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Feeding Ethology of the Domestic Dog (*Canis familiaris)* Correlates with the Phenomenon of Classical Conditioning

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Aim: Feeding ethology of *Canis familiaris* is closely related to their overall health and wellbeing. Domestic dog (*Canis familiaris*) acquire behaviors, attitudes, ideas and new knowledge through the process of learning. This learning can occur through both conscious and unconscious pathways. One of those unconscious methods of learning in case of *Canis familiaris* is classical conditioning. It is a learning process in which learning occurs by association. It is a process of learning in which an automatic, conditioned response is paired with a specific stimuli and the dog's innate reflexes are conditioned to react to subtle signals. Over time, the dog learns to associate the subtle signal with the specific event. This phenomenon has been well-illustrated in the Pavlov's experiment.
Conclusion: The unconditioned response in this experiment was the dog salivating for food and the conditioned stimulus was the stimulus that can eventually trigger a conditioned response. In this case, the conditioned stimulus was the ringing of the bell for the dog to have its food and the conditioned response was the salivation caused in the dog. Eventually, the dog could associate the ringing of the bell with the food and would salivate at the sound of the bell alone. However, classical

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conditioning describes how environmental stimuli such as advertisements of food can activate physiological and psychological responses in a dog causing cravings for food and increased salivation. Thus the body of *Canis familiaris* adapts itself to the given conditioned reflex and expects food exactly at the same time everyday.

Keywords: Canis familiaris; classical conditioning; conditioned reflex; dog; salivation; phenomenon.

1. INTRODUCTION

Learning is an essential process through which all living organisms may undergo. Learned behavior refers to a process where an individual reacts to a stimulus [1]. It not only refers to the processes but also the mechanisms by which humans and animals can gain specific behaviors, beginning with a stimulus [2,3,4]. Scientifically, learned behavior can be referred to the learning process where subjective impressions or new responses are auto-generated to a situation the instant it occurs [5].

1.1 Classical Conditioning / Pavlovian Conditioning

In the late 1890s and the early 1900s, Ivan Pavlov discovered classical conditioning during his experiments in dog. Pavlov studied classical conditioning (a type of learned behavior) with salivating dogs [6]. The dogs were salivating because they had learned that the stimuli preceded a reward [1]. On observing this, Pavlov found that the dogs started salivating naturally when an unconditioned stimulus i.e. food was presented to them. To test his theory, Ivan Pavlov set up an experiment in which Pavlov before presenting food to the dogs rang a bell shortly [7,6,8-10]. At first, no response was elicited by the dogs to the bells. But eventually, the dogs began to salivate at the sound of the bell alone [11]. However, through repeated pairings of a neutral stimulus such as bell and an unconditioned stimulus such as the food presented to the dogs, the dogs eventually learned to associate the bell with the arrival of the food [12,11,13].

2. MATERIALS AND METHODS

To study the feeding ethology of the domestic dog (*Canis familiaris*), food materials such as biscuits, milk, rice, dal and meat (Local chicken) were collected for providing to the domestic dog under study every day at a specific time. This study was carried out for 20 days.

Canis familiaris (Linnaeus, 1758).

2.1 Taxonomic Review

Systematic position:

Kingdom : Animalia
Phylum : Chordata
Class : Mammalia
Order : Carnivora
Family : Canidae
Genus : *Canis*
Species : *Canis familiaris* (Linnaeus, 1758)

Vernacular/Assamese name:

Kukur

Characteristics:

The morphological features of *Canis familiaris* include:

- **Body plan:** Typically slender with elongated muzzles, upright ears and long legs.
- **Facial features:** *Canis familiaris* have evolved shorter faces and crowded teeth.
- **Dentition:** Carnassial apparatus with small incisors and elongated canines.

