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Zoochosis: A short review on stereotypical behavior of captive animals

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Abstract
Zoochosis is a stereotypical behavior of animals. It is commonly observed in captive animals. The stereotypic activities in animals are tiresome in conduct, consistent in practice, with no seeming goal or definite purpose. Common forms of Zoochotic conduct in captive conditions include head rolling, striding, extreme licking, hair or feather pulling, and outline swimming. Various studies that explained the effects of stimulus's expectedness on animal conduct and welfare have been inclined to manipulate certainty. Zoos play an animated part in wildlife and are ex-situ protection sites which are playing a lively part in wildlife supervision and protection. However, Zoo tourists might serve as an important cause of stress on captive animals. These stresses result in self-biting and hurting in captive animals which is comparable to self-injurious behavior (SIB) in humans. This review article would highlight the conditions of captive animals and analyze the factors that are directly affecting captive animals.
Keywords: Tiresome, Behavior, Captivity

Introduction
Zoochosis or stereotypes are tiresome conduct, consistent in practice, with no seeming goal or purpose, and usually irregular behaviors shown in captive animals (Garner, 2003; Mason, 2010). These are also known as mental disorders (Stoner, 2013). Common forms of zoochotic conduct in captive conditions include head rolling, striding, extreme licking, hair, or feather pulling, pacing, and playing with the food items, unsuitable socio-sexual conduct, and outline swimming (Marriner and

Drickamer, 1994; Jafari Shahani, 2022). Stereotypes frequently ascend when an imprisoned animal has extended contact with a significant problem and they are unable to resolve this, inside its inclusion. Such environmental problems include discovering a mate, pursuing food, and avoiding human interaction (Shepherdson, 1989). The frustration triggered by the animal's incapability to bring out firm goal-oriented activities usually leads to stereotypic conduct. It is stated hens that if they are not provided with suitable nesting places then they started to show stereotypic striding (Duncan, 1970). Stereotypies can also progress if the imprisoned animals are enforced to live in atmospheres with stubborn and inescapable stress and anxiety. In substandard infertile surroundings stereotypes are much more apparent than in enclosures that offer species suitable ecological habitats (Mason and Latham, 2004). It is also under consideration that captive sites should be kept away from the cities as it was in practice in old times however, due to urbanization these are now surrounded by buildings, and transport and are contaminated with heavy metals as compared to those sites which are away from cities (Yasmeen et al., 2018; Yasmeen et al., 2020). The number of metals can be a possible reason for the anti-predator relationship (Lefcort et al., 2000). Anti-predation is also stereotypic conduct (Tran, 2014).

In captivity, animals showed different psychological behaviors such as anxiety, depression, and obsessive-compulsive disorder (OCD), similar to human psychology (Jones, 2016; Kumar, 2021). These behaviors can limit animals from intermixing with their natural environment in a species-characteristic manner. Animals that contribute to persistent stereotyped obsessions sometimes display an overall decline in interactive diversity among the species (Garner et al., 2003). Abnormal fragmentation of habitat and the incapability to interact suitably with the new environment provide evidence for the neglected welfare of animals that results in distress. The representation of stereotypies is regularly increased in irrelevant conditions connected with reduced welfare. Sterk, (2013) proposed that the 'Zoochosis term can be used as a comprehensive term for all deceptively functionless, tiresome behaviors, even when the precise motorized patterns elaborate are flexible. In combination with the more extensively documented stereotypic obsessions (head rolling, pacing, etc.), anomalous behaviors such as roaming, squeaking, anxiety, spewing, and coprophagia (feeding on excrement) and urophagy are frequently witnessed in captive animals (Marriner and Drickamer, 1994). These actions are related to stereotypes because they repeatedly become ritualized and tiresome; Irrespective of how abnormal behaviors are categorized, their incidence is problematic as they are enormously pervasive in captive apes (especially gorillas), and due to their hostile nature

(Akers and Schildkraut, 1985). In response to apprehensions about animals' safety and the educational understanding of the Zoo, numerous Zoos are executing enrichment platforms to reassure natural behavior outlines that estimated behaviors found in the wild environment (Table 1).

