

Food preference by Nile rat *Arvicanthis niloticus* in multi choice of different cereal and legume seeds under laboratory conditions

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Abstract

The total consumptions from cereals whole and grinded in the 1st day of the trial were 3.1, 1.1, 1.5, 1.6, and 1.9 g / 100 g body wt. of wheat, maize, sorghum, rice and barely, respectively. The total intake from whole and grinded cereals in the 2nd day exceeded the intake in the 1st day recording 3.4, 1.4, 1.7 and 2.0 g / 100 g body wt., consecutively. The total accounted consumptions from these cereals (whole and grinded) in the 3rd day recorded the highest amounts of 5.4, 1.6, 2.4, 2.8 and 1.6 g / 100g body wt., respectively. The counted total consumptions of these foods (wheat, maize, sorghum, rice and barely) in the 4th day were reduced than the 3rd day recording 3.9, 1.8, 2.1, 2.5 and 0.9 g / 100 g of body wt., respectively. At the 5th day (the trial finale) the total consumed of both whole and grinded cereals reduced to be 3.2, 1.3, 1.8, 2.4 and 0.8 with wheat, maize, sorghum, rice and barely, respectively.

Total consumption of lentil, fenugreek, cowpea, broad-bean, soybean, sweet pea and groundnut (whole and grinded) in the 1st day were 1.2, 0.0, 2.4, 0.7, 1.6, 2.7 and 3.2 g / 100g body wt., respectively. In the 2nd day the total consumed amounts of lentil, fenugreek, cowpea, broad-bean, soybean, sweet pea and groundnut in the 2nd day were 1.6, 0.0, 2.3, 1.1, 2.1, 3.1 and 3.2 g / 100 g body wt., respectively. The 3rd day recorded the highest consumed values from lentil, fenugreek, cowpea, broad-bean, soybean, sweet pea and groundnut these values were as follows 2.0, 0.0, 2.2, 1.4, 1.9, 3.2 & 3.4 g / 100g body wt., from the total (whole and grinded), respectively. The 4th day of trial show less total consumption than that of the 3rd day recording 1.9, 0.0, 2.1, 1.0, 1.6, 3.0 and 3.2 g / 100g body wt., respectively. In the last day of the trial (5th day) the intake of legume food items was in similar and didn't differ obviously than the consumption of the 4th day recording the total intake of the whole and grinded legumes as follows 1.6, 0.0, 2.0, 1.3, 1.7, 3.0 and 3.1 g / 100 g body wt., respectively

Key words: Food preference, Nile rat, *Arvicanthus niloticus*, Cereal seeds

Introduction

Rodents are a dominant group of mammals. Most of living rodent species the Muridae, and most of rodents exist in Egypt also belong to this family. Rodents occupy a wide natural habitat; they can be found in forests, grasslands, agricultural landscapes, villages and townships. Rodents play an important role in the food web, both as consumers of plants and as food resources for many of larger predators, they also help aerating the soil through their digging and burrowing activities such as the Nile rat *Arvicanthus niloticus*.

The success of rodent control depends on the preference of the bait materials used. The ideal bait is the one that shows attractiveness and acceptance to many rodent species and it is easy to be prepared and to be applied (Thompson *et al*, 1972; Brooks and Bowerman, 1973; Abdel-Gawad and Maher Ali, 1982; Asran *et al.*; El-Deeb *et al*, 1985; Sherief *et al*, 1985; I-Bahrawy, 1989; Abd El- Rahman *et al*, 1991; Shafi *et al*, 1992; Abdel-Galil, 1997; Khan *et al*, 2000; Witmer *et al*, 2008 and Desoky, 2011).

This study aims to shed light upon the preference and consumption of different cereal seed food items by the Nile rat, *A. niloticus*.

Materials and methods

In multi-choice feeding trials, ten food items of cereals *i.e.* whole wheat, grinded wheat, whole maize, grinded maize, whole rice, grinded maize whole

sorghum, grinded sorghum, whole barely and grinded barely were presented simultaneously to rat. Each container attached with the multi choice unit was offered 20 g of each food in separate bait containers for five consecutive days. The position of the food containers was changed clockwise daily to avoid place preference by the rat. Five replicates were used. Other units were processed and supplied with seven whole legume seeds and seven for the grinded legume seeds of lentil, fenugreek, cowpea, broad-bean, soybean, sweet pea and groundnut.

