

Feeding Ethology of Domestic Horses, Dogs and Rabbits

Alivia Souther

Dr. John McGlone

ANSC 3318 Ethology Research Report

3 March 2018

## Abstract

A single domestic horse, dog and rabbit were recorded via video to observe the feeding behaviors of each respective species. The results are compared to the available literature on feeding regarding each species as a baseline for normal feeding behaviors. Eating, drinking, licking and 'other' behaviors were some focused behaviors. All of the subjects were observed in their normal housing conditions at their individual feeding times. They were also provided with their usual feedstuffs and water access. It should be noted that the presence of an observer with a camera did distract all of the species recorded and may have affected the results. Not all behaviors were observed in all species due to limitations of vision/ camera angle and physiology of the animal (ex: the dewlap and hair of the rabbit prevented observation of swallowing).

## Introduction

All mammalian species have to exhibit feeding behavior in order to acquire the appropriate nutrients for survival. All animals that consume a meal must ingest and digest food. Digestion in rabbits, dogs and horses alike is a rhythmic process (Food and Nutrition Board; Institute of Medicine). There is a large focus on domestic animal nutrition, but scientific literature discussing the process of feeding (biting/grasping (prehension), mastication, saliva production/licking and swallowing) is limited.

## Methods and Materials

The experiment was designed in the Animal Science department at Texas Tech University. The data was collected during standard husbandry practices in February and March 2018 in three different locations.

### Animal Subjects and Housing

The data was collected from a single feeding observation session of a domestic rabbit (Animal I.), a domestic horse (Animal II.) and a domestic dog (Animal III.).

I. Mollie, an eight year old, female, Dutch/Rex cross rabbit was observed at normal feeding time (6pm). Mollie was fed two large handfuls (approximately two cups) of *Earthbound* brand Farm Spring Mix greens consisting of: baby spinach, red chard, baby kale, radicchio, green oak, Lolla Rosa, and red romaine. Mollie had ad libitum access to water, one flake of *Kaytee*® sun-cured timothy hay and *Wild Harvest Adult Rabbit Advanced Nutrition Diet*. She was observed when fed the mixed greens. Mollie was observed in her normal housing- an open top, wire cage (approximately 2 x 5 ft.).

- Wild Harvest Adult Rabbit Advanced Nutrition Diet (no guaranteed analysis available)
- Earthbound brand Spring mix: vitamin A 45% dv, vitamin c 50% dv, calcium 6% dv, iron 20% dv
- Kaytee® sun-cured Timothy Hay guaranteed analysis: crude protein 6%, crude fat 1%, crude fiber 32%, moisture 12%

II. Lorelei, a twelve year old, American Paint Horse mare was observed at normal feeding time (5pm). Lorelei is fed 2lbs. Hi-Pro Performance sweet feed morning and evening with a single pump (OZ) of *HylaLUBE* joint supplement in the evening. She is also fed 3 flakes of alfalfa hay each morning and evening. She has ad libitum access to ten gallons of water. Lorelei was observed while eating her sweet feed mix. Lorelei was observed in her 12x12 ft. stall under lights.

- Hi-Pro Performance feed guaranteed analysis: crude protein 13%, lysine 0.7%, methionine 0.2%, crude fat 9%, Crude Fiber 9%, starch 29.5%, sugars, sodium 0.4%, calcium 1.3%, phosphorus 0.5%, magnesium 0.2%, copper 60 ppm, manganese 140 ppm, zinc 225 ppm, cobalt 0.7 ppm, selenium 0.6 ppm, vitamin A 5,000 IU/lb., vitamin D 750 IU/lb., vitamin E 150 IU/lb., vitamin b12 10mcg/lb.
- HylaLUBE (no guaranteed analysis): 325mg hyaluronic acid sodium per oz.

III. Whiskey, a one year old, female, Cattle Dog mix was also observed at her normal feeding time (6pm). She was fed two cups of *Taste of the Wild High Prairie Canine Formula with Roasted Bison and Roasted Venison* with 1 tsp *ETTA SAYS!* Liver Sprinkles and ¼ cup hot water. Whiskey had ad libitum access to water. Whiskey was observed freely in a kitchen (free to roam and move around while eating).

