Hand rearing and development of douc langurs (*Pygathrix* sp.) at the Endangered Primate Rescue Center, Vietnam

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Summary

Douc langurs are nutritionally very sensitive primates. This is especially true for the rearing of young animals. The Endangered Primate Rescue Center has raised a total of about 80 young of all three douc langur species, 8 of them from the first day of life. A feeding system has been established that has led to successful rearing in most cases. Normal ordinarily UHT-cow milk, 3,5 % fat is used for feeding in a mixture with oak bark tea in a proportion 3:1. The housing conditions of the animals, accommodation, temperature and hygiene are a prerequisite for successful rearing. Housing in a community of young animals and possibly mixing faeces from healthy animals in the milk feed can bring about the necessary change in the microbiomes in the digestive tract and thus avoid digestive problems and diarrhoea. Recording of feeding amounts, animal weight and behaviour is necessary to detect negative development. The average feeding amounts and weight gain of several individuals give an indication of the rearing of young animals.

Chăm sóc nuôi bộ và phát triển voọc chà vá (*Pygathrix* spec.) tại Trung tâm Cứu hộ Linh trưởng Nguy cấp, Việt Nam

Tóm tắt

Voọc chà vá là nhóm loài linh trưởng rất nhạy cảm về mặt dinh dưỡng. Thực sự chính xác đối với việc nuôi bộ động vật còn non. Trung tâm Cứu hộ Linh trưởng Nguy cấp đã chăm nuôi bộ khoảng 80 cá thể con non của cả ba loài voọc chà vá, 8 trong số đó từ ngày đầu sơ sinh. Một quy trình cho ăn đã được xây dựng và đưa đến việc nuôi thành công trong hầu hết các trường hợp. Thông thường sữa bò UHT, 3,5% chất béo được sử dụng để cho ăn trong hỗn hợp với trà vỏ cây sồi theo tỷ lệ 3:1. Điều kiện chỗ ở của động vật, chuồng nuôi, nhiệt độ và vệ sinh là điều kiện tiên quyết để nuôi thành công. Trong khu chuồng nuôi chung động vật còn bé, có thể lấy phân của động vật khỏe mạnh trộn vào trong thức ăn sữa cho động vật sức khỏe yếu ăn, điều này có thể mang lại sự thay đổi cần thiết trong hệ vi sinh vật trong đường tiêu hóa và do đó tránh được các vấn đề tiêu hóa và tiêu chảy. Ghi chép lại lượng thức ăn, trọng lượng và hành vi của động vật là cần thiết để phát hiện các dấu hiệu không tốt. Số lượng cho ăn trung bình và tăng cân của một số cá thể cho thấy một dấu hiệu tốt về việc nuôi động vật còn non.

Introduction

Douc langurs, genus *Pygathrix*, occur only in Indochina, East of the Mekong. The three species red-shanked, grey-shanked and black shanked douc langurs (*P. nemaeus*, *P. cinerea*, *P. nigripes*) are distributed generally allopatric in geographically separated regions of Vietnam, Laos and Cambodia, but with small parapatric zones between red- and grey-shanked douc langurs (Nadler & Brockman 2014, Bui Van Tuan et al. 2019). Douc langurs are rarely kept in zoos and often not succesfully over a longer period (Ruempler 1991). The grey-shanked douc langur, the last discovered species (Nadler 1997), and the black-shanked douc langur are never kept legally in facilities outside of Vietnam.

The gastrointestinal tract in douc langurs differs from other langurs (Kuhn 1964; Chivers 1994) which is probably a reason, that these species are very sensitive feeders (Otto 2005). Hand rearing

of young individuals is a special challenge and little is known and documented about successful attempts. The experiences with hand rearing on a high number of individuals at the EPRC should provide information for other facilities and also call for an exchange of experiences on methods, food and keeping conditions.

Material and Methods

A number of immature douc langurs of all three douc langur species arrived at the EPRC, confiscated from forest protection authorities in several provinces in central and southern Vietnam where douc langurs occur (Fig. 1, 2, 3). The animals are victims of poaching, hunting with snare traps or guns. The females which carried immatures were killed and used for meat or traditional medicine. The immatures - if they survived - are "useless" for such purposes and mostly offered alive to the illegal trade as pets. This is now also more and more practiced via internet, using several platforms. Although not only hunting and trading, also possession and keeping of all primate species is in Vietnam illegal and punishable by law, but it exists still a market for such animals. However, the chance of survival for immatures and juvenile douc langurs as a pet is close to zero.