The dental formula of *Canis familiaris***:**

$$2\times\left(\frac{3142}{3143}\right) = 42 \text{ teeth}$$
$$\frac{(6\ incisors\ 2\ canines\ 8\ premolars\ 4\ molars)}{(6\ incisors\ 2\ canines\ 8\ premolars\ 6\ molars)}$$

- **Size:** Being evolved from *Canis lupus* (wolves), *Canis familiaris* have undergone a number of morphological changes including reduction in size.
- **Limb morphology:** *Canis familiaris* walk on their toes. They are digitigrade.
- **Reproductive morphology:** Males tend to be larger and more muscular than females but there is little sexual dimorphism.
- **Other features:** *Canis familiaris* have highly developed senses of hearing, smell and they also possess sharp teeth. However, fur coat depends on breed.

3. RESULTS

3.1 Food Items Presented to the Domestic Dog (*Canis familiaris*)

- Several pieces of biscuits
- Rice mixed with milk
- Rice mixed with dal
- Rice mixed with meat (Local chicken)

3.2 Method of Presenting Food Items to the Domestic Dog (*Canis familiaris*)

- Food was provided to the domestic dog (*Canis familiaris*) exactly at 4:00 p.m. each day and this was continued for 20 days.
- Food items such as several pieces of biscuits, rice + milk, rice + dal and rice + meat (Local chicken) was provided to the dog under study every day at a particular specific time.
- This particular study was carried out for 20 days.
- Each day, a different food item was provided to the dog amongst the four types of food items mentioned above.
- Out of the four different food items, each food item was repeated for 5 times during the period of 20 days.
- As already mentioned, the food was presented to the dog at a specific time of the day and this specific time remained constant throughout the 20 days.
- 1 meal per day was served to the dog at that specific time of the day.
- The quantity of food provided to the dog, the quantity of food consumed by the dog and the quantity of food wasted by the dog were noted each day in a notebook.
- The time taken for consumption of food by the domestic dog (*Canis familiaris*) was measured using a stopwatch every day and was also noted in a notebook.
- By observing the amount of food provided to the domestic dog (*Canis familiaris*) and the amount of food consumed by the dog, the percentage of food consumed by the *Canis familiaris* was calculated.

From the below readings provided in Table 1, it may be inferred that the experimental domestic dog (*Canis familiaris*) under study gave more preference to rice + meat and biscuits than rice + milk and rice + dal. The dog appetizes the food laced with meat more than the food laced with other plant products. However, the number of biscuits provided to the dog was not constant because on the day of feeding the dog with biscuits, it showed a strong urge to have some more amount of biscuits as the days proceeded.

