

A BEHAVIOURAL STUDY OF A CAPTIVE SINGLE PRIMATE IN A ROMANIAN ZOO - CASE STUDY

STUDIU COMPORTAMENTAL LA O MAIMUȚĂ CAPTIVĂ AFLATĂ ÎNTR-O GRĂDINĂ ZOOLOGICĂ DIN ROMÂNIA - STUDIU DE CAZ

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ABSTRACT | REZUMAT

Improving the well-being of a captive animal is becoming a priority in many zoos throughout the world. Whereas several studies have been concerned with the behaviour of a group of captive primates, little attention has been paid to isolated animals. We have not encountered a specific case study that focuses on this particular aspect, which is why this matter remains under-represented in the scientific literature. The current study is therefore aimed at analysing the behaviour of a single captive primate in a zoo in Romania in order to determine how this animal spends its time while being isolated. Data were recorded using the continuous sampling method to obtain the percentage of time the primate spends for each activity during the opening hours of the zoo. The literature correlated with our own observational data shows that the organization of the available enclosure for the animal, as well as the visitors' effect on the primate can considerably modify the primate's behaviour. Social deprivation due to the absence of other primates significantly impacted the quality of the time spent by the primate and it had a direct effect on its well-being. All in all, this study highlights the importance of the zoo management, with an emphasis on the need of social interaction among the primates in captivity. This paper could encourage and contribute to further studies in the management of isolated primates in order to improve the well-being of the animals in captivity.

Keywords: primate, isolation, captivity

În prezent, îmbunătățirea bunăstării animalelor captive a devenit o prioritate globală în grădinile zoologice. Majoritatea studiilor efectuate au analizat comportamentul unor grupuri de maimuțe captive, foarte puțină atenție fiind acordată maimuțelor izolate și crescute în captivitate. Potrivit datelor existente în literatura de specialitate, la ora actuală nu există studii care să abordeze acest aspect particular, motiv pentru care această problemă rămâne subreprezentată în literatura de specialitate. Prin urmare, în studiul de față am efectuat analiza comportamentului unei maimuțe captive crescută singură într-o grădina zoologică din România. Datele au fost înregistrate utilizând metoda de eșantionare continuă în scopul evaluării timpului acordat de către maimuță fiecărei activități în parte și desfășurate pe întreaga perioadă de funcționare a grădinii zoologice. Literatura de specialitate corelată cu datele noastre observaționale subliniază influența directă atât a vizitatorilor, cât și a modului de amenajare al adăpostului asupra comportamentului maimuței examinate. Bunăstarea maimuței este în mod direct afectată atât de către deprivarea socială la care aceasta este supusă, cât și de către calitatea timpului petrecut de aceasta în adăpost. Astfel, este imperios necesară atât asigurarea unei interacțiuni sociale între primatelor crescute în captivitate, cât și un bun management al acestor grădini zoologice. Acest studiu reprezentând un punct de plecare către alte cercetări referitoare la îmbunătățirea bunăstării primatelor izolate și crescute în captivitate.

Cuvinte cheie: maimuță, izolare, captivitate

Captivity represents an evident source of stress for non-human primates leading to some potential abnormal behaviours such as stereotypies (54), as well as aggression towards visitors (13). Thus, the promotion of the psychological well-being of captive animals is nowadays becoming a priority and a real challenge for science. The current literature concerning the princi-

pal stressors that can influence the welfare of primates includes such factors like the size of the enclosure, the presence of other animals near the cage, the light or feeding etc. Among these factors, a very controversial subject is the visitors' effect on primates. Their presence near the animals is a stress relief factor and it could become an enriching source (38).