- Taste of the Wild High Prairie Canine Formula with Roasted Bison and Roasted Venison guaranteed analysis: crude protein 32%, crude fat 18%, crude fiber 4%, moisture 10%, zinc 150 mg/kg, selenium 0.35 mg/kg, vitamin E 150 IU/kg, omega-6 fatty acids 2.8%, omega-3 fatty acids 0.3%, total microorganisms (lactobacillus plantarum, bacillus subtilis, lactocobacillus acidophilus, enterococcus faecium, Bifidobacterium animalis)
- ETTA SAYS! Guaranteed analysis: crude protein 52%, crude fat 20%, crude fiber 1%, moisture 6%

### **Data Collection**

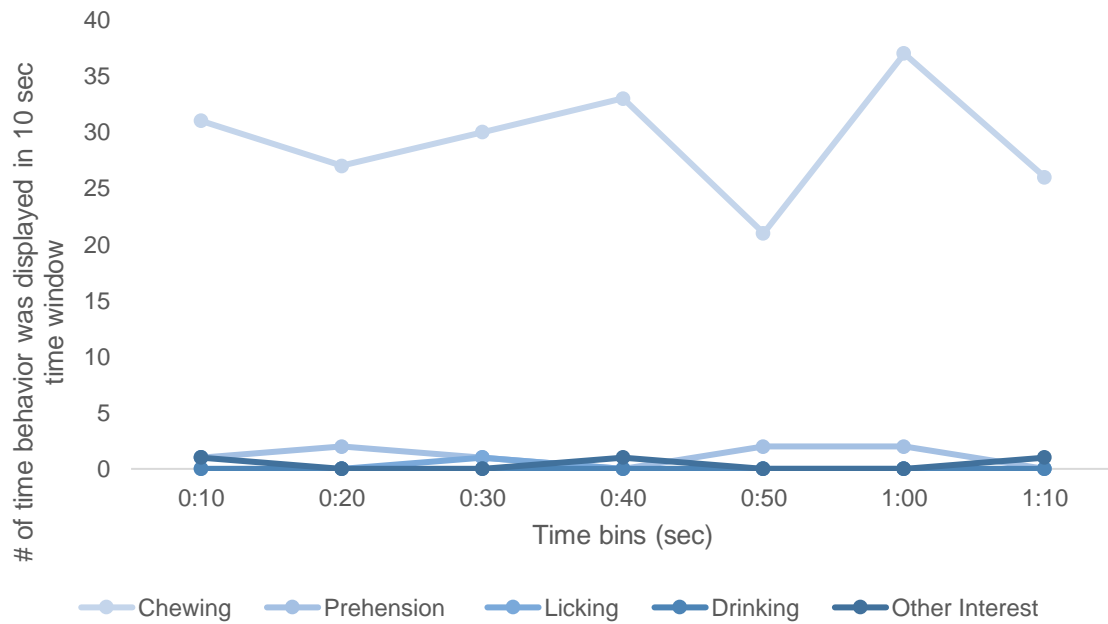
All of the data collected was from a period less than 10 minutes per species during feeding only. The videos were recorded standing outside of the cage/stall/kennel to allow the animals to be as comfortable as possible. The entire feeding process was observed in the horse and dog, but the rabbit was nervous being watched for an extended period of time. The rabbit was observed for approximately 2 minutes before she stopped showing behavior all together. The dog was observed for 3 minutes and completed the meal within this time frame. The horse was observed for 7 ½ minutes, did not finish the meal and stopped showing feeding behavior.

### **Results**

I. During observation, Mollie consumed a small amount of wet forage. She did not finish the meal during observation. She consumed some leaves and began grooming, licking her face and legs. While leaves she preferred over others. She

grasped leaves using her lips and front incisors and began chopping them up into pieces using her teeth. Continuing to masticate, Mollie began grinding her food using her cheek teeth before swallowing. During the 1 minute, 10 seconds (70 total seconds) Mollie was observed, she spent most of her time chewing and grinding the plant material (mean= 2.98 chews/1 sec). She spent a moderate amount of time on preference of food and grasping the leaves with her lips and teeth. She spent very little time interested in other objects and licking. It was difficult to make note of swallowing as her dewlap and hair covers her throat/esophagus. Mollie was observed in her open-top wire cage inside of an open garage.

