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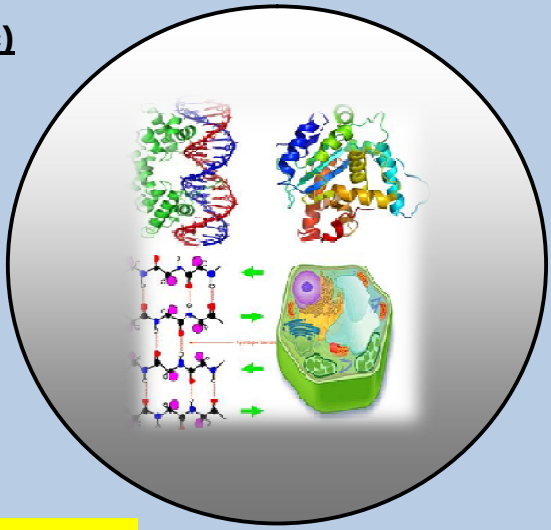

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Food Preference Behaviour of Rodents in Rice Sheller

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ABSTRACT

Food preference behavior of the rodents was determined in randomly selected rice sheller in district Kaithal (Haryana) by conducting no-choice trials, bi-choice trials and multiple-choice feeding trials. Rodents showed great variations in food consumption in each trial. There was significant increase in the uptake of baits materials by rodents when sthe bait materials were offered to them mixed with additives over plain alternatives in separate no-choice feeding trials. The order of preference of six food items in no-choice feeding trials was found to be germinated pulse > millet grains > maize grains > wheat grains > soyabean flour (dough form) > wheat flour (dough form). Six food items, after mixing with additives, were presented in separate bi-choice trials, the rodents significantly preferred (P<0.05, Student's 't' test) one of the two alternatives everyday in all these trials. However, when choice was given in multiple-choice feeding trials, rodents preferred one food significantly over other alternative(s). Germinated pulse was the most significantly preferred food item and the wheat flour (dough form) was the least preferred food item in multiple choice feeding trials.

Key words: No-Choice Trials, Bi-Choice Trials, Multiple-Choice Trials, Rodents, Rice Sheller and Germinated Pulse.

INTRODUCTION

The problems caused by rodents are prevalent both in the developed and developing countries as they are responsible for causing pre-harvest and post-harvest losses besides being carriers and reservoirs of numerous diseases of man and domestic stock (Taylor, 1972; Chopra *et al*., 1996; Glass *et al*., 2002; Panti-May *et al*., 2012).

They show diversity, ranging from tiny pigmy mice to big capybaras, from arboreal flying squirrels to subterranean mole rats, from opportunistic omnivores to specialist feeders (Kumar, 1989; Phutela, 2007). Post-harvest losses of food grains in developing countries are enormous but the quantum of losses not only vary from country to country but also in the same country from place to place due to variations in the environmental factors and human efforts utilized for prevention (Ahmad *et al*., 1995). These notorious pests not only feed on grains but also contaminate 20 times more than what they consume with their droppings, urine, hair and even sometimes with their own dead bodies (Rao and Joshi, 1986; Parshad, 1999; Lathiya *et al*., 2008). A realistic estimate of the damage caused by rodents is difficult to assess due to the varied approaches and methods used in evaluating damage in crops and storage (Buckle, 1994; Singleton *et al*., 2004; Yonas *et al*., 2010). These losses indicate the urgency of attaching the highest importance to the management of post-harvest problem if the grain production is to be fully exploited for the benefits of the community and country. Therefore, the present study was planned in randomly selected rice sheller of district Kaithal (Haryana) to ascertain the most favored bait material to be used for preparing poison baits for the management of rodent populations.