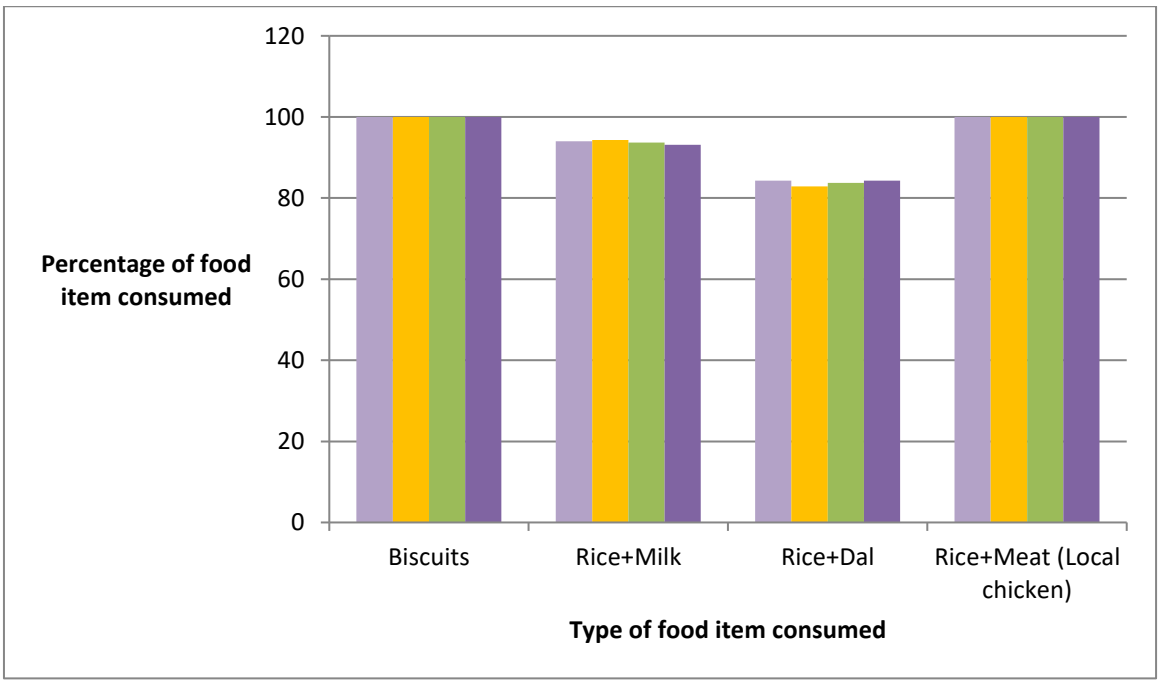

Fig. 1. Statistical analysis of food consumption by *Canis familiaris*

Table 1. Feeding chart of the domestic dog (*Canis familiaris*)

Sl. No.	Feeding time	Food Item	Amount of food provided (Grams)	Amount of food consumed (Grams)	Time taken for food consumption (Minutes)	Percentage of food consumed (%)
1.	4 : 00 p.m.	Biscuits	3	3	1	100
2.	4 : 00 p.m.	Rice + Milk	350	329	10	94
3.	4 : 00 p.m.	Rice + Dal	350	295	11	84.29
4.	4 : 00 p.m.	Rice + Meat (Local chicken)	350	350	8	100
5.	4 : 00 p.m.	Biscuits	5	5	1	100
6.	4 : 00 p.m.	Rice + Milk	350	330	11	94.29
7.	4 : 00 p.m.	Rice + Dal	350	290	9	82.86
8.	4 : 00 p.m.	Rice + Meat (Local chicken)	350	350	7	100
9.	4 : 00 p.m.	Biscuits	7	7	1	100
10.	4 : 00 p.m.	Rice + Milk	350	328	9	93.71
11.	4 : 00 p.m.	Rice + Dal	350	293	10	83.71
12.	4 : 00 p.m.	Rice + Meat (Local chicken)	350	350	8	100
13.	4 : 00 p.m.	Biscuits	10	10	2	100
14	4 : 00 p.m.	Rice + Milk	350	326	8	93.14
15.	4 : 00 p.m.	Rice + Dal	350	295	11	84.29
16.	4 : 00 p.m.	Rice + Meat (Local chicken)	350	350	8	100
17.	4 : 00 p.m.	Biscuits	15	15	5	100
18.	4 : 00 p.m.	Rice + Milk	350	322	7	92
19.	4 : 00 p.m.	Rice + Dal	350	292	12	83.43
20.	4 : 00 p.m.	Rice + Meat (Local chicken)	350	350	8	100

Fig. 2. *Canis familiaris* feeding on Biscuits

Fig. 3. *Canis familiaris* feeding on Rice + Milk

Fig. 4. *Canis familiaris* feeding on Rice + Dal

Fig. 5. *Canis familiaris* feeding on Rice + Meat (Local chicken)

By conducting this study in *Canis familiaris*, it was observed that each day, the dog always appeared to have its food at the particular specific time at which the food was provided to it. It was because the body of the domestic dog (*Canis familiaris*) got conditioned to expect food every day at those specific times.

4. DISCUSSION

Ivan Petrovich Pavlov, a Russian physiologist in the year 1927 was best known for his experiments in classical conditioning [6]. To explore this phenomenon of classical conditioning in an objective manner, Pavlov designed a series of carefully controlled experiments to see which stimuli would cause the dogs to salivate [6,14-16]. In response to a certain stimuli such as the sound of a bell which had nothing to do with food, he was able to train the dogs to salivate [6,1]. Through his series of experiments, Pavlov realized that there are three types of stimuli to which an organism elicit responses [6,17-20]. These three types of stimuli include

1. **Unconditioned Stimulus (UCS)**
2. **Neutral Stimulus (NS)**
3. **Conditioned Stimulus (CS)**

