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Ethological Study of Chimpanzees (Pan troglodytes) in the Rehabilitation Process at Uganda Wildlife Conservation Education Center, Uganda

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Authors' contributions

This work was carried out in collaboration among all authors. Author DM searched for related literature; designed the methodology; collected data; analyzed the data; typeset the manuscript. Author AB formulated the title of the study and objectives; Searched for related literature; Analyzed the collected data; discussed the findings; proof read the entire manuscript. Author DM searched for related literature; discussed the findings; proof read the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Chimpanzees are part of the great ape family and the largest of the living family, belonging to the genus *Pan (Pan troglodytes)*, native to Equatorial Africa, and believed to be the closest extant relative to humans with 98.7% of the human DNA. They live in extended family groups of as many

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as 20-120 individuals. The study evaluated the effect of the rehabilitation process on behavioral changes among the ex-situ chimpanzees' community at the Uganda Wildlife Education Centre -Conservation Area (UWEC CA) Uganda. Chimpanzees in the wild live in cohesive social units known as communities, where kinship and social strata significantly influence group dynamics. However, threats such as habitat destruction, illegal wildlife trade, poaching, the bush meat crisis, climate change, and diseases disrupt this social structure, especially for rescued chimpanzees, leading to long-term behavioral changes in captivity. Therefore, the study sought to understand the effect of the rehabilitation process among the ex-situ chimpanzees on their behavioral changes, knowing that the chimpanzees in ex-situ facilities are rescued from various walks of life due to the aforementioned threats. The study set out to assess the behavioral changes among the rescued chimpanzees, understand their social dynamics, and the correlation between their behaviors caused by the rehabilitation process so as improve their rehabilitation and their welfare strategies. Using experimental, observational research designs among others; including focal, scan, ad libitum, and all-occurrence sampling techniques, the study found a moderate positive correlation between aggression and mating behavior (r = 0.3) and a strong negative correlation between grooming behavior and both aggression and mating (r = -0.7). The findings highlight the importance of understanding the behavioral changes of rescued chimpanzees and how these changes are influenced by their rehabilitation process while in ex-situ environments. By considering individual social positions, caretakers can better manage rehabilitation and release strategies, minimizing aggressions and enhancing the chimpanzees' long-term well-being. Consistent monitoring of their behavior is crucial for successful rehabilitation, and promoting grooming behavior may help reduce aggression in captivity. The study recommends training more animal caretakers in chimpanzee behavior management, and social dynamics and encourages future research that includes longitudinal studies.

Keywords: Ad-libitum; behavioral trends; chimpanzee rehabilitation; ex-situ; social strata; Uganda.

1. INTRODUCTION

The chimpanzees (Pan troglodytes) in the wild live as kin in a cohesive social organization known as a troop or a community, comprising social strata, units, or bands that are highly influenced by values that individuals within the troop possess (Bloomsmith et al., 2006). Contrary to the chimpanzees in the ex-situ facilities, which are rescued from different places. Chimpanzees are part of the great ape family and the largest of the living family (Groves, 2005), belonging to the genus Pan (Pan troglodytes), native to Equatorial Africa (Project, 2008), and believed to be the closest extant relative to humans with 98.7% of the human DNA (Jon, 2021). They live in extended family groups of as many as 20-120 individuals. The characteristics of social organization can include qualities such as sexual composition, spatiotemporal cohesion, leadership structure, division of labor, communication systems, and many others (Wheelan, 2005).

The difference between the sexes in the resources that limit reproduction is particularly stark in chimpanzees, where the pace of female reproduction is among the slowest of any mammal (Emery, 2013). Females in the wild do

not start reproducing until they are 13–15 years old; they then produce one infant every 5–7 years and die at a maximum age of 50–60 years. To maximize reproductive success, females must therefore invest in their own mortality reduction as well as parental care. In chimpanzees, as in many other mammals, reproduction is accelerated by increased access to food (Kaufhold et al., 2024).