MATERIAL AND METHODS

The present study has been conducted in district Kaithal of the state of Haryana located between latitude $29^0$81' N and longitude $76^0$40' E (Fig. 1). Food preference behavior of the rodents was studied by conducting no-choice trials (with and without additives), bi-choice trials (with additives) and multiple-choice trials (with additives). In all, 6 food items, namely, wheat grains, maize grains, millet grains, wheat flour (dough form), soyabean flour (dough form) and germinated pulse were offered for consecutive 5 days in all feeding trials in bait stations placed at strategic locations usually 2-3 m apart in the godowns of selected rice shellers where significant rodent activity was witnessed. Prior to experiment, rodents were presented mixed baits in these bait boxes to avoid bait shyness. After acclimatization to these bait containers, 50 gm of each food item was placed in bait stations and after 24 hrs., unconsumed bait materials were daily collected and fresh baits were replenished. To avoid place preferences, food items were rotated orderly in bait stations daily. The collected left-over baits were air-dried and weighed. Daily records of consumption of each food item was maintained. In no- choice feeding trials, one food item was offered at a time in bait station for fixed number of days. In bi-choice trials, food items were presented two at a time in combination and the position of containers was rotated everyday . In multiple-choice trials, all the six food items were presented together and the position of containers was rotated clockwise daily to avoid place preference by rodents. Two additives, namely, 2% vegetable oil and 2% sugar were mixed with each of the six food items when food choice trials were conducted with additives.

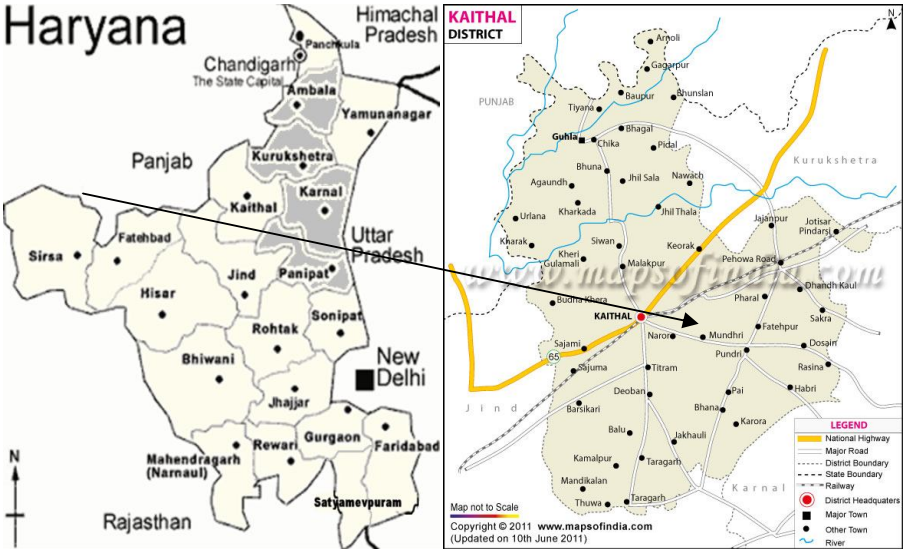


Fig. 1. Map of Haryana showing district Kaithal.

RESULTS AND DISCUSSION

Rodents are omnivorous; however, their feeding habits are successfully adapted to the availability of food in a particular habitat (Parshad, 1999). In the present study, rodents showed great variations in food consumption. In no-choice feeding trials (without additives), average daily intake (g)/bait station of wheat grains, maize grains, millet grains, wheat flour (dough form), soyabean flour (dough form) and germinated pulse were found to be 8.97 ± 1.45(g), 13.03 ± 1.77(g), 15.03 ± 1.92(g), 5.61 ± 1.13(g), 6.89 ± 1.21(g) and 32.79 ± 2.61(g) respectively (Table 1) whereas, in no-choice feeding trials (with additives), average daily intake (g)/ bait station of these six food items was found to be greatly enhanced, *i.e.*, 19.79 ± 2.08(g), 23.78 ± 2.21(g), 27.24 ± 2.52(g), 13.61 ± 1.70(g), 8.92 ± 1.38(g) and 44.58 ± 3.01(g) respectively (Table 2). Marsh (1988) earlier has also described that additives, *i.e.*, sugars and vegetable oils when mixed with cereal baits had improved the acceptance and palatability of bait materials by rodents. According to Meehan (1984), attractants are effective because they mask the taste of a rodenticide and increase their palatability. Howard *et al*. (1972), Smythe (1976), Pathak and Saxena (1995), Munjal (2000) and Kandhwal (2006) has also earlier reported enhanced intake of baits by *R. rattus* when mixed with sugars and oils. The order of preference of six food items in no-choice feeding trials was found to be germinated pulse > millet grains > maize grains > wheat grains > soyabean flour (dough form) > wheat flour (dough form). Variations in average daily intake(g)/bait station of different food items (without and with additives) in no-choice feeding trial in a rice sheller are presented in Fig. 2 and Fig. 3 respectively. In bi-choice trials (with additives), the rodents preferred one food item over another with marked significant difference ($P<0.05$, student's 't' test) in average daily intake (g)/ bait station when these food items were presented in different combinations (Table 3).

