

The Effect That Time Of Day Has On The Behaviors of Maine-Anjou Cattle (*Bos taurus*)

Introduction:

Time of day can influence the different behaviors of many species. Temperature and weather are factors pertaining to the time of day. *Theropithecus gelada*, a type of primate, increase their eating time when it is cooler, perhaps due to increased energy requirements (Dunbar, 1992). According to Xiang *et al.* (2010), resting behaviors of *Rhinopithecus bieti*, a type of monkey, occurred more during the summer, when the sun is hot than another other season. European ground squirrels, *Spermophilus citellus*, were most active during the morning hours than in the midday hours observed (Vaczi *et al.* 2006). They were also more active in a cloudy environment versus a sunny environment (Vaczi *et al.* 2006). When the temperature increased, the morning activity of female mouflon, *Ovis aries*, occurred earlier and the evening activity occurred later (Bourgoin *et al.* 2011). All of these studies indicate that most activity occurs when it is cooler, whether it pertains to temperature, weather, or time of day.

The behaviors of many species of cattle are also affected by the time of day. Gibb *et al.* (1997) stated that the Holstein cows observed were less active during hours when the sun was out and hot, which was during the middle of the day. They spent less time eating and more time chewing their cud. The results showed that the cows spent the most time eating during evening hours. Goncalves *et al.* (2011) found that Simmental bulls were more active while in a cool shaded area than in a hot sunny area. These studies show that the cattle observed were most active in a cooler environment.

This study describes the different behaviors of Maine-Anjou cattle (Phylum Chordata, Class Mammalia, Order Artiodactyla, Family Bovidae, Genus *Bos*, and Species *taurus*; New World Encyclopedia, 2008). Maine-Anjou originated in France and first came to North America in 1969 (AMAA, 2011). They came to Canada and then were brought into the United States through artificial insemination (AMAA, 2011). Maine-Anjou came about when breeders decided to cross a Durham with a Mancelle (AMAA, 2011). The name “Maine-Anjou” was named after the Maine and Anjou river valleys in France (AMAA, 2011). Maine-Anjou are known for their great performance, disposition, feed efficiency, and for their exquisite carcass traits (AMAA, 2011). Cows prefer to eat grass and many different types of grain (New World Encyclopedia, 2008).

The purpose of this paper was to describe and quantify the behaviors of Maine-Anjou cattle. The cattle were observed in an enclosed 4.05 hectare pasture at a small, family-managed farm in Auglaize County, OH. The hypothesis that cattle will be more active when temperatures were cooler was also tested. I predicted that cattle activity was the highest in the evening and lowest midday.

Methods:

Study Site

The cattle were observed from outside the pasture enclosure at a small farm in Waynesfield, Ohio ([40.60056°N 83.97528°W](#)) in Auglaize County. There were approximately fifteen cows (females that have already produced at least one offspring), three heifers (females that have not had offspring) and one gomer bull (infertile male) that were observed (New World Encyclopedia, 2008). They were enclosed in a pasture that covers 4.05 hectares of land surrounded by an electric fence. They all had access to a hay feeder, water and grass. There were no trees and the land is very flat. They also had the ability to go in the barn for shelter.

Part I- Description of Behaviors

The cattle were viewed for six hours over a span of two weeks. The different weather patterns included: sunny, windy, rainy, and cloudy. The temperatures ranged from 4.4°C to 18.9°C. I observed the cattle from outside the pasture, 9.1 meters away. Due to the animal's large size and close proximity, no binoculars or observation aids were used. I recorded the different actions that the cattle performed in a notebook through written observations and sketches. The cattle were distinguished by tag numbers and variation in morphology. There were cows that were grey, red and white, and black. The cattle were also distinguished by their quality. Some had better features than others. These features included quality of muscularity, soundness, structure, and depth of rib. Some also had more hair than others.