A possible way of improving animals' welfare in zoos is the use of environmental enrichment factors such as alimentary, sensory, physical but also social types of sources. Furthermore, primates live in mixed-

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gender groups, this is how they can express a large variety of behaviours, and this is why social relationships are essential for their well-being (3, 12, 34). Despite these findings, some zoos still house primates alone, neglecting the importance of social interaction. Yet, it is unclear how such an animal behaves when it is isolated in a zoological park and scientific literature provides little information on this subject. This prompted us to investigate the behaviour of a captive single primate: a macaque kept in a zoo in Romania. Moreover, as far as we know, no study on this subject has been conducted in Romania yet and this article could be a starting point in the development of such a type of research in this area.

We aimed to investigate the daily behaviour of a single captive primate. We chose to evaluate its behaviour using an ethogram, adapted for a single individual, excluding social interaction as allo-grooming. Among the questions that arose, we considered the following: (a) "How will an isolated animal spend its daily routine?" and (b) "How are the usual behavioural patterns divided?". Different behaviours were recorded along with the location of the animal in its enclosure during the day, including the inner and outer part of the enclosure. Recommendations regarding its daily routine could be proposed to the zoo manager in a way to improve the well-being of the studied animal. This study could be used as a possible model for how to deal with other single primates kept in captivity all over the world in order to improve knowledge concerning social deprivation in primates.

MATERIALS AND METHODS

Subject

The subject of this study was a single female primate from the species Macaque rhesus (*Macaca mulatta*) (Fig. 1).

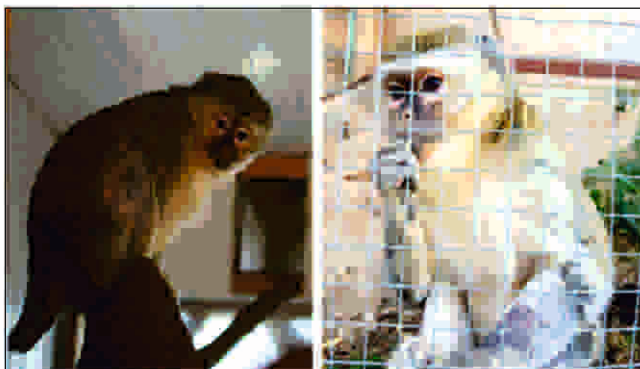


Fig. 1. Luisa, the primate subject of this study

The 17-year-old primate, Luisa, of unknown origin, was brought to the Zoo "Recreation Park – Windmill", located in Cluj-Napoca, Romania, in 2008.

Before this, it had been a pet for two different families. Luisa was the only primate of the zoo during the period in which the current research was carried out, living alone since it had been brought there.

Housing and Management

The facilities for the primate included both indoor and outdoor exhibits and visitors could see the primate in these two areas. The indoor facility (Fig. 2) included a wood base with some hay on it and two branches that allowed access to the outdoor area and the house. A plush and some plastic toys were put on the floor. The zoo did not use artificial light during the night or the day. Food was given directly on the floor, in the inner or outer area, depending on the weather and the zoo-keeper's choices. Water was given directly through the bars of the cage in a cup placed on the floor, inside the enclosure. There was no feeding menu or any type of feeding frequency established; the keepers gave the food to the primate every day, without a specific timetable. The animal received seeds (bird seeds), fruits, mainly banana, sometimes an egg or some raw chicken. Furthermore, at the entrance of the zoo, the visitors had the possibility to buy a packet of fresh carrots in order to give them to the primate. We noticed that the visitors who ate during the zoo visit also fed the primate with their food (such as chips, biscuits, sandwiches), while looking at the animal.

An access door made of plastic separated the indoor and the outdoor enclosure and this was open all the time, during all the seasons, including the night time. The outdoor facility (Fig. 3) included a lower part made of concrete with areas of vegetation on it and some branches that allowed the primate to climb to a higher position. The inner enclosure was situated in a room that also included areas for other species, such as chinchillas, rabbits or Guinea pigs. The outside enclosure was surrounded by the raccoon's cages separated by a common grilling.

