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April 2018

# Observational Study of *Boa constrictor*, *Canis lupus familiaris*, and *Felis silvestris catus*

## ABSTRACT

A *Boa constrictor*, *Canis lupus familiaris*, and *Felis silvestris catus* are observed for their individual feeding behaviors. The animals were fed their usual and meals filmed in their own environment with in slow motion for easier coding of behaviors that happen in a single moment. The dog was the fastest to eat and was observed using her teeth, lips, tongue, lower jaw, and neck while eating. The cat was observed using his teeth, tongue, lower jaw, and neck while eating. The was the slowest to eat and snake was observed using her body muscles, teeth, and upper and lower jaws while eating.

## INTRODUCTION

Over millions of years, species have evolved to consume their nutrients in very diverse manners from animal to animal. The *Boa constrictor*, *Canis lupus familiaris*, and *Felis silvestris catus* were chosen to observe in order to contrast feeding behavior. The latter two species are of the same order, Carnivora, and are expected to have similar feeding topography. The *Boa constrictor's* closest taxon to either of these species is the phylum, Chordata, and the feeding behavior is predicted to greatly contrast any of the behaviors seen in the other species. The objective of this paper is to thoroughly analyze the differences of each of the species and consider how their anatomy has evolved for their behaviors.

## METHODS

In this observation, three animals of different species were observed. The dog observed was a 4-year-old spayed female black lab. The cat observed was a 7-year-old neutered male color point. The boa constrictor that was observed was a 9-month-old female snow.

Each of the three species were filmed in their home environments to ensure that their behavior would be as close to normal as possible. They were filmed in slow motion at 30 frames per second to better feature the small, quick movements that are harder to notice with the naked eye. The behaviors were coded into an ethogram afterword. The dog, cat, and boa were observed for 47 seconds, 9 minutes and 47 seconds, and 15 minutes and 10 seconds, respectively. The dog and cat were fed on a plate, and the snake was fed by dangling the prey in the air.

The dog was fed 1 cup of Pure Balance Lamb and Brown Rice Recipe, a kibble-food with a crude protein minimum of 23%, crude fiber maximum of 15%, crude fiber maximum of 5%, and moisture content maximum of 10%. The food also provides linoleic acid, alpha-linoleic acid, zinc, vitamin E, ascorbic acid, and L-carnitine. The cat was fed 3 oz. of BLUE Healthy Gourmet Meaty Morsels Chicken Entrée, a wet food with a crude protein minimum of 9%, crude fat minimum of 4%, crude fiber maximum of 1.5%, and moisture content maximum of 82%. The food also provides taurine (0.1% max). The boa was fed a 2 week old, pre-killed, 26g fancy rat pup.

## RESULTS

### *Canis lupus familiaris*

The plate is set on the ground and the dog approaches the food. The dog opens her mouth, lifts her lips, and sinks her muzzle into the food. Closing her mouth, the teeth pick up the food. The tongue only assists with pulling in a small amount of food. This is repeated several times, while the dog shifts the placement of her head where more food is. Finally, the dog pulls her head away from the food then suddenly jerks her head back and she swallows the food while smacking her jaws. She repeats the process again, picking up a little less food before swallowing. She turns back and looks towards her owner while swallowing and smacking her jaws, and then walks towards her owner. She looks back at the food and the observer with the camera. The observer

tells the dog, “it’s okay” and points to the food, worried that the dog stopped eating due to the adjusted feeding environment. The dog returns to the food and eats the food quicker than before. Instead of picking up bites of food, jerking her head back, and swallowing, she simultaneously picks up bites of food and uses her tongue to lift and push the food to the back of her mouth and swallows. She finishes the second part of her food at this fast pace. After completing the meal on the plate, the dog walks around the bowl and licks up a few remaining kibbles that escaped the bowl and returns to her owner.