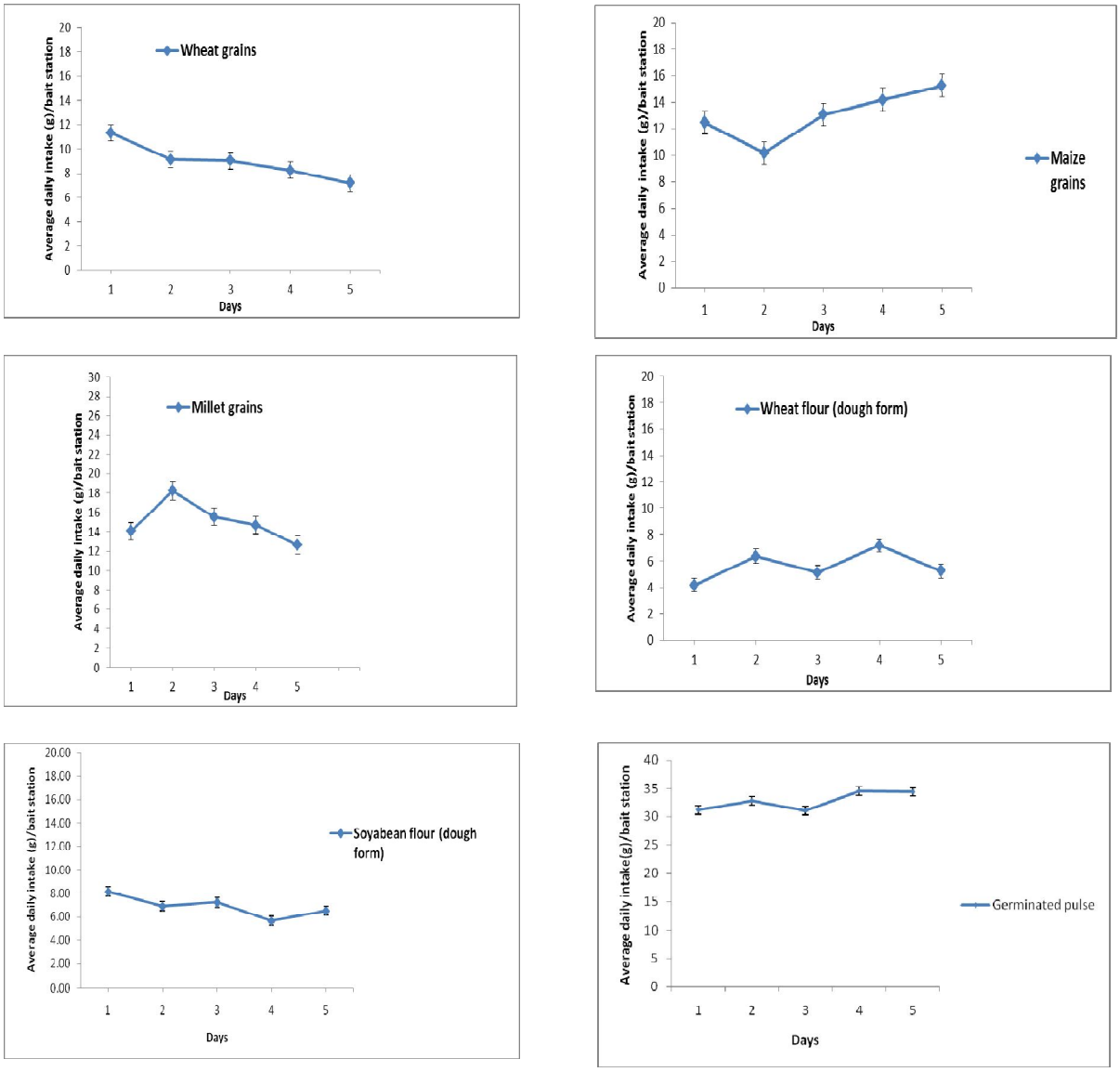


Fig. 2. Variations in average daily intake (g)/bait station of different food items without additives in no-choice trials in rice sheller.