The units of multi-choice trial for comparison ten food items of the cereal seeds were four circular plastic dishes attached by ten tubes and ten containers (five for the food as whole seeds and other five were for the grinded seeds of the these foods) for testing the type of food whoever preferred. Each unit served as a replicate from five replicates. Other large units attached with fourteen tubes served for the testing of legume food

Results and discussion

Data in Table (1) show the consumed in the 1st day of the experiment from the whole and grinded cereals by Nile rat *Arvicanthes niloticus* under laboratory condition. The consumption from whole cereals surpassed other from grinded cereals of wheat, sorghum, rice and barely, while the opposite result was recorded with maize whereas the grinded cereals was consumed more than the whole cereals Ford (1977) found that increasing hardness of diet reduced

food wastage by mice and rats . The recorded intake in the 1st day of the experiment were 2.34, 0.4, 1.2, 1.4 and 0.6 g / 100g of body wt. from whole cereals of wheat, maize, sorghum, rice and barely, while the intake from the grinded seeds of these cereals were 0.7, 0.7, 0.3, 0.2 and 0.3 g / 100g body wt., respectively. The total consumption from cereals whole and grinded were 3.1, 1.1, 1.5, 1.6, and 1.9 g / 100 g body wt. of wheat, maize, sorghum ,rice and barely, respectively. These results indicate the excellence of wheat as preferred food for the Nile rat than other cereals. This result agreed with other reported by **El-Deeb *et al.*, (1985)** who studied the preference and consumption of selected bait materials offered to the Nile rat, *A. niloticus* under field conditions in the governorate of Benni-Suef, Egypt and mentioned that wheat was the preferred one.

In the 2nd day the intake amounts clearly increased, whereas the recorded intake amounts from the whole cereals of wheat, maize, sorghum, rice and barely were 2.5, 0.6, 1.4, 1.7 and 0.6 g / 100 g body wt., respectively. While the intake from the grinded of these cereals were 0.9, 0.8, 0.3, 0.3, 0.3 g / 100g body wt. Total intake from whole and grinded cereals in the 2nd day exceled the intake in the 1st day recording 3.4, 1.4, 1.7 and 2.0 g / 100 g body wt., consecutively (Table 2) . Continues increase in the consumption of the whole and grinded cereals so the total consumption was observed in the 3rd day from the trial (Table 3). Consumption of 4.0, 0.2, 2.2, 2.6 and 0.6 g / 100 g body from the whole cereals of wheat, maize, sorghum, rice and barely were recorded, consecutively. As for the consumption of grinded wheat, maize, sorghum, rice and barely cereals by Nile rat at the 3rd day were 1.4, 1.4, 0.2, 0.2 and 1.0 g / 100 g body wt., respectively. So the total accounted consumptions from these cereals (whole and grinded) were 5.4, 1.6, 2.4, 2.8 and 1.6 g / 100g body wt., respectively. These results emphasize the superiority of wheat as preferred food for Nile rat. These results in agreement with the results obtained by **Abdel-Karim (1991)**, who reported that the wheat grain was the most preferred food to the Nile rat, *A. niloticus*.

Table (4) indicate that the consumption of cereal food items in the 4th day of trial started in reduction, whereas the amounts of the whole cereals of wheat, maize, sorghum, rice and barely were 3.0, 0.8, 1.8, 2.0 and 0.6 as well as 0.9, 1.0, 0.3, 0.5 and 0.3 g / 100g body wt. from these cereals in grinded shape, respectively. So the counted total consumptions of these foods were 3.9, 1.8, 2.1, 2.5 and 0.9 g /100 g of body wt., respectively. The consumptions of the whole cereals of wheat, maize, sorghum, rice and barely at the 5th day (the trial finale) reduced to be 2.2, 0.4, 1.5, 2.0, and 0.6 g/100 g body wt., respectively while the consumed from the grinded of these cereals were 1.0, 0.9, 0.3, 0.4 and 0.2 g / 100g of body wt. Total consumed of both whole and grinded cereals in the 5th day were 3.2, 1.3, 1.8, 2.4 and 0.8 with wheat, maize, sorghum, rice and barely, respectively. Figure

(1) illustrates the daily consumed of different cereal seed types /100 g of body weight of *A. niloticus* under the laboratory conditions. It was obvious that the high consumption of the cereal foods was attained in the 3rd day in opposite to the low consumption that recorded in the 1st day. The curve of the cereal food consumption clearly declined at the 5th day of trial. We can distinguish three stages in this curve the 1st low consumption, the 2nd high consumption then the stable consumption that may be attributed to the caution of rats in the 1st stage then increasing of food consumption resultant the feeling of assurance by rats and reparation the lesser intake in the 1st stage. Last stable consumption rate may be due to the feeling of stability by rats.