*Felis silvestris catus*

The plate is set on the ground and the cat approaches the food. After a few sniffs, the cat leans his head in and opens his mouth. As the mouth opens, the upper lips are pulled upwards enough for food to pass into the mouth. The tongue extends out of the mouth, curls down towards the chin, and then makes contact lying flat against the food. The tongue presses into the food slightly for the papillae to sink in and is then pulled back into the mouth. This process is completed and repeated whether the tongue brings in chunks of food or not. Once the cat is satisfied with the amount of food in his mouth, he jerks his head back with his neck quickly, and begins to chew with his back molars, then swallows. This is continued over and over until the animal is satiated. In the single meal, the cat ate 2.13 oz. of a 3 oz. can in 9 minutes and 4 seconds. Throughout the meal, he stopped to look at the camera and his surroundings. Once, he stopped again to walk around his food, smell and inspect the camera and the observer, and then went back to his food, at a better eating angle than before. When the cat stopped eating, he left his food to find a place to groom himself. This cat did not drink water before or after any time relative to his meal.

*Boa constrictor*

Before presenting the food, the terrarium is opened and the first third of the female’s body is already wound an “S” shape. The rest of her body is in a loose oval, giving her body stability for

when she decides to strike. As soon as the observer moves when the food has been presented, she immediately sees and watches the movement and flicks her tongue. The rat is dangled by the tail and shaken in the snake's presence. This manipulation is necessary for the snake to eat. She has learned to eat this way and refuses to eat any other way. Before striking, the boa constrictor watches her prey with her left eye and stalks it by extending her body very slowly. She occasionally flicks her tongue as she gets closer. At her closest distance, the wiggling rat comes into contact with her nose and she strikes in less than a second. She opens her mouth just wide enough to encase the rat's head in her mouth, and then clamps down and immediately starts pulling back. The observer, startled, pulls pack on the rat before letting go, and the boa is pulled up with the rat. The observer releases the rat, and the snake falls to the terrarium floor with the rat still in its bite. Within another second, she coils the rat. The moment she is grounded, she starts to rotate her neck clockwise, and the first third of her body follows. Without ever relaxing her restraint on the rat's head, she creates a tight spiral around the rat. Once the length of the rat's body has been wrapped, all movement seems to stop. She then constricts the rat for over 4 minutes. After constricting, the boa constrictor starts to feed. She adjusts her head to be parallel with the floor, and then starts to consume the mouse. She opens her mouth, then turn her head slightly to one side and bites down. After a brief pause, she opens her mouth again and turns her head slightly to the other side and bites down. This is repeated until many times and more of the rat is pulled into the snake's body. The further the rat goes into the boa's throat, the snake's body muscles start to contract and pull the rat in. The muscles scrunch together, then release and slip over the prey like an inch worm crawls. When nothing but the legs, feet, and tail of the rat are left outside of the boa's mouth, she raises her head and neck up off the floor. Her last bites are spent with her neck contracting, and then stretching as far as she can with her nose to the sky.

Finally, the rat is completely inside her body. Still nose skyward, her muscles contract and move the rat further into her body. Once the rat reaches her stomach, the boa constrictor has completed her meal and moves away to find a place to hide. From end of constriction, the swallowing process took 8 minutes. Once hiding and warm, she will digest and be very inactive for about two days. The snake was not observed drinking water any time relative to the end of her meal.

## DISCUSSION

Behaviors described in literature were true to the behaviors observed by all three species. Being pack animals, wolves usually only have the chance to eat one large meal a day if they are lucky. They will hastily consume their food, competing for a full meal alongside their packmates, and for fear of other predators who may come along looking for a meal. While evolution has increased the domesticated dog's frequency of meals to a preferred 2-3 occurrences per day, it has not altered the rate at which dogs feed. (Bradshaw, 2006) It is common to observe this carried-over behavior from wolves of rapid eating in dogs and was seen in this study. Dogs may also eat at a quick pace due to their teeth not being appropriate for the function of chewing. The large carnassial teeth found in dogs, cats, and other carnivore species are made for ripping flesh from bone and cutting the meat into smaller pieces before passing through to the esophagus and stomach. To break kibble down, it must be ground, and teeth of dogs and cats cannot perform this action. Kibble is typically small enough for the stomach to digest, and true chewing is unnecessary. (Hudson & Hamilton, 2010)

