


RESEARCH ARTICLE

First observation of a chimpanzee with albinism in the wild: Social interactions and subsequent infanticide

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Abstract

Albinism—the congenital absence of pigmentation—is a very rare phenomenon in animals due to the significant costs to fitness of this condition. Both humans and non-human individuals with albinism face a number of challenges, such as reduced vision, increased exposure to ultraviolet radiation, or compromised crypticity resulting in an elevated vulnerability to predation. However, while observations of social interactions involving individuals with albinism have been observed in wild non-primate animals, such interactions have not been described in detail in non-human primates (hereafter, primates). Here, we report, to our knowledge, the first sighting of an infant with albinism in wild chimpanzees (*Pan troglodytes schweinfurthii*), including social interactions between the infant, its mother, and group members. We also describe the subsequent killing of the infant by conspecifics as well as their behavior towards the corpse following the infanticide. Finally, we discuss our observations in relation to our understanding of chimpanzee behavior or attitudes towards individuals with very conspicuous appearances.

KEYWORDS

albinism, infanticide, *Pan troglodytes*

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1 | INTRODUCTION

Color variation in skin, eyes, hair, fur, or feathers is influenced by the availability and distribution of melanin, the pigment responsible for coloration (Hofreiter & Schöneberg, 2010). A shortfall in, or total lack of, melanin production in some body regions, or throughout the entire body, can contribute to anomalous pigmentation or the absence of pigmentation (Acevedo & Aguayo, 2008). Extreme deficits of melanin are rare in wild individuals, but instances have been recorded in diverse animal species including both vertebrates and invertebrates (Abreu et al., 2013; McCardle, 2012).

Albinism is the result of the expression of recessive alleles belonging to several different genes that disrupt melanin pigmentation (Owen & Skimmings, 1992). Several factors have been associated with the occurrence of albinism. Environmental stress and, in particular, inbreeding, have been hypothesized as possible causes (e.g., Bensch et al., 2000). Anomalous coloration due to melanin deficiency has been usually classified as either partial (piebaldism and leucism) or total albinism. Piebaldism has been described as a lack of pigmentation in some parts of the body, but with typical coloration in the eyes (Fertl & Rosel, 2009; Miller, 2005). Leucism is described as a total or partial absence of pigmentation in the whole body, but with the eyes and/or body extremities still having dark or blue pigmentation (Acevedo & Aguayo, 2008; Fertl & Rosel, 2009). Total albinism presents as a complete absence of pigmentation in the whole body including the eyes, which have no traces of pigmentation (Acevedo & Aguayo, 2008; Fertl & Rosel, 2009; Miller, 2005). In humans, the eye sclera is typically white and remains so in individuals with albinism. However, the iris, highly variable in color in typical individuals, is a pink or red color in individuals with albinism. In most non-human primates, and all non-human apes, both sclera and iridial color vary substantially, the sclera varies from pale to black, and the iris from light to dark brown (Kobayashi & Kohshima, 1997; Mayhew & Gómez, 2015; Perea-García et al., 2019).

Albinism is extremely rare in vertebrates, especially in mammals (McCardle, 2012). In humans, globally, only one person in 17,000–20,000 people has albinism (Witkop, 1979). Although rare, the prevalence of albinism in some human populations appears higher than in other primates or mammals (e.g., Hong et al., 2006). In non-human primates, only a few instances of albinism have been observed in wild populations: In Toque macaques (*Macaca sinica*), Bonnet macaques (*Macaca radiata*) (Fooden, 1979; Mahabal et al., 2012), and in spider monkeys (*Ateles geoffroyi*) (Espinal et al., 2016). Furthermore, only two instances of a great ape with albinism have been recorded: A male western lowland gorilla (*Gorilla gorilla gorilla*) captured in the wild as an infant and subsequently kept in captivity until his death as an adult (Prado-Martinez et al., 2013; Sabater Pi, 1967) and a female western chimpanzee (*Pan troglodytes verus*) also captured in the wild at the age of several weeks and kept in captivity until her death at the age of 9 years for unknown reasons (Tacugama Chimpanzee Sanctuary; <https://www.tacugama.com>). However, to our knowledge, there have been no observations of an ape with albinism interacting with conspecifics in a natural environment.