Data in table (6) show that the legume seed consumptions by Nile rat as in the 1st day were 1.0, 0.0, 1.0, 0.2, 0.6, 1.0 and 1.3 for whole seeds and 0.2, 0.0, 1.4, 0.5, 1.0, 1.7 and 1.9 g / 100 g body wt. for grinded seeds of lentil, fenugreek, cowpea, broad-bean, soybean, sweet pea and groundnut, respectively. Total consumption of these legume food items (whole and grinded) were 1.2, 0.0, 2.4, 0.7, 1.6, 2.7 and 3.2 g /100g body wt., respectively. It was obvious that groundnut was the most preferable food and this result consented **Abdel-Karim (1991)** who found that peanut was the most preferable crop to Nile rat *A. niloticus*

In the 2nd day the consumption amounts of the whole legumes were 1.3, 0.0, 1.1, 0.3, 0.9, 1.1 and 1.5 g / 100 g body wt., while the consumed from grinded seeds were 0.3, 0.0, 1.2, 0.8, 1.2, 2.0 and 1.7 g / 100 g body wt. So the total consumed amounts of lentil, fenugreek, cowpea, broad-bean, soybean, sweet pea and groundnut in the 2nd day were 1.6, 0.0, 2.3, 1.1, 2.1, 3.1 and 3.2 g /100 g body wt., respectively (Table 7). The 3rd day consumption as shown in Table (8) recorded the highest consumed values from lentil, fenugreek, cowpea, broad-bean, soybean, sweet pea and groundnut as follows, 1.5, 0.0, 0.8, 0.5, 0.5, 1.2 & 1.6 from whole seeds and 0.5, 0.0, 1.4, 0.9, 1.4, 2.0 & 1.8 from grinded seeds and 2.0, 0.0, 2.2, 1.4, 1.9, 3.2 & 3.4 g /100g body wt., from the total (whole and grinded), respectively. The 4th day of trial show less consumption than that of the 3rd day recording 1.5, 0.0, 1.1, 0.5, 0.6, 1.0 and 1.3 g / 100g body wt. from the whole seeds and 0.4, 0.0, 1.0, 0.9, 1.0, 1.0 and 1.9 g / 100g body wt. from grinded seeds, so the total consumed from lentil, fenugreek, cowpea, broad-bean, soybean, sweet pea and groundnut were 1.9, 0.0, 2.1, 1.0, 1.6, 3.0 and 3.2 g / 100g body wt., respectively (Table 9). In the last day of the trial (5th day) the intake of legume food items was in similar and didn't differ obviously than the consumption of the 4th day recording intake values of 1.4, 0.0, 1.2, 0.5, 0.6, 1.2 and 1.3g /100 g of body wt. from whole legumes and 0.4, 0.0, 0.8, 1.1, 1.8, 1.9 and 1.9 g /100 g body wt. from the tested grinded legumes, The total intake of the whole and grinded legumes were 1.6, 0.0, 2.0, 1.3, 1.7, 3.0 and 3.1 g / 100 g body wt., respectively. Figure

(2) illustrates the daily consumed of different legume seed types /100 g of body weight of *A. niloticus* under the laboratory conditions. It was obvious that the high consumption of the legume foods was attained in the 3rd day in opposite to the low consumption that recorded in the 1st day. The curve of the legume food consumption clearly declined at the 5th day of trial in similar trend with cereal foods. We can also distinguish three stages in this curve the 1st low consumption, the 2nd high consumption then the stable consumption that may be attributed to the caution of rats in the 1st stage then increasing of food consumption resultant the feeling of assurance by rats

and reparation the lesser intake in the 1st stage. Last stable consumption rate may be due to the feeling of the state constancy by rats. Data illustrated in Figure (3) show general mean of the daily consumed from cereal and legume item foods during the experiment period. This Figure clear the high intake attained in the 3rd day 13.8 from cereal and 14.1 g from legume than other tested days during the five days of the experiment and in 4th or 5th day the consumption was between 11.2 and 9.5 for cereals and between 12.8 and 12.7 for legume.