Unlike dogs, cats eat their meals more frequently and in smaller amounts. This is most likely due to how their close ancestors ate, consuming multiple small prey over 24 hours. (Beaver, 2003) The cat observed in this study was consistent with this. Out of a small, 3 oz meal, he only ate 2.13 oz. He returned and completed the food as another meal over an hour later. The cat may

have eaten even less if it weren't for the addition of an observer to his environment. About 7 and half minutes into his meal, he stopped eating to investigate the area around his food and the observer. Normally, the cat might have left his food until he was ready for another meal. Beaver's literature also discussed pre- and post-meal behaviors that were confirmed by this cat. Premeal behaviors of vocalizing and extra owner engagement were not filmed but are always displayed by the cat. Depending on how quickly food is delivered, the cat may rub against objects, but it was not observed in this trial. The cat's tail was raised when approaching the meal. Post-meal behaviors of walking away from the meal tail-down, grooming, and less owner engagement were also displayed. (Beavers, 2003) The cat observed did not drink and it is suspected that he does not drink water. Beaver explains that it is not necessary for most cats who consume wet food, as the food provides their daily water needs.

The only behavior not found in literature was the head-jerk. This behavior's function is most likely to use zero gravity to move food further to the back of the throat with ease.

Literature on snakes feeding was very extensive, most likely because the behavior is very unique when compared to many other species. Every behavior that was observed was accounted for in the snake feeding chapter by Cundall and Greene. They described how snakes hunt and kill their prey, and the mechanics of how consumption of whole prey is allowed for by the snake's cranial anatomy. The quadrate is a rod-like bone located at the back end of the snake's head and connects the upper jaw to the lower jaw. It acts as a hinge for the boa constrictor's mouth to open wide enough to consume its entire prey. Once the prey is in the oral cavity, the pterygoid bones and teeth work the prey into the mouth. The pterygoid bones are an inner row of teeth in the upper jaw, adding up to 4 total rows of teeth. Either, but not both, of the pterygoid bones slides forward, and then plants the teeth into the prey. As these bones only shift rostrally, the snake

turns its head in order to adjust the outer row of teeth to align with the inner row. The process is repeated with the other side of the mouth, and then over and over until the overall mass of the prey is consumed. Once the prey is in the first part of the throat, the muscles of the body take over, contracting the food lower and lower into the digestive tract until the meal is complete. (Schwenk, 2008)

Of all three species, dogs and cats consume their food the most like one another. While the amount of time actually consuming food is relatively the same, the order in which they eat is very different. The dog observed would lick her food up with chewing only occurring as absolutely necessary before swallowing. The cat would lick up his food, then chew a few times before swallowing almost every time he consumed a bite of food. In Figure 5 this chewing difference is evident, as the dog chews for almost half the time the cat chews. Licking was less in overall time for cat since he stopped to chew whereas the dog does not, and about a 20% difference was seen.

While dogs and cats eat similarly, holding true to their close relations, the snake has few features of ingestive behavior that are similar. Like dogs and cats, snakes use their teeth to catch and hold prey, consume food through their opening their mouth, and use jaws to manipulate the food caudally through their digestive system. After these facts, not much else is the same. Stalking from the snake and approaching from the canids were coded as similar, as both animals are moving towards their prey, but the canids no not show hunting behaviors when moving towards food. Snakes consume their prey whole. The bodies of snakes are practically formed for feeding only. They use their body to squeeze prey until long after the prey is deceased. This is why we see a 15% plus percent difference between the snake eating time and the other species (Figure 4). Snakes tongues are useless when feeding, whereas eating without a tongue would be near

impossible for dogs and cats. Snakes' body muscles, pterygoid teeth, and pterygoid bones are what pulls the prey into the digestive tract. After finishing their meal, a resting period occurs. Dogs and cats may lounge around for a few hours after eating to digest, but the duration of this time is much less than the reptile. Permitting the environment causes no threats or changes, the resting period of snakes will always be determined by the size of prey consumed, and usually lasts 2 days for this boa.

This paper is intended to give owners of these species better insight to the logistics of their pet's feeding behaviors. Snake owners may not fully understand how highly evolved their pet's anatomy is for the type of food they eat. Owners may become concerned with a dog's speed of eating, or a cat not drinking any water when being supplied wet food. While every concerning behavior should be consulted by a veterinarian, this information may help owners have peace with the normal behaviors their pets are exhibiting, that seem abnormal to them.