Part II- Quantification of Behaviors

A subset of the behaviors described in Part I (See Part I Results) was quantified. The locomotion behaviors that were quantified were walking and galloping. The resting behaviors that were quantified were standing and laying down. The interactive behaviors that were quantified were head butting, setting up, ear movements, nose wrinkling, sniffing, following, and vocalization. The self maintenance behaviors that were quantified were itching and tail wagging. The foraging behaviors that were quantified were eating, grazing, drinking, chewing of the cud and depositing waste. During 30-minute observation periods, I tallied how many times any cow portrayed a certain behavior. I calculated the proportion of times each behavior occurred from the total of all the behaviors for each 30-minute period. I then calculated the average and standard deviation of the twelve 30-minute observations for each behavior.

Part III-Hypothesis Testing

The cattle were observed in the morning between the hours of 7a.m. to 9a.m., in the afternoon from 12p.m to 2 p.m., and in the evening from 5p.m. to 7p.m to test the hypothesis that the cattle are most active at evening hours. The same measures were used as in Part II. The weather was scored as: Sunny=0; Rainy=1; Windy=2; Cloudy=3. The time was recorded using the 24-hour clock. The behaviors and time of day were entered into Microsoft Excel (14.0, Microsoft Corporation, Rosa,California) and then were analyzed using Program JMP Version 9.0.0 (SAS Institute Inc., Cary, NC, www.jmp.com).

Results:

General Observations

I observed the actions and behaviors of fifteen cows, two heifers and one gomer bull. The cattle stayed in two groups most of the time. One group huddled around the round bale feeder while the other group huddled around the excess hay approximately 2.5m from the round bale feeder. Group membership changed frequently.

Part I-Description of Behaviors

Locomotion behaviors included walking and galloping (Table 1). Resting behaviors included standing and laying down (Table 1). Interactive behaviors included head butting, setting up, ear movements, nose wrinkling, sniffing, following, and vocalization (Table 1). Self maintenance included itching and tail wagging (Table 1). Foraging included eating, grazing, drinking, chewing cud and depositing waste (Table 1).

Table 1: Maine-Anjou cattle behaviors observed during eight hours of observation in a 4.0 hectare pasture at a small farm in Waynesfield, Ohio.

Behavior	Definition
Locomotion	
Walking	This is a slow consistent pace with no stops or other distractions. They stagger their feet back and forth while moving forward, and the back hoof reaches up and touches the front hoof.
Galloping	This is a fast consistent pace with no stops or other distractions. All feet leave the ground at once.
Resting Behaviors	
Standing	This includes no movement. They will stand with their head at natural height, which is level with their topline.

Laying down	This includes resting on the ground with their legs tucked underneath their body and their neck and head up at a natural height, which is level with their topline.
	Interactive Behaviors
Head butting	The head goes down either almost touching the ground or at normal position, which is level with their topline and is then swung at another cow.
Set up	They stop and stand still and the head rises up 0.3m and the right back leg sets back 0.3m farther than the left back leg. This position is what is portrayed in a cattle show to display their qualities. Bulls often do this when close to the female.
Ear movement	The ears move forward and perk up at attention, usually because of a distraction or movement.
Nose wrinkling	The nose wrinkles up and the upper lip is curled up.
Sniffing	As they follow another cow, sometimes they will sniff the rear end.
Following	One cow closely follows another cow while moving forward.
Vocalization	They will raise their head and point it up and let out a moo like sound.
	Self Maintenance
Itching	This is repeated licking or rubbing in one spot. They use their tongue, their hoof, or another object or cow.
Tail wagging	This is a side to side movement of the tail. It will move sideways and hit one side of its back and then move the other way and hit the other side of its back.
	Foraging
Eating	They stick their tongue out and use their mouth to obtain hay out of the feeder or off the ground.
Grazing	They bend down their head until it is close enough to tear out grass, chew

	it up, and swallow it. This is a slower pace than walking. They stop to eat for a certain amount of time and then slowly move to a different spot to eat. They do this randomly and at no set pace.
Drinking	They bend their head down until it reaches the tank, and then open their mouth and slurp water out of the metal tank.
Chewing cud	This included moving of the mouth back and forth horizontally while they chew regurgitated food.
Waste depositing	The tail lifts up and out, the back roaches up and the feces or urine is deposited.

Part II- Quantification of Behaviors

Two of the most common behaviors, eating and chewing cud, were foraging behaviors (Figure 1). The second most common behavior was standing, a resting behavior (Figure 1). Walking, a form of locomotion was the third most common behavior (Figure 1).