Equipment Setup – Data Collection

Due to the configuration of the inner and the outer enclosure, the observer could find a place to sit in front of the cage without influencing the primate or the visitors. A comprehensive ethogram was developed, with input from the primate keepers. The behavioural categories included daily maintenance behaviours, such as: feeding, social, aggressive, grooming and stereo-

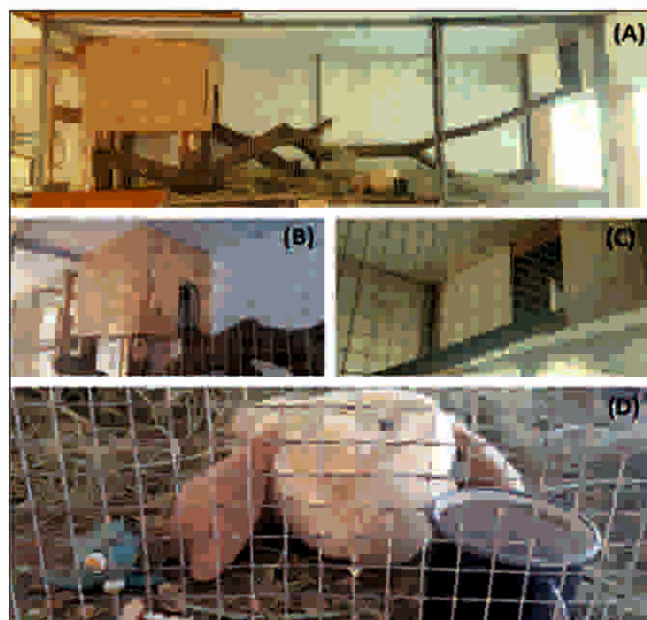


Fig. 2. Inner enclosure: (A) the entire inner enclosure, (B) the house, (C) the passage from inside to outside, (D) the toys and water cup



Fig. 3. The outside enclosure

typic behaviours (Table 1). Data were collected over a 4-month period, from the beginning of October 2017 to the end of February 2018. Reliability was tested with a biologist and behaviour specialist in order to get some accurate observations. The behavioural data were collected using the focal recording sampling with 15-s intervals during one-hour-observation periods (resulting in 240 data points per hour-observation period). The data were collected via direct observation during 3 daytime hours per day, during a period of 4 months. A total of 86,400 observations were conducted for a total of 360 hours of data with the animal. The number of observations for each behaviour is noted in each cell of the table.

The primate's enclosure area was also observed using the same focal recording sampling. The enclosure was divided in different areas for the study (Fig. 4).

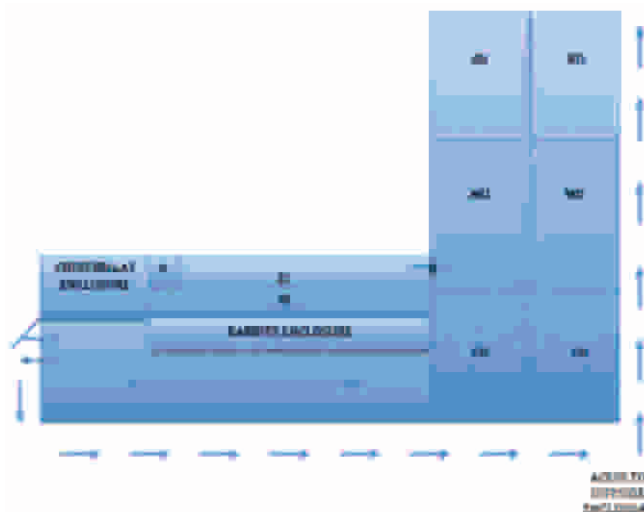


Fig. 4. The primate's enclosure (H: house of the primate; IU: inner enclosure upper part; ID: inner enclosure lower part; RU: outside enclosure upper part right side; RD: outside enclosure lower part right side; LU: outside enclosure upper part left side; LD: outside enclosure lower part left side; MU: outside enclosure upper part middle; MD: outside enclosure lower part middle; D: doors access inside / outside)

Data Analysis

The obtained data were analysed using *Excel Software*. The behavioural data of the primate were analysed separately by calculating the mean percentage of time engaged in each behaviour throughout each condition. The same calculation was used to analyse the mean percentage of the primate's time engaged in each area of the enclosure.