Figure 1a



Behaviors Observed During the Feeding of a Domestic Rabbit (n=1)

Table 1b

Behavior	Description
Prehension	Grasping the food using the front incisors and lips to pull food into the mouth. The tongue may swirl to pull in forage; taking a bite
Mastication (chewing)	Opening and closing the mouth while grinding the food with the cheek teeth (left to right)

Licking

Using the tongue to wet the nose and lips, as well as to lubricate the outside of the mouth

Showing other interest

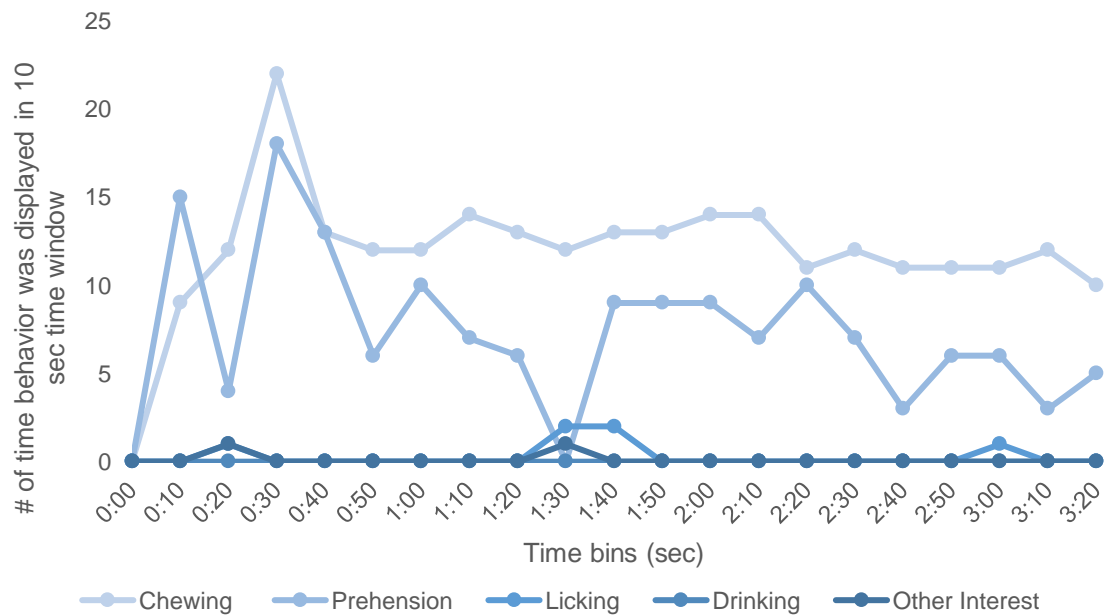
Attention directed to a stimuli not associated with feeding (i.e. looking at a person, walking around, thumping, grooming, etc.)

---

II. Lorelei consumed grain for 7 minutes and 41 seconds before drinking water and finishing her meal. She moves the tip of her nose left to right, spreading the feed across the pan and moves her lips apart to grasp the pellets. Her tongue is also used to lick and grab some food during intake. There is no specific pattern to where she takes bites out of the pan, they seem to be random. Lorelei uses her mandibular and maxillary molars and pre-molars to grind food left to right before swallowing. She lifts her head several times during observation, staying alert and continuing mastication.

Figure 2a

---



Feeding Behaviors Observed During Feeding of a Domestic Horse (n=1)

---

Table 2b

Behavior	Description
Prehension	Grasping the food using the front incisors and lips, as well as sticking the tongue to the food particles to pull food into the mouth; taking a bite
Mastication (chewing)	Opening and closing the mouth while grinding the food left to right using the molars and pre-molars
Drinking	Intake of water by sucking and swallowing; lips pucker to allow intake
Licking	Using the tongue to wet the lips and lubricate the outside of the mouth
Showing other interest	Attention directed to a stimuli not associated with feeding (i.e. looking at a person, walking around, sniffing, etc.)