Table 1. Food preference by *Arvicanthis niloticus* in multi choice of different cereal seeds in the 1st day of the test under laboratory condition.

Food	Food type	Mean ±S.E. ¹	Food type	Mean ±S.E.	Total consumed
Wheat	Whole wheat	2.4a	Grinded wheat	0.7 c	3.1
Maize	Whole maize	0.4 e	Grinded maize	0.7 b	1.1
Sorghum	Whole sorghum	1.2	Grinded sorghum	0.3	1.5
Rice	Whole rice	1.4	Grinded rice	0.2	1.6
Barely	Whole barely	0.6 e	Grinded barely	0.3d	0.9

1, Mean of consumed food / 100 g of body weight

Table 2. Food preference by *Arvicanthis niloticus* in multi choice of different cereal seeds in the 2nd day of the test under the laboratory condition

Food	Food type	Mean ±S.E. ¹	Food type	Mean ±S.E.	Total consumed
Wheat	Whole wheat	2.5a	Grinded wheat	0.9 c	3.4
Maize	Whole maize	0.6 e	Grinded maize	0.8 b	1.4
Sorghum	Whole sorghum	1.4	Grinded sorghum	0.3	1.7
Rice	Whole rice	1.7	Grinded rice	0.3	2.0
Barely	Whole barely	0.6 e	Grinded barely	0.3d	0.9

1, Mean of consumed food / 100 g of body weight

Table 3. Food preference by *Arvicanthis niloticus* in multi choice of different cereal seeds in the third day of the test under laboratory condition

Food	Food type	Mean ±S.E. ¹	Food type	Mean ±S.E.	Total consumed
Wheat	Whole wheat	4.0 a	Grinded wheat	1.4 c	5.4
Maize	Whole maize	0.2 e	Cracked maize	1.4 b	1.6
Sorghum	Whole sorghum	2.2	Cracked sorghum	0.2	2.4
Rice	Whole rice	2.6	Cracked rice	0.2	2.8
Barely	Whole barely	0.6 e	Cracked barely	1.0 d	1.6

1, Mean of consumed food / 100 g of body weight

Table 4. Food preference by *Arvicanthis niloticus* in multi choice of different cereal seeds in the 4th day of the test under laboratory condition

Food	Food type	Mean ±S.E. ¹	Food type	Mean ±S.E.	Total consumed
Wheat	Whole wheat	3.0 a	Grinded wheat	0.9 c	3.9
Maize	Whole maize	0.8 c	Grinded maize	1.0 b	1.8
Sorghum	Whole sorghum	1.8 b	Grinded sorghum	0.3	2.1
Rice	Whole rice	2.0 b	Grinded rice	0.5	2.5
Barely	Whole barely	0.6 c	Grinded barely	0.3d	0.9

1, Mean of consumed food / 100 g of body weight

Table 5. Food preference by *Arvicanthis niloticus* in multi choice of different cereal seeds in the 5th day of the test under the laboratory conditions

Food	Food type	Mean ±S.E. ¹	Food type	Mean ±S.E.	Total consumed
Wheat	Whole wheat	2.2 a	Grinded wheat	1.0 c	3.2
Maize	Whole maize	0.4 e	Grinded maize	0.9 c	1.3
Sorghum	Whole sorghum	1.5 b	Grinded sorghum	0.3 d	1.8
Rice	Whole rice	2.0 a	Grinded rice	0.4 d	2.4
Barely	Whole barely	0.6 c	Grinded barely	0.2 d	0.8

¹, Mean of consumed food / 100 g of body weight.