The chimpanzees' leadership structure is generally dominated by the dominant, who is commonly referred to as the alpha male, and the alpha female, with others under them, commonly referred to as the beta males and the beta females (Project Chimps, 2022). The alpha male is always the overall leader of the troop, exemplified by building bonds with his fellow chimpanzees, grooming and spending more time interacting with them, defending the inferiors, and manifesting high effectiveness in using tools such as sticks to fish objects from water and stones to break hard nuts (Handwerk, 2020).

In the wild, chimpanzees maintain spatiotemporal cohesion through ecological activities such as border patrols or hunting, which can influence the formation and structure of parties, which therefore can vary in size, composition, and duration (Goodall, 1986). Chimpanzees have a wide home range of 18 to 21 sq km in the forest and 100 to 200 sq km in the savannah (YPTE, 2023). The home range resonates with the ecological requirements of the troop demarcated; living in a densely forested habitat (IFAW, 2024), They have a maximum visual range of 50 m, but their loudest communication modality, the drumming on buttresses, has a range of approximately 1.0–1.5 km (Boesch, 2010).

Stream National Park. In Gombe with approximately 20 communities, it was discovered that a particular community or troop would aggressively attack an individual that had strayed into another community, or either community would do routine attacks (Wilson et al., 2014). This is largely because of the failure of the individuals attached to a particular community to respect the sovereignty and autonomy of each other's territorial boundaries (Massaro et al. 2022). The same applies internally within a particular chimpanzee's community. where individuals relate to each other and form a bond depending on the value systems, historical backgrounds, and sex ratios (Project & R, 2025). The members of the community do not travel as a unit but rather move about and feed into four to six small, loose associations (Project & R, 2025). The value systems are empathy, respect for one's space. compassion. generosity, consolation, solace, responsiveness, courage, civility (Alice & Klaus, 2022). and The composition of the strata or bands within the troop, or the community of chimpanzees, changes gradually as individuals or groups separate from one another. Some members only meet when they have special interests, for example, when attracted to food sources or charming females, and others are together often. and strong bonds develop between some of them (Warneken et al., 2007). However, due to the unprecedented challenges that chimpanzees in the wild face, they end up in ex-situ facilities as orphans, often abandoned by their parents, poached on, and other challenges (Lucy and Fisher 2011).

Chimpanzees are classified as endangered species by the International Union for Conservation of Nature (IUCN) (Humle et al., 2016). This means that they are in immediate danger of going extinct and require protection to exist. Chimpanzees are threatened and highly victimized by poaching, illegal wildlife trade, habitat destruction, and diseases (Pascual et al., 2023). Poaching, illegal wildlife trade, and habitat

destruction account for most cases of chimpanzee victimization (Goodall. 2020). According to UN statistics, poaching and illegal wildlife trade are worth between \$7 billion and \$20 billion, and this is done through an organized syndicate of goons ranging from local poachers, local buyers, middlemen, potential buyers, and black-market sellers to final destinations (UNEP, 2015). Habitat destruction entails the destruction of the chimpanzee's ecosystems (Walwambe 2024: Chitavat. and Barakagira. 2021). Deforestation is one of the most ways that grossly plummeted the habitat of chimpanzees (Lucky and Fisher, 2011), 10 million hectares of forests are destroyed annually (15.3 billion trees), each day 200,000 acres, every minute 139 acres, and every minute 55,600 trees. All these threats continue to threaten the existence of chimpanzees. Uganda Wildlife Conservation Education Centre, as an ex-situ facility, continues to play a fundamental role in the rescue and rehabilitation of chimpanzees for release and introduction into the wild, respectively. However, due to the circumstances under which the chimpanzees are rescued, this kind of relationship is compromised and has long-term effects on their behavior patterns. Therefore, the study sought to understand the effect of the rehabilitation process among the ex-situ chimpanzees on their behavioral changes, knowing that the chimpanzees in ex-situ facilities are rescued from various walks of life due to the aforementioned threats. The findings of the study can be benchmarked as a hallmark to reinforce better chimpanzee welfare strategies whilst in exsitu facilities.

