groups must follow certain principles:

- the group can range from 5 to 25 individuals;
- there must always be more males than females in a group, as females are dominant. Generally, if males are placed together, they will get along well. If several females who do not know each other are placed together, this can lead to conflict and the failure of the group to form;
- lemurs less than one year old must remain with their mothers.

Once the group has been formed and the hierarchy established, the release process begins gradually. Before this phase, a dietary transition is carried out, giving the lemurs as much food as possible that they would find in the wild: wild fruits, leaves, and flowers. The release takes place in three phases:

1. Short phase with food. The animals are released for two hours, during which time they are fed. At the end of the two hours, they are returned to captivity.
2. Long phase with gradual reduction of food. The animals are released for a whole day. During this day, their access to food is gradually withdrawn to encourage them to feed themselves. This stimulates their foraging behaviour. At the end of the day, they are returned to captivity.
3. Final phase without food. The animals are released into the forest for the rest of their lives. They are no longer fed. However, their behaviour is monitored by specialists on site, who remain ready to act in case of any problems.

Methods used for behavioural analysis of the animals. In order to assess the well-being of the lemurs, it was observed their behaviour and, more specifically, the presence of stereotypical behaviours (a stereotype is a rhythmic movement, always repeated in the same sequence, and without any apparent purpose). This type of movement is a consequence of captivity and can indicate that the animal is unwell. Several stereotypical behaviours have been identified in lemurs. The main one is "pacing", which consists of walking back and forth along one of the walls of the cage. It is linked to a lack of stimulation and boredom in the animal. Another behaviour is specific to males: they rub their forearms with their tails. In the wild, this behaviour allows them to deposit pheromones on their tails, which they then shake to disperse them into the environment. In captivity, it can be observed for long periods without the tail being shaken: it then serves no purpose and is also considered stereotypical behaviour. For 10 days, the lemurs were observed every morning to see if they exhibited any stereotypical behaviour before and after meal times (*ZooAquarium Guideline, 2014*).

Methods used to study the lemurs' diet. To verify that the lemurs' diet was appropriate for their needs, the keepers were observed and assisted in preparing and distributing meals (what foods were given, the quantity, and the distribution methods). According to the lemur care and management manual, adult *Lemur catta* should be fed between 500 and 600 grams of food per day (Katz and Durham, 2020). It should be noted that the nutritional needs of individuals vary depending on many factors, particularly age and gestation status. The lemurs are weighed every month. The weight limits for an adult animal are between 2 and 2.5 kilograms.

Parasitological screening: because lemurs are highly susceptible to parasitic infections, they are dewormed when they arrive at the NGO during their quarantine period. Deworming is also repeated once 2 time a year for the entire population. In our study, in order to verify the effectiveness of their deworming program, was performed coproparasitological sedimentation and flotation tests on part of the herd. The samples must be taken from fresh faeces (ideally less than an hour after emission). The samples were collected every morning, immediately after emission, identifying the individual to whom they belonged. Three samples were collected each day. The methods used were found in the book Atlas de coproscopy (Beugnet et al., 2004). It was used the Flotation Technique (this is a concentration method that allows the eggs to be concentrated at the surface of the tube. Its purpose is to observe the light eggs) and the Sedimentation technique (this method

complements the first- it is also a concentration method that allows heavy eggs to be observed).

RESULTS AND DISCUSSIONS

The results obtained in the lemurs' behaviour study led to the observation of stereotyped behaviour, before and after meal distribution. As explained above, pacing and rubbing the tail against the forearms without shaking it are the main stereotypical behaviours observed in lemurs in captivity. The lemurs were observed each morning for 10 days, 30 minutes before meals and 30 minutes after, whether or not the individuals exhibited any of these behaviours. Below is a summary of the results obtained.