Germinated pulse mixed with additives was highly preferred by rodents over other presented food items in all combinations. Variations in average daily intake (g)/bait station of different food items when presented in bi-choice feeding trials are shown in Fig. 4. Earlier, Siddiqui and Khan (1982) have reported that moist foods particularly boiled rice and pulses were comparatively preferred over dry alternatives by the soft-furred field rats. In the present study also, germinated pulse was highly preferred by the field rodents in confined conditions.

Among a variety of seeds, millet was highly preferred by *R. rattus* (Brooks and Bowerman, 1973; Khan, 1974). Prakash *et al*. (1980) have also reported similar results for *R. rattus* under confined conditions. Texture of food also plays an important role in food preference behaviour of rodents (Khan, 1974).

Table. 1. Food preference behavoiur of rodents in the rice sheller when food items were presented in separate no-choice feeding trials.

Sr. No.	Food items	Average daily intake (g)/bait station (Mean ± S.E.)
1	Wheat grains	$8.97^{d} \pm 1.45$
2	Maize grains	$13.03^{bc} \pm 1.77$
3	Millet grains	$15.03^{b} \pm 1.92$
4	Wheat flour (dough form),	$5.61^{ef} \pm 1.13$
5	Soyabean flour (dough form)	$6.89^{e} \pm 1.21$
6	Germinated pulse	$32.79^{a} \pm 2.61$

Table. 2 Food preference behavior of rodents in the rice sheller when food items mixed with additives were presented in separate no-choice feeding trials.

S. No.	Food items	Average daily intake (g)/bait station (Mean±S.E)
1.	Wheat grains + 2%Oil + 2%Sugar	$19.79^{bcd} \pm 2.08$
2	Maize grains + 2%Oil + 2%Sugar	$23.78^{bc} \pm 2.21$
3.	Millet grains + 2%Oil + 2%Sugar	$27.24^{b} \pm 2.52$
4	Soyabean flour(dough form) + 2%Oil + 2%Sugar	$13.61^{e} \pm 1.70$
5	Wheat flour (dough form) + 2%Oil + 2%Sugar	$8.92^{ef} \pm 1.38$
6	Germinated pulse + 2%Oil + 2%Sugar	$44.58^{a} \pm 3.01$