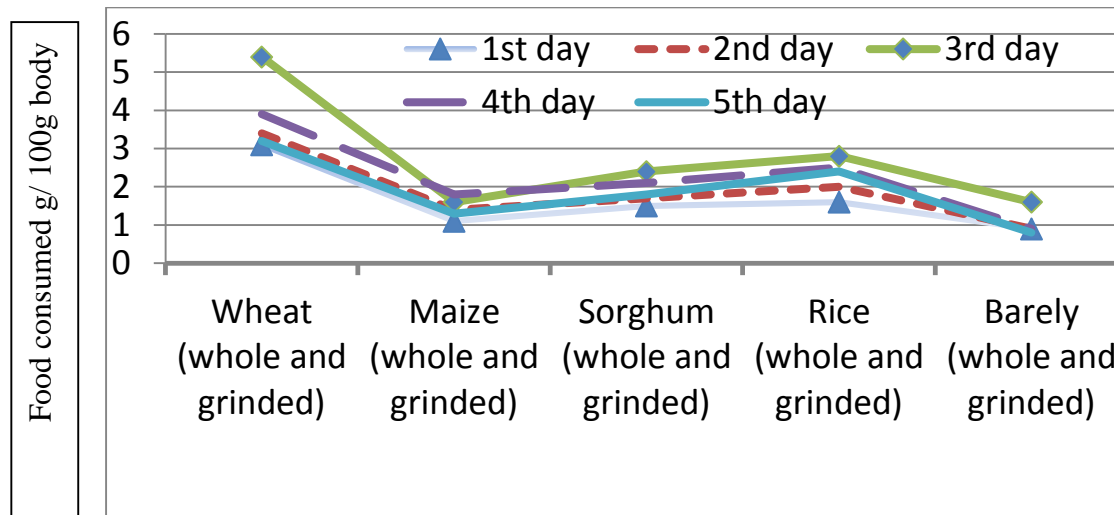


Fig. (1): Daily consumed of different cereal seed types /100 g of body weight of *Arvicanthus niloticus* under the laboratory conditions

Table 6. Food preference by *Arvicanthis niloticus* in multi choice of different legume seeds in the 1st day of the test under laboratory condition

Food	Food type	Mean ±S.E. ¹	Food type	Mean ±S.E.	Total consumed
Lentil	Whole lentil	1.0	Grinded lentil	0.2 c	1.2 c
Fenugreek	Whole fenugreek	0.0	Grinded fenugreek	0.0 b	0.0
Cowpea	Whole cowpea	1.0 c	Grinded cowpea	1.4	2.4 b
Broad-bean	Whole broad bean	0.2	Grinded broadbean	0.5	0.7
Soybean	Whole soybean	0.6 e	Grinded barely	1.0d	1.6 bc
Sweet pea	Whole sweet pea	1.0 c	Grinded sweet pea	1.7	2.7 ab
Groundnut	Whole groundnut	1.3	Grinded groundnut	1.9	3.2 a

¹Mean of consumed food / 100 g of body weight

Table 7. Food preference by *Arvicanthis niloticus* in multi choice of different legume seeds in the 2nd day of the test under laboratory condition

Food	Food type	Mean ±S.E. ¹	Food type	Mean ±S.E.	Total consumed
Lentil	Whole lentil	1.3 a	Grinded lentil	0.3 c	1.6 c
Fenugreek	Whole fenugreek	0.0	Grinded fenugreek	0.0 b	0.0 e
Cowpea	Whole cowpea	1.1 b	Grinded cowpea	1.2	2.3 b
Broad-bean	Whole broad-bean	0.3 c	Grinded broad-bean	0.8	1.1 d
Soybean	Whole soybean	0.9 b	Grinded barely	1.2d	2.1 b
Sweet pea	Whole sweet pea	1.1 ab	Grinded sweet pea	2.0 a	3.1 a
Groundnut	Whole ground nut	1.5 a	Grinded groundnut	1.7 b	3.2 a

¹Mean of consumed food / 100 g of body weight

Table 8. Food preference by *Arvicanthis niloticus* in multi choice of different legume seeds in the 3rd day of the test under laboratory condition

Food	Food type	Mean ±S.E.*	Food type	Mean ±S.E.	Total consumed
Lentil	Whole lentil	1.5 a	Grinded lentil	0.5 d	2.0c
Fenugreek	Whole fenugreek	0.0 c	Grinded fenugreek	0.0 e	0.0 d
Cowpea	Whole cowpea	0.8 b	Grinded cowpea	1.4 b	2.2 b
Broad-bean	Whole broad-bean	0.5 b	Grinded broad-bean	0.9 c	1.4 c
Soybean	Whole soybean	0.5 b	Grinded soybean	1.4 b	1.9 bc
Sweet pea	Whole sweet pea	1.2 a	Grinded sweet pea	2.0 a	3.2 a
Groundnut	Whole ground- nut	1.6 a	Grinded groundnut	1.8 a b	3.4 a