Table 1. Number of days on which stereotypical behaviours were observed in at least one individual in each enclosure

Enclosure number	Number of days or "pacing" was observed in at least one of the animals		Number of days on which "tail rubbing with forearms" was observed in at least one of the animals	
	Before feeding	**After meal**	**Before feeding**	**After meal**
1	**1**	0	**7**	**9**
2	**2**	0	0	0
3	0	0	0	0
4	**2**	0	0	0
5	**1**	0	0	0
6	**5**	**2**	0	0
7	**4**	**3**	0	0
8	**2**	0	0	0
9	**3**	0	0	0
10	**8**	**1**	0	0
11	**4**	**2**	0	0
12	**7**	**2**	**4**	**4**

Several points are worth noting from this table. Pacing behaviour appears to be linked to meal distribution. Regardless of the cage, it is always observed more frequently just before mealtime and remains much rarer once the meal has been distributed. Conversely, tail rubbing behaviour by males was only observed in two animals and does not appear to be more frequent before or after meals. It is interesting to compare these results with cage size (Figure 3).

Looking at this diagram, we can see that pacing behaviour is very common in the 8 m³ enclosures, while it is rare or even absent in the larger ones. This could be a sign of an unsuitable environment and frustration for the animals. The lemur care and management manual recommends a minimum enclosure size of 15 m³ per lemur (aszk.org-au, 2009). Other references recommend a minimum of 30 m³ per enclosure. This space is justified by the fact that in the wild, these animals live in large territories ranging from 6 to 30 hectares (Thernström, 2010).

In our case, we can therefore assume that these cages are too small for the animals. It should also be taken into account that there may be two lemurs in some of these cages, which further reduces the space per animal. Another interesting point is that animals that are alone in cages only interact with the lemur in the adjacent cage. However, lemurs are animals that live in groups and need interaction, including physical interaction, with each other. In these cages, they may lack contact, which can also lead to stereotypical behaviour.

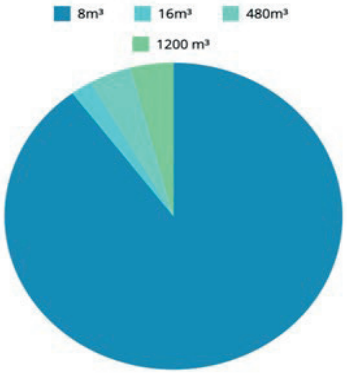

Figure 3. Frequency of pacing behaviour according to cage size

Several improvements are possible to reduce the frequency of stereotypical behaviours.

- The first parameter that can be adjusted is mealtime. When food is distributed at fixed times, some animals end up anticipating the arrival of food, which leads to stereotypical behaviour. At Reniala, each meal is served at the same time every day: one meal in the morning at 9 a.m. and one in the afternoon at 3 p.m. Changing meal times on a daily basis could therefore be a good strategy for preventing these behaviours, which, as we have observed, are very common before food is distributed. Furthermore, in the wild,

animals only eat when they find food. Changing meal times regularly would therefore also help prepare them for release.

- A second parameter that can be adjusted is the frequency of meals. In fact, it has been shown in some species that stereotypical behaviours are motivated by hunger. For lemurs, 2 to 4 meals per day are recommended. For example, the daily ration could be divided into 3 meals. This would reduce the time without food and therefore limit feelings of hunger between meals.
- A third well-known method for combating stereotypical behaviour is environmental enrichment. This increases the complexity of the captive environment and improves the animals' well-being. At the NGO, environmental enrichment was already carried out once a day. However, we suggested implementing new enrichment ideas:
  - the creation of a large net using ropes for the large enclosures (Figure 4). The objectives were to encourage climbing and hanging behaviours that are normally found in nature with trees;

Figure 4. Making a net for environmental enrichment

  - providing whole, uncut fruits and vegetables. At each meal, food was cut into small pieces to make it easier to eat. The aim here was to teach them to cope with whole foods, as they would find them in the wild;
  - hide food in baobab fruit. The purpose of this enrichment is to encourage food seeking behaviour and enrich the environment with new elements;
  - put branches and leaves in a bucket and hide food at the bottom. As with baobab fruit, the aim here is to encourage foraging behaviour, particularly "digging" and "lifting" objects;
  - make ice cubes with fruit inside. This idea was only suitable for periods of high heat and has already been implemented in several zoos in France. The aim is to hydrate the animals during the hot season and stimulate them at the same time.
- The fourth possible improvement would be the most suitable, but also the most difficult to implement. The 8 m³ enclosures are too small, even for a single lemur. Ideally, these enclosures should be enlarged so that each animal has at least 16 m³.