RESULTS AND DISCUSSIONS

In the Fig. 5 is outlined the significant differences among the behavioural activities done by the primate. Foraging was the activity that took most of the time, i.e. more than 40% of the daily activity budget.

The second highest activity observed was «in house», meaning that the primate was in its house; we can guess it rested, hiding from the visitors, but it could not be seen. The social activity is above 2%, which means that during this part of the day the primate had social interaction only with visitors or zookeepers. Those positive relations mainly happened

Table 1

The ethogram used to monitor the behaviour in Macaque rhésus (*Macaca mulatta*)

Behaviours Noticed	Definition
Object	The primate is manipulating (holding, throw, move) plastic toys/plush situated in her cage.
Rest SS	The primate is sleeping, resting, holding his head between her legs, lying down, with no othersbehavioursoccurring simultaneously.
Groom	The primate is grooming himself (looking in his fur, licking, eating something on him, and scratching).
Forage – Feeding related activity	Looking for food on the floor, can be walking at the same time too, this include ingestion of food or water.
Observations	The primate is standing and looking around her without any activity, in a stationary position.
In House	The primate is hidden in her house and cannot be seen by the visitors.
Negatives interactions towards humans	The primate shows aggressive/stress signs towards visitors, showing her teeth, can include vocalizations, throws her against the cage, showing evident unpleasant situation.
Social	Showing positive social interaction with human (food given, grooming request)
Negatives interactions towards animals	The primate shows aggressive signs towards animals near her (dogs from visitors, raccoon from thecage around).

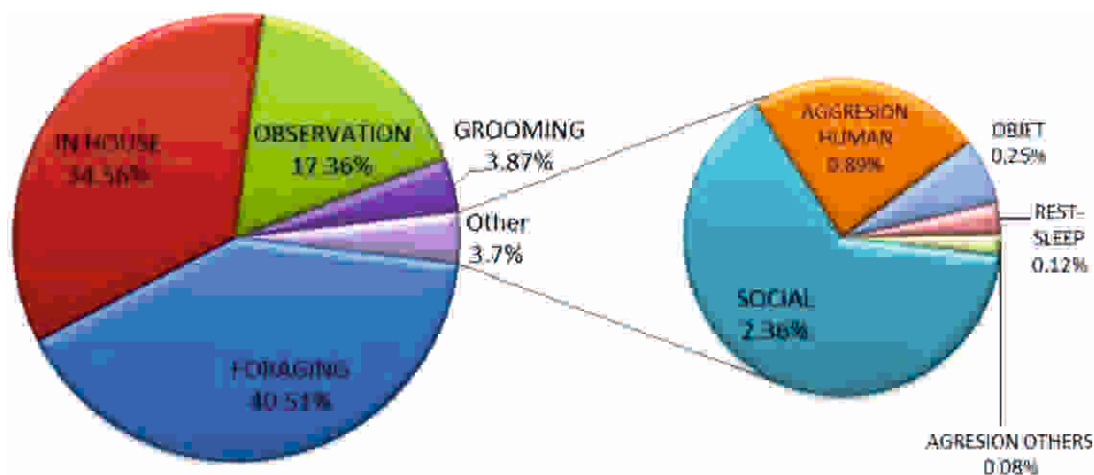


Fig. 5. Mean percentage of primate major activities

when visitors gave it food or when it stood close to the grill for the people to “groom” it. Nevertheless, the primate spent 0.89% of the time having non-positive reactions to humans, which can be qualified as aggression-stress related. This number is not alarming but the causes should be investigated in order to avoid them. Almost 4% of the time spent was for grooming and it was represented by scratching and fur parting. Most of the time, the animal was in the inside enclosure and in the house. The area that was less used by the primate was the door passage (Fig. 6).