2. RESEARCH METHODOLOGY

2.1 Description of the Study Area

Uganda Wildlife Education Center- Conservation Area is located in the central part of Uganda, in the Wakiso District, Entebbe, at plot 57 Lugard Avenue, from the off shores of Lake Victoria. It is around 8 km from Entebbe International Airport and around 36 km from the capital city, Kampala, on 0.0512° N, 32.4637° E GPS coordinates. The institution cares for over 300 individual animals classified into over 60 species, ranging from cats, herbivores, reptiles, primates, and omnivores to birds, and with over 200 species of plants.

2.2 Research Design

Due to the nature of the study, the behavior of chimpanzees was highly influenced by factors

such as environmental conditions, social dynamics, and individual differences, so as to isolate the effects of the specific factors that are of interest to the study. Therefore, the researcher utilized a cross-sectional, and a longitudinal research design. The cross-sectional research design was used to assess the group structure

and social roles, especially for the alpha male and female, during the feeding and display times. This is due to the overtime analysis of the group to examine dominance and affiliative behaviors such as grooming, proximity, and playing. Other various approaches were employed to gather data and these including the following.

STUDY AREA (WAKISO DISTRICT) 680000 80000 0000 00000 200000 00000 Legend Wakiso District Other Districts 80000 680000

THE MAP OF UGANDA SHOWING THE

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Fig. 1. The map showing the study area (UWEC, 2023)

2.2.1 The observational approach

This approach facilitated the observation of chimpanzees in their semi-natural controlled area known as Budongo Chimpanzee Island at UWEC without any intervention (Altman, 1974) by the caretakers (Primate Keepers). The structured methods such as focal, scan, all-occurrence, and ad libitum sampling aided this approach.

2.2.2 The experimental approach

This was used for specific research questions pertaining to dominance, hierarchy, and response to novel stimuli. This design involved the manipulation of chimpanzees' proximity and eating of food while keeping others constant to observe changes in behaviors. This was very evident during the introduction of bamboo poles with the cocktail of honey and ground nuts put in their internodes. This was important to allow causation analysis.

2.2.3 Longitudinal research approach

This approach was employed while examining changes in social strata for 7 months; this entailed tracking individuals so as to provide insights into behavioral changes. Consequently, this helped to reveal trends and stability in their social hierarchy.

2.2.4 Network analysis approach

Due to the quantitative nature of some data, network analysis was to map and analyze social structures and relationships using interactional data such as grooming and aggression so as to build quantitative graphs of relationships within the chimpanzees' community.

2.3 Population

The targeted population for this research were the ex-situ chimpanzee individuals that have been rescued from diverse areas within the country. The study involved 17 chimpanzee individuals that are always at the Chimpanzees' Budogo Island which is a semi-natural controlled habitat.

2.4 Data Collection Methods and Materials

Data collection was conducted over a period of seven months, spanning weekdays (Monday to Friday) between 9:00 AM and 10:00 AM. The average observation duration per session was one hour. Morning hours were specifically chosen for data collection as this is the time when the chimpanzees are released from their night dens to the Budogo Chimpanzee' Island. Before their release, food is strategically scattered across various locations on the island to ensure equitable access for all individuals. This setup encourages natural interactions among the chimpanzees, providing an ideal context for studying their social behaviors and hierarchical dynamics.

Data collection was facilitated through a combination of well-established observational methods, including focal sampling, scan sampling, all-occurrence sampling, and Ad-libitum sampling (Altmann 1974, Bouchard, & Zuberbühler, 2022). These methods allowed for a comprehensive and nuanced analysis of the chimpanzees' social strata, interactions, and behaviors during the early hours of their active period.

2.4.1 Focal animal sampling

Individual chimpanzees were selected, especially the Alpha male and female, were selected as the primary focus of observation. This is because the Alpha chimpanzees are very influential and have alliances with other strong chimpanzees. Subsequently, their behaviors were recorded on a data sheet during an interval of 10 minutes for 2 hours (Fall, 2011).

