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Food preference tests of Black rat, *Rattus rattus* (L.) in laboratory

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Abstract

The present study was aimed to evaluate food consumption and preference of the *Rattus rattus*. L. The experiment was conducted in Khartoum Bahri General Plant Protection Department (PPD).Two groups of foods were used; the first included groundnut, sorghum and wheat, the second included cracked sorghum, floured sorghum and sorghum mixed with sugar 5%, and sorghum mixed with oil 2%).For the two tests, 5 males and 5 females were used as replicates. The tests were conducted as a non-choice test in the Vertebrate Laboratory.

The results showed that, there was a significant differences between the three food (groundnut, sorghum and wheat) consumption by rat during the 4 days. The more preference food for females and males of *R.rattus*, was the sorghum seeds. While the less preferred food was the groundnut seeds for both females and males. It was noticed that, for the three food crops males were consumed more than females.

Results stated that, the most preferred form of sorghum by both females and males, was the sorghum that mixed with sugar. Males of *R.rattus* consumed more amount of sorghum mixed with oil (6.7gm) compared with females (5.1gm). The study recommended, that sorghum seeds is more suitable for food bait and sweaty sorghum is more attractive for rodents.

Key words: Food preference, Black rat, Rattus rattus

1. Introduction

Rodents are the largest group of mammals, distributed on every continent of the world except Antarctica (Wilson and Reeder, 2005). Muridae**,** largest extant rodent family, indeed the largest of all mammalian families. There are 2552 rodent species available, of which three species, i.e., house mice (*Mus musculus* L.), brown rat (*R.norvegicus* Berk.), and black rat (*R. rattus* L.), occupy different habitats with higher density than other species of rodents. (Rabiee, *et. al.,* 2018 and Burgin, *et al.,* 2018). These human commensals live in diverse ecosystems throughout the world.

Domestic rodent species feed on wide range of food stuff of plant and animal origin, (Calhovn, 1941). Food selection in rats is determined by factors such as taste, odor!' and texture signals (Jackson, 1965, Bullard and Shumake1977). Rats had been observed to select a nutritionally balanced diet when given a wide range of food to choose to satisfy energy requirements, (Schein and Orgain, 1953). Rats consume an amount of food equal to 1/10 of their body weight daily. On the other hand, males consume an amount of food more than females, (Arafa, *et al.,* 1975). Ansari *et al.,* (2005) estimated the food preference of the house rat, *Rattus rattus* L .He found that wheat grains were more preferred compared to maize and barley grains. Jackson, (1965) found that the rodent's ability to hold and handle, as well as carry, the food material played an important role in preference behavior.

Most rodents are herbivorous, feeding exclusively on plant material such as seeds, stems, leaves, flowers, and roots. Some are omnivorous and a few are predators. (Waggoner and Ben 2000).

The justification: Recently, it was observed that *R.rattus* L, became an invasive pest with high density and population in different environments (farms, stores, homes and restaurant). Food preference tests will make rodent control more success because will determined the materials that used in rodent baits.

Objectives: 1- To evaluate the preferred food stuff of *R.rattus* L.

2- To determine the best forms of the preferred foods.

2. Materials and Methods

2. 1. Collection of tested rat

R. rattus rats were trapped at Khartoum Bahri market and were brought to the General Plant Protection Department (PPD), at December 2022, and were kept in the Vertebrate Laboratory. These animals were then weighted, differentiated sexually, and marked individually and then placed in separate cages before testing. They were remained there for two weeks before the test, in order to let them adapt the laboratory environment and to stabilize the kind of food.

2.2. Food test

There are two types of food preference tests conducted in this experiment. For the two tests, 5 males and 5 females were used as replicates. The tests were conducted as a non-choice test in the Vertebrate Laboratory.

In the first test three kind of food were used (groundnut, sorghum, and wheat). The tested rats were feed by the different three crops daily for four days. Amount of 20 grams from each crop were used. The data was taken daily for food consumption in grams for males and females.

2.3. Sorghum forms test

In the second test, four different forms of sorghum were used (cracked sorghum, floured sorghum, sorghum mixed with sugar (5%), and sorghum mixed with oil (2%) as a non-choice test. That is depend on the result of the above first test for food preference (sorghum was preferred). Rat males and females were evaluated for sorghum preference for the different mentioned forms.