As regards the outside enclosure, most of the time the animal was in the lower part, more specifically, on the left side. The upper part of the outside enclosure is less used by the primate (Fig. 7).

The basic idea of this research was to evaluate the daily activity behaviour of a single captive primate in the Zoopark Moara de Vant located in Salicea, Cluj. Therefore, we examined the animal's expressed behaviour and we analysed each discovered category.

Firstly, our data highlight the fact that foraging is the most important activity done by the primate.

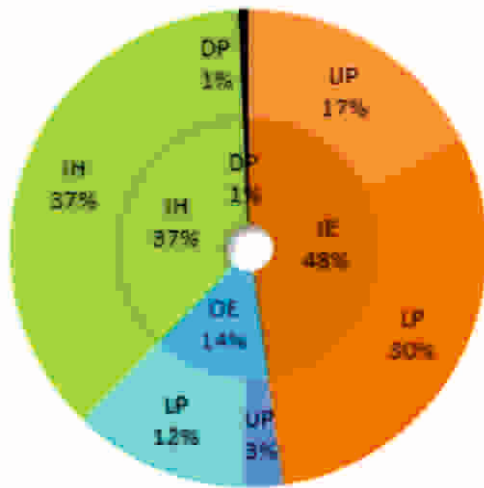


Fig. 6. Mean percentage for each localization (major) of the primate (UP – upper part; LP– lower part; IH–in the house; DP–the Passage - allowing the access Inside-Outside; OE–Outside Enclosure; IE–Inner Enclosure)

Foraging takes more than 40% of the time and this result is supported by other findings showing that this behaviour can reach up to 60% of a primate's daily activity (2, 22). As it was previously mentioned in the literature (32), in our research foraging includes 2 phases: appetitive and consuming. Unlike primates living in groups, in the case of this study, the absence of food and water competition represents a specific factor which influences the daily behaviour of the primate (10). It is known that the main goal of animals is to find food to survive, spending as less energy as possible (1, 42, 44). However, this activity is influenced by food distribution and the available quantity. Studies show that natural plants are recognized as being more attractive for primates (29). Nevertheless, in our case, as the temperature was lower than usual, the vegetation in the outside enclosure was rare and the primate had less opportunity to obtain food from there. Moreover, as this study shows, the primate used to spend the majority of its time in the inner enclosure during winter because of the low environmental temperature. Consequently, in this case, one of the possible solutions could be to create a more diverse and interesting inside enclosure for the primate. Furthermore, another possibility could be to increase the diversity of food (29), or to spread woodchips on the floor with some sunflowers in order to stimulate the need to explore the environment (8, 11). Thus, although studies on primates' behaviour highlight the importance of using new enrichment sources, such as food puzzle (46), in our case more attention should be paid to cer-

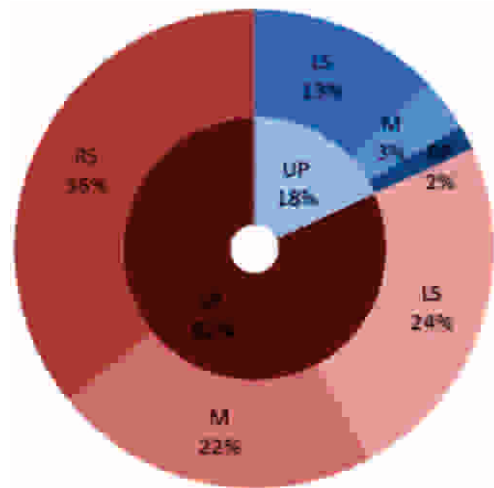


Fig. 7. Mean percentage of the body part movements in the outside enclosure (LP – lower part; UP – upper part; LS – Left side; M-middle; RS-right side)

tain essential elements for the well-being of Luisa, such as the access to a cleaner and more interesting water source in order to increase the primate's curiosity to explore and to manipulate objects.