Figure 1: Proportion of time captive Maine-Anjou cattle spent in various behaviors observed 12 30-minute observation periods at a 4.0 hectare pasture in Waynesfield, Ohio.

Part III- Hypothesis Testing

A main category, locomotion increased later in the day (Figure 2; $F_{1,22}= 18.02$, $P=.0003$). Contradicting to my hypothesis, instead of being least active midday, they proved to be least active in the morning (Figure 2). Walking increased later in the day ($F_{1,22}=17.36$, $P=0.0004$). Head butting increased later in the day ($F_{1,22}=4.33$, $P=.0493$). Setting up increased later in the day ($F_{1,22}=8.47$, $P=.0081$). Ear movement also increased later in the day ($F_{1,22}=4.21$, $P=.0522$). Laying down decreased later in the day ($F_{1,22}=4.88$, $P=.0378$). Sniffing decreased later in the day ($F_{1,22}=4.57$, $P=.0439$). Following decreased later in the day ($F_{1,22}=4.14$, $P=.0542$). Chewing cud also decreased later in the day ($F_{1,22}=4.60$, $P=.0432$). Tail wagging dipped mid-day, but was high early and late in the day ($F_{2,21}=3.99$, $P=0.03$).

Figure 2: Time of day vs. the proportion of locomotion behaviors of captive Maine-Anjou cattle observed 12 30-minute observation periods at a 4.0 hectare pasture in Waynesfield, Ohio.

Discussion:

My main finding was that locomotion increased later in the day. This result is similar to Dunbar (1992) who studied *Theropithecus gelada*, a type of primate. He found that the primates increased their eating time when it was cooler. My study also relates to Gibb *et al.* (1997) who stated that the cows spent the most time eating during evening hours. Goncalves *et al.* (2011) found that Simmental bulls were more active while in a cool shaded area than in a hot sunny area which also relates to my study.

I observed that cattle spent most of their time foraging, followed by resting and locomotion. This result is similar to Braghieri *et al.* (2011) who studied Chianina, Podolian, and Romagnola cattle. They also found that foraging (grazing) was most common, followed by locomotion (walking) and resting. Tuomisto *et al.* (2008) studied only hereford bulls and found that ruminating (chewing cud), a type of foraging, was the most common behavior. Like in my study, Tuomisto also found that resting was the second most common behavior (Tuomisto *et al.* 2008).

Reinhardt and Reinhardt (1981) state that cattle form groups in which the individuals stay together voluntarily for most of their life. I observed that the cattle, for the most part, stayed in two groups the entire six hours of observation, but conflicted with their study because the same cows were never together in the same group. This could be a result of many things but a good possibility as to why the cows never stayed together might be because of competition of resources. The round bale feeder could have been surrounded by too many cows at the time, so the cows might have just decided it would be easier to eat the excess hay that was on the ground away from the feeder. The findings of this study could be applicable to other species that also travel in groups including sheep (Michelena *et al.* 2006).

I found it surprising that more behaviors did not increase later in the day. Two of the most common behaviors observed, eating and chewing cud, disagreed with my hypothesis greatly. Eating proved to be insignificant and chewing cud decreased later in the day. I also found it surprising that locomotion increased as the day progressed. I thought locomotion would be highest in the evening, but would occur more in the morning versus midday.

There are many limitations to this study. The time of day, the weather, and the time of year could all affect the behaviors. Different reproductive stages could also result in different behaviors. Limitations to grass might also be a factor. For example, if the grass is abundant in some areas of the pasture, the cows will most likely all want to go to that spot to eat. This will increase competition which may result in aggressive behavior including head butting. Other species' behaviors might also be affected by these limitations. They too have to deal with the environment and their own reproductive stages. Better methods could be developed, which also might be a limiting factor. I observed 19 individuals as a whole group, if only one at a time is observed for a certain time period, maybe keeping track of the

behaviors will be easier. If a different site with more grass to travel and forage on is used, maybe the cows will spread out more and not huddle in groups so much.

Overall my hypothesis proved to be partially correct. Most activity progressed as the day went on instead of being highest in the evening and then second highest in the morning like my hypothesis stated.

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