The Results on the analysis of the feeding plan, with regard to the animals' diet, were obtained studying the quality and quantity of the food distributed.

Quality: the diet adopted at Reniala consists mainly of seasonal vegetables and fruit. They have their own orchard and grow their own fruit and vegetables. The study was made in August, it was the dry season, and the fruits and vegetables available were tomatoes, eggplants, Chinese cabbage, bananas, and squash. They therefore juggled these foods, mixing two per meal. This type of diet, adopted in many zoos, is very suitable for the animals. However, caution should be exercised when using cabbage. This is because it contains glucosinolates. Glucosinolates are sulphur-containing heterosides that can be difficult to digest in large quantities and can also interfere with thyroid function by inhibiting iodine absorption. It was noticed on several occasions that some animals had loose stools, particularly when Chinese cabbage had been fed the day before. One possible cause of this intermittent diarrhoea could therefore be the use of too much cabbage in the diet. Another point to note is the use of industrial biscuits for enrichment. These biscuits are not suitable for animals. They are very different from what animals would find in the wild and do not really provide any benefits. It is therefore preferable to opt for other methods of enrichment, such as those mentioned above.

Table 2. Feed plan of Lemurs in Reniala, example 1

	Feed distributed (kg)	Caloric density (kcal)
Morning	8 kg tomatoes	1520 kcal
	8 kg eggplants	1680 kcal
Afternoon	8 kg tomatoes	1520 kcal
	8 kg squash	2730 kcal
Total	32 kg	7450 kcal
Value per animal	744 g	173.3 kcal

Quantity: the animals receive 16 kilograms of feed in the morning and 16 kilograms in the evening. The feed given varies each day, which means that the energy value of the ration changes. But here are two examples of a typical day.

Table 3 Feed plan of Lemurs in Reniala, example 2

	Feed distributed (kg)	Caloric density (kcal)
Morning	8 kg bananas	7120 kcal
	8 kg eggplants	1680 kcal
Afternoon	8 kg tomatoes	1520 kcal
	8 kg Chinese cabbage	960 kcal
Total	32 kg	11280 kcal
Value per animal	744 g	262,3 kcal

According to a guide on lemurs, a minimum of 100 kcal/kg of body weight is recommended, bearing in mind that an adult lemur weighs between 2 and 2.5 kg (Katz and Durham, 2020). This means that a minimum of 200 kcal per animal is required. Strictly speaking, this value is met in Table 3, but not in Table 2. The calorie density may therefore appear to be lower than current recommendations. However, it should be noted that a number of young lemurs under one year of age were included in the population. Before the age of one, the caloric requirements of a young lemur are lower than those of an adult, although they are proportionally higher per kilogram of body weight. It has also been found that it is best not to overload the ration, as lemurs are particularly prone to obesity. The animals are weighed every month to ensure that none are overweight or underweight. Therefore, the amount distributed to animals can be considered correct as long as their weight remains within normal limits.

During the study, two females had a slightly low body score. According to the information received, they were pregnant and have been struggling to regain weight since giving birth. This is because metabolic requirements are higher during the postpartum period, particularly during lactation. If the mother does not receive enough calories, she draws on her body reserves, which can lead to weight loss and deficiencies. It is therefore also essential to closely monitor the weight of these females, for example by weighing them weekly. In an attempt to restore their lost weight, they were given a piece of Kiri cheese per day as a supplement. Kiri cheese is a soft cheese made from whole milk, cream, milk powder, salt, and milk proteins. This food is not suitable for lemurs, which are mainly frugivorous and phyllophagous. The digestive tract of an adult lemur cannot digest lactose. The food will therefore not be well absorbed and may even cause digestive problems. Similarly, the first year of life is crucial for young lemurs and requires a suitable diet. This is a period of intense growth, during which the skeleton, muscles, and organs develop rapidly. This development requires a diet richer in protein, vitamins, trace elements, calcium, and phosphorus. A diet that is too poor could lead to growth retardation.