Fig.1. Red-shanked douc langur (*Pygathrix nemaeus*) one month old. Photo: Tilo Nadler.

Fig.2. Grey-shanked douc langur (*Pygathrix cinerea*) one month old. Photo: Tilo Nadler.

Fig.3. Black-shanked douc langur (*Pygathrix nigripes*) one month old. Photo: Tilo Nadler.

The Endangered Primate Rescue Center (EPRC) kept all three douc langur species.

Since its foundation in 1993, a total of 110 red-shanked douc langurs, 112 grey-shanked douc langurs and 9 black-shanked douc langurs were kept.

In total 34 immature and juvenile douc langurs arrived at the EPRC until end of 2022; 18 red-shanked douc langurs, 12 grey-shanked douc langurs and 4 black-shanked douc langurs. Additional 12 douc langurs which are born at the EPRC were also hand reared, including 8 individuals from its first day of life. One red-shanked douc langur female had missing or dwarfish respectively milk glands but involved in a group and has given birth. After this anatomical feature was recognized the newborn were hand reared.

A douc langur is refered to as juvenile until the age of about one year until it's depends from milk feeding. This period of milk feeding we defined it as hand rearing. It needs a close and direct contact of the keepers to the animals. After this period the animals are normally involved in groups, fed on leaves and not in a dircet "hand contact" with the keepers.

Conditions about the acquirement of confiscated animals and transportation

After information to the EPRC about the confiscation of a young douc langur, one animal keeper started immediately by car to pick up the animal. The distance to travel is usually 500 to 1000 km, often close to the distribution area of the species. If the animals already kept at a ranger station of forest protection authorities the rangers get information about handling and feeding of the animal prior arrival of the animal keeper. After many years of work and closer connections to the forest protection authorities the necessary documents for taking over the animal and permits for the transport are now usually faster issued and the return of the transport can arrange immediately.

For the transport of the young animals, a transport box with a hot water bottle and soft pads is carried along, as well as special baby milk bottles with nipples, which are commercially available for the rearing of small animals, and milk for feedings on the way. If the young animal already very weak, the animal keeper holds the animal by its body during transport to better control the health status.

Housing and Temperature

When a confiscated young animal reaches the EPRC, it is placed in isolation in quarantine. Hand rearing of an animal requires steady regulation but also involves a process of trial and change. It is very important to note all measures in order clearly to see their effects. Only with accurate reporting

it is possible to correct undesired developments. The care of the animals with similar management and good exchange of information should be limited to 2, maximum 3 persons.

For a newborn or very young animal in the beginning a small cage is used with a floor made of a thick polystyrene layer, covered with a clean fresh cloth/towel. A rubber hot-water bottle is wrapped in a towel and should provide body temperature. The water bottle should be so organized that the baby can sit more upright, easy to eructate. A furnishing of the cage, like branches or ropes is not necessary.

The room temperature should be regulated between 28-30 °C.

After about one month, slowly reduce temperature so that the cage is warmer at night than during the day. If weather permits, a window should be opened during the day time, but draught is absolutely to avoid.

Feeding

For the feed we opted for normal UHT cow milk, with the following data per 100 ml: energy 60 kcal, fat 3.5%, protein 3 g, carbohydrates 4.1 g, calcium 110 mg. Milk powder for human babies has a slightly higher energy value, around 67 kcal, a much higher carbohydrate content of 7 to 8 g and a lower calcium content of 53 to 66 mg. The UHT cow milk is used for feeding in a mixture with oak bark tea in a proportion 3:1. The oak bark tea is prepared in a strong dissolution, about 2 teaspoons per 100 ml water, boiled for five minutes, and infused for another 10-20 minutes. The tea works as an astringent and should prevent diarrhea. Very important that the milk/tea mixture in the bottle for feeding should be brought to body temperature.

For a newborn or very young animal 12 feeding times a day are arranged, which means every two hours during day and night time. Usually starts with 6 ml mixture per meal. If the animal finishes the offered amount it can increased slowly. With an increase of the amount, a change of the feces should be observed. With an increase of the amount of the food the number of feedings, can be reduced, preferably the night feeding.