All the three types of stimuli are discussed below:

1. **Unconditioned Stimulus (UCS):** It is the stimulus that elicits a reflexive response in an organism [1]. The dogs' salivation was an unconditioned response. Before conditioning, the unconditioned stimulus (food) caused unconditioned response (salivation) in dogs [6,13].
2. **Neutral Stimulus (NS):** It is a stimulus that does not naturally elicit a response [1]. It is presented immediately before an unconditioned stimulus. During conditioning, the neutral stimulus (bell) was followed by the unconditioned stimulus (food) which caused salivation in dogs [12,7,6]. But before conditioning, the neutral stimulus (bell) could not cause salivation in dogs [6].
3. **Conditioned Stimulus (CS):** It is a stimulus that elicits a response after being repeatedly paired with an unconditioned stimulus [13]. Thus, after classical conditioning, the neutral stimulus (NS) itself became the conditioned stimulus (CS) [1,21]. This implies after conditioning, the dogs got conditioned to the neutral stimulus (bell) and the neutral stimulus (bell) which got converted into conditioned stimulus (CS) could itself cause conditioned response (salivation) in dogs [11,6,13].

Table 2. Classical Conditioning: a basic form of learning in *Canis familiaris*

Before Classical Conditioning	
Neutral / Unconditioned Stimulus	**Response Elicited**
Bell (Neutral stimulus)	No salivation
Food (Unconditioned stimulus)	Salivation
During Classical Conditioning	
Neutral / Unconditioned Stimulus	**Response Elicited**
Bell followed by Food	Salivation
After Classical Conditioning	
Neutral / Unconditioned Stimulus	**Response Elicited**
Bell	Salivation

Thus this concept of classical conditioning in *Canis familiaris* has been well-illustrated in Table 2.

The preference for the type of food varies from species to species. However, preference for meat in case of *Canis familiaris* is seen to be highest. Their evolution and physiology stands as a evidence for this.

4.1 Evolution

Canis familiaris have evolved from *Canis lupus* which also has a strong preference for meat as they prefer to eat large hoofed mammals such as bison, elk, deer, mouse, etc. Apart from this, *Canis lupus* also hunt smaller mammals such as rodents, hares, beavers, etc. In a single meal, adults of *Canis lupus* can consume 20 pounds of meat.

4.2 Physiology

The physiology of *Canis familiaris* is suitably designed to tear through flesh but not designed to grind plant material. Their teeth are designed for tearing flesh, stomachs are larger and intestines are shorter. The acids produced in the stomach are optimized for meat digestion. However, sufficient amount of enzymes are not produced to digest starch and other plant products.

5. CONCLUSION

The feeding ethology of the domestic dog (*Canis familiaris*) was chosen for this behavioral study to practically examine the phenomenon of classical conditioning. Feeding a dog regularly at a specific time of the day provides it security and predictably of a routine. Thus it could be concluded that in accordance with the experiment of classical conditioning on *Canis familiaris* conducted by the Russian physiologist Ivan Petrovich Pavlov in the year 1927, the dog always expect food at the same time every day as the body of the dog get conditioned to it. Therefore, after the association is learned by the dog, the previously neutral stimulus (bell) is sufficient to produce salivation in the dog. Dogs preference for meat is always high as compared to other foods as the gut flora produced in a dog's digestive system is critical for a healthy immune system has been designed to process meat which forms the main staple food of a dog's diet. The microbiota in the dog's stomach provides immunomodulatory stimuli to the immune system which metabolizes and ferments complex carbohydrates into beneficial SCFA (Short Chain Fatty-Acids). Though dogs do not consume a large quantity of plant-based additions, however, the micronutrients delivered by plant products also have certain health benefits. The health benefits include delivery of extra nutritional reinforcement and support in the repair and maintenance of lean muscle, development, recovering from illness or injury, healthy weight gain or maintenance of weight. This implies dog protein supplements like plant-based protein are an excellent addition to a dog's meat-based diet.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Author has declared that no competing interests exist.

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