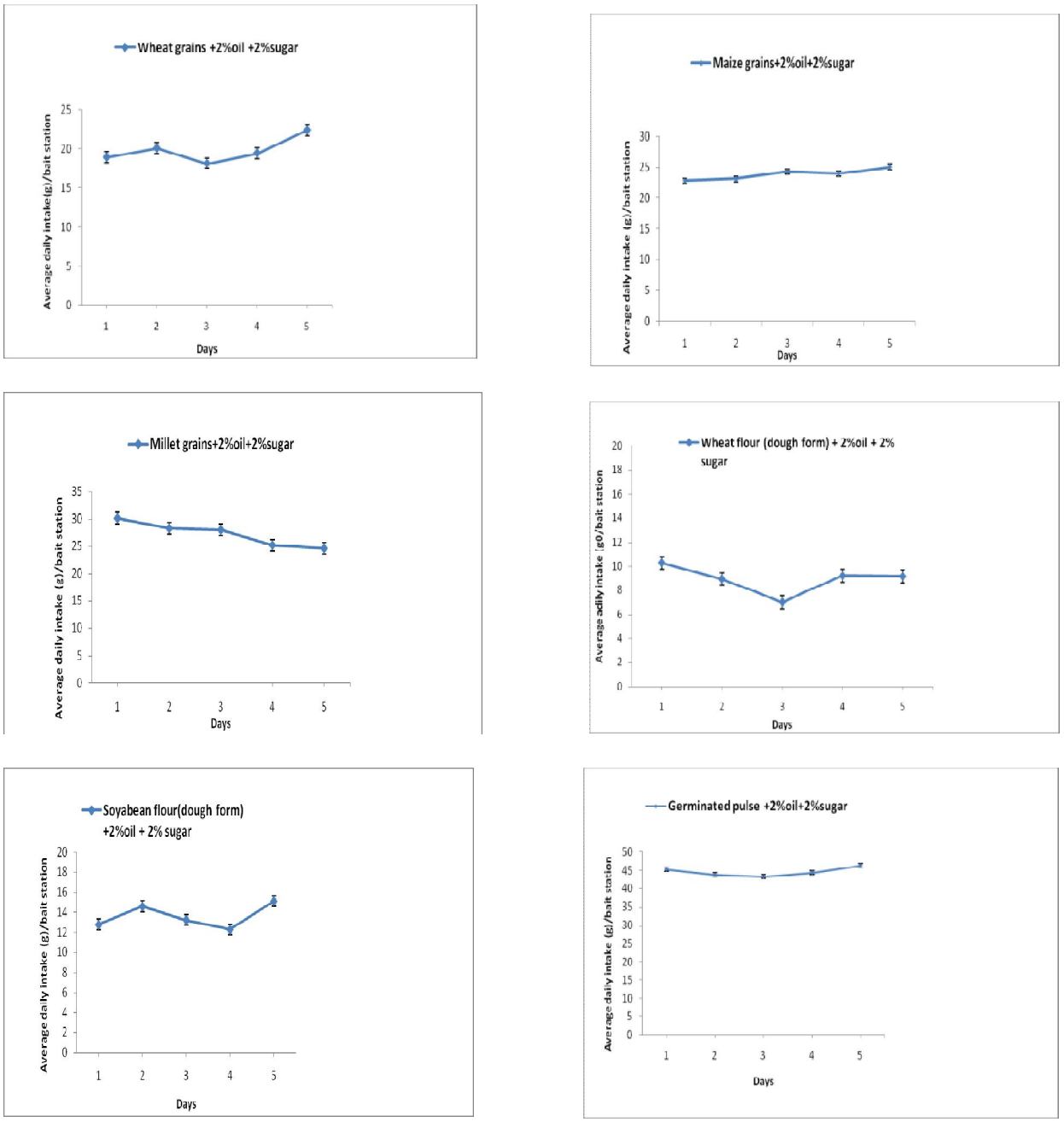
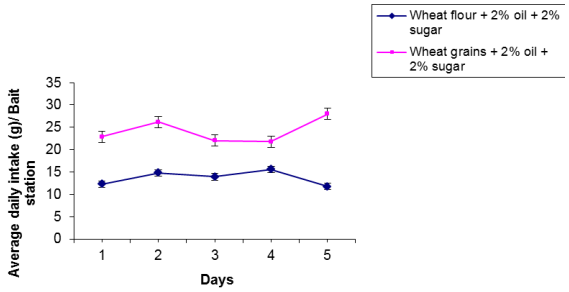


Fig. 3. Variations in average daily intake (g)/bait station of different food items with additives in no-choice trials in rice sheller.

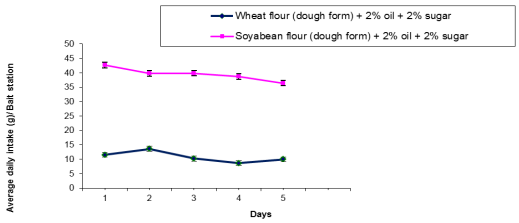
Table. 3. Food preference behavior of rodents in the rice sheller when food items mixed with additives were presented in bi-choice feeding trials.