**III.** During the observation of Whiskey, she ate for 3 minutes, 15 seconds (195 seconds total). She grasped the pieces of kibble with her upper and lower incisors while her head is down in the bowl. She also used saliva and tongue texture to stick food particles to her tongue, aiding her teeth in pulling particles into her mouth. Because she is eating kibble instead of meat, she does not need to use her canines as much to rip and tear tissue. She grasps the food an average of 6-7 (mean= 6.34/10 sec; s= 4.56) times before continuing to chew. After grasping the food with her front incisors, she moves the food to the back of the mouth to continue mastication. Whiskey continues chewing with her premolars and molars, usually while her head is out of the bowl, parallel to the ground. After swallowing the bolus of food, she smacks her lips a few times. She also moves around the bowl, not staying in the same spot she originally started eating in. She looks up at the camera and her surroundings a few times, staying alert. Whiskey finished eating with about 1/8 cup of food remaining in the bowl. She did not drink water during the course of eating.

Figure 3a

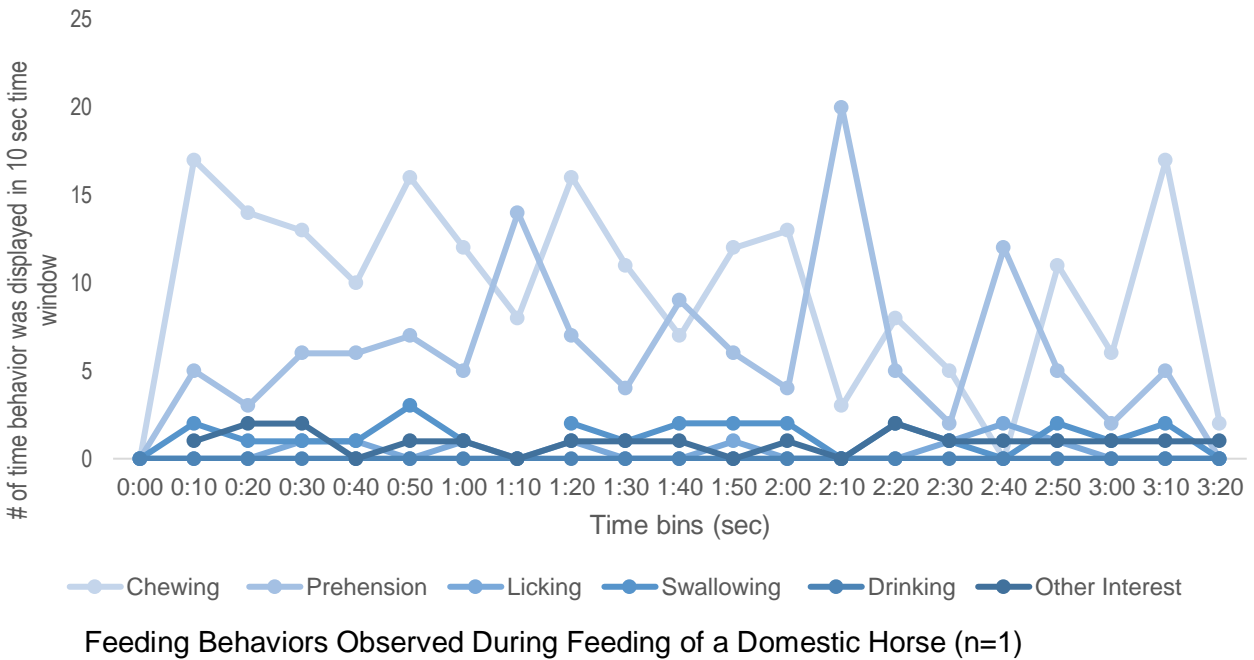


Table 3b

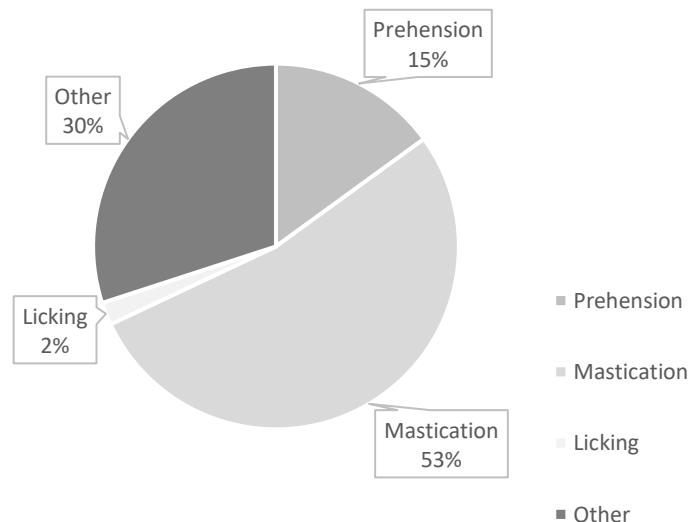
Behavior	Description
Prehension	Grasping the food using the front incisors, canines and tongue to pull food into the mouth; taking a bite
Mastication (chewing)	Opening and closing the mouth while smashing the pre-molars, molars and carnassial teeth together (straight up and down or left to right)
Drinking	Intake of water by lapping (tongue curling to pick up water)
Licking	Using the tongue to wet the nose and lubricate the outside of the mouth
Swallowing	Intake of a bolus (food particles combined with saliva) of food
Showing other interest	Attention directed to a stimuli not associated with feeding (i.e. looking at a person, walking around, etc.)

