

Going Green: Examining Taste Preference in Laboratory Rats

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Abstract

Rats are used in a variety of instances in behavioral research conducted in laboratory settings. We greatly rely on our rodents, but a problem exists in our field. The rats are not given a great deal of choice in what is given to them in a diet. Several studies have been done to assess the health benefits of fruits and vegetables. There is, however, a gap in our knowledge. It has not been questioned what types of fruits and vegetables rats prefer. Our project explored this topic. We set out to determine the preferences of rats when presented with four different types of green vegetables. We performed a focal, continuous scan of eight Long-Evans rats to determine their preferences. We presented them with broccoli, green beans, celery, and spinach. We weighed the vegetables before and after the rat's exposure to them. We also created a time budget to determine the time the rats spent consuming each type of vegetable. After one week of familiarization to the vegetables and two weeks of live observations, we were able to determine that rats consumed differing amounts of each vegetable. This shows that there are clear food preferences. Rats consumed broccoli more frequently and in greater amounts than the other three vegetables. Our experiment shows that rats have preferences for vegetables and will consume differing amounts based on these preferences.

Introduction

Wild rats are omnivorous eater. They eat based on opportunity, and they consume what is available to them. However, getting adequate nutrients can be a problem. Some rats resort to eating their own feces in order to obtain all their necessary nutrients. Many studies show that added vegetables in diet can improve health and reduce diseases. For example, lettuce consumption can improve health by providing necessary antioxidants (Nicolle, 2004). Spinach added to the diet gives the rats improved motor learning ability (Bickford, 2000). Vegetables also have an impact on decreasing oxidative cellular damage (Prior, 2003). It is known that vegetables provide necessary nutrients that benefit the animals. This is demonstrated by useful Selenium that is present in broccoli (Finley, 2001). Another study done shows that when rats ingest red cabbage and Brussels sprouts, they had increased protection against breast, bladder, colon and testicular cancer (Steinkellner, 2001). It is important to ensure all rats in labs also are receiving adequate nutrition. Diet is also important for rats in terms of longevity. Investigations show that rats that consume a diet higher in fat will have a decreased life expectancy (Ross, 1961).

A problem currently exists in laboratory animal care. One paper claims that nutritional requirements for rodents used in long-term investigations have not been fully investigated (McDonald, 1997). The problem is that rats are not given a great deal of choice in what is given to them in a diet. Much of what they are given is pre-packed and not challenging for them to eat. This diet is also not a fresh source of nutrients that are enjoyable to eat for the rats. Several studies have been done to address this problem. These studies show the effects of fruits and vegetables in diet. Many studies have shown positive health benefits to these dietary changes. There has also been shown to be a lowered risk of cancer with regular consumption of fruits and vegetables (Nicolle, 2004). There is a gap in our knowledge. We do not know exactly what kinds of vegetables the rats like. The more they enjoy the food, the more they will eat and the more

nutrients and vitamins they receive. It is important for the rats to eat a variety of fruits and vegetables. Combinations of different vegetables give a more balanced and comprehensive nutrient content (Bickford, 2000). Our project will explore what green vegetables the rats most prefer and will show which vegetables to be given out with diets.

Based on prior research, our hypothesis was that rats will consume differing amounts of vegetables based on their preferences. We predicted the rats would consume more of the broccoli than other vegetables because it is larger, has unique textures compared to the other vegetables, and has different shades of green.

Materials and Methods

Timeline, Animal Housing

Our group gathered information using live observation. We took our live observations in a separate room so our group had ample space and limited disruptions. For this experiment, we had a total of eight rats split between four cages. Each cage was clear, containing a red hut and aspen bedding on the ground. Each cage contained two rats of the same sex. Our experiment used male rats, but the study could have been just as affective using females. Our rats were first introduced to our treatment of four different types of raw, green vegetables: broccoli, spinach, green beans, and celery. These specific rats were a Long-Evans strain. This introduction occurred at 11:30 on February 23, 2017. This familiarization and the two weeks of data collection took place in the animal lab located at Lilly Hall in West Lafayette, IN.

