

An investigation in the use of forage grains for laboratory rats

Michael Rowntree

Covance Laboratories Ltd.,
Otley Road, Harrogate, HG3 1PY, United Kingdom
Phone: +(44)-1423-500011

Abstract

Providing enrichment for rodents on regulatory toxicity studies creates a number of challenges for Scientists and Animal House personnel. Any potential enrichment material must comply with Good Laboratory Practice requirements and have a detailed analytical report of its constituents. In addition, it must not introduce a new variable that could affect the interpretation of the results of the experiment.

In a natural environment animals enjoy a diet which provides the opportunity to experience different textures and flavours. However, in a laboratory environment providing animals with natural diet can introduce factors that may change how the animals interact with a test substance under examination or effect the animal's development, behaviour or life span. For these reasons, laboratory rodents are fed strictly controlled formulated diets that satisfy their nutritional needs but do not offer a natural variety of consistency or flavour.

The aim of this study was to investigate the response of laboratory rats to search for food, of exactly the same composition as their standard diet, if it was provided as small grains and scattered amongst their bedding rather than provided in a traditional food hopper. Providing food in this way has the potential to add enrichment to the cage environment whilst maintaining the integrity of the study.

Keywords: forage, grains, environmental enrichment, diet, rodents



Study objectives

The objective of this study was to determine if rats would choose to forage for grains of food (supplied within their bedding) in preference to being fed pelleted or powdered diet via a food hopper.

We wanted to investigate the following:

- 1 - Will rats actively forage for food if it is provided within the cage?
- 2 - If rats forage for food, will they stop eating the standard food provided via the hopper or will they eat both?
- 3 - If rats have been exposed to the presence of forage material, will they readily return to consuming standard diet once it's all gone?

- 4 - Was there any effect on animal behavior when forage grain was introduced to the cage?

Materials and methods

The study was performed to the spirit of GLP.

Two groups, each of 15 male and 15 female rats, were housed in groups of five in cages that conform with the 'Code of practice for the housing and care of animals used in scientific procedures' (Home Office, London, 1989).

Aspen wood chip bedding (Datesand LTD, Manchester) was provided. This was changed on Days -7, 1, 8 and 15 of the study. The animals were also provided with wooden Aspen chew blocks. Mains water was provided *ad libitum* via bottles.

Group 1 animals were given SDS R&M No 1 (Expanded) diet and Group 2 animals were given SDS R&M No 1 (Fine ground) diet for one week to acclimatise the animals to their relevant standard study diet. Both diet types were manufactured from the same batch. The animals were maintained on their group-specific diet type throughout the study period. The forage material used during the study was prepared from the same batch as the standard diet offered to the animals to avoid them showing any potential for preference associated with possible

slight variations in palatability of diet type or batch.

The study commenced with collection of food consumption data for one week (Days 1 to 7) following the acclimatisation week. During Week 2, each cage of animals had 200 g of forage material mixed into the bedding substrate on two occasions (Days 8 and 11, 400 g total). Finally, during the last week of the study (Week 3), forage material was not added to the cages.

Bedding within each cage was changed on completion of each week's data collection. The bedding was not changed prior to the addition of the second administration of forage material to evaluate if there was a change in consumption associated with clean or soiled bedding.



Fig. 1 Grains being scattered on top of bedding

On Days 8 to 15, a daily assessment was made of the animal's activity within the cage; at the same time, visual observations were made to record the approximate amount of forage grain that was being consumed. This information was recorded as follows:

Experimental observations		
Observation type	Frequency	System
Cage activity	Daily, Day -7 to 22	1- All animals resting 2- 1-3 animals moving around the cage / exploring environment 3- 3-5 animals moving around the cage / exploring environment 4- Other observations (to be explained in free text)
Forage grain observations	Daily, Day 8 -15	1. No visual consumption apparent 2. Approximately 25% of grains consumed 3. Approximately 50% of grains consumed 4. Approximately 75% of grains consumed 5. All grains consumed

Body weights were recorded twice weekly throughout the study period, to coincide with the timing of food consumption data collection. Food consumption was calculated as g/animal/day.

Results

➤ Graph of food consumption over 4-week period (pelleted diet)

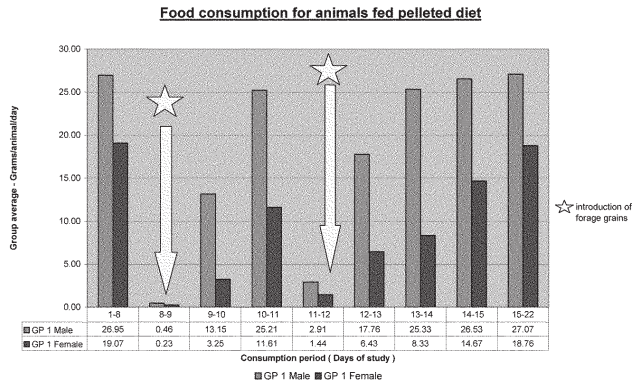


Fig. 2 Food consumption, pelleted diet

➤ Graph of food consumption over 4-week period (powdered diet)