S.No.	Combination	Average daily intake (g)/bait station
1	Wheat flour (dough form) + 2% Oil + 2% Sugar	13.66 ± 1.73
	Wheat grains + 2% Oil + 2%Sugar	24.18 ± 2.49*
2	Wheat flour (dough form) + 2%Oil + 2%Sugar	10.78 ± 1.62
	Soyabean flour (dough form) + 2%Oil + 2%Sugar	39.49 ± 2.91*
3	Wheat grains + 2%Oil + 2%Sugar	10.30 ± 1.52
	Soyabean flour (dough form) + 2% Oil + 2%Sugar	40.97 ± 2.64*
4	Germinated pulse + 2%Oil + 2%Sugar	43.95 ± 3.03*
	Wheat flour (dough form) + 2%Oil + 2%Sugar	19.88 ± 2.17
5	Germinated pulse + 2%Oil + 2%Sugar	42.01 ± 2.91*
	Soyabean flour (dough form) + 2%Oil + 2%Sugar	13.69 ± 1.79
6	Germinated pulse + 2%Oil + 2%Sugar	43.22 ± 2.94*
	Wheat grains + 2%Oil + 2%Sugar	21.59 ± 2.16
7	Millet grains + 2%Oil + 2%Sugar	38.83 ± 2.92*
	Soyabean flour (dough form) + 2%Oil + 2%Sugar	20.65 ± 2.24
8	Millet grains + 2%Oil + 2%Sugar	24.62 ± 2.49
	Germinated pulse + 2%Oil +2%Sugar	42.26 ± 2.99*
9	Millet grains + 2%Oil + 2%Sugar	34.61 ± 2.80*
	Wheat flour (dough form) + 2%Oil + 2%Sugar	12.19 ± 1.76
10	Millet grains + 2%Oil + 2%Sugar	36.72 ± 3.05*
	Wheat grains+ 2%Oil + 2%Sugar	25.06 ± 2.29
11	Maize grains + 2%Oil + 2%Sugar	34.62 ± 2.62*
	Wheat grains+ 2%Oil + 2%Sugar	26.07 ± 2.29
12	Maize grains + 2%Oil + 2%Sugar	26.09 ± 2.30
	Germinated pulse + 2%Oil + 2%Sugar	46.09 ± 3.08*

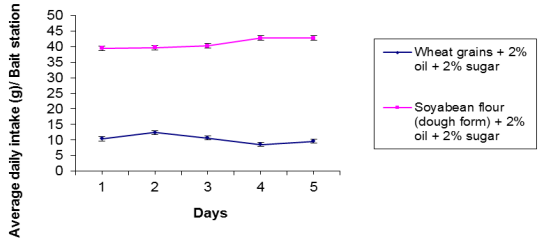
***(P>0.05, student's 't' test)**


Wheat flour + 2% oil + 2% sugar
Wheat grains + 2% oil + 2% sugar
Average daily intake (g)/ Bait station
Days

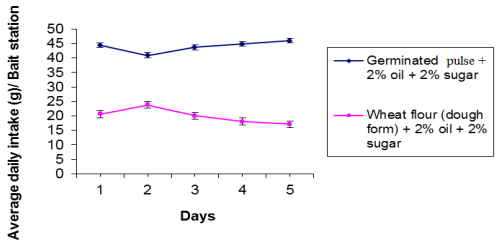
(a)


Wheat flour (dough form) + 2% oil + 2% sugar
Soyabean flour (dough form) + 2% oil + 2% sugar
Average daily intake (g)/ Bait station
Days

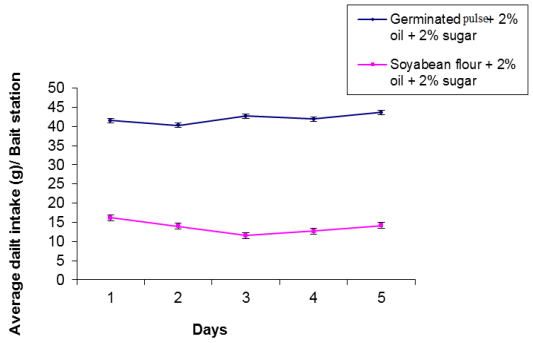
(b)


Wheat grains + 2% oil + 2% sugar
Soyabean flour (dough form) + 2% oil + 2% sugar
Average daily intake (g)/ Bait station
Days

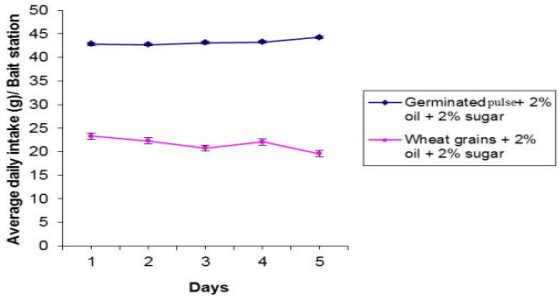
(c)