Comparison and Treatment Groups

Our treatment groups were the four different types of green vegetables- green beans, spinach, broccoli, and celery. All eight rats were exposed to the treatment. Due to this, there was no control group in our experiment.

Measurements

Our group collected data for rats in cages 7, 9, 11, and 13. Because these animals are very cautious of new items we first introduced the rats to the vegetables the first day of observation. We placed the four vegetables in the four corners of the cage and simply let the rats familiarize themselves with the vegetables before we started to collect data. Our data collection spanned three weeks; the first week consisted of the rats getting acquainted to the vegetables while the two weeks following consisted of live observations. During data collection, each of our four group members teamed up to observe the rats. All four students observed one cage in teams of two, with 2 members observing one rat. Within the group of two, one student wrote down the observations while the other watched time. Each cage has two rats inside, so this accounts for the eight rats and each cage was observed individually. Before data collection started, we weighed the vegetables on a scale to determine the weight of food per dish before consumption. The vegetables were placed in separate corners of the rat cage in order to keep the vegetables separate and consistent.

We also kept the vegetables consistent in the sense that each vegetable was placed in the same corner of the cage during each observation for each cage. We placed the broccoli in the back left corner, green beans in the back right corner, celery in the front left corner, and spinach in the front right corner. **Figure 1** shows the layout of the vegetables in the cages. We oriented our placement so the front of the cage was the side where the information card was hung. Focal, continuous data collection was used for a total of five minutes for each cage. We then recorded

our data into Excel. We believe this is the most reliable form of observation. We also believe the time span of 5 minutes was long enough to be accurate and allow us to determine vegetable preference. During that time, we observed and collected data on the latency to consumption of each individual vegetable, whether they are eating broccoli, eating spinach, eating green beans, eating celery, sniffing the broccoli, sniffing the spinach, sniffing the green beans, sniffing the celery or not eating. These behaviors can be shown in our ethogram (**Table 1**).

Additionally, after the five minutes is up, we collected the leftover vegetables from the cage and weighed them individually to determine the amount the rats had consumed. Because there have not been any studies like this in previous literature, we collectively determined that using a focal, continuous method coupled with this specific design layout, would allow us to best conclude which green vegetable rats prefer the most.

The second week of our procedure was the first week to actually gather data rather than introducing the rats to the food. This observation took place from 11:00 to 11:30 am on Thursday, March 2. Our second observation happened on Thursday, March 9 from 10:45 to 11:15. We worked to keep our times and days of observation consistent over our procedures.



Figure 1. This picture shows the spatial arrangement of how each type of vegetable was placed in our cages. We kept this placement consistent throughout the experiment. We designed the front of the cage as the side that contains the red hut.

Group Ethogram

Behavior:	Definition:
Eating	The rat picks the vegetable up and uses hands and mouth to consume. The rat places the vegetable in its mouth.
Sniffing	The rat makes contact with the vegetables with whiskers or snout.
Not Eating	The rat is not interacting or showing any interest in the vegetables.

Table 1. This table shows the behaviors that were observed and measured for during our experiment. We used these basic behaviors to extend to each of the four vegetables. We had separate categories of eating and sniffing for broccoli, spinach, green beans, and celery.

Results

Our results show that there is clear preference for one vegetable over another from the rats. Other than not eating, eating broccoli was the most frequent behavior displayed by the rats

in weeks 1 and 2 both separately as well as average or totaled (See **Figure 2**). For both weeks, the rat showed a clear preference for broccoli, followed by green beans. It seems that the rats did not have a clear preference for vegetables in terms of which is sniffed. This is demonstrated in **Figure 3**.