It is therefore preferable to systematically supplement lactating females and lemurs under one year of age with foods that are more suited to their digestive system. For example, half a boiled egg four times a week or 10 grams of seeds per day. Eggs are rich in high-quality protein, which is necessary for milk production. The lipids they contain provide additional calories and enable the nervous system of young animals to develop. Certain seeds, such as peanuts, can also be beneficial. They are high in energy (567 calories per 100 grams) due to their high content of lipids and high-quality protein. Like eggs, they contain certain vitamins (B, E) and phosphorus. They also contain magnesium, which reduces stress and aids muscle development, as well as a small amount of calcium.

Parasitological screening- In order to improve prophylaxis, the study included a parasitological screening of the captive group, it was produced a method sheet for carrying out a remote clinical examination, and carried out an inventory of the NGO's pharmacy with a view to proposing improvements.

Despite the prophylaxis in place, **parasitelogical screening** has revealed that many individuals are infected with gastrointestinal parasites. The results are listed in the Table 4.

Table 4. Results of flotation and sedimentation tests

Animal name	Floating	Sedimentation
Cage 1		
Rania	*Subulura baeri*	*Ascaris*
Cage 2		
Alix	Negative	Negative
Late	*Subulura baeri*	*Eimeria* spp. *Subulura baeri* *Capillaria* spp.
Cage 3		
Samy	Negative	Negative
Cage 4		
Amandine	Negative	*Strongyloides* (larvae)
Cage 5		
Lemar	Negative	*Subulura baeri*
Sandra	Ascarid	*Strongyloides* (larvae)
Cage 6		
Cuicui	Roundworm	Roundworm
Cage 7		
Alice	Negative	*Subulura baeri*
Cage 8		
Nicolas	Negative	Ascarid
Cage 9		
Maeva	Negative	Negative
Cage 10		
Félido and Vigo	Negative	Negative
Cage 11		
Josepha	Negative	*Subulura baeri* *Ascaris*
Billy	Negative	Negative
Released lemurs		
Twenty	Negative	Negative
Dylan	Negative	Negative
Winter	Negative	*Subulura baeri* *Strongyloides* (larvae)
Y	*Ascaris*	*Strongyloides* (larvae)
Baby Pinky	Negative	*Strongyloides* (larvae)
Titon	*Ascaris*	*Strongyloides* (larvae) *Ascaris*
Quarantine		
Middle cage	*Subulura baeri*	*Strongyle* *Ascaris*

Out of a total of 21 animals tested, 14 animals tested positive. Several parasites were identified: *Subulura baeri*, *Eimeria* spp., *Capillaria* spp., and parasites belonging to the genera *Ascaris*, *Strongyloides*, and *Strongylus*. Below are some photos of the eggs and larvae observed.