Roughly, at an age of three months, the animal seems to be hungry at all time. The hand reared langurs request a much higher quantity of milk than mother fed juveniles, but a feeding of more than 60 ml per meal was not practiced. If the intake of liquid food is too high mostly it causes diarrhea. On age of around six months the milk feeding can be reduced slowly to force the baby to feed on leaves.

After the baby finishes the milk/tea meal it's to keep upright and to force to a burp by softly tapping its back. In the very beginning, it also is necessary to massage the anus and softly the belly to stimulate excretion. In the age of about one month the animals get also bundle of leaves. At this age, the animals play mainly with the foliage, but also begin to nip at it.

Hygiene

Important is to keep the environment of the animal and all tools flawless hygienic clean. A minimum of keeper personnel should be working directly with the animal and any contact with persons not involved in the keeping should be avoided. Careful hand cleaning is necessary before any contact with the animal and a change of clothings where the animal has contact with is necessary.Tools for feeding, like bottles, nipples should be rinsed with hot water before every use. Clothing which is used for the keeping and towels and cloth which is use in the cage should be washed by 90 degrees.

Weighing

It is strongly recommended the daily weighing of the infants. The time is dependent from management of the work, but it should be at the same time and following the frequency of feeding – before or after feeding.

To keep the animals calm on the scale it is helpful to give them a thin slice of carrot or sweet

potato in the hand. This is usually taken by douc langurs with pleasure.

Monitoring / recording

The weight and observations of the animal's development should be recorded. This allows changes to be identified and appropriate responses to be made. Counting daily feed intake and recording fecal consistency are helpful in making decisions about feeding. Physical development should be recorded, e.g., tooth development, behavioral changes, beginning to walk, climb, vocalizations, etc.

Digestion problems / Diarrhea

The experience with the number of hand-reared animals showed a more problematic period at the age of three to four months. The reason is probably the energetic difference between cow's milk and natural breast milk. However, this difference cannot be compensated by a higher fluid intake. But a higher amount than 40 ml per meal cannot be recommended. Exceeding this amount sometimes leads to vomitting or diarrhea. This is also the time the animals start to feed more intensively on leaves.

This change in the diet also changes the microbiome in the digestive tract of the animals. This change in the microbiome can be supported by adding faeces from healthy older animals, preferably of the same species. A very small amount of faeces can be dissolved in water and added to the milk feed.

To support the development of the microbiome in the alimintary tract, necessary for the digestion of the leaves, to convert cellulose into proteins the animals at the EPRC, where young animals are regularly kept, are moved to a group with other youngsters, called 'kindergarden'. The animals in this 'kindergarden' are hand reared orphans in different age, confiscated from the illegal trade. It's assumed that the close contact to these animals has also a positive influence to the microbiome development.

A practiced support by young cows is also the additive of feaces from healthy adult individuals to the food. It is supposed that it could be also helpful for duoc langurs in this age and was also practized oaccasionally by the EPRC with a positive result, but without the proof about the effective impact.

Development of weight and milk intake

The weights of newborn red-shanked douc langurs in the EPRC show quite considerable differences. This concerns both the births of different females and the births of one female. The birth weights of four males range from 407 to 577 g, with an average of 495 g. The birth weights of 6 females range from 304 to 465 g, with an average of 394 g. Two red-shanked douc langurs born at Cologne Zoo also showed a marked difference in weight, one male weighing 324 g and one female 462 g (Ruempler 1991). These large differences also continue in the further development of the animals (Fig. 4). The increase in the amount of milk fed is greatest in the first week after birth. On the first day of life, between 22 and 40 ml was fed, with an average of 28 ml. After one week, the amount of milk fed was already between 110 and 148 ml, with an average of 130 ml. An adult female in the EPRC allowed her baby to be handed over to a keeper without any problems, which made it possible to record the weight gain during natural rearing. There was a clear difference in weight gain between natural and artificial rearing in the first twelve months (Fig. 4).