Individuals with albinism in the wild face several challenges that impair survival. First, they are conspicuous in most environments making them vulnerable to predation (Uieda, 2000). Second, albinism is associated with serious bodily defects such as abnormal eye development resulting in poor vision and reduced protection against sunlight that can increase susceptibility to cancer (Forrest & Naveen, 2000; Heiduschka & Schraermeyer, 2008). Finally, individuals affected by albinism potentially face challenges in conspecific interactions. For example, it has been suggested in tiger sharks (*Galeocerdo cuvier*) and giant electric rays (*Narcine entemedor*) that individuals with albinism may be less attractive as mates and, therefore, fail to reproduce (Sandoval-CaStillo et al., 2006). One particular aspect that remains understudied is how albinism can affect social interactions. A few anecdotal observations in birds have shown both agonistic (Roberts, 1978) and tolerant (Forrest & Naveen, 2000; Garner, 1997) attitudes towards individuals with albinism; however, to our knowledge, there are no similar reports in non-human primates. Here, we report a unique observation of an infant with albinism in the wild Sonso community of East African chimpanzees (*Pan troglodytes schweinfurthii*) in the Budongo Central Forest Reserve, Uganda. We provide a detailed observational account of behavior exhibited by other chimpanzees from this community towards the infant and its mother. First, we describe an initial encounter of several members of the community with the infant. Second, we report the killing of the infant. Third, we describe behavior exhibited by third-party chimpanzees towards the corpse of the infant immediately following the infanticide. Finally, we provide results of the autopsy of the infant and other details regarding its apparent health.

2 | METHODS

2.1 | Ethical approval

All applicable international, national, and/or institutional guidelines for the care and use of animals were followed. The study was approved by Uganda Wildlife Authority and the Uganda National Council for Science and Technology. The study complied with the American Society of Primatologists Principles for the Treatment of Non-Human Primates and Code of Best Practices in Field Primatology.

2.2 | Study site and study subjects

Observations were recorded in the Sonso chimpanzee community of the Budongo Forest Reserve, Uganda. At the time of the observation, the community consisted of 75 individuals, with a core home range of around 6 km². The group has been continuously studied since 1990 and is well habituated to the presence of human observers (Reynolds, 2005), with researchers and field collaborators following the chimpanzees and collecting observational data on their behavior every day, all year round, from around 07:00 a.m. to 04:30 p.m.

3 | RESULTS

3.1 | Initial encounter of the infant with albinism by party members

UP, a young adult female, with an estimated age of 19 years, immigrated into the Sonso community in May 2012. She produced her first recorded infant in July 2017, which was killed in within-group infanticide by Sonso males at around 2 days old. In January 2018, the veterinary team confirmed UP to be pregnant and on July 15, 2018, UP was seen carrying a "white" infant which we later confirmed to be a male chimpanzee affected by albinism. Before the first sighting of UP with the infant, the Sonso research team had last seen her on June 24, indicating that, at first sighting, the infant was no older than 19 days and, judging from its size and appearance, not younger than 2 weeks.

In the morning hours of July 15, immediately before the initial sighting of UP with the infant, an experienced field assistant (Gideon Monday) was following a party of two adult males: FK and ZL. At 8:43 a.m., FK and ZL rushed in the direction of screams heard at around 300 m away. FK was the first one to reach the area, where it was observed that UP was screaming. Two other adult individuals were in the party: An adult male SQ and an adult female ML (with her dependent offspring) feeding at 30 and 20 m from UP, respectively. Both SQ and ML were producing alarm hoos and waa barks: Calls that chimpanzees typically produce when encountering potentially dangerous animals such as snakes, bush pigs, or unfamiliar humans (Crockford et al., 2012; Slocombe & Zuberbühler, 2010).

Immediately after reaching UP, FK charged at her and hit her. UP reacted by screaming and waa barking at FK, who climbed a nearby tree and watched UP from a distance. While in the tree, FK produced a series of alarm hoos and waa barks. The infant could be seen clinging to UP's chest. Around 3 min later, ZL appeared pilo-erect and approached UP. He stopped at a distance of 3 m from UP and gave a series of alarm hoos followed by waa barks, at which point UP climbed a tree. Around a minute later, an older adult female NB arrived in the party, climbed the tree UP was in, and sat at a distance of 1 m from UP. NB appeared calm and silent, watching UP's infant attentively. KC, a late adolescent male, joined and climbed the tree, approaching UP to within 1 m. UP responded by barking and arm flinging towards KC, who ran away. Soon after, an adult male KZ arrived and approached UP within 1 m and extended his hand towards UP apparently to reassure her. UP responded by reaching out towards KZ and the two shook hands, after which KZ climbed down the tree. After around 2 min another adult female, OK, arrived alarm hooing and waa barking while looking at UP from a distance. Three minutes later, UP climbed down the tree and entered a dense thicket obscuring further observations. At 10:47 a.m., field assistant Gideon Monday and researcher Pawel Fedurek located UP and the infant in an opening of the thicket. She was being disturbed by KC who was again trying to approach the infant. At around 11:00 a.m., UP moved out of sight again. At around 11:30 a.m., GM and PF again saw UP in

an opening of the thicket and observed an adult male SM joining the party and responding with a tantrum scream on encountering (likely unexpectedly) UP and the baby at a close distance. At this point, UP again entered dense vegetation and no further observations were possible on that day.

3.2 | Infanticide of the infant with albinism

A detailed chronological description of the event is provided in Supporting Information Material 1. At 7:33 a.m., on July 19, field assistant Bosco Chandia and researcher Maël Leroux arrived at a large party of chimpanzees. The chimpanzees were producing agonistic and alarm calls such as hoos, waa barks, and screams. An aggressive interaction was taking place within the party, but they were located within a dense thicket and it was not possible to confirm the individuals involved. Judging from the sounds, the aggression involved repeated physical contact. The screams of an infant were also heard. At 7:34 a.m., HW, the alpha male, emerged from the thicket holding the infant with albinism screaming against his belly with his right hand. The infant's left forearm was missing and the wound was fresh, so likely resulted from the recent out-of-sight aggression. Three adult males (SM, FK, and ZL) followed HW displaying (running pilo-erect). The males were followed by UP; three other adult females (ST, NB, and ML), MB and MZ (ML's juvenile and infant sons, respectively), and one subadult male (KC), all of whom were giving waa barks, apparently towards HW. HW climbed up a tree holding the infant by the foot in his mouth and was joined by SM, KZ, KC, ML, MB, and MZ. At 7:36 a.m., HW started biting the fingers, legs, and the right ear of the infant while sitting on the tree with the baby clinging to his belly screaming, followed by ML approaching the infant and sniffing it. At this point, FK climbed the same tree and sat 5 m away from HW while UP, still screaming and barking, was chased by SM and subsequently left the party.

At 7:38 a.m., HW and FK turned towards adult female ML who took the infant, leaned towards it, and observed it. ML moved away and started biting the limbs and the head of the infant while MB and MZ repeatedly approached it and sniffed it. At 7:41 a.m., ML bit the infant's head repeatedly, apparently causing its death as the infant remained silent and stopped moving after the bite.

3.3 | Behavior of party members towards the carcass of the infant with albinism

At 7:42 a.m., FK approached and took possession of the carcass after ML dropped it on a branch. ZL approached and touched the carcass while FK approached and sniffed its anus and foot. At 7:44 a.m., FK repeatedly inspected the carcass, sniffing and touching it, and grooming its back. FK also examined the genital region, touching the testicles and then placed his finger on the anal region before sniffing it. At 7:49 a.m., juvenile male OZ approached the carcass, sniffing the

anal region while FK resumed the inspection of the genitals, back, and arm. After moving away briefly, OZ approached the carcass again and sniffed the back of its head as FK moved away. OZ grabbed the right leg of the carcass before sniffing the anal region, stepping over the body, and looking at it from a distance. At 7:50 a.m., OZ sniffed the anal region again and then placed his hand on the back of the body and stroked it twice, and then ran away from the body. A few seconds later, MZ climbed down the tree and both OZ and MZ approached the carcass. After looking at it for approximately 30 s, OZ reached the carcass, approached the head of the body, and sniffed it. MZ reached the carcass a few seconds later and sniffed the anal region of the carcass while OZ looked at it. At 7:52 a.m., OZ touched the back of the corpse followed by MZ who manipulated the testicles and stroked the back of the carcass with his hand. As OK (OZ's mother) grunted, MZ moved away from the carcass and OZ resumed moving its hand against the body's back hair. OZ then repeatedly inspected, sniffed, and manipulated the genital and anal region of the carcass as well as his fingers. MZ came back and resumed inspecting the carcass in a similar manner as OZ. At 7:53 a.m., both infants resumed touching the hair of the carcass and stroking its back (see Figure 1 and Supporting Information Material 2), then both ran away from the corpse and moved towards other individuals from the party that was vocalizing at a distance.

At 7:54 a.m., FK approached the carcass again, picked it up, and moved 4 m away holding it by the foot. He bit part of the palm of the right hand of the carcass and immediately spat it out. MZ and OZ again approached the carcass to sniff it. At 8:09 a.m., FK placed the carcass in a tree branch and after grooming its back, moved around 7 m away to rest. At 8:25 a.m., ZL approached the dead infant, sniffed it, touched its penis and anus. ZL then inserted a digit into the anus of the carcass, moving the digit in and out before sniffing it. After 10 min of repeated manipulations and inspections of the corpse, ZL moved away. At 8:36 a.m., ST approached the carcass and inspected it by sniffing and touching it. ST was joined by KZ who also inspected the carcass. Both ST and KZ inspected, sniffed, manipulated, touched, and groomed the carcass repeatedly for 8 min. Notably, at 8:42 a.m., KZ pinched some hair on the right arm of the carcass with his lips before doing the same on his own body. At 8:44 a.m.,



FIGURE 1 The dead body of the infant with albinism inspected by two infants, MZ and OZ, stroking its back and sniffing it, respectively. Picture by Maël Leroux

ST and KZ moved away, after which OK and OZ approached the carcass. OK and OZ repeatedly inspected, sniffed, manipulated, and touched the carcass for around half an hour. During this time, ST returned to the corpse twice and sniffed it briefly. OZ touched the anal region before sniffing it. At 9:15 a.m., OZ started carrying the carcass holding it by the leg and dropped it on the ground. The carcass was later collected from the ground by the veterinary team for an examination.

In summary, from 16 individuals present in the party at the time of the death of the infant, 10 came into direct contact with the dead body (including one subadult and two adult females, and one infant, two juveniles, and four adult males). All these individuals carefully inspected the body, with particular focus on the back hairs and the anogenital region.

3.4 | Autopsy results

The autopsy was performed on July 19 within 3 h of death. The infant weighed 2.1 kg and its date of birth was estimated at around July 1, 2018. Total absence of pigmentation was noted for the skin, hair, and eyes. Substantial injuries were present in several body parts including the absence of the left hand and forearm, the index and middle fingers on the right hand, and the right ear (see Supporting Information Material 3; note that the images contain graphic content). In addition, several deep cuts were visible on the head and the skull was cracked on the right side (see Supporting Information Material 3). The right hemisphere of the brain was damaged. The cause of death was established to be due to a head injury caused by a bite given by an adult female chimpanzee (ML).

4 | DISCUSSION

We describe here, to our knowledge, the first observation of a chimpanzee with albinism in a wild ape population. Importantly, we provide a unique account of interactions between the community members and the infant with albinism (and its mother) upon initial encounter and during the day of the infanticide.

The initial reaction of community members towards the infant appeared to be different from a typical situation in which chimpanzees encounter females with a newborn for the first time. Community members of both sexes often show signs of curiosity towards a newborn upon first sighting, such as grooming the mother or looking attentively at the newborn, touching, or grooming it (Goodall, 1986; Gideon Monday and Pawel Fedurek, personal observation). While individuals can respond to such events with excitement or aggression, particularly in the study community where infanticides are common (Lowe et al., 2019), interactions which included apparent fear towards a newborn are unusual and have not been observed to the same extent as seen on this occasion.

Although it is not possible to draw firm conclusions from this one observation, it appears that the encounter with the infant with albinism had an arousing effect on most adult community members.

For example, even though some individuals responded calmly to the infant, most adult individuals seemed to react with fear upon encountering the newborn by keeping distance and producing alarm hoos and waa barks. In chimpanzees, these two call types are associated with risky, and potentially deadly situations, such as encountering snakes, bush pigs, or unfamiliar humans (Crockford et al., 2017; Goodall, 1986; Schel et al., 2013). Notably, this initial, apparently fearful, behavior was followed by physical aggression towards the infant and eventually death. In this respect, our observation shares similarities to those recorded in some bird species, where agonistic behaviors towards individuals with albinism were observed (Roberts, 1978).

The captive infant female chimpanzee Pinkie, the only other known chimpanzee with albinism, was captured alive in the wild as a newborn. However, it is not possible to establish how the original community members had reacted to, or interacted with, her before her capture (or whether they had seen her in the first place) as no such records before the capture exist. Similarly, the account of the successful introduction of Pinkie to a group of captive chimpanzees has not been published, which makes it difficult to establish whether and how an introduction of an infant with albinism to a group of stranger chimpanzees differs from an introduction of an in-group chimpanzee infant. We consider, therefore, our descriptive account of interactions of several conspecifics with an individual with albinism from the same wild community as unique.

The Sonso community has a history of infanticide committed by both adult males (Newton-Fisher, 1999) and, more rarely, females (Lowe et al., 2019; Townsend et al., 2007), which includes frequent within-community killings (Lowe et al., 2019). It is, therefore, possible that the infant with albinism would have become a victim of infanticide regardless of its appearance. The way the body was mutilated did not differ considerably from the way bodies of chimpanzee victims of within-community killings are often afflicted (Lowe et al., 2019; Wilson et al., 2014). For example, fingers of the right hand were bitten off, so was (partially) the left foot (see Supporting Information Material 3). However, the magnitude of the reaction some of the community members exhibited towards the infant with albinism makes it likely that the infant was not considered as a typical chimpanzee. The vigilant and even fearful behavior including alarm calling by individuals upon the initial exposure to the infant seems to support this idea.

Similarly, the careful and repeated inspection of the carcass by several individuals ranging from infants to adults of both sexes does not seem to be a typical behavior that chimpanzees direct towards a dead infant. Indeed, in contrast to our observation, most studies report that mainly the mother, and sometimes kin, initiate extended contact with a dead infant, sometimes displaying affiliative behaviors towards it, such as grooming (Biro et al., 2010; Cronin et al., 2011; Lonsdorf et al., 2020). Furthermore, in our study, one adult male was seen using his lips to pinch the hair of the dead infant, and several other individuals were seen stroking the hair of the carcass. Such behaviors have not been reported before in the context of infanticide in the Sonso community (Lowe et al., 2019; Catherine Crockford,

personal observation), and could have been elicited by the unusual pigmentation of the infant. Indeed, the behavior of the chimpanzees towards the corpse of the infant with albinism resembles that of chimpanzees when presented with a novel object: Chimpanzees usually engage with such objects with initial caution followed by examining it carefully and touching it (Russell et al., 1997). However, some of the behaviors of group members towards the carcass of the infant with albinism, such as grooming it—a behavior previously described in this context in non-human primates including chimpanzees (Gonçalves & Carvalho, 2019), clearly indicate that the infant was not perceived by them as an object, but as a conspecific of an unusual appearance. However, since observations of chimpanzees interacting with individuals of atypical appearance are very rare, more data of this kind are needed to explore the cognitive mechanisms behind this behavior. Likewise, although our unique observations are potentially relevant to the understanding of chimpanzee death perception (e.g., Gonçalves & Carvalho, 2019), more data of this kind are needed to investigate the cognitive processes underlying it.

The inspection of the carcass by individuals often focused on the anogenital regions, with several individuals inserting their fingers into the anus of the carcass. To our knowledge, only one observation of this kind has been made in chimpanzees before: An adult female inserting a digit in the anus of the former alpha male dead body (Pruetz et al., 2017). In our study, both adult and infant males were seen inserting a digit in the anus of the infant with albinism. Several mammal species possess anal glands that play a role in olfactory communication. For example, anal gland secretion conveys information about kinship in beavers (*Castor canadensis*) (Sun & Müller-Schwarze, 1998) and lemurs (*Lemur catta*) (Charpentier et al., 2010). In spotted hyenas (*Crocuta crocuta*), individuals discriminate identity and social status of a conspecific through anal gland scent (Burgener et al., 2009), whereas black rhinoceros (*Diceros bicornis*) can differentiate sex and age using gland scent (Linklater et al., 2013). Chimpanzees also use olfactory communication when identifying the recent presence of individuals from other communities in their territory (Henkel & Setchell, 2018). Furthermore, another study on chimpanzees reported an observation of the mother and another adult female bringing their hands towards their face after touching a dead infant as if to gain information about its body (Cronin et al., 2011). Our observation potentially indicates that olfactory cues were used to gain information about the infant with albinism because, for example, it was not perceived by conspecifics as a typical individual or an individual from their own territory.

Although in some species individuals with albinism tend to have smaller body sizes (Slagsvold et al., 1988), the size of the infant in this study was normal considering its estimated 3 weeks of age. Autopsy results did not reveal any apparent major health issues and, during the initial encounter, the infant appeared to behave normally. Thus, we have no observations that suggest that the peculiar behavior of the chimpanzees towards the infant, or its carcass, were driven by any potential morphological abnormalities of the body except its coloration. It is important to note, however, that histopathology tests on the carcass were not conducted, and therefore, we do not have

detailed information about the infant's health. The white coloration of the infant bears similarities to that of black and white colobus monkey (*Colobus guereza*) infants that Budongo chimpanzees often prey on (Reynolds, 2005). Therefore, another intriguing possibility is that the infant's pattern of coloration matched features of this community "prey image" (Uehara, 1997), but with the form and odor of a chimpanzee and this incongruence could explain the behavior of some of the individuals towards the infant.

To conclude, we provide a unique account of behaviors of wild chimpanzees towards an infant with albinism before and following its death. Our observations provide insights into chimpanzee behavior in extremely rare social circumstances.

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CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

AUTHOR CONTRIBUTIONS

Maël Leroux: data curation (equal); writing original draft (equal); writing review & editing (equal). **Gideon Monday:** data curation (equal); writing review & editing (equal). **Bosco Chandia:** data curation (equal); writing review & editing (equal). **John W. Akankwasa:** data curation (equal); writing review & editing (equal). **Klaus Zuberbühler:** project administration (equal); writing review & editing (equal). **Catherine Hobaiter:** data curation (equal); writing review & editing (equal). **Catherine Crockford:** funding acquisition (equal); writing review & editing (equal). **Simon W. Townsend:** funding acquisition (equal); writing review & editing (equal). **Caroline Asimwe:** data curation (equal); writing review & editing (equal). **Pawel Fedurek:** data curation (equal); writing original draft (equal); writing review & editing (equal).

DATA AVAILABILITY STATEMENT

All data is available upon request.

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