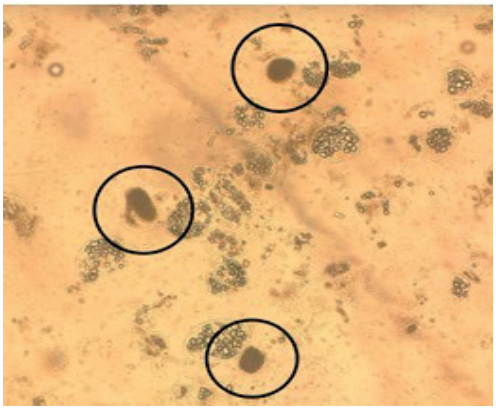

Figure 5. *Suburula baeri* eggs

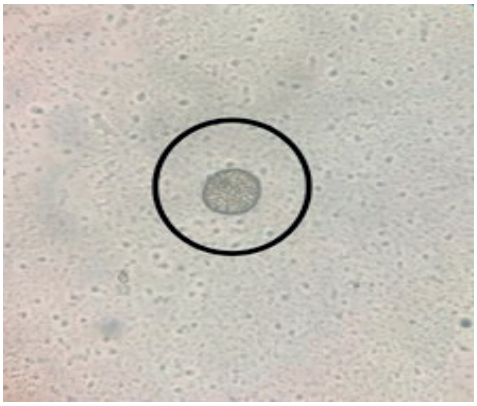

Figure 6. *Ascaris* eggs

Figure 7. Strongyloid larvae

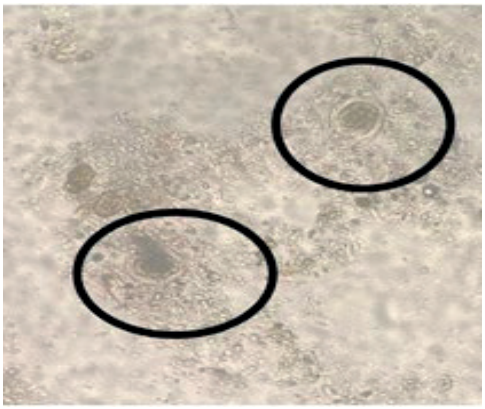

Figure 8. Strongyloid eggs

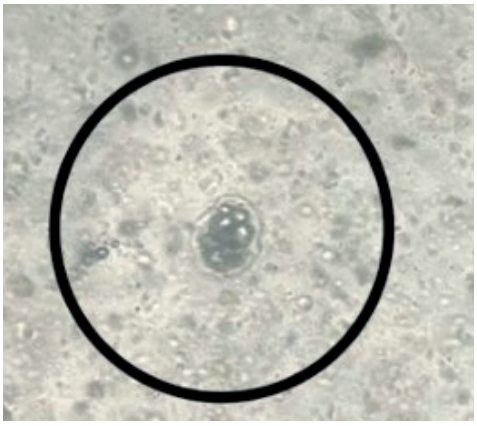

Figure 9. Egg (oocyst) of *Eimeria* spp.

Figure 10. *Capillaria* spp. egg

Interpretations. It can be assumed that if one lemur is infested, the other individuals in the same group are also infested. This assumption is based on the fact that they share the same environment, which is contaminated with parasitic eggs that are often extremely resistant, and on the presence of certain behaviours that facilitate transmission, such as coprophagia or grooming. As it was mentioned, the animals were last dewormed about five months ago with fenbendazole, a benzimidazole that mainly treats digestive and respiratory nematodes. It is therefore normally effective against *Suburula baeri, Capillaria* spp., roundworms, strongyloids, and strongyles. However, it is ineffective against *Eimeria* spp., a single celled parasite that is usually treated with sulphonamides or diclazuril. This explains the infestation of one individual with this parasite, which would therefore require specific treatment. For all individuals infested with nematodes, it is worth considering whether prophylaxis has been effective. It is worth looking at the prepatent period, i.e. the time between infestation and the appearance of eggs and larvae in the faeces. The prepatent period is considered to last between 15 days and 6 months, depending on the species of parasite and the intrinsic factors of the host (Rakotoarivelo, 2009). It is therefore entirely possible that fenbendazole worked at the time of administration, and that the animals became reinfested a few weeks later. In addition, some small young animals were able to pass through holes in the fencing, allowing them to leave and re-enter at will. It is possible that these animals contributed to the contamination of the herd by becoming infested in the outside environment and bringing parasite eggs back into the pens (Irwin & Raharison, 2009). The effectiveness of fenbendazole treatment is also questionable. Upon arrival at the NGO, the animals are quarantined and treated with Panacur. Given their recent treatment and their presence in disinfected cages, the test on the animals in quarantine should have been negative, but it revealed a massive infestation by several parasites: *Subulura baeri*, strongyles, and ascarids. This result proves that Panacur did not completely eliminate the parasites. There are several reasons for this. Firstly, in the event of a massive infestation, it is recommended to carry out treatment for 3 to 5 consecutive days to ensure that all worms are eliminated. A single treatment will eliminate some of the worms, but if the parasite load is too high, some will remain. In addition, numerous studies have identified the

development of resistance to fenbendazole in certain parasites, such as roundworms and strongyles. No such studies have been conducted in lemurs, but it can be assumed that resistance also exists in this species.