2.4.2 Scan animal sampling

The researcher collected data from a group of chimpanzees while making observations after every lapse of 10 minutes for 2 hours while writing and recording videos of each individual within their community. With scan sampling, the observations were repeated over time and helped to estimate how much time each chimpanzee spent during the predetermined data collection.

2.4.3 Ad-libitum animal sampling

The behavior of individual chimpanzees that appeared relevant to the study was recorded. These were very significant at the initial phase of the study, especially during the reconnaissance observations. Consequently, the researcher recorded the behaviors of individuals or groups encountered, with little or no reference to specific individual chimpanzees (Boesch et al., 2010. This, too, was a good method for initial observations. It is more of an opportunistic sampling with no restraints (Lehner, 1991).

2.4.4 All-occurrences animal sampling

The researcher selected a few specific behavioral events, such as the environmental enrichment activities and feeding, and recorded every occurrence of those behaviors within the community chimpanzees' (such as the occurrence of grooming, chasing, and others). This technique was significant in determining the rate, frequency, or synchrony of occurrence of specific behaviors of the chimpanzees. The observations made were meant to make a complete record of every occurrence of more predetermined behaviors such as grooming, mating, displaying, closeness, and cooperation (sharing of food) for every individual (Higham, & Hebets, 2013).



Plate 1. Chimpanzees' community grooming and playing (Field data, 2023)

2.5 Data Analysis

Data collected was analyzed using means, percentages and correlation techniques. The analyzed data was then presented in form of tables and line graphs (Humle, et al., 2016).

3. RESULTS

3.1 The Sex Composition of the Chimpanzees' Community

The sex composition of the chimpanzees in respect to this study was inappropriately rationed. This is because 99% of them had been rescued from various places.

Table 1. Sex composition of the chimpanzees' community

Sex	Frequency	Percentage			
Female	10	58.8			
Male	7	41.18			
Total	17	100			
Source: Primary Data (2024)					

Source: Primary Data (2024)

In Table 1, it was observed that the chimpanzee' females contributed the highest percentage (almost 58.8%), whereas the males contributed 41.18%. This implies that the chimpanzees' community in the study area were dominated by females (Langergraber et al., 2007).

3.2 Age of the Chimpanzees

Majority of the chimpanzees were aged between 15-20 years, followed by those between 20-25 years, 5-10 years, and 10-15 years (Table 2). There were no individuals aged between 25-30 years, 30-35 years, and 45-50 years. Only one (1) individual in each case was aged between 35-40 years, 40-45 years, and 50-55 years. The table further illustrates that the mean age of the chimpanzees' community was 20.4 years. This suggests that most chimpanzees were youthful adults.

3.3 Levels of Behavioral Activities among the Chimpanzee Community

Chimpanzees, known for their social nature and intelligence, display a variety of behaviors that can be organized into various levels according to their complexity, purpose, or social context. These behaviors encompass social interactions, tool usage and problem-solving, aggressive feeding actions. foraging and practices. reproductive behaviors, among others (Ivory, 2007). The table illustrates the relationship between the behaviors of chimpanzees.

The correlation matrix provides useful information about the relationships between various behavioral activities in the chimpanzee community (Table 3). To begin, it shows a moderately positive correlation between aggression and mating behavior at 0.3, implying that chimpanzees that exhibit higher levels of aggression may also engage in more mating activities, albeit not strongly correlated. Grooming, on the other hand, appears to have a strong negative correlation at -0.7 with both mating and aggression, implying that as grooming behavior increases, mating and aggression decline. Furthermore, there is a weak positive correlation between grooming and resting at 0.008, implying that those who groom more may also rest more.