Germinated pulse + 2% oil + 2% sugar
Wheat flour (dough form) + 2% oil + 2% sugar
Average daily intake (g)/ Bait station
Days

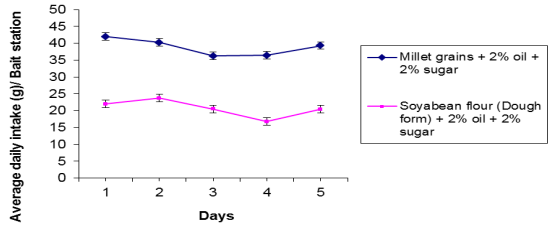
(d)


Germinated pulse + 2% oil + 2% sugar
Soyabean flour + 2% oil + 2% sugar
Average dailt intake (g)/ Bait station
Days

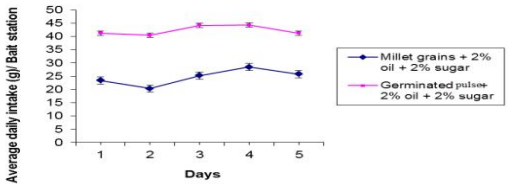
(e)


Germinated pulse + 2% oil + 2% sugar
Wheat grains + 2% oil + 2% sugar
Average daily intake (g)/ Bait station
Days

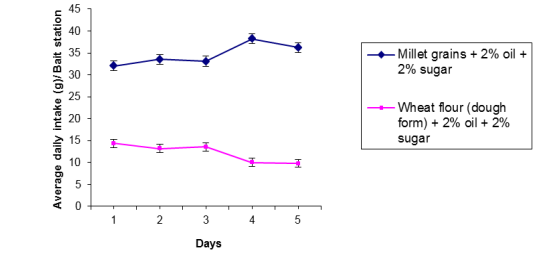
(f)


Millet grains + 2% oil + 2% sugar
Soyabean flour (Dough form) + 2% oil + 2% sugar
Average daily intake (g)/ Bait station
Days

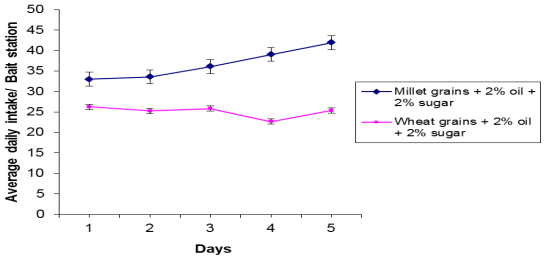
(g)


Millet grains + 2% oil + 2% sugar
Germinated pulse + 2% oil + 2% sugar
Average daily intake (g)/ Bait station
Days

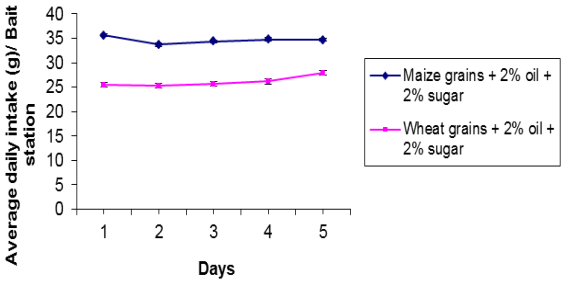
(h)



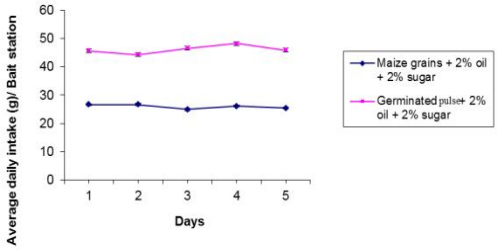
(i)



(J)



(k)



(l)

Fig. 4. Variations in average daily intake (g)/bait station of different food items with additives in bi-choice trials in rice sheller.

Table 4. Food preference behavior of rodents in the rice sheller when food items mixed with additives were presented in multiple-choice trials.