Table 1. Minimum Requirements for Leopard Enclosure (Maulana et al., 2020)

Name	Definition
Minimum size of the enclosure	28 square meters no specific width/length is defined
Height	Minimum height of 11.4829 Foot
Roof	cages must be enclosed with a roof
Ameliorations	1. Placement of climbing elements such as a tree, a branch, and a platform. 2. Minimum at least one elevated resting place. 3. Instructed to provide a puddle. 4. Instructed to provide food supplementations.

On these occasions, the role of ecological enrichment is to offer the captive animal the stimulus desired to contribute to species-characteristic behavior and to surge the extent of time the animals occupy in goal-oriented behaviors (Sambrook and Buchanan-Smith, 1997). Two issues pretense specific tests to the welfare of captive animals. One of the challenges is the absence of inconsistency and encouragement in the animals' existence. The second challenge is the continuous incidence of human visitors to the Zoo, who might offer some stimulus but whose occurrence or behavior may be traumatic. Ecological enhancement is currently used to solve the principal of these harms, to counter the glitches of a straightforward environment. The second problematic situation is much more challenging to address, as tourists are part of the cause for Zoos' survival and their figures and behavior are very hard to forecast or regulate. Enslaved environments are identified to induce abnormal behavior outlined in a diversity of species, containing non-human primates. Averting natural behavior in animals can stretch to anxiety and hindrance and harm the growth of brain parts that are intricate in behavioral patterns, thus dropping the animal's capability to act submissively and suitably (Hook et al., 2002; Bonier et al., 2007; Mason and Rushen, 2008; Poole and Granli, 2009). To explore whether the witnessed disparity in the well-being of diverse species might ascend from a differential influence of imprisonment on their natural behavior is shown in Table 2.

Table 2. Zoochosis behavior reported in different animals

Sr No.	Species	Type of Zoochotic behavior	References
1.	Siberian tiger, and other tigers	Excessive dental wear, pacing, anxiety	Konjević et al. (2015); Haque (2011)
2.	Javan leopard	Stereotypical pacing	Maulana et al. (2020)
3.	Apes	Depression	Haque (2011)
4.	Crocodile	Bent their tail and stop eating	
	Elephant	Annoyance and stress, attack on their keepers, etc. Camels also showed aggressiveness in the rain	
	Giraffes		
	Zebra		
	Camel		
5.	Orangutans	Depression in males after the death of their female, females start to sleep and prefer to live in the enclosure after the death of their babies, show aggression in rain	
	Chimpanzees and other primates	Sensitive to rain, shouting, jumping around, pacing, etc.	

If the captive conditions do not fully tailor to the species-definite requirements then it enforces unusual stress or obstruction that is termed an alarm reaction and observed as weaknesses in the animal's physical and psychological health (Weinberg and Levine, 1980; Jones, 2016). This may be apparent in the growth of sickness or unusual behavior (Mason, 2005).

Effects of captivity on the reproduction of animals

The association between Zoochosis and reproduction remains uncertain and, amazingly, only few studies focused on this question. Although, this question demands much more studies. A few studies described a negative association between zoochotic animals and reproduction (Clubb and Mason, 2007; Mason, 2010; Benhajali et al., 2014) while others have evidenced that stereotyping in animals showed better reproduction and reproductive feat (Benhajali et al., 2014). These inconsistent outcomes may curtail from the multifaceted association amongst stereotypies as (extremely) stereotypic animals: 1) are much lively, subsequently in improved physical capability connected with developed fertility (Jeppesen et al., 2004) (2) have established a managing answer that decreases stress, increasing hypothalamic—gonadal axis collective functions, and therefore reproductive yield (Mason and Rushen, 2008) or (3) are fewer susceptible to reply to the imprisoned environment with a despair-like condition (Meagher et al., 2017). The later evidence is held by proof from numerous species signifying that entities can reply to the naturally encouraged anxiety moreover by acting repeated stereotypies (Mason and Rushen, 2008). By inconsistency, zoochotic animals may have a