Class (Years)	Frequency	Mid-point (x)	Fx
5-10	3	7.5	22.5
10-15	3	12.5	37.5
15-20	5	17.5	87.5
20-25	3	22.5	67.5
25-30	0	27.5	0
30-35	0	32.5	0
35-40	1	37.5	37.5
40-45	1	42.5	42.5
45-50	0	47.5	0
50-55	1	52.5	52.5
	$\Sigma_{f=17}$		$\Sigma_{fx=347.5}$

Table 2. The age pattern of the chimpanzees

Source: Primary Data (2024); Mean Age=347.5/17; Mean Age= 20.4

	Aggression	Mating	Grooming	Playing	Resting	Defending	Closeness		
Aggression	1								
Mating	0.3	1							
Grooming	-0.7	-0.7	1						
Playing	-0.5	-0.5	0.8	1					
Resting	-0.5	-0.1	0.008	-0.3	1				
Defending	0.15	-0.2	-0.1	-0.3	0.1	1			
Closeness	-0.3	0.3	0.1	0.3	-0.1	-0.8	1		
$P_{\text{result}} = P_{\text{result}} = P_{\text{result}$									

 Table 3. Correlation matrix to show the effect of levels of behavioral activities in chimpanzee

 community

Source: Primary Data (2024)

Playing has a moderate negative correlation with defending at -0.3, implying that chimpanzees who engage in more playful activities may be less prone to defensive behavior (DP et al., 2021. Watts et al., 2006. Resting, on the other hand, has no significant correlations with other behaviors, indicating that it is independent of other activities. Finally, defending has a weak positive correlation with aggression at 0.15, implying that chimpanzees who are more aggressive may also be more prone to defensive behavior. Overall, this correlation matrix sheds light on the complex interplay of various behavior community, within the chimp activities highlighting both positive and negative associations between them.

3.4 Behavioral Patterns of the Chimpanzee Community

The chart organizes a range of behaviors, including aggression, movement, grooming, resting, playing, feeding, mating, defending, closeness, and isolation. Columns represent each behavior, with their heights reflecting the observed frequency and intensity of the behavior on a monthly basis. This visual representation allows for a straightforward comparison of how various behaviors vary over time, providing valuable insights into the chimpanzee community's social dynamics, daily activities, and seasonal changes.



Fig. 2. A line graph showing the behavioral patterns of chimpanzees (Primary Data, 2024)

3.5 Behavioral Patterns of Chimpanzees (January–July 2023)

Fig. 2 presents the social behaviors exhibited by the chimpanzee community, including aggression, movement, grooming, resting, playing, feeding, mating, defending, closeness, and isolation, over the seven-month period from January to July 2023. The results are summarized below:

January: In January, playing behavior was the most prominent, recorded at 33.1%, indicating a high level of positive social interaction. Other behaviors included aggression (8.2%). movement (3.7%), grooming (11.8%), resting (10.3%), feeding (11.2%), mating (4.7%), closeness (6.9%), defending (2.8%), and isolation (1.9%).

February: During February, playing remained dominant at 31%, followed closely by movement at 28.2%. Grooming (11.8%), resting (10%), feeding (5.2%), and closeness (9.6%) were also observed, alongside aggression (8.2%). These behaviors reflect positive social dynamics, with active interaction and mobility among the group.

March: In March, playing reached its peak at 37%, with movement recorded at 19%. Grooming (12.4%), resting (9%), feeding (7%), and closeness (10%) were also documented. Aggression decreased to 5%, indicating continued positive interactions within the group.

April: In April, playing was again the most observed behavior at 40%. Other notable behaviors included aggression (10%), movement (19%), grooming (8%), resting (8.4%), feeding (6%), and closeness (9%). This month highlighted the chimpanzees' strong inclination toward engaging in interactive and playful activities.

May: May saw a significant dominance of playing behavior, recorded at 45%. Other behaviors included aggression (18%), movement (7%), grooming (8%), resting (8.4%), feeding (6%), and closeness (9%). The data suggest that the group maintained positive social interactions with relatively low levels of movement.

June: In June, playing behavior reached its highest level at 45.2%, while aggression and movement were recorded at 18% and 17%, respectively. Grooming was minimal at 3%, while defending behavior increased to 11%. Feeding

(6.1%) and other behaviors were observed in smaller proportions. These results underscore the predominance of play in the chimpanzees' daily interactions.