Grooming was another daily behaviour of the primate, observed and recorded during the research period. Generally, literature describes three main types of grooming: motherly, social and self-grooming (21). However, in the case of the present study, the only observed behaviour was self-grooming, the primate being single. Previous studies show that allo-grooming is a well-studied social function of primates, especially in the case of females (17). Moreover, as it is shown in the literature (25), females get help and strengthen social bonds by this action which can take up 20% of their time. Naturally, the length of the fur is an important factor that influences the grooming need of each individual (7). According to the literature data (56), it is also important to describe the hygienic role of grooming. Allo-grooming is performed mainly in the body part that is not accessible to the animal itself (like the head, neck or the back) because this action helps the primates to remove the parasites found on their skin (27). Moreover, it has a real utilitarian function for the primate. Since the primate observed within this research was single, only self-grooming could be performed and, consequently, some parts of its body always remained uncleansed.

It is well known that primates are very social animals that interact with one another when this is possible (12). Consequently, a single individual is really li-

mitted to express itself without another congener (40). This is one of the reasons why a single individual develops some stereotypes or some 'abnormal' self-directed behaviours (23, 35, 37, 49). In fact, pairing single primates is one of the solutions meant to improve their well-being (45) and to promote their social behaviour (18, 47, 50). Furthermore, pairing has a therapeutic effect on any possible abnormal behaviour (18, 47). Several scientific publications recommend housing *Rhesus macaques* in groups of male/females as it is in the wild (3, 34). Interestingly, it is shown that social enrichment is even more important than the size of the enclosure (except for locomotion) (15). Considering the subject of the present research, this primate has never been in contact with other animals of the same species, which is why social enrichment could be a great improvement for it (35). In other respects, a decrease in incidence/the severity of a degenerative joint disease, but also a low frequency of diseases and wounds are described in the case of single primates (31). From this point of view, an isolated animal is 'physically healthier' but the psychological and behavioural needs and requirements are not met (40).

In this view, Luisa showed the need for physical interactions with some of the visitors. Some past studies used the term 'zoo-visitors relationship' in order to define the interaction between the observed animal and the visitors (16). Although this animal had positive interactions with humans that wished to interact with it (for instance for grooming), the primate also got stressed especially because of children who were often very noisy or shook the fence of the enclosure. In most of the cases, the visitors did not have the necessary knowledge to interpret the behaviour of the animal, which is why the zoo management should consider the visitors' awareness and the children's education with regard to these problems. Eventually, these could become an important goal of the mission of the zoo.

Primates often associate the arrival of visitors with a potential source of 'tasty food', as visitors often throw food to animals (24). A similar cause-effect behaviour was observed in the case of Luisa, the observed primate. Another equivalent result was also observed in a zoo in Chester where the human-primate interaction was motivated only by the presence of food (14). However, nowadays, the influence of visitors on captive primates remains an important topic and a source of debate. While some authors assume that a high number of visitors lead to a higher level of stress for the animal, as a study carried out in the zoo of Sacramento shows (57), other authors (52)

report that primates are not influenced by the presence of people. Following a focus study on the interactions between chimpanzees and visitors, it was outlined the enriching potential of visitors (14). All in all, one may consider that the activities of the public, such as the intensity of the voices or an exaggerated body language, especially if they become oppressive, have more impact on primates than the number of the visitors (5, 26). In the case of Luisa, a high density of visitors as well as their oppressive body movements and vocalizations determined some characteristic behaviours, such as aggressiveness and fear. Furthermore, the unusual visiting period can also represent a possible source of routine disruption for primates (52). However, these specific findings cannot be compared to the results of the present study because the observation of Luisa was conducted only during the opening hours of the zoo.