Possible improvements. The main objective is to achieve a parasite-free herd. Given the infestation of a large part of the herd and the high probability of false negative tests, it would be ideal to treat all individuals. Various molecules can be used for this purpose. Ideally, fenbendazole should be avoided.

It is important to change the molecule regularly to prevent the development of resistance. Ivermectin, a molecule available to the NGO, could be ideal. It generally treats nematodes with a single subcutaneous injection. The only individual infected with Eimeria should also be treated with a suitable molecule such as diclazuril, administered in a single oral dose. Ideally, coproparasitological tests should be carried out again one week later to check the effectiveness of the treatment. After this complete and appropriate treatment, a new prophylaxis program should be put in place.

One of the main problems is **soil infestation with eggs**. As parasitic eggs are very resistant in the environment, the ideal solution would be to remove the sand and replace it with clean sand. If this is not possible, it is important to pay particular attention to cleaning the enclosures every day.

Another problem is the young lemurs going back and forth between the cage and the outside. The solution in this case would be to reduce the size of the holes in the cages, but this would require considerable work. For all these reasons, it is difficult to prevent recontamination.

The most appropriate measure in this situation would therefore be to **increase the frequency of deworming**. Instead of administering prophylaxis every six months, deworming can be given to animals every three to four months, while regularly varying the molecule used. This helps prevent massive infestations and thus limits their impact on animal health. It is also possible to carry out a coproparasitological test once or twice a year to check the parasite status of the herd and verify the effectiveness of the measures. For animals in quarantine, it is essential to carry out tests after administering the worming treatment to ensure that no infested animals are introduced.

Creation of a form to improve remote examination. Reniala's ultimate goal is to reintroduce lemurs into the wild. It is therefore very important to minimize their contact with humans. However, it is also necessary to ensure that they are in good health, as sick animals released into the wild have little chance of survival. To this end, it is useful to carry out a remote examination. This examination is based on careful observation of the animals. It is difficult to determine whether an animal has a problem by simple observation alone.

The effectiveness of this examination will therefore depend on the methodology used. the examiner's experience and in-depth knowledge of the animals being observed. Preferably, this examination should be carried out every day in the same way, keeping a written summary of the observations made in order to monitor progress. To facilitate observation of the animals by the keepers, it was designed a method sheet detailing, step by step, how to carry out this examination without omitting anything (Table 5).

Medicine cabinet inventory. In the NGO Reniala - Madagascar, veterinary services were different from those found in Europe. When necessary, the veterinarian would come to the site and bring very little equipment. He used whatever he could find in the treatment room's medicine cabinet.

After a consultation with Bucharest Zoo and comparing with the inventory existent in NGO Reniala, it was proposed a list of medicines and equipment to be purchased.

It is important to add antibiotics to the list. The only one available in Reniala is a specialized antibiotic for respiratory tract infections. It will therefore be less effective for all other types of infection (urogenital, skin, eye, dental, etc.). It is preferable to have broad-spectrum antibiotics that have a more comprehensive action. Amoxicillin combined with clavulanic acid or enrofloxacin are very useful as a first line treatment. Doxycycline could possibly be dispensed with for respiratory infections and adjusol used instead, but in the case of tick-borne diseases, only doxycycline will be effective.