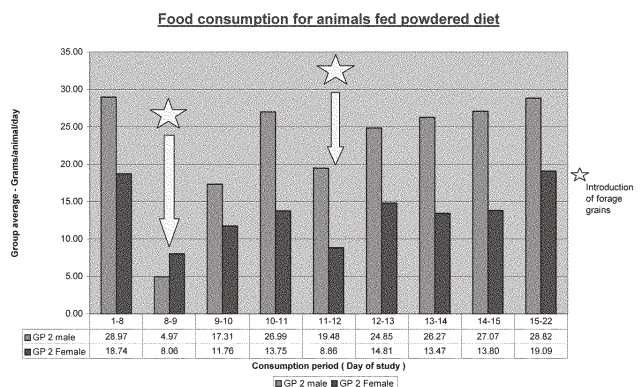


Fig. 3 Food consumption, animals fed powdered diet.

➤ Activity observations (group mean/sex/week)

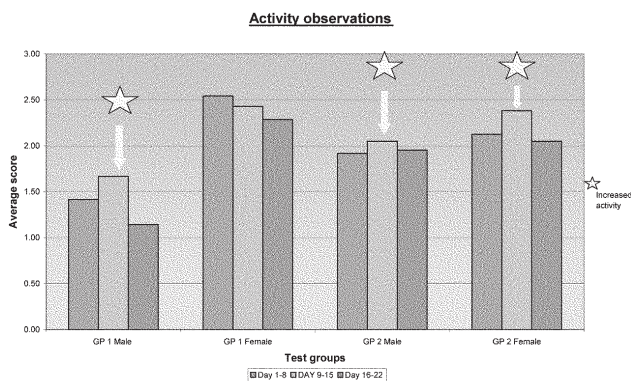


Fig. 4 Activity observations

➤ Bodyweight information (group mean/sex/week)

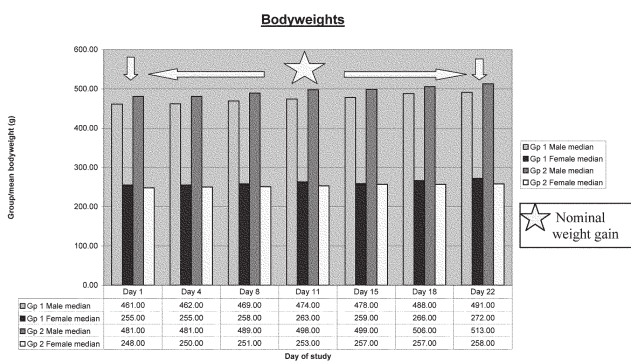


Fig. 5 Bodyweights

Conclusions

- Will rats actively forage for food if it is provided within the cage?
Yes, there was evidence of foraging activity from the first day of introduction of forage grains, increasing as exposure continued.
- If rats forage for food, will they stop eating the standard food provided via the hopper or will they eat both?
Initially, the animals consumed the forage grains at the expense of the standard diet provided via the hopper. However, after a few days, as the amount of grains available decreased, food consumption returned to normal levels. It appears that the overall consumption of diet (grains plus standard diet) was relatively stable across the study; this needs further investigation to confirm.
- If rats have been exposed to the presence of forage material, will they readily return to consuming standard diet once it's all gone?
Yes, food consumption during week 3 was comparable to that in week 1.
- Was there any effect on animal behaviour when forage grain was introduced to the cage?
Possibly. Activity levels of the animals showed a slight increase during the week the animals were provided with forage material; this needs further investigation.

Discussion

The aim of this trial was to begin investigation into the potential use of foraging material as a welfare-positive tool in long-term rodent studies. Foraging is a natural behaviour in rodents and, if forage material is suitable for use in toxicological studies, it would provide variation in the cage environment, stimulation and increased activity. However, alterations to standard study designs can only be implemented if they have negligible effect on the data collected throughout the study period and allow continued comparison with background data already available.

The major concern of adding foraging material to a study design is that it may lead to the animals overeating with consequent obesity and possible effects on the survival in long-term studies. While there was an initial decrease in consumption of the standard diet, this slowly reversed and there appeared to be good correlation between the consumption of the grains and the standard diet, such that overall food consumption was relatively stable. In addition, there was a small, but noticeable, increase in activity with the introduction of forage material so longer-term effects on body weight may not occur because of this increased activity.

These initial results do show that there is potential for the use of forage material as a welfare positive tool and that further investigation into the possible long-term effects is worthwhile.

Future recommendations

- Longer term studies are required to investigate overall diet consumption and bodyweight, and any other related secondary effects, in more detail
- Further investigation is required to assess in more detail the potential activity changes and to see if animals show signs of acclimatisation to the grains (this may also include investigation of other forage materials/diet mix).
- Possible investigation into benefits for other rodent species / strains.

Acknowledgment

The Author would like to thank the following for their contributions, the reviewing of data for this study, and their help in interpreting the data into its current format.

Timothy Jameson, - Section Manager
Janet L. Kelly. MSc - Associate Director
Sarah Nolan-holderness. BSc, CBiol, MIBiol - Manager, Toxicology Business Systems

Reference

'Code of practice for the housing and care of animals used in scientific procedures' (Home Office, London, 1989).