Even though human beings can be a cause of stress for primates, the principal role of a zoo is to satisfy the need for proximity of the visitors and the animals. For this reason, one of the recommendations is to facilitate naturalistic enclosures by using plants in order to separate the visitors from the primates in an aesthetic way (20). Under the circumstances, Luisa could be less impressed by humans if it only saw the upper part of the visitors' body or if it had the possibility to climb to a higher position compared to the visitors. On the other hand, the using of one-way mirrors could be an interesting layout to put in place. However, it seems quite difficult to implement this enrichment considering the structure of the enclosure of this zoo and the financial costs associated with it (41). Another study has shown a proportional relation between the animal's activity and the visitors' interest during their visit (6, 30, 53). Therefore, in the case of Luisa, what was easy to observe was that the visitors lost their interest in the primate quickly and moved to another enclosure when the primate was resting in the house. This fact is to be taken into consideration for the second part of the present research, which focuses on the percentage of time spent in the different parts of the enclosure. Luisa stood mostly in the inner enclosure, more specifically in the lower part of it, but also in its house, hidden from the visitors. Actually, this observation is important because it is proven that the environment in which primates live influences their daily behaviour (43). The weather temperature in Romania, during the observation period, was too low for such primates, which caused the animal to stay in the single warmer area, i.e. the inner enclosure.

Furthermore, this unique accessible house for the primate allowed it to stay hidden from the visitors, and this is how it had the chance to avoid social interaction when it wished. Moreover, food distribution was done in the inner enclosure as well, so the animal had no motivation to exit. Improving the interest in the type of enclosure for such an animal could be a solution for the management of such problems and this comes along with some further studies concerning the costs, the difficulties of cleaning and the maintaining of the naturalistic exhibits (9, 28, 36, 51, 55). For example, an interesting study conducted at the California National Primate Research Center focuses on the influence of grass vs. substrate in an outdoor enclosure for the daily activities of primates (4).

Maintaining the vegetation found in the outer enclosure of our primate is important. However, it could also be important to improve the upper part of the outer enclosure to increase Luisa's activities and, at the same time, to be made more interesting for the visitors. When monitoring a primate's exhibit, keepers need to keep in mind the specificity for each species regarding lighting and temperature requirements (19). Furthermore, the use of a naturalistic enclosure remains a better solution regarding firstly, the costs associated with it, and secondly, the positive effect on both the animal and the visitors (39).

Additionally, it is important to inform the parents about their role in educating children to consider the animal's lifestyle, its diet and behaviour. Thus, in order to get a quick access to documentation concerning the visitors' behaviour in a zoo, the setting-up of some information boards could be a helpful tool to be implemented. Other findings support the necessity of such information boards, as the use of boards containing information about the animal decreased the negative effect of visitors on the animal (26).

In addition to all the data above regarding the behaviour of this single captive primate, we noticed a rare manipulation of the available plastic toys. Generally, the use of objects by primates represents a way of improving their psychological well-being. Yet, in the present study, we concluded that the presence of the actual toys in the primate's enclosure did not influence her daily routine, which means that the existent toys must be reconsidered. For instance, it has been previously shown that toys made of natural components are usually preferred by primates to the artificial ones (48). What is more, such enrichment is more aesthetic and educational for the visitors as they have a more realistic view of how primates act in the

wild (33). Finally, the rotation and the periodical removal of the toys determine a higher benefit (33). Besides the introduction of toys in order to improve their well-being, some studies have been done on the use of some modern enrichment devices, such as videotapes. However, in their case, the general activity budget is proven to be only a bit modified and the content of the video has no real influence on the primates' behaviour (7). Another unfavourable aspect is the financial cost of such implementation which is considerable for the zoo and not feasible in our case.

CONCLUSIONS

In light of our results, we can conclude that the enclosure management and the visitor's attitude have a real effect on the primate's behaviour under our study conditions. With regard to social interaction, we can argue that social deprivation affects negatively the daily activity behaviour of our observed primate. Attention must be paid to factors that could disturb the animals' normal activity patterns, such as human interactions, non-adapted enclosure and social deprivation. In order to ensure the single monkeys' well-being in captivity future research using a larger population of isolated primates may be beneficial in order to fully explore and improve the well-being of those animals.

Conflicts of interest:

The authors declare that they have no conflict of interest regarding this publication.

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