2.4. Data analysis

The software Statistics (8) was used to analyze the data using analysis of variance (ANOVA) procedure. Least Significant Difference Test (LSD) was used for means comparison.

3. Results

3.1.Food test

The observations results of food preference test of *R.rattus* L. for the different three crops (groundnut, sorghum, and wheat) in a non-choice test, were showed in (Table 2). The results indicated that, there was a significant difference between the three food consumption by the rat during the 4 days.

The more preference food for females and males of the roof rat, was the sorghum seeds. The less preferred food for *R.rattus* L. was the groundnut seeds for both females and males. The wheat crop was being the midst preferred food for the rat consumption. It was noticed that, for the three food crops males were consumed more than the females.

3.2. Sorghum forms test

The results of sorghum preference test of *R.rattus* L. for the different four forms (cracked sorghum, floured sorghum, sorghum mixed with sugar (5%), and sorghum mixed with oil (2%) were presented in (Table 2). Results stated that, the most preferred form of sorghum by both females and males, was the sorghum that mixed with sugar. However, the smaller amount of food that consumed by both females and males of rat was the floured sorghum (1.0gm).

The results also indicated that, there were no significant differences between the amounts consumed by female of cracked sorghum and that of sorghum mixed with oil. But, the amount that consumed by males of cracked sorghum and sorghum mixed with oil, was significantly different, which means that rat males consumed more amount of sorghum mixed with oil (6.7gm) compared with females (5.1gm).

Table (1). The food consumption of *R. rattus* L. during four days for preference test (non – choice)

Preference crops	Food consumption (gm.)	
	Female	Male
Groundnuts	1.7^{c}	2.6^{c}
Sorghum	16.0^{a}	16.5^{a}
Wheat	4.1^{b}	5.1^{b}
C.V.%	12.79	12.43
S.E±	0.59	0.63

Means within the same columns with different letters are significantly different according to (LSD) at $\rho \leq 0.5$

Table (2). Sorghum consumption of *R. rattus* L. during four days for forms preference

Preference of sorghum forms	Food consumption (gm)	
	Female	Male
Cracked sorghum	5.3^{b}	5.0^{c}
Floured sorghum	1.0^{c}	1.0^{d}
Sorghum mixed with sugar (5%)	16.0^{a}	16.4^{a}
Sorghum mixed with oil (2%)	5.1^{b}	6.7^{b}
C.V.%	12.35	9.24
S.E±	0.54	0.42

Means within the same columns with different letters are significantly different according to (LSD) at $\rho \leq 0.5$

4. Discussion

Rattus rattus L is found on all continents of the earth. Although the species is believed to be native to India and possibly other Indo-Malayan countries, it has been introduced through human travel overseas to all continents. It is most common in coastal areas because it is a rodent that flourishes in areas inhabited by humans as well as on large ships. For this reason, these animals are often called ship rats, some other common names for this species include house rat, black rat, and roof rat.

R. rattus L. thrives in tropical regions but has been largely driven out of more temperate regions by Norway rats, *R. norvegicus* B. However, some data show that R. rattus L. has been able to adapt to more extreme cold and harsh climate conditions. (Pye , and Seppelt, 1999 and Grzimek, 2003).

Meehan, (1984) stated that, there is no such thing as generally suitable bait for rat, because it is difficult to say which specific food is favored by individual rats or even whole population.

R. rattus L. diet has been described in various habitats and climatic regions of the world (Copson, 1986; Tobin, *et al.,* 1994; Cole, *et al*. 2000; Pisanu, *et al*., 2011; Shiels and Pitt 2014 ; Shiels *et al*., 2014 ; Riofrío-Lazo and Páez-Rosas 2015).*R. rattus* L. eats a wide range of plant and animal foods (Shiels *et al*., 2013) but it is also described as a selective feeder (Clark 1981 and Clark 1982).