¹Mean of consumed food / 100 g of body weight**Table 9.** Food preference by *Arvicanthis niloticus* in multi choice of different legume seeds in the 4th day of the test under laboratory condition

Food	Food type	Mean ±S.E.*	Food type	Mean ±S.E.	Total consumed
Lentil	Whole lentil	1.5 a	Grinded lentil	0.4 d	1.9 c
Fenugreek	Whole fenugreek	0.0 e	Grinded fenugreek	0.0 e	0.0 e
Cowpea	Whole cowpea	1.1 b	Grinded cowpea	1.0 b	2.1 b
Broad-bean	Whole broad-bean	0.5 d	Grinded broad-bean	0.5 c	1.0 d
Soybean	Whole soybean	0.6 c	Grinded barely	1.0 b	1.6 b
Sweet pea	Whole sweet pea	1.0 a	Grinded sweet pea	2.0 a	3.0 a
Groundnut	Whole ground nut	1.3 c	Grinded groundnut	1.9 b	3.2 a

¹Mean of consumed food / 100 g of body weight**Table 10.** Food preference by *Arvicanthis niloticus* in multi choice of different legume seeds in the 5th day of the test under laboratory condition

Food	Food type	Mean ±S.E.*	Food type	Mean ±S.E.	Total consumed
Lentil	Whole lentil	1.4 a	Grinded lentil	0.2 c	1.6 c
Fenugreek	Whole fenugreek	0.0 c	Grinded fenugreek	0.0 d	0.0 d
Cowpea	Whole cowpea	1.2 a	Grinded cowpea	0.8 b	2.0 b
Broad-bean	Whole broad-bean	0.5 b	Grinded broad-bean	0.8 b	1.3 c
Soybean	Whole soybean	0.6 b	Grinded barely	1.1 b	1.7 c
Sweet pea	Whole sweet pea	1.2 a	Grinded sweet pea	1.8 a	3.0 a
Groundnut	Whole groundnut	1.2 a	Grinded groundnut	1.9 a	3.1 a