Table 5. Method sheet - Remote clinical examination

Objectives: to assess the general condition, identify visible clinical signs and unusual behaviour in order to select animals requiring a more thorough clinical examination.	
Step 1 General condition	**Body score**: a score of 1 to 5 is given. A score of 1 corresponds to a very thin animal, while a score of 5 corresponds to an obese animal. A score of 3 corresponds to a good body condition.
	General attitude: observe whether the animal is active, interacts with other animals, or remains isolated and inactive. Normally, most lemurs are sociable and curious.
	Facial expression: this refers to the animal's facial expression. Look for signs of pain, fear, or anxiety.
	Body position: an animal with a hunched back (kyphosis) may be in pain.
Step 2: Skin and fur	**Hair:** the hair of a healthy animal should be clean, smooth, and shiny. Certain conditions are accompanied by dull, greasy hair. If the hair is dirty, for example covered in faeces, this may indicate poor hygiene. A sick animal may neglect its grooming.
	Skin: identify areas where hair has been pulled out and note any open wounds, redness, or scabs. Any open wounds require a thorough clinical examination, followed by disinfection and, depending on the severity, bandaging or stitches.
Step 3: Eyes and ears	**Eyes**: Check if the eye is red or if there is any discharge. These can be signs of infection.
	Ears: Check whether the animal is scratching or shaking its head, whether the ear is red or whether there is any discharge.
Step 4: Musculoskeletal system	**Resting examination**: the animal's posture is assessed at rest to determine whether it is normal or indicates discomfort. Check whether the animal is leaning to one side or holding a leg up. The limbs are also inspected. Is a joint swollen? Are the joint angles normal? Don't hesitate to compare both limbs, as they should be symmetrical.
	Examination in motion: observe the animal as it moves. Does it avoid putting a leg on the ground? Is its gait symmetrical? Can it climb into the aviary without difficulty? Does it have difficulty lying down and getting up? A change in the animal's movement indicates trauma, pain, or stiffness that warrants further investigation. If in doubt, it may be helpful to film the animal to show the veterinarian.
Step 5: Breathing	**Breathing efforts at rest and after exertion**: observe whether breathing appears smooth, easy, and quiet, or, conversely, laboured, difficult, noisy, or painful. Some symptoms may be accentuated after physical exertion.
	Cough: if present, note its frequency (single or repeated), rhythm (simple or quintuple), and tone (wet or dry).
	Nasal discharge: observe the nasal cavities. If present, note the colour (clear, yellow, green, bloody) and the amount.
Step 6: Digestion	**Observation of the animal during meals**: check if the animal has an appetite, if it chews its food properly (otherwise this may be a dental problem), and if it swallows correctly.
	Appearance of faeces: diarrhoea, blood or mucus in the stool.
	Presence of nausea: a nauseous animal may salivate excessively. Saliva may be seen dripping from the corner of the mouth.
	Vomiting: note its characteristics (food content, liquid, bilious, faecal, containing blood, etc.).

CONCLUSIONS

The higher frequency of stereotypical behaviour in the 8 m³ cages may indicate that the cages are too small for the animals or that they lack social interaction in this environment. Enlarging the enclosures to a minimum of 16 m³ would be ideal. Increasing the frequency of meals, varying meal times, and enriching the environment may be temporary solutions to prevent these behaviours from occurring.

A diet based on fruits and vegetables meets the needs of lemurs. The amount of food distributed is also appropriate for the animals. However, cabbage should be given in limited quantities as it contains glucosinolates, compounds that can be toxic. In addition, certain foods such as soft cheeses and industrial cakes should be avoided as they are not suitable for the digestive system of lemurs and can cause health problems. Pregnant females should always be given supplements, such as boiled eggs or seeds.

Of the 21 animals tested, 14 were found to be infested with gastrointestinal parasites. The parasites identified were *Subulura baeri*, *Eimeria* spp, *Capillaria* spp, roundworms, *Strongyloides*. These results show us the need to treat all animals in the herd with a new molecule such as ivermectin in order to avoid resistance. It is also important to carry out adequate prophylaxis by treating animals more regularly – for example, every three months – and by performing coproparasitological tests to verify the effectiveness of the measures adopted.

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