**Figure 1**
*Canis lupus familiaris* feeding ethogram

| Term | Definition | Time, s | Time, % |
|---|---|---|---|
| Approach | Locomotion towards object | 3s | 6.38% |
| Bite | Using teeth to grab food | 29s | 61.70% |
| Chew | Using teeth to slice food into smaller bits for digestion | 8s | 17.02% |
| Eat | Consuming food using tongue and teeth | 32s | 68.09% |
| Head-jerk | Sudden backwards movement of head and neck during eating | 1s | 2.13% |
| Investigate | Walking around environment alert and sniffing | 8s | 17.02% |
| Lick | Using tongue to pull in an object | 31s | 65.96% |
| Not in view | Dog is not in view of the camera | 2s | 4.26% |
| Stand | Dog is positioned with all legs extended | 32s | 68.09% |
| Survey | Observing the environment by turning neck, without locomotion | 2s | 4.26% |
| Walk | Locomotion at a relaxed speed | 13s | 27.66% |
| | | 47s observed | |

**Figure 2**

*Felis silvestris catus* feeding ethogram

| Term | Description | Time, s | Time, % |
|---|---|---|---|
| Approach | Locomotion towards object | 10s | 1.70% |
| Chew | Using teeth to slice food into smaller bits for digestion | 190s | 32.37% |
| Crouch | Cat is positioned low to the ground, all legs bent, hind legs sitting | 349s | 59.45% |
| Eat | Consuming food using tongue and teeth | 431s | 73.42% |
| Head-jerk | Sudden backwards movement of head and neck during eating | 7s | 1.19% |
| Investigate | Walking around environment alert and sniffing | 21s | 3.58% |
| Lick | Using tongue to pull in an object | 255s | 43.44% |
| Not in view | Cat is not in view of the camera | 19s | 3.24% |
| Sit | Cat is positioned with posterior to the ground, fore legs extended, hind legs bent | 173s | 29.47% |
| Sniff | Inhaling air through nose | 33s | 5.62% |
| Survey | Observing the environment by turning neck, without locomotion | 20s | 3.41% |
| Walk | Locomotion at a relaxed speed | 18s | 3.07% |
| | | 587s observed | |

**Figure 3**

*Boa constrictor* feeding ethogram

| Term | Description | Time, s | Time, % |
|---|---|---|---|
| Bite-hold | Strong bite that holds prey in place | 257s | 28.24% |
| Coil | Wrapping around prey | 1s | 0.11% |
| Constrict | Squeezing a coiled prey | 255s | 28.02% |
| Contract | Rhythmic muscle contractions to move prey into the throat once in mouth | 435s | 47.80% |
| Eat | Consuming food using teeth, jaws, and body | 480s | 52.75% |
| Pterygoid walk | Repeated movement of left and right upper jaw over prey | 300s | 32.97% |
| Reposition | Adjusting the head after coiling and bite-hold for consumption | 4s | 0.43% |
| Stalk | Moving forward slowly towards prey | 46s | 5.05% |
| Stand | Front portion of body lifted vertically | 114s | 12.53% |
| Strike | Opening mouth and moving with great speed towards prey, and biting | 1s | 0.11% |
| Strike position | Snake's neck is positioned in an "S" shape, body positioned for stability | 32s | 3.52% |
| Survey | Moving head and neck around to observe environment | 24s | 2.64% |
| Tongue flick | Tongue extends from oral cavity, wags, and returns to oral cavity | 6s | 0.66% |
| Watch | Observing a specific object | 103 | 11.32% |
| | | 910s observed | |