## Discussion

I. Rabbits (Lagomorph) are non-ruminant (monogastric), hindgut fermenting herbivores (Cheeke 160). Rabbits require a high fiber diet. In: Feeding Behaviour of Rabbits of Nutrition of the Rabbit, the authors describe a unique behavior in the rabbit called coprophagy (ingestion of soft feces). According to the literature, the rabbit's diet is comprised of feeds and caecotrophes (T. Gidenne et al 233). The typical diet of a domestic rabbit is a combination of pelleted feed, dry forage (like hay) and occasionally fresh (wet) forage. Mollie did not show and coprophagy, but did display feed eating behavior. Coprophagy generally occurs hours after feeding, so it makes sense that this behavior was not observed.

Many household rabbits are fed ad libitum. Young rabbits start eating solid feed at 16-18 days of age (T. Gidenne et al 235). Mollie can be seen spending much of her time chewing and grinding food during feeding. Chewing is important because food must enter the stomach finely ground (Cheeke 160). She chews (makes a grinding motion left to right) approximately 3 times/second. She made 179 mastication movements the first minute of observation. One average, rabbits make 120 mastication movements per minute (Lebas et al 1). Swallowing behavior was not recorded, because it was not easily visible (her esophagus is covered by her dewlap). They require a high fiber diet to prevent the overgrowth of their teeth. This is due to the fact that rabbits have continuously erupting teeth designed for grinding plant material throughout the day (Lebas et al 14). Teeth that are too long and are not worn down will cause behavior upsets. Rabbits may become aggressive due to extreme pain, or stop feeding altogether due to abscesses, spurs or pain from malocclusion (Fawcett 1).

Figure 4a



Percentage of Time Spent Exhibiting Specific Behaviors in a Domestic Rabbit (n=1)

