

Degutopia Independent 30-Day Feed Trial: Supreme Science Degu Diet

C.V. Long and M. Tiley-Waters

Abstract

Degu colony groups from two samples were trialed on a new degu-specific diet, 'Science Selective Degu' (Supreme Petfoods Ltd.), to assess its suitability for maintaining healthy degus. The trial feed was found to meet the needs of the degu appropriately and is recommended as a degu maintenance diet by Degutopia, in addition to hay and fresh vegetable matter. There was no significant difference in weight change between trial and control degus, and the diet performed well in preference tests. It was found that degus ate less of the trial diet as compared to the control, this was attributed to one of two possibilities; 1. that degus could be maintained on less than the recommended 10 g of trial diet, or 2. that degus increased their hay / fibre consumption in order to compensate.

Introduction

The degu (*Octodon degus*) is a diurnal, semifossorial herbivorous rodent, native to the semi-arid scrublands of central Chile. Degus have become popular as domestic pets over the last few decades, and interest in them has expanded throughout the UK and Europe. Although closely related to other caviomorphs such as the guinea pig and chinchilla, and having a similar digestive system, the degu has a unique dietary requirement making many feed products formulated for these other species somewhat unsuitable and in some cases leading to severe health problems for the degu. The most notable feature of a degu's physiology is that they are extremely intolerant of dietary glucose (e.g. Brown and Donnelly, 2001; Nishi and Steiner, 2003; Opazo *et al.*, 2003). Much research in this area has shown that degus very easily develop diabetes mellitus when regularly fed on a sugar-containing diet (Nishi and Steiner, 2003; Brown and Donnelly, 2001), therefore it is key that any degu-specific feed exclude free sugars and has a low carbohydrate content. Research suggests that dietary protein should also be low in degu feeds, since they have only an 85% dietary capacity for protein (Ebensperger, 2001), of which large amounts can lead to a significant increase in water consumption / drinking behaviour (Cortes *et al.*, 