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Research Article

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Medical behavior training for blood collection of Bengal tiger (*Panthera tigris tigris*) in Dubai safari park

Abstract

This research highlights the efficacy of systematic training methodologies in promoting tiger welfare and management. By gradually acclimatizing tigers and reinforcing positive associations with confinement, these methods improve overall well-being and ease of handling. The observed calm demeanor and voluntary crate entry signify successful establishment of a positive relationship with the enclosure, reflecting acceptance and acknowledgment of it as a secure environment. Such achievements highlight the effectiveness of systematic training in fostering adaptive behaviors and cooperative interactions between animal keepers and the animals within a scientific framework. Additionally, in veterinary medicine and animal research, collecting blood samples from healthy animals is crucial for diagnosis and investigation. Following strict guidelines ensures animal welfare, while obtaining blood establishes a baseline for comparison during illness, particularly in older animals. Training in voluntary blood draws reduces anesthesia risks, with samples analyzed for hormone levels, pregnancy detection, and guiding treatment decisions by veterinarians.

Keywords: tiger, training, blood collection, welfare

Volume 8 Issue 2 - 2024

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Received: August 05, 2024 | **Published:** August 20, 2024

Introduction

The Bengal tiger, a species of big cat native to Asia, primarily inhabits hot and humid forests and wetlands in countries of the Indian subcontinent such as India, Bangladesh, Bhutan, and Nepal. With only around 3000 wild Bengal tigers remaining globally, most of which are in India and approximately 355 in Nepal.[1] It is listed as endangered on the IUCN.[2] Major threats to tigers are habitat destruction and fragmentation due to deforestation, poaching for fur and the illegal trade of body parts for medicinal purposes. At Dubai Safari Park, annual animal health screenings are conducted to monitor their well-being and to promote welfare needs.

Health screenings for tigers often require training and anesthesia due to associated risks, as highlighted by Gareth E Zeiler in 2013.[3] Sedation of tigers is associated with complications and risks such as profound bradycardia and hypotension during general anesthesia, which may be unresponsive to anticholinergic treatment. Potential causes of these cardiovascular issues include drug pharmacodynamics (medetomidine, morphine, isoflurane), reduced sympathetic tone from epidural administration (ropivacaine), and hypothermia.[3] Therefore, training for physical examination and blood collection is essential to minimize animal stress and avoid complicacies/risk of anesthesia. This training not only facilitates blood sampling but also serves as a foundation for animal therapy and examination.

Veterinarians can conduct visual and physical examinations, treat superficial wounds, administer subcutaneous/intramuscular/intravenous injections, and perform diagnostic imaging procedures without the need for sedation. Dubai Safari Park has fifteen Bengal tigers, which are divided in several groups and are housed in various areas with different types of dens and exhibits. Trained tigers were placed in double dens equipped with air conditioning and connected to ventilated holdings accessible from both sides.

Materials and methods

All tigers undergo behavior management training for positive reinforcement, enrichment, problem-solving, and assessment purposes. Health assessment training initiated in the veterinary hospital successfully trained two males and three female Bengal tigers for various procedures such as blood collection, comprehensive physical examinations, and detailed eye examination including infrared and laser therapy. Training sessions commenced with a briefing to review the animal's behavior, temperament, safety concerns, and important notes from previous training. The training took place in a double den with a squeeze cage and adjacent sides, where the veterinarian conducted assessments while the keeper engaged in cooperative feeding training with the animals.

Personnel safety

Precautions must be taken to ensure the safety of animal keepers in captive environments. Veterinarians, supported by keepers, are actively involved in training sessions. Safety protocols, including protected contact setups, are strongly recommended to safeguard both humans and animals.[4] Coordination meetings are held to discuss animals' responses and behaviors at the beginning and end of each training session, with a focus on individual animal temperament. During training sessions, three animal keepers, one veterinarian, and one veterinary assistant must be present to monitor animal movements and responses. Target selection is crucial, with a primary focus on ensuring the safety of both the animal and the animal keeper, particularly in preventing injury or harm from the target itself.

Protected contact

Training sessions were conducted in standard percussion in a protected contact set-up,[4] with a squeeze cage positioned in front of the sliding door of double dens. The objective was to train the tiger

to move in and out of the cage easily for safety purposes. During the training, one keeper focuses on feeding and positioning the tiger with another managing the squeezing barrier of the cage, and a third keeper monitored the animal's behavior. Meanwhile, the veterinarian and nurse performed physical examinations and blood collection. Only team members involved in the training attended the sessions, each equipped with knowledge of emergency exits and actions based on the protocol.