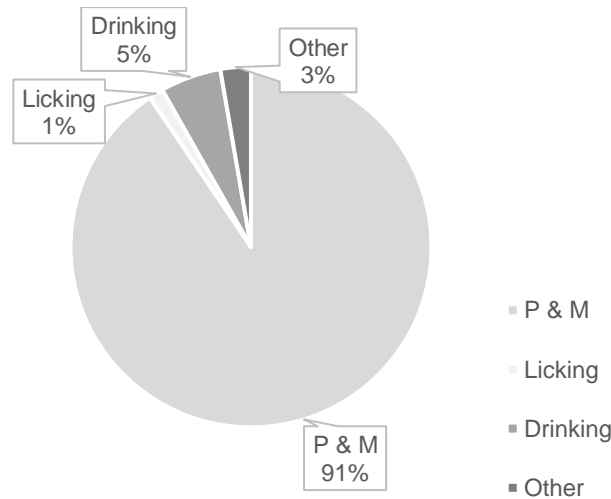


Mollie did not finish eating the 2 cups of greens during the video session. This is probably due to two facts. First, rabbits are crepuscular. This means that they are most active beginning at dusk, spending much of the night hours feeding (Kennedy et al 385). In a study analyzing rabbit feeding behavior and light conditions in 1977, François Lebas discovered that the “absence of light (24h/24 dark)” feed intake was dramatically increased compared to rabbits on a variety of light/dark schedules (Lebas et al 14). Mollie, being a domestic pet rabbit is awake during some of the day time due to living with humans and not having the ability to burrow in darkness during day light. Mollie is fed at 6pm, much earlier than she would probably feed if she were a wild rabbit. Secondly, rabbits are small prey animals (Barrio et al. 986). Being monitored while eating could possibly have made Mollie uncomfortable. She was also fed in an open garage inside of her open top wire cage. The light flooding in from the open garage door at 6pm in the spring could have prevented her from showing longer feeding behavior.

**II. Horses (equine)** are non-ruminant, hindgut fermenting herbivores, like rabbits. They can be fed a variety of different feeds and forages, from beet pulp to sweet feed to alfalfa hay to pasture only. It depends upon the horse. In this case, Lorelei is fed sweet feed and alfalfa hay. She was observed while eating her sweet feed in the evening. Lorelei is kept on a property without pasture access. Horses on pasture spend between 60-80% of their time grazing (McDonnell 16). Lorelei’s forage feeding patterns are drastically different than horses with access to pasture (wild or domesticated).

Lorelei moved the tip of her nose left to right, spreading the feed across the pan and moves her lips apart to grasp the pellets. In *The Equid Ethogram: A Practical Field Guide to Horse Behavior*, Sue McDonnell explains that horses use their lips and tongue to gather forages and dry matter before beginning to chew (McDonnell 25). When grazing, the front incisors are also used to rip roots and forages out of the ground. There is no specific pattern to where she takes bites out of the pan, they seem to be random. Lorelei uses her mandibular and maxillary molars and pre-molars to grind food left to right before swallowing. She lifts her head several times during observation, staying alert and continuing mastication. Similarly to rabbits whom are also hindgut fermenting monogastrics, horses exhibit coprophagy (McDonnell 29). Lorelei did not display this behavior during feeding. Lorelei did show drinking behavior after feeding, unlike the two other species observed. She spent 38 seconds drinking water in the 7:41 minutes observed. Lorelei puckered her lips and sucked water into her mouth before swallowing (McDonnell 31). Horses slightly part their lips before sucking in water Lorelei’s behavior was consistent with the literature.

Figure 4b



Percentage of Time Spent Exhibiting Specific Behaviors in a Domestic Horse (n=1)