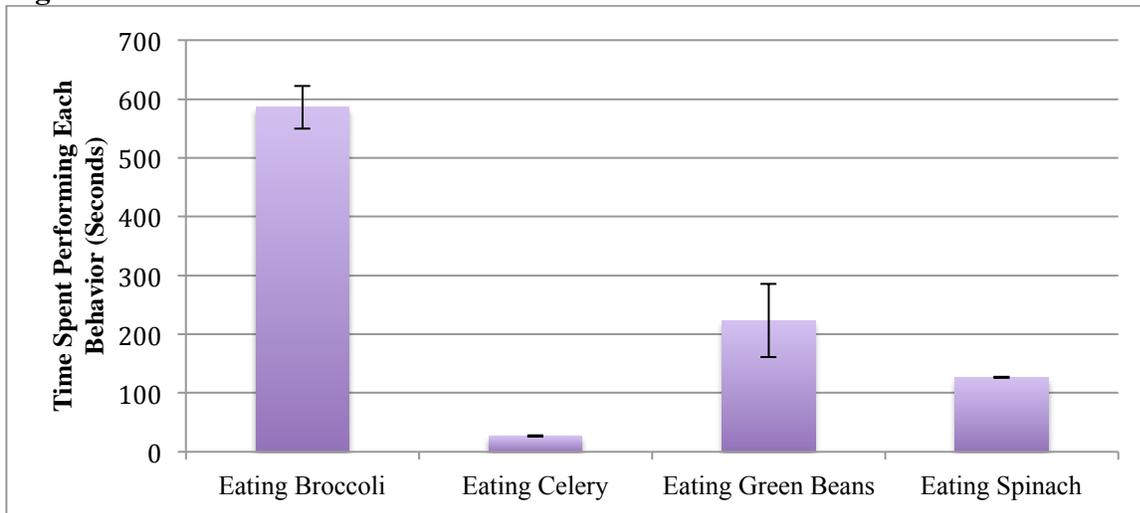


Figure 2. Average time rats spent performing eating behaviors during observation weeks 1 and 2.



Figure 3. Average time rats spent performing sniffing behaviors during observation weeks 1 and 2.

Discussion

Our results show that our hypothesis is supported. Our data demonstrates that there is a clear preference of green vegetables by the rats. Our data demonstrates that rats do in fact consume broccoli more frequently and in larger quantities than the other vegetables tested. These results confirm that our hypothesis that the rats will consume differing amounts of each type of vegetable was correct. Our group predicted that the rats would most prefer the broccoli. Our results also show that our prediction was correct.

While our experiment was successful in many aspects of our experiment could be improved. A problem that could be resolved is increasing our observation time. Our group could have taken observations over several more weeks or sampled for a longer time period each week. More data could further solidify our hypothesis and prediction. Another limitation of our experiment was that we only used eight rats. We also could have gotten more definitive data if we sampled a larger population. Another problem that we encountered was that rats would take vegetables and try to bury them. These buried vegetables could not be retrieved at the end of observation to be weighed. This could have lead to less accurate weights. The last limitation we encountered was that the vegetables chosen were not fresh the second week of observation. They were still safe to eat and would not lead to any health problems, but might not have been as desirable as the first week.

There are several suggestions to follow should this experiment be repeated in the future. I would suggest taking observations for more weeks as opposed to the two weeks we recorded. I also suggest observing for a longer time period. It could be a good idea to give the rats more than one week to adjust to the vegetables added. The rats might be more comfortable with the vegetables if they were exposed to them for multiple weeks. It might also be a good idea to leave the vegetables in the rat cages for extended periods of time to allow them to explore and taste each time. While our results seemed to suggest that our hypothesis was correct, it might be a positive idea to provide more vegetables to see if there are any other vegetables that the rats prefer.

Overall, I thought our experiment was successful. We were able to run our observations smoothly and gather data that supported our hypothesis and prediction. There were a few limitations experienced, but we worked to ensure that the data we gathered was correct and accurate. If this experiment were to be repeated, I think that a few simple suggestions could greatly improve our methods. This field of behavioral research is very interesting, and much more can be learned from this field.

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