Training sessions

The training begins by making a move of the animal from the big dens to small squeeze cage of the dimension Outside dimensions: 28 1/2″W x 87″L x 51″H / Inside dimensions: 19 1/2″W x 84″L x 51″H.[5] This procedure started by introducing the squeeze cage to the animal, then rewarding the animal after they enter the cage. The animal's behavior and response must be recorded from the first day of training. The animal is monitored for any stress and discomfort inside the squeeze cage which may be achieved after several training sessions. The training is continued by holding the position of the animal inside of the squeeze cage. Once the animals exhibit comfort inside the squeeze, stimulation training is initiated with the veterinarian starting physical assessment, light to heavy long pressure with fingers on the limbs and tails to engorge veins and introduction of syringe and needle to the animal. The same procedure was done repeatedly in several sessions. The goal of the training is to build trust between the tigers, the keepers, and the veterinarians for blood collection.

Goal behaviors: The tiger was taught five behaviors to complete the blood sampling training program.

a) Make a movement

To gain trust of the animal and direct its movements to enter the squeeze cage without fear and to continue to the next step of the training. All the equipment needs to be introduced in front of the animal. In this session, the procedure began by shifting the animal from big dens into the small squeeze cage. Reduce the fear and anxiety of the animal by feeding them inside of the squeeze cage and make them feel safe.

b) Hold the position

The process involves shaping the physical position of the animal through successive approximations, such as standing, sitting, and laying down, and gradually extending the duration of time the animal remains in each position during procedures. Positioning the animal involves applying gentle pressure to the body or limbs/tail and gradually squeezing the cage to prepare the assessment position. Building trust with the animal is achieved by gently touching and grabbing the tail, while providing positive reinforcement directly related to the tiger's behavior. This training requires multiple sessions to establish trust and maintain the desired behavior of the animal, ensuring they remain still while the veterinarian works. Once the animal is comfortable and responsive to the keeper's instructions, the objective is achieved.

c) Recognize the stimulus

The objective of this session is to reduce aggression and promote calm behavior in tigers. The physical stimulation training progresses gradually, starting with visual and tactile interactions using hands and fingers, then transitioning to non-sharp natural objects until the animal becomes accustomed. Subsequently, veterinarians introduce the actual equipment for blood collection, beginning with light touches that gradually increase in pressure and duration. The stimulation includes long press with a syringe without a needle or with the cap on, followed by the introduction of blunt needles to simulate the sensation without skin penetration.

d) Desensitization

The training session begins with a step involving the gradual pairing of positive rewards with the sensation of being touched by a benign item, progressing towards exposure to an actual sharp needle. This desensitization process allows the animal to experience the sensation without skin penetration, ensuring the animal remains calm and relaxed during needle insertion. Once the tiger is in a state of calmness and relaxation, the veterinarian proceeds to administer the real injection. While discomfort during injection can naturally cause stress and fear in the tiger due to pain, the established trust from the training process enables the animal to tolerate the real injection procedure effectively.

e) Engage the expression of emotional state

In the final session, the veterinarian successfully withdrew blood from the tiger without any signs of stress. The blood collection was performed through either the median caudal artery or the lateral caudal veins located in the tail of the tiger.

Results

The tiger in this study underwent training for blood sample collection and physical examination over a period of five months. Training sessions were conducted by the primary keeper once a week, between 07:30am and 08:30 am. Table 1 outlines the training results, indicating the number of sessions required to achieve each behavior approximation. A behavior was considered complete once the animal could consistently maintain it. It is important to note that regression is a common occurrence during the training of new behaviors, and sustaining a complete behavior can be challenging.

a) Animal response: During the initial training session, allowing the tiger free access to explore the cage is a fundamental aspect of the training process. The cage serves as an enrichment tool, with both doors left open to provide the tiger with one hour of free space for five sessions. Bedding materials such as hay or grass, is placed inside the cage to encourage the tiger to enter and become comfortable. In the first few sessions, the male tiger typically marks the squeeze cage as its territory before entering. All tigers exhibited excitement as they move around and explore the new squeeze cage. A significant form of reinforcement known as a jackpot or bonus is utilized, providing a larger and more valuable reward than usual as a surprise to the animal after successful training.

b) Training session: This training is divided into five categories in several sessions (Table 1).

c) Diagnostic: In veterinary medicine and animal research, collecting blood samples is vital for diagnosis and investigation, but it must be done following strict guidelines to ensure animal welfare. Obtaining blood from healthy animals establishes a baseline for comparison during illness, detecting changes in organ function, especially in older animals. Training in voluntary blood draws reduces anesthesia risks. These samples are analyzed for hormone levels, pregnancy detection, and guide treatment decisions by veterinarians (Table 2).