P: *Prehension behavior*

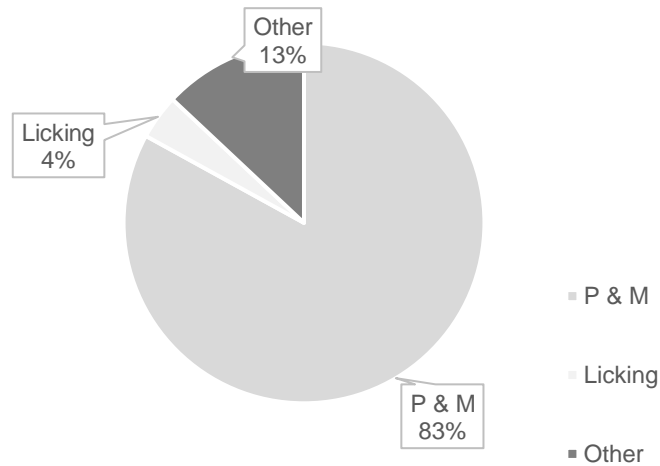
M: *Mastication behavior*

**III.** Dogs (canine) are monogastric scavenger carnivores. This means they have some of the enzymes and physiology to digest plant matter and carbohydrates, but require a diet of primarily animal tissues. Whiskey however, is not fed a “species appropriate” diet like her ancestors, but her diet is still nutritionally balanced according to Taste of the Wild brand. Many domestic dogs can consume a large bowl of food in a short period of time. Ancestrally, this is similar to what wild dogs and wolves would do. In the research article, *The Evolutionary Basis for Feeding Behavior of Domestic Dogs (Canis familiaris) and Cats (Felid catus)*, John Bradshaw (author) explains that a pack of wild dogs would kill/locate large prey and as a group, according to a hierarchy, would feed rapidly on the carcass. The rapid feeding is an adaptation of scavenger carnivores. Modern feral dogs, however scavenge rather than hunting at all (Bradshaw 1927S). This could be a clue as to the reason our domestic dogs can tolerate a larger quantity of “other” nutrient sources (vegetables, grains, fruit, seeds, etc.) and no longer rely as heavily on pure animal tissue and carcass to thrive like cats do.

After locating a food source, prehension and mastication of the feedstuff occurs. During prehension, Whiskey used her teeth (front incisors and canines) and tongue to pull the food up into her mouth. She spent more time taking bites (prehension) than chewing (masticating). Mastication is a rhythmic process like much of the digestive process. It is controlled by a group of brain stem cells known as the central timing network (CTN) (Gerstner et al. 2266). A study from 2010: *Chewing rates among domestic dog breeds*, analyzed chewing rates in a variety of dogs based on their body mass (breed and jaw length were not factors analyzed but these did not affecting

chewing rates). This indicates that larger dogs generally chew more while eating than smaller dogs in regards to body mass (Gernster et al. 2271). Whiskey, being a medium/average size dog (approximately 50-55 lbs.) did a moderate to high amount of chewing during the feeding session at a total of 201 times in a 3:15 time frame.