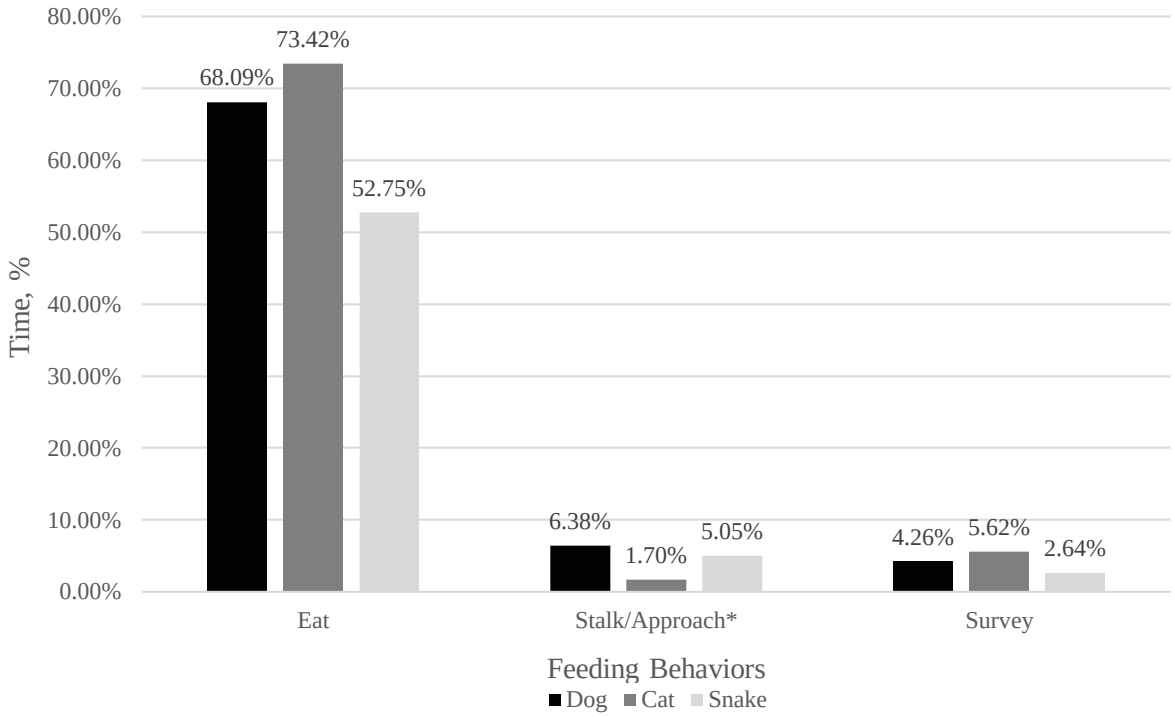


**Figure 4**. Percent Time of Feeding Behaviors for Dog, Cat, and Snake *Stalk and Approach behaviors were used as one for comparison of similar behaviors.

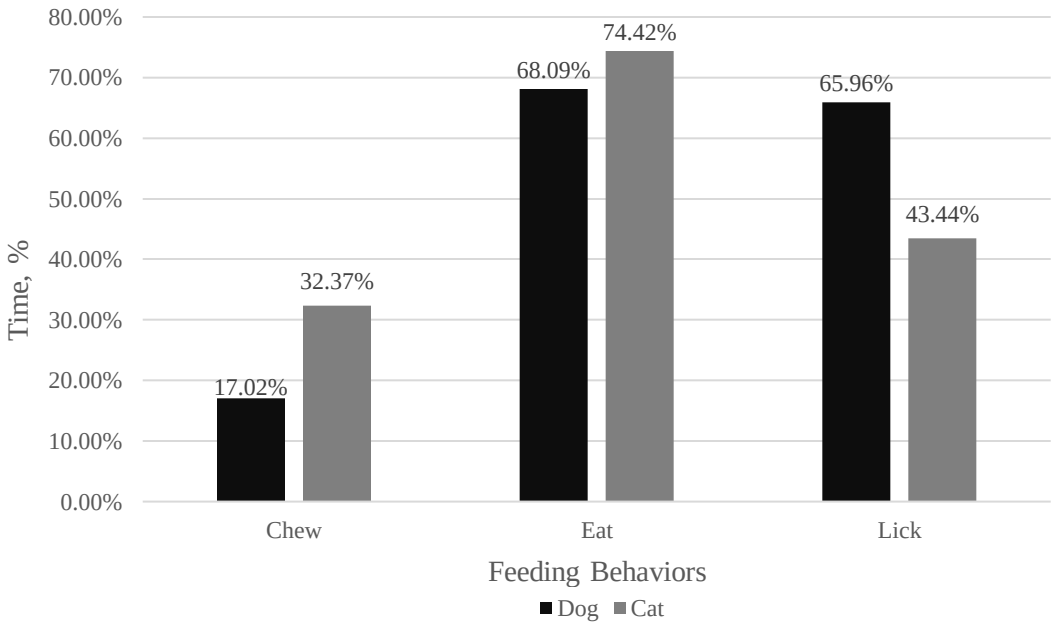


**Figure 5**. Percent Time of Feeding Behaviors for Dog and Cat

# References

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