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Table 1 Training goal of tiger behavior

Goal behaviors	Behavior step	Number of session
Make a movement	Introducing the cage to tiger	5
	Tiger entering the cage	
Hold position	Shifting the tiger from dens to cage	5
	positioning the animal	
	Hold the position of the animal	
Recognize the stimulus	Light touch	
	Moderate touch in several duration	3
	Increase pressure with extended duration	
Desensitization	Spray the alcohol and capped syringe touching	3
	Blunt needle attached in several tail area	
	Extended of blunt needle duration	
	Small sharp needle lightly touches	
	Small sharp needle piercing the skin	
Engage the expression of emotional state	Large needle gently piercing the skin	3
	Real blood collection process	

Table 2 Tiger blood result

Component	Tiger blood result					Reference interval	Unit
	T1	T2	T3	T4	T5		
ALB	29	28	30	29	29	32 - 42	g/L
ALP	35	28	19	43	43	0 - 81	μ/L
ALT	40	39	47	42	42	11 - 47	μ/L
AMY	469	456	430	414	394	83 - 424.2	μ/L
TBIL	7	7	6	7	7	0 -10	μmol/L
BUN	13	13.1	13.5	12.2	11.9	7.14 -12.13	mmol/L
CA	2.8	2.69	2.61	2.78	2.78	2.35 - 2.71	mmol/L
PHOS	2.5	2.45	1.76	2.24	2.28	1.42 -2.32	mmol/L
CRE	201	178	205	189	167	159 - 319	μmol/L
GLU	5.5	5.6	5	6.9	6.6	4.99 - 9.99	mmol/L
NA+	149	142	138	149	148	146 - 154	mmol/L
K+	4.9	5.1	4.9	5.3	5	3.8 - 4.6	mmol/L
TP	74	76	76	77	75	65 - 77	g/L
GLOB	46	48	46	47	46	27 - 39	g/L

The blood results of the tiger indicate no significant abnormalities in organ function or infection or signs of stress from their behavior. Based on blood analysis, tiger's overall health is in stable condition. Environmental conditions such as nutrition, predation, and disease patterns may also differ between captive and wild populations, which may be reflected result of the serum biochemical parameters. Differences in biochemistry parameters between captive and free-ranging populations have been demonstrated for several wildlife species. These differences are likely due to species-specific responses to capture and captivity, ranging from zoos to managed game parks. Additionally, free ranging and captive animals often have dramatically different diets, which can be reflected in serum levels of essential minerals such as calcium and phosphorus.[6] Disease management is more rigorous in captive animals compared to those in the wild, potentially affecting biochemical parameters. Considering the complex influence of environmental factors is crucial when interpreting biochemical data for wild animals.

This may explain the seasonal variability in immunoglobulin levels and resultant decreased albumin: globulin ratio. Globulin is strongly associated with immune stimulation and inflammation, while albumin is a negative acute phase protein that decreases in response to inflammation, therefore this ratio is often used as an indicator of recent disease exposure. The decreased albumin: globulin ratio during the wet season could be attributed to either increased disease exposure, or alteration in immune status due to reproductive timing.[7] Higher BUN in free-ranging tigers may be attributable to differences in behavioral ecology and diet compared to captive populations. Free ranging tigers hunts as infrequently as once a week and consume a high protein, high blood diet punctuated by protracted periods of starvation, which may contribute to differences in renal physiology and muscle catabolism and lead to increases of nitrogenous waste within the blood. The slight increase in BUN may be attributed to natural variables, the increases in CRE captured by ISIS values would be pathologic if seen in a free-ranging population, a discrepancy that is most-likely attributable to decreased renal function in captive animals of geriatric age.[8]

Discussion

In the initial stages of tiger training, the introduction of a crate serves as a pivotal component in acclimating the animals to confinement and facilitating subsequent handling procedures. Placing the crate within an empty room, adorned with bedding infused with familiar scents such as tiger urine, aims to create an environment conducive to exploration and comfort. During the inaugural session, it is common for tigers to exhibit cautious behavior, opting to circle

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the crate rather than enter it directly, a natural response rooted in their innate inclination to assess new stimuli (Figure 1 & 2). Progressing to the second day, observations of a tiger leaping into the crate signify an initial curiosity and willingness to engage with the enclosure, albeit accompanied by a degree of restlessness and excitement. This pattern of behavior persists into subsequent sessions, with tigers displaying increased familiarity yet retaining elements of apprehension and frenetic activity upon entering the crate. However, by the fourth session, discernible advancements are noted as tigers eschew leaping in favor of entering with deliberate steps, indicative of a developing sense of comfort and confidence (Figure 3 & 4).