In this research the results indicated that, *R. rattus* L. preferred sorghum seeds more than the other two foods (groundnut and wheat). It consumed about 16g/ day of sorghum, this finding was nearly similar to the finding of Nowak, (1999a) who reported that, *R. rattus* L. consumed about 15 g/day of food. Roof rat *R.rattus* L. seemed to be prefer sorghum food more, it might be because it have less calories (330) compared with groundnuts which have

high calories (567), that is may be due to avoid feeling indolence. Schein and Orgain (1953) and Barnett and Spencer (1953), found that wild Norway rats consumed more low caloric value food (sorghum).In addition, sorghum have a carbohydrates about (69 gm) which is higher than that in groundnuts (16gm). Rodents in general prefer grains of low protein, high carbohydrate and moderate fat or seed of low carbohydrate, high protein and high fats, Smythe (1976).

The consumption rate of food was not influenced by the texture but the taste (oily and non-oily) and energy richness may influence the consumption rate in both single and multi-food choice experiments, (Soni and Rana, 1982).

Although sorghum and wheat is nearly similar in contents of calories, protein, and carbohydrates, *R.rattus* L. preferred sorghum seeds to wheat seeds, that is might be due to the circular shape of sorghum seeds which make it easier to hold by rat fingers, moreover, it might be due to the dominance of sorghum crop in Sudan more than wheat. It was noticed that, rodents prefer more the seeds of the dominant crop through the countries. Studies have found that rodents prefer particular foods to others. Boiled rice has been recommended for *R. rattus* L and *R. exulans* in Burma (Harrison and Woodville, 1950).Cereal grains and seeds are preferred and represent typical baits: oats and maize in England (Cornwell and Bull, 1967) rolled oats in sugarcane fields of Hawaii (Crabb and Emik, 1946), wheat meal in the USA (P.H. S., 1970), and binlid (broken rice) in the Philippines (Kuehnert, 1976).

The present study through sorghum forms preferences test, was proved that, *R.rattus* preferred the whole sorghum seeds to the cracked and floured seeds. This result nearly similar to the finding of (Suliman *et al*., 1984) who found that Nile rat was preferred sorghum whole to cracked and ground sorghum. In addition, Barnett and Spencer (1953), stated that, Norway rat was found to prefer whole meal and whole wheat to wheat flour.

Through the current study, it was found that, the more preference form of sorghum for *R.rattus* was sorghum mixed with sugar (sweaty sorghum), this explained that, rats often select the food according to their flavor, taste, and odor. Barnett and Spencer, (1951) explained that, rats preferred to take slight samples from the food obtainable, and then they began to select the material that had the most powerful taste, odors and sweet.

Although *R.rattus* L. prefer sorghum mixed with sugar firstly, it was prefer secondly sorghum mixed with oil more than cracked sorghum and flour sorghum. This result stated that, rats select food according to the additive flavors. According to Marsh, (1988), sugar and vegetable oils and animal fats are the most commonly effective flavors for cereal baits to improve acceptance and palatability.

Many reports (Crabb and Emik, 1946; Barnett and Spencer, 1953; Shumake, 1978) have indicated that rats of given species will show varying degrees of preference for certain oils added to their food.

In contrast, Norway rats have been shown to increase acceptance when wheat or whole meal was treated with groundnut oil (Barnett and Spencer 1953).

According to the sorghum forms preference test, it was noticed that, the more less preference for sorghum forms by *R.rattus*, L. was the flour sorghum, this result proved that, the rats need to gnaw food materials by their teeth during feeding in order to limit the elongation of teeth. Single, *et al*., (2001) and Nowak, (1999b) explained this phenomena. They reported that, the distinguishing feature of the rodents is their pairs of continuously growing, razor-sharp, open-rooted incisors. These incisors have thick layers of enamel on the front and little enamel on back. Because they do not stop growing, the animal must continue to wear them down so that they do not reach and pierce the skull.

The present study recommended that sorghum is more suitable for food bait of rats. Moreover, it was recommended that the sorghum preferred to be in the form of sweaty sorghum (sorghum mixed with sugar) and feed by oil to be more attractive for rodents.

5. Conclusions

The study concluded that,the black rat *R. rattus* L. prefers sorghum as the best food compared to wheat and groundnuts.In addition, it prefers sorghum mixed with sugar to other forms of sorghum.

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