comparatively less effective reproduction rate due to (1) stereotypic animals have complex stress intensities which are related to repressed HPG axis functions or (2) extremely stereotypic animals are more behaviorally unconstraint, which settles courtship behavior, and/or parental care (Garner et al., 2003). It is still uncertain which of these shreds of evidence may best describe the association between captivity and reproductive outcome, or even if they are equally limited. According to Marriner and Drickamer, (1994) more stereotyped were recorded in hand-reared animals as compared to normal breeders. Irrespective of all, more experimental effort is essential to untangle these complex relations between captive animals and reproduction (Faust and Thompson, 2000). Sex distribution theory expects that females in better situations should prefer young ones' production towards the sex with greater reproductive variance (Roberts, 1972). In polygyny systems, male animals have better variation in the reproductive act. Parental investment can yield more competitive males that produce more offspring. The proof gathered in humans and animals showed that females existing intense, suboptimal situations showed production of females, and this influence is often facilitated by glucocorticoid levels (Bonier et al., 2007; Navara, 2010). Therefore, stress level varies within organisms in captive conditions which affect reproduction. Stereotypic behavior may also be connected with birth sex relations by two separate means. If increased stereotyping individuals face high stress or glucocorticoids level, then high stereotypic behavior should relate to female-influenced offspring births. If high stereotypic individuals face less stress or glucocorticoid levels, then they should have male-influenced offspring births (Navara, 2010). So, it is observed that the variable level of stress affects the animal's reproduction ratio.

Psychological effect of captivity on animals

Numerous chimpanzees retained in the laboratory display a range of serious psychological and behavioral anomalies, such as tiresome rocking, sipping of urine, or self-injury (Hook et al., 2002; Bourgeois et al., 2007; Bradshaw et al., 2008). Even though, various earlier studies specify numerous abnormal behavior configurations that happen amongst chimpanzees detained in Zoological Gardens. However, comprehensive, quantifiable studies on Zoo populations are limited (Martin, 2002; Hosey and Skyner, 2007). Abnormal behaviors may specify psychological misery but this is rarely painstaking nonstop (Rollin, 2017). Values of evolutionary analysis proposed that some uncharacterized behaviors may be suggestive of primary psychological illness, ignoring areas of investigation in apes. These aptitudes raise thoughtful moral queries, predominantly given the expressive and mental capabilities of apes and other captive animals (Searle and Willis, 2002).

Although a reliable outline for the study of irregular behavior in chimpanzees has not yet been attained (Searle and Willis, 2002). Deficiency in social interaction, and predominantly parental separation, have been considered fundamental aspects in the expansion of abnormal behavior in imprisoned apes. All such activities may be responsible for mental stress or may withdraw individuals from chances to learn some suitable behavior. The influence of nurturing history, though patent in younger apes, seems to diminish as an individuals age. Such conclusions might propose that common group cover, with the consequential chances for the growth of suitable social associations, will improve the harmful effects of initial practices (Lutz and Novak, 2005).

Human Psychology about animal behavior

Psychologists' key purpose in studying animal conduct is to expand the information on animal physiology. Learning experimentations with animals help psychologists to understand human cleverness, pressure, and even violence. A novel part of a psychologist's study called "Animal Assisted Therapy" deals with how humans can be advantaged by animal communication. Interactive psychologists have now merged determinations with experts from other parts of animal sciences and are investigating functional companions, psychology, animal ethology, and behavior therapy. Though, animal study by psychologists is infrequently engaged in studying sensations such as anxiety and depression (Lutz and Novak, 2005). Behavioral studies of animals in captivity are the greatest part of the non-interfering study used to measure the welfare of animal fauna. Studying animals' behavior in captivity enables researchers to explore the factors directly affecting animals' conduct in captivity. Fear of disease catching keeps researchers away from the enclosures. This may change the researcher's psychology, especially in developing countries, and facilitate close observation of animal behavior.