Food items	Daily intake (g) of food items					Average daily intake (g)
	Day 1	Day 2	Day 3	Day 4	Day 5	
Wheat grains + additives	10.53	20.62	15.74	18.95	25.19	18.20 ± 2.92
Maize grains + additives	25.46	24.82	23.99	26.86	26.99	25.62 ± 2.28
Millet grains + additives	30.25	32.19	25.05	28.54	30.32	29.27 ± 2.63
Soyabean flour (dough form) + additives	15.08	12.30	10.54	14.86	13.18	13.19 ± 1.77
Wheat flour (dough form) + additives	10.40	8.23	9.84	8.13	10.42	9.40 ± 1.40
Germinated pulse + additives	44.43	43.89	45.94	46.18	44.97	45.08 ± 3.01

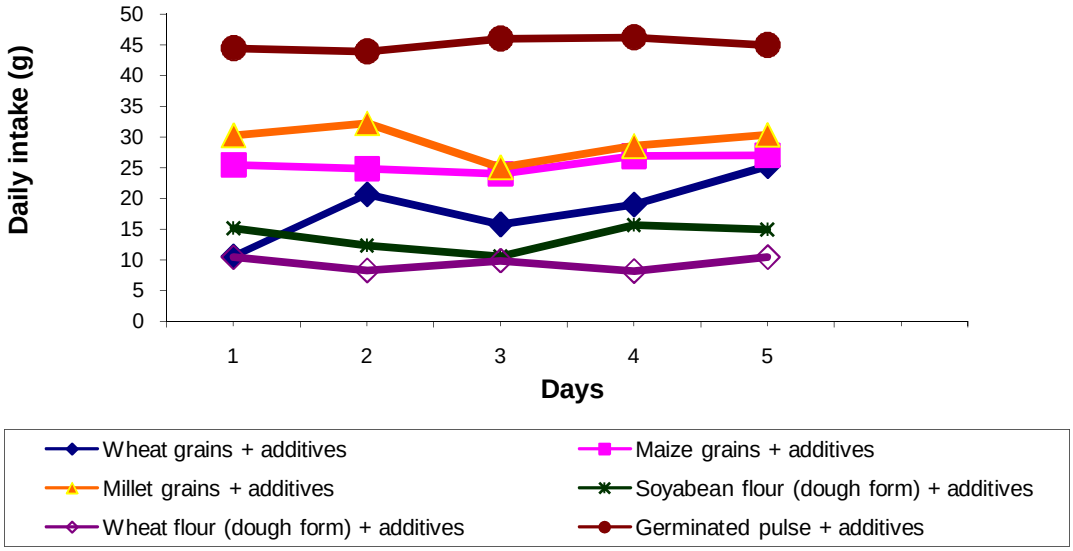


Fig. 5 Variations in average daily intake (g) of different food items mixed with additives in multiple-choice trials in rice sheller.

In the present study also, rodents preferred finely divided food forms, *i.e.*, germinated pulse and millet grains over other alternatives in no-choice and bi-choice feeding trials. Similar findings have been reported in case of Indian bush rat *Gollunda ellioti* and the short-tailed bandicoot rat *Nesokia indica* (Chopra and Parshad, 1983). Lund (1988) discussed the issue of neophobia in relation to baiting techniques for rats and recommended that bait stations should be placed close to a runway and not directly on it. Establishing permanent bait stations and/or pre-feeding the target rats with familiar highly palatable foods are some suggested ways of mitigating the effects of neophobia (Inglis *et al*., 1996).

In multiple choice feeding trials, the rodents showed significant differences ($P<0.05$, Student's 't' test) in their average daily intake (g) of presented six food items for 5 consecutive days. The results showing daily variations in the average daily intake (g) of these food items are presented in Table 4 and Fig. 5. When choice was given, the rodents preferred one food significantly more over other alternative(s). Clark (1982) also observed that meals of *R. rattus* tend to be dominated by one food. Even then, the rats consumed the other alternatives available in small amounts. Even in natural habitats, this sampling behaviour has survival value as it enables the rats not only in finding new sources of food but also in avoiding toxic baits (Barnett, 1966; Siddiqui and Khan, 1982; Chopra *et al*., 1996).

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