Figure 1 Cage introduction to tiger.

Figure 2 Tiger entering the cage.

Figure 3 Tiger entering the cage, developing sense of comfort and confidence.

Figure 4 Tiger entering the cage, calm and composed behavior, actively choosing to settle within the confines of the crate.

Finally, in the fifth session, a significant breakthrough occurs as the tigers demonstrate a notable shift towards calm and composed behavior, actively choosing to settle within the confines of the crate (Figure 5). In the sixth training session, a notable transformation in the behavior of the tigers towards the crate was observed, signifying a significant milestone in the training process. By this stage, training continued by holding the position of the animal in the cage to develop a recognizable recognition of the stimulus, up to resulting in a notable decrease in apprehension and an increase in overall calmness. Gail Laule et al,[9] said that one of fundamental aspect of training is teaching animals to "positioning" and " desensitization,". it was started in 11th until 16th session, when animals are reliably trained to hold the position, they can be easily examined then while remaining calmly positioned furthermore, then animals can be trained to present specific body parts and veterinarians introduce the actual equipment for blood collection, beginning with light touches that gradually increase in pressure and duration up. This desensitization process allows the animal to experience the sensation without skin penetration. The stimulation includes long presses with a syringe without a needle or with the cap on, followed by the introduction of blunt needles to simulate the sensation without skin penetration (Figure 6 & 7).

Figure 5 Shifting the tiger from dens to cage.

Figure 6 The physical stimulation training, starting with visual and tactile interactions using hands and fingers, then transitioning to blunt natural objects.

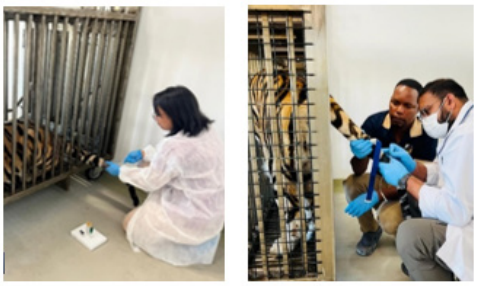

Figure 7 Stimulation training by blunt object (needle or with the cap on), followed by the introduction of blunt needles to stimulate the sensation without skin penetration.

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S Parasuraman et al,[10] said that blood sample collection generally is withdrawn from venous, arterial blood vessels or heart chambers. The recommended maximum volume of blood collected as a single sample is 10% of the circulating blood volume. Circulating blood volume, in turn, is generally estimated to be approximately 5-10% of the animal's body weight. Consequently, a conservative approach dictates that no more than 1% of the total body weight should be extracted as a blood sample in most cases.[11] This precautionary measure is rooted in considerations of maintaining hemodynamic stability and preventing adverse effects such as hypovolemia or compromised perfusion. In this tiger blood collection training, the blood draw position was in tail vein. This method ensures a safe and successful blood sample collection, as demonstrated by the successful drawing of tigers in Dubai Safari Park (Figure 8). In all cases of bleeding post- withdrawal blood, hemostasis procedure must be planned prior blood collection. Pressure should be applied immediately following withdrawal of the needle, or when sufficient blood has been obtained from a needle-prick. Aids to control excessive bleeding should also be readily available (e.g. antiseptic powders, cornstarch or tissue glue) (Figure 9).[11]

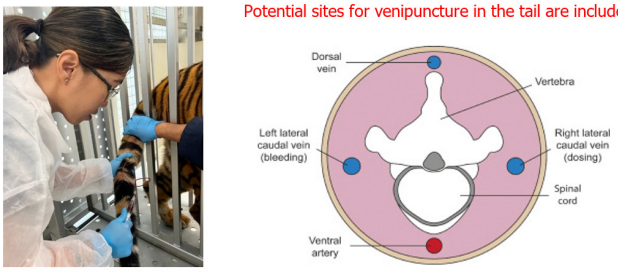

Figure 8 Blood sampling in right lateral caudal vein of tiger.