Figure 4c



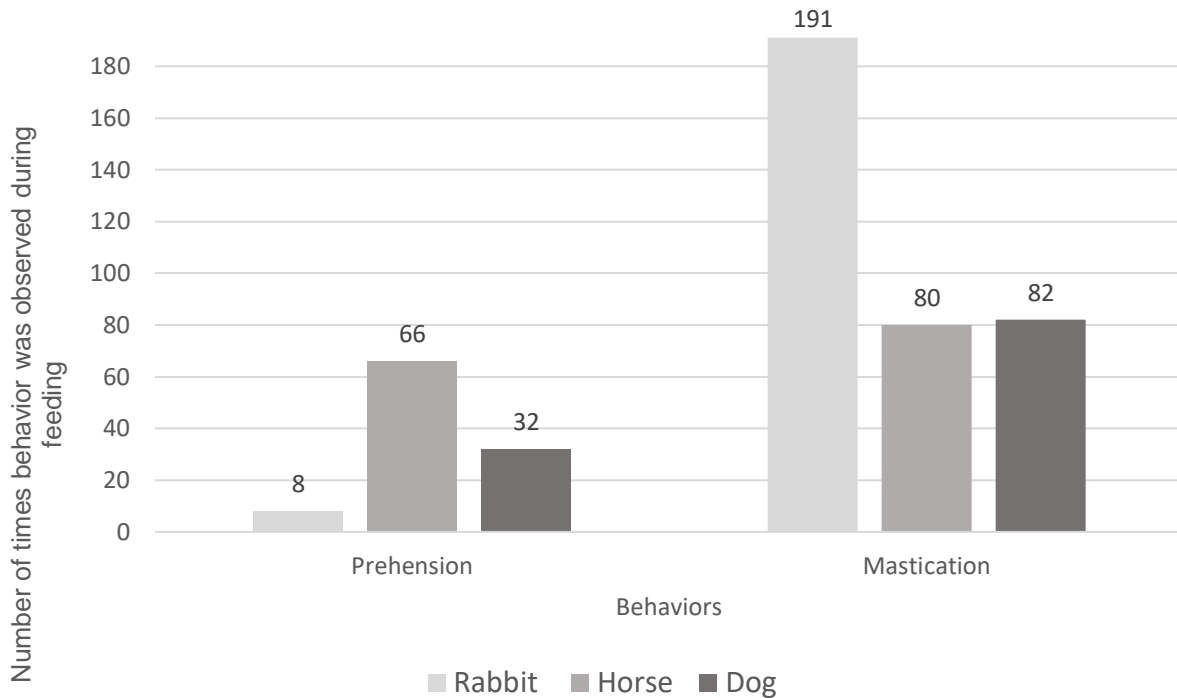
---

Percentage of Time Spent Exhibiting Specific Behaviors in a Domestic Dog (n=1)

---

Prehension occurred most in the horse, followed by the dog. Mastication occurred for the highest percentage of time in the rabbit, followed by the horse. Herbivores seem to prehend and masticate more than carnivores. Each species prehend and masticated food differently, but both behaviors were observed in all species observed. All of these animals were fed a commercial diet in a controlled familiar environment. In the wild, as well as in other domestic animals, the feeding behaviors exhibited could vary drastically. Being observed also drew the attention of each species away from their food. Animals may act differently or show different behaviors when they believe that no one is watching. Feeding behaviors of the domestic rabbit, horse and dog could be observed in a more inconspicuous manner in the future. This could identify behaviors that occur when an animal believed it is secluded.

Figure 4d



Time spent exhibiting prehension and mastication behaviors by the rabbit, horse and dog in the first observed minute of feeding

## Conclusion

In summary, all three species (rabbit, horse and dog) exhibited the same basic behaviors during feeding. These behaviors included, but are not limited to (nor were they described in each feeding session): prehension, mastication, drinking, swallowing and licking. 'Other' behaviors were also recorded. These behaviors included: sniffing, looking at a person or object, playing, grooming and more. Previous literature and this study agree that herbivores masticate for a longer period of time than carnivores. They also rely heavily on their lips and tongue during prehension, while carnivores rely on their teeth more.

### Links to feedstuffs:

<http://www.ettasays.com/specialty-items/>

<https://www.kaytee.com/all-products/small-animal/hay/timothy-hay/timothy-hay>

<https://www.tasteofthewildpetfood.com/dog-formulas/high-prairie-canine-formula-with-bison-and-roasted-venison/>

<https://www.hiprofeeds.com/products/performance-textured-feed>

### Works Cited

Barrio, I. et al. (2010, June 30). Prey naiveté in an introduced prey species: the wild rabbit in Australia. *Behavioral Ecology*. 21(5). pp.986-991

Bradshaw, J.W.S. (2006, July 1). The Evolutionary Basis for the Feeding Behavior of Domestic Dogs (*Canis familiaris*) and Cats (*Felis catus*). *The Journal of Nutrition*, 136(7). pp. 1927S

Cheeke, P.R. (1987). Rabbit Feeding and Nutrition. Orlando, Florida: Academic Press, Inc.

Feist, J.D. & McCullough, D. R. (1975, January 25). Behavior Patterns and Communication in Feral Horses. School of Natural Resources. Pp.337-371

Gerstner, G. E. (2010, July 1). Chewing rates among domestic dog breeds. *Biologic and Materials Science*. 213(13). pp.226-2272

Kennedy, G.A. et al. (1993, April 6). Circadian Wheel Running Activity Rhythms in Two Strains of Domestic Rabbit. *Physiology & Behavior*. 55(2). pp.385-389

Lebas, F. & Gidenne, T. (2005, November 2). Feeding Behaviour in rabbits. III International Rabbit Production Symposium, 1 (1). pp. 1-19

McDonnell, S. M. (2003, January). *The Equid Ethogram: A Practical Field Guide to Horse Behavior*. Lexington, KY: The Blood-Horse Inc.