July: In July, playing behavior remained significant at 37%, accompanied by a notable increase in closeness at 20%. Aggression (15%), movement (14%), grooming (6.3%), resting (8.4%), and feeding (9%) were also observed. This indicates a balanced display of interactive behaviors, with a marked emphasis on social bonding.

The findings from January to July 2023 demonstrate that playing behavior consistently dominated the social dvnamics of the chimpanzee community, reflecting a strong inclination toward positive social interactions and group cohesion. The presence of grooming, movement, and closeness further indicates healthy interpersonal relationships and the establishment of social bonds within the group. Variations aggression and defending in behaviors months across were minimal, harmonious suggesting stable and а environment. These results provide valuable into the behavioral insights patterns of chimpanzees in captivity and support the ongoing efforts in their rehabilitation and social integration.

4. DISCUSSION

4.1 The Sex Composition of the Chimpanzees' Community

The female chimpanzees contributed the highest percentage (almost 58.8%), whereas the males contributed 41.17%. This implies that females largely dominate the chimpanzees' community in the study. This is crucial to the social and intergroup dynamics of the chimpanzees' community. According to Borgeaud et al. (2017), 'nonhuman primate species exhibit differences in and intraintersex-based social bonding strategies across communities. Group differences in male and female social strategies appear to be particularly pronounced across chimpanzee populations. Relatedly, for instance, some research in Gombe National Park (Tanzania) and Kibale National Park (Uganda) showed that male-male chimpanzee social bonds are particularly strong compared to females and serve fitness benefits, including facilitating protection from other chimpanzee communities, increasing status, siring offspring, boundary patrols, and hunting cooperation, as well as food sharing between males (Feldblum et al., 2021; Gilby et al., 2013; Mitani, 2006, 2010; Mitani, 2006; Mitani et al., 2001; Watts et al., 2006), and can last over a decade (Bray, 2020). In one exception, when assessing long-term association patterns across five wild populations that differed group sizes, sex ratios, and general in demographic makeup, chimpanzees were predominantly associated with same-sex partners. However, the sex composition in the study area is not determined by nature but rather is determined by the number of rescue cases.

4.2 The Age Composition of the Chimpanzees

The study revealed that the mean age of the chimpanzees' community is 20.4 years. This suggests that most chimpanzees were youthful adults. The age of the chimpanzees is very fundamental during their rehabilitation process (Llorente et al., 2015). The reason for such an age is largely attributed to the circumstances under which the chimpanzees are rescued; according to the documentation of the records that were reviewed, the study established that 99% of the chimpanzees in the study area were rescued from various walks of life at an infancy purpose for rescuing The voung age. chimpanzees is because the trade of wildlife species is categorical: either traded as wildlife products or as live species. Preferably, the chimpanzees are always wanted on the black market when they are alive; this is largely due to their purposes, such as laboratory tests and being used as pets as well in the zoos as a potential tourist' attraction. This argument is in tandem with the findings of Nuwer (2023), who revealed that "Most of the African apes go to China, Pakistan, Libya, or the Gulf Statesespecially the United Arab Emirates-where they become pets or, increasingly, attractions at private zoos. Some 10,000 zoos opened in China between 2013 and 2020, nearly doubling the total number". These revelations underscore the reason why most ex-situ facilities for wildlife have chimpanzees that are young.

4.3 The Chimpanzees' Behavioral Patterns

During the period of the study of the chimpanzees' behavioral patterns, many of the chimpanzees in captivity largely spent much of their social behavior playing and moving. Behavioral categories that were recorded include playing, feeding, closeness, movements,