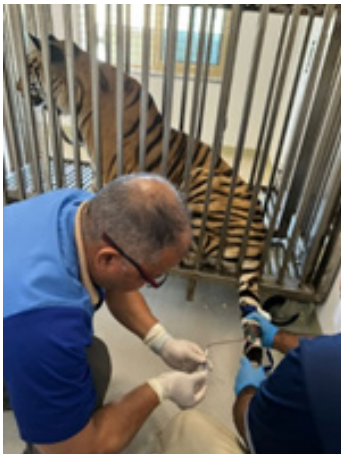

Figure 9 Vacutainer have been used for blood collection.

The option of the equipment for the specimen collection is very important, due to affecting the duration of specimen collection including quality of the sample. Anticoagulants and stabilizing additives used for blood collection can affect biochemical, hematological and coagulation tests results. For some routine biochemical laboratory tests, results can be changed by choice of blood collection tube and storage conditions.[12] The husbandry training of zoo animals has been widely recognized as a valuable tool with numerous benefits. By training animals to actively participate in necessary husbandry and medical procedures, the welfare of captive animals can be significantly improved. Without proper training or the use of anesthesia, the extent of a physical examination is limited. This is particularly challenging for carnivore especially tiger, which are highly aggressive and additionally, underlying factors such as disease, old age, pregnancy, nutritional deficiencies, and weaknesses caused by parasites can further complicate their health conditions. Stress responses in these animals can lead to immunosuppression, weight loss, and even death. Therefore, the implementation of trained medical behaviors, employing positive reinforcement strategies, is crucial for enhancing tiger care.

Challenges motivation to train the animals

All the tigers demonstrated a rapid ability to learn about every section of the training. Although initially, in the first few weeks of training, the animal struggled to response to verbal stimulation from the keeper, it quickly adapted and showed proficiency in learning and adapting to the squeeze cage and associated equipment. The training for blood sample collection in tigers was conducted over a period of three months by the primary keeper and veterinarian. A breakdown of the training results, including the number of sessions required to achieve each desired behavior, is presented in Table 1. It is worth to note that multiple behaviors were often addressed within a single session. Keepers considered a behavior completed once they were confident that it was under stimulus control. Importantly, every training session is designed to allow the tiger to choose to participate or disengage their session in the first, second or third place. Keepers prioritized creating a positive environment for the tiger, adjusting the training criteria to ensure success and minimize confusion.

Motivation

This tiger has shown remarkable progress in learning visual and vocal cues. The enthusiasm of the tigers towards new challenges, coupled with their strong appetite, has greatly facilitated the training process of shifting them from big dens to the squeeze cage. The keepers have demonstrated patience with the tiger and have consistently been able to regain the animal's engagement during each session. The success of the training sessions relies on understanding the unique characteristics and behaviors of the animals, as well as employing positive reinforcement techniques to create lasting memories. While some tigers have already reached a relaxed state and the keepers are able to maintain their positions after five weeks of training, there are other cases where additional routine training is required to help the animals relax in specific positions.

Animal participation

The tigers were trained by the primary keeper and veterinarian for blood sample collection in 6 months. Table 1 displays a breakdown of the training results and how many sessions it took to complete each approximation of behavior. Multiple behaviors were often trained within one session. The animal keepers recorded the behavior as complete once they felt that the behavior was under stimulus control. Training sessions were voluntary, giving the tiger the option of participating or leaving the session. Keepers aimed to ensure that the sessions were positive for the tiger, adjusting training criteria to allow the tiger to succeed and avoid confusion.

Conclusion

Training animals in positive reinforcement strategies is crucial for improving their overall health and well-being. In the context of animal health screening, early detection of diseases and maintaining good health are paramount. Blood samples serve as a vital diagnostic tool, providing valuable insights into an animal's organ function and overall health status. Therefore, implementing medical behavior training for procedures such as blood sampling is essential, particularly

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for animals like tigers at Dubai Safari Park. This training not only facilitates annual health screenings without the need for sedation but also enhances the collaboration between animal keepers and veterinarians. It enables efficient physical examinations and allows for prompt treatment of superficial wounds, ultimately contributing to the overall welfare of the animals under care.

Acknowledgments

We extended our gratitude to Dubai Safari Park Management and for their support to conduct this study and for providing guidance to improve the intellectual content of the subject; We also thank the animal keeping staff who supported the training procedure with their enthusiasm and awesome skill, to lead this training program to have a valuable and great training construction and development for this study. We also want to thank Al-Karawan Medical & Scientific equip. Est. for supplying the Tiger squeeze cage, Mr. Hamed Soliman, Mr. Husam Ali Lulu, Mr. Waleed Mohammed, for providing the required technical training and support.

Conflicts of interest

The authors declared that there are no conflicts of interest.

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