¹Mean of consumed food / 100 g of body weight

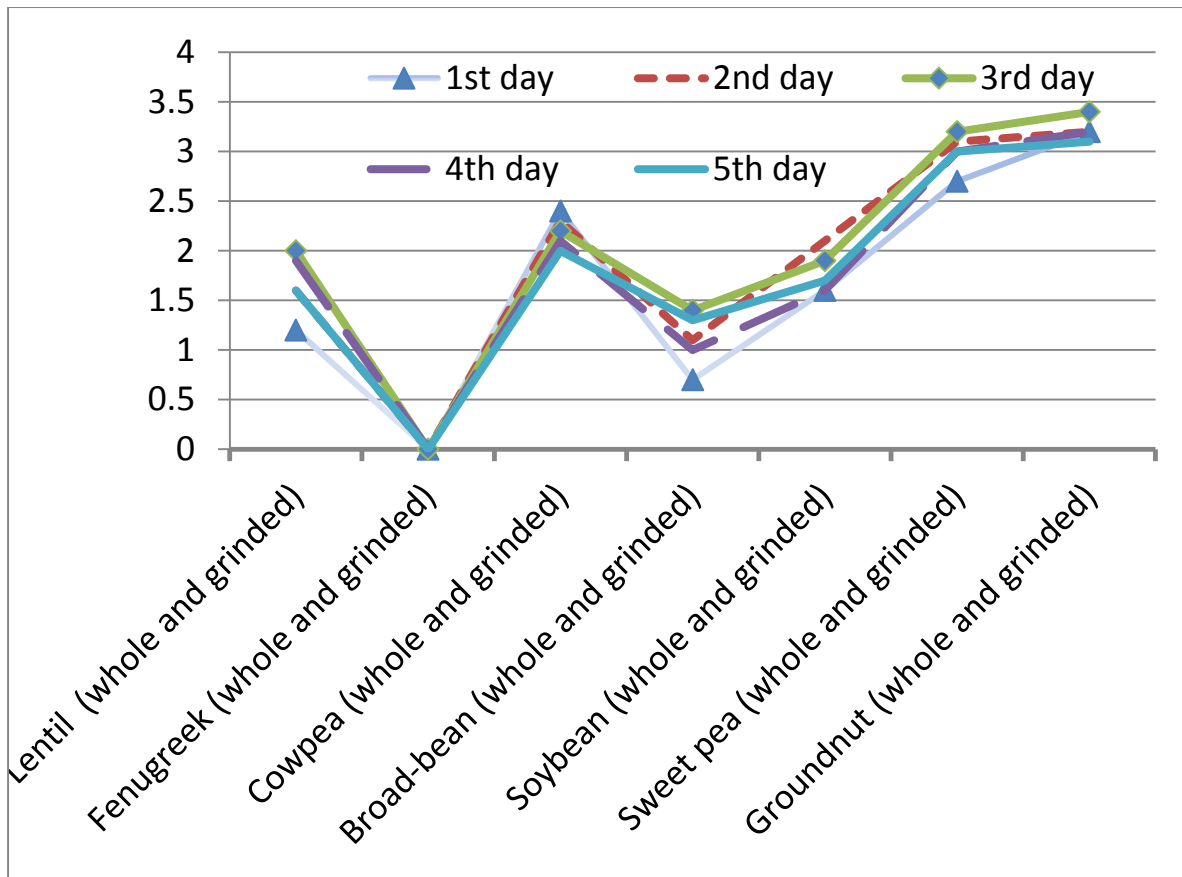


Fig. (2): Daily consumed of different cereal seed types /100 g of body weight of *Arvicanthus niloticus* under the laboratory conditions

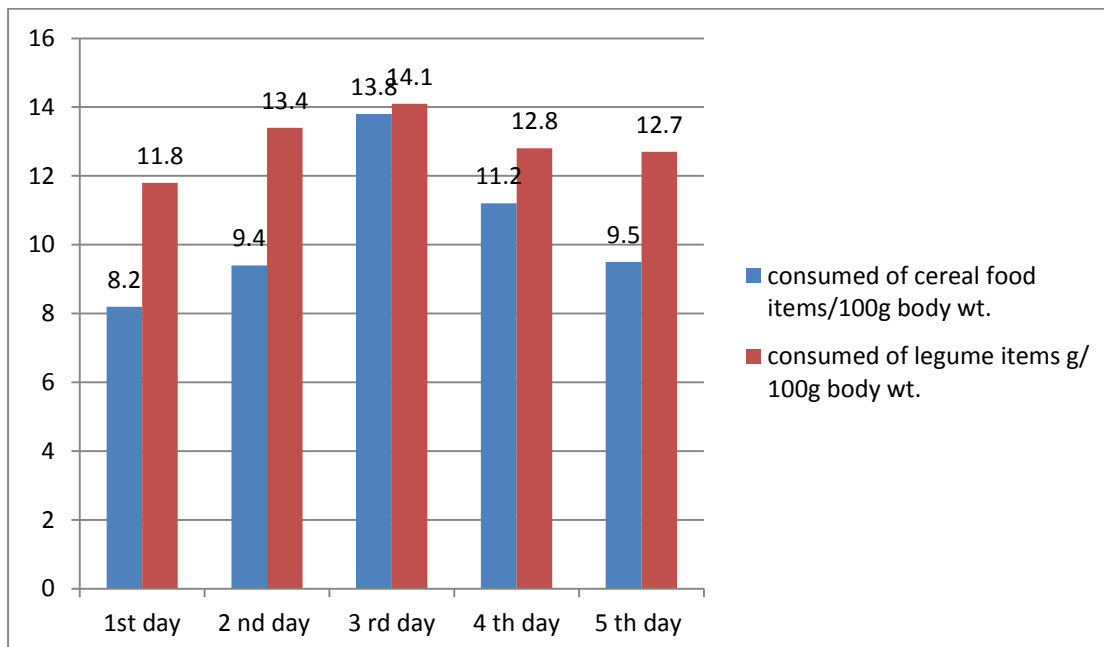


Fig. 3. General mean of the daily consumed from cereal and legume item foods during the experiment period.

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