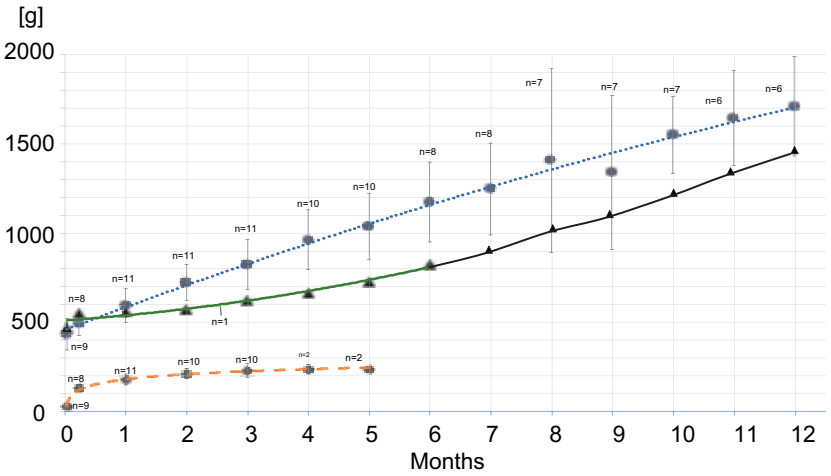

Fig.4. Weight (g) and Milk intake (ml) in relation to the age of the juveniles. Each data point represents the mean value for juveniles at a specific time, and 'n' represents the number of sampled juveniles at each time point. The error bars represent the standard deviation (SD) from the mean, indicating data variability within each group. A polynomial regression analysis for weight when handfed in relation to age produced a well-fitting model with an R^2 value of 0.9925, resulting in the equation $y = -2.1502x^2 + 129.61x + 455.79$. A polynomial regression analysis for weight when motherfed in relation to age produced a well-fitting model with an R^2 value of $R^2 = 0.9531$, resulting in the equation $y = 4.3515x^2 + 23.642x + 509.77$. A logarithmic regression analysis for milk intake when handfed in relation to age resulted in a strong fit with an R^2 value of 0.9906, yielding the equation $y = 40.912\ln(x) + 178.96$ for the relationship. (y = weight in g; x = months). Dats-hand reared; Triangles-mother reared.

Ruempler (1991) reports on the hand rearing, food composition and weight development of 2 newborn red-shanked douc langurs at Cologne Zoo. The amount and composition of food given there caused the animals to gain weight even more rapidly (Fig. 5).

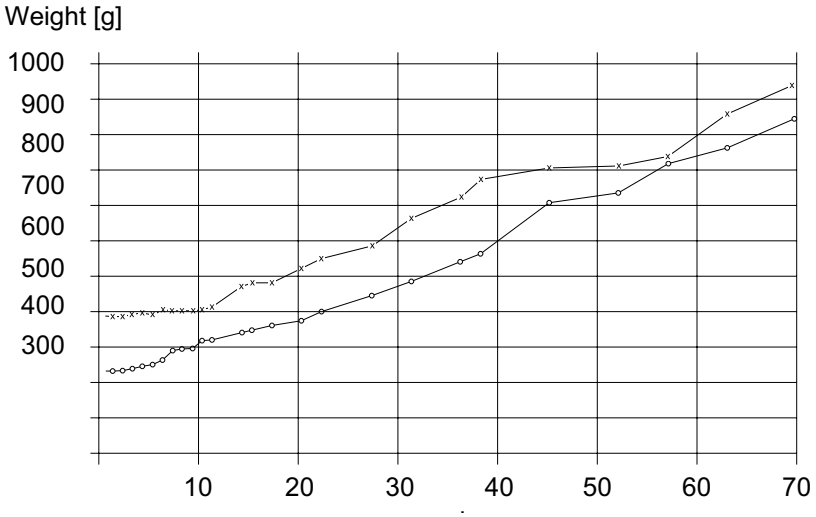

Fig.5. Weight development of two red-shanked douc langurs at Cologne Zoo. (Female upper line, male lower line). From Ruempler (1991).

Discussion

Some of the procedures in feeding and management of the animals are undertaken intuitive and don't have a scientific justified background. Some changes probably don't reduce the success, but can also increase the risk for a failure. This is the reason that a nearly stable procedure retained over years at the Endangered Primate Rescue Center.

The reason for the significant difference in weight development between natural and hand

rearing is unclear, although the data from natural rearing is based on only one individual. However, this juvenile showed completely normal and active behaviour, so that abnormalities cannot be regarded as the cause. The juvenile did not reach the same average weight of several hand reared animals until it was well over a year old. The individual differences in the weight gain of the hand reared animals are considerable. This is mainly due to the different individual behaviour of the young animals. Some animals are very greedy eaters, while others are less interested in eating and often need to be stimulated. Short-term digestion problems or diarrhea can lead to rapid weight loss, which is only recovered more slowly.

It is not possible to determine the age of young animals by weight alone, as the possible deviations are too great.

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