mating. groomina. aggressions. defendina. restina. closeness. and isolation. The chimpanzee community is primarily dominated by the category of playing and movements, which are attributes of harnessing social cohesion within the chimpanzees' community. For instance, the category of praying was above 30% throughout the study. The purpose for playing and movements dominating the social behavior of the chimpanzees is largely due to the age (20.4 years) of most of them and the fusionfission relationship. This finding resonates with the findings of Project (2023), which established that chimpanzees' complex family and social interactions are essential to them; family relationships are vital to chimpanzees. They live in extended family groups of as many as 20-120 individuals. They have a fission-fusion social organization in which they break off into smaller interchangeable groups and periodically come together. Chimpanzees live, eat, hunt, and play communally in groups. Usually, these groups consist of 20 or 30 individuals but can grow to several dozen. The movements that were recorded denote the "fission-fusion social organization". Additionally, many movements manifested by the chimpanzees are meant to prevent high concentration of individuals in one place and also help to break the monotony and avoid other associated social stereotypes such as over-grooming. This fact is supported by previous studies (O'Neil, 2012), which found out that "most non-human primate communities are more or less close to contact with members of other communities. Most often, they are tied to a particular locale and rarely migrate outside of their home range. This aloofness from other high troops prevents concentrations of individuals, which could result in the rapid depletion of local resources. Communities usually avoid each other and are aggressive toward outsiders. As a result, social interactions between members of different troops are usually very rare, especially for females. However, this is in contrast with other studies (Manning, 2024) that asserted that "Play is not very common in the wild, at least among adult animals. Natural selection tends to suppress the costly exercise after it serves its purpose for development, and the time comes to focus on finding food, watching out for predators, and mating. With chimps, however, adult play serves to cement social bonds."

This study found that there is a positive correlation between aggression and mating behavior (Table 3), implying that chimpanzees

that exhibit higher levels of aggression may also engage in more mating activities. This finding is in line with other previous study by Feldblum et al. (2021) where social bonds offer short and long-term benefits. In Gombe National Park (Tanzania) and Kibale National Park (Uganda), it showed that male-male chimpanzee social bonds are particularly strong compared with bonds among females and serve fitness benefits, including facilitating protection from other chimpanzee communities, increasing status, siring offspring, boundary patrols, hunting cooperation, and food sharing between males. Consequently, among the chimpanzees' hierarchy, aggressive individuals tend to be somewhat influential within their community, which implies that the females would prefer to mate with them for strategic purposes such as to avoid being attacked by them in the future as well as to establish a relationship that would protect the female from other aggressive males.

5. CONCLUSION AND RECOMMENDA-TIONS

5.1 Conclusion

The study revealed that proximity and grooming behaviors are predominant in the chimpanzee community, highlighting their importance in maintaining social cohesion. This reinforces the idea that social bonding activities significantly influence group dynamics and individual wellbeing. Additionally, the findings demonstrated that varying levels of behavioral activities, such as grooming, sharing, and searching, play a crucial role in shaping the social structure of Increased chimpanzees. grooming was associated with decreased aggression and increased mating behaviors, suggesting that promoting such interactions can enhance chimpanzees' community harmony. This further demonstrates that a broader understanding of these behaviors is very critical to ensuring that a successful chimpanzee rehabilitation process. Additionally, the prominence of grooming and proximity behaviors further aligns with the observed correlations between increased social bonding and reduced aggression, reinforcing the importance of these behaviors in rehabilitation efforts.

5.2 Recommendations

1. Encourage future research that includes longitudinal studies to track rehabilitated chimpanzees' behavior and social

dynamics over time. This research can provide valuable insights into the longterm effectiveness of different rehabilitation strategies.

- 2. Provide ongoing training for animal caretakers focused on chimpanzee ethology, behavior management, and social dynamics. This will empower staff to better understand and respond to the needs of the chimpanzees, enhancing overall welfare.
- 3. The prospective release of the chimpanzees back in the wild, is critical to enhancing the genetic pool of those in the wild, therefore the study recommends that research should also focus on individuals in the wild as well.
- 4. Establish a systematic monitoring and evaluation framework to assess the effectiveness of rehabilitation strategies. Collect data on behavioral changes, social interactions, and overall well-being to inform future practices and improve rehabilitation outcomes.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

FINANCIAL DISCLOSURES

This research was privately funded.

DATA AVAILABILITY

The data presented in the manuscript is available on request.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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