Effects of predictability on captive animals

The unpredictability of an event is recognized to upset an animal's response more as compared to predictability. Researchers investigating the effects of expectedness of stimulus on animal conduct and prosperity. The clearest technique comprises manipulating the time-based characteristics of the stimuli exhibition, carrying it to the animal on either a static-time or flexible-time plan. For example, positive stimuli, such as food, or a cruel stimulus, such as electric shock, might be used and animals were exposed unplanned. These stimuli were unequal and consequently unpredictable. Unpredictable events produced more stress in studied animals (Gottlieb et al., 2013). Instead, the stimuli could be

delivered at fixed times, which are consistent and consequently predictable. The second technique involves previous stimuli with an indication. A consistent signal previous to the stimuli by the similar time intermission will purify it predictably, regardless of whether it happens on a static or flexible time plan. Differences in the certainty of the stimuli may be attained by operating the consistency of the signal before it. Therefore, a stimulus happening subsequently after 50% of signals is comparatively less foreseeable than one occurring after 100% of signals (Bassett et al., 2007). Closer attention is required to captive animals for their good fare and well-being as uncertainty in their daily routine disturbs the captive animals, especially primates, and enhances their stress levels (Bloomsmith and Lambeth, 1995).

Effects of visitors on captive animals

Zoos play an animated part in wildlife supervision and protection and are places of ex-situ protection. The main role of zoos aimed at wildlife management has reformed a lot being a base of entertainment to protection places to institutions for investigation and community education. Zoos are also considered conservation hubs or shelters for wild animals, which safeguard them from intimidation due to human activities (Anderson et al., 2003; AZA, 2008; Yasmeen et al., 2018). To grow in imprisonment, a species must acclimatize to the Zoos environment; an animal's capacity to reply to captive environments with behavior from its typical catalog depending on the point to which the specific enslaved condition looks like its natural atmosphere (Mallapur and Choudhury, 2003). For different species, for example, the lion-tailed macaque, which hardly interacts with humans in its natural rainforest living spaces, while, Zoo tourists might serve as a cause of pressure, and this has also been witnessed in various other species of non-human apes in captive conditions (Mitchell et al., 1991; Venugopal and Sha, 1993; Hosey, 2000). Venugopal and Sha (1993) also described Zoo visitors as disrespectful of captive apes, which were found to their behavior. Captive apes are noticed as more violent with each other in the existence of Zoo visitors (Mitchell et al., 1991). Furthermore, social relations inside captive assemblages have been witnessed to decline while behavioral anomaly levels increase through visitors' occurrence (Glatston et al., 1984; Mitchell et al., 1991). Research has also revealed that configurations in enclosure space usage are also recognized to alter; therefore, individuals in the paddock with better flying spaces have been witnessed to be less anxious than animals contained in insignificant enclosures with small flight spaces (Anderson et al., 2002). Hosey (2000) proposed that long-lasting exposure of caged apes to the Zoo visiting community could lessen the stressful effect on certain species. It has also been proposed that feeding can be enhanced human-

animal communications in captive animals It is therefore vital that welfare experts understand the likely effect of Zoo visitor conduct on animal welfare, either to decrease stressful conditions or to exploit chances for enrichment. While, at one thrilling, disruptive visitor behavior such as teasing, nursing, shouting at animals, and tossing stones are animal welfare apprehensions.

Most current Zoos have five key, interrelated aims: animal safety, conservation, public awareness, study, and entertainment (Anderson et al., 2003; AZA, 2008). Although Zoos categorically place key stress on the first four objectives, the mainstream of Zoo visitors comes, at least in part, for entertainment. Deprived of appealing and amusing visitors, Zoos would fight to sustain their other aims. A Zoo's status for providing a pleasurable experience boosts primary visits and succeeding returns to the Zoo, both of which interpret into better income for conservation determinations, study, and common animal care and safety. Additionally, the investigation has revealed that sometimes Zoo visitors progress more positive observations of animals in Zoos and become additionally helpful in conservation determinations (Anderson et al., 2003; Hosey, 2005). Therefore, Zoos often meet conflicts amongst their objectives. Such as, the likelihood of being close to and interrelating with animals raises the demand for a Zoo for numerous visitors (Hosey, 2005). If people are disheartened or prohibited from intermixing with the local animals, fewer visitors appear, lessening public monetary funding. However, visitors, particularly noisy, active masses, have demonstrated a basis of anxiety for numerous species, predominantly apes, upsetting both their welfare and the pleasure of the visitor. So it is now demanded time to outline the main purpose of Zoos.

Self-Injurious Behavior of Animals in Captivity

Many researchers have considered self-biting and self-hurting in macaques to be comparable to self-injurious behavior (SIB) in humans (Lutz et al., 2003a, b; Novak, 2003). Novak (2003) described that 14% of 188 independently kept rhesus macaques at the New England Regional Primate Research Center displayed self-injurious behavior as they were involved in hair plucking. The author also suggested that habitual biting is usually not hard enough to inflict a wound. According to Lutz et al., (2003b), self-injurious behavior does not associate with externally focused aggression. Moreover, there is a sign that self-injurious behavior in rhesus monkeys is connected to malfunctions of nor-adrenaline and serotonin neurotransmitters as an outcome of early social deficiency. Self-injurious behavior also negatively connects with plasma cortisol (Tiefenbacher et al., 2000), which is a managing device to decrease arousal (Novak, 2003). Although most of our information on self-injurious behavior in non-human apes develops from studies of lab-accommodated rhesus monkeys,

and to lesser degree stump-tailed macaques. In captive apes, it frequently occurs in circumstances that are traumatic to the individual.

Bernstein et al. (1963) described self-biting as found in wild-native but it happened in laboratory-kept gibbons in response to novel matters. Mootnick and Nadler, (1997) did an analysis of sexual conduct in gibbons in the variability of enslaved settings and observed self-biting in numerous individuals regarding anxiety. While Mitchell et al. (1988) and observed self-focused violence in golden-bellied mangabeys to happen predominantly in caged-born females, particularly in stressful circumstances. Considering the associates of self-injurious behavior is infrequently by itself the objective of the studies; however, Skynner et al. (2004) point out that the self-injurious behavior of an imprisoned pileated gibbon amplified when it was bare to large human viewers. There should be more studies on such behaviors to highlight the outcomes of injurious behavior.

Suggestions to overcome Zoochotic behavior in animals

There is a need to focus sizes of enclosures for each animal with this attention to the cleanliness of enclosures is also needed. As some times this mental problem results in a decrease in appetite which is probably enhanced by the dirty environment as reported by Haque (2011) in crocodiles. Maulana et al. (2020) also reported minimum enclosure requirements for the leopards as shown in Table 2. These sorts of studies should be carried out for all types of wild animals that are placed in captivity. The provision of enrichment in the enclosure is one of the best remedies to control stereotypic behavior (Pizzuto, 2003). In another study, the cinnamon odor was used as enrichment and found as an effective remedy to control pacing in *Leopardus tigrinus* (Resende et al., 2011). An increase in the size of the enclosure help to reduce stereotyping in cheetahs (Quirke et al., 2012).

Conclusion

After studying different research, it is concluded that captive conditions directly alter the behaviors of animals by disrupting their hormonal level which ultimately affects them psychologically. The existence of stereotypic behavior has long been agreed to be a sign of poor welfare. Visitor existence was found to affect an increase in abnormal and aggressive behaviors in the behavioral repertoire of captive animals. It is now demanded time to investigate the steps which lessen the effects of isolation on animals and the actual role of Zoos around the world. Captivity leads to an irreparable decline in brain size, through breeding, is assumed to be responsible for the loss of wild behaviors, such as abilities for nesting, escaping from predators, discovering food, and nurturing young ones. It is

imperative now to study all aspects of captive conditions and execute prospective policies that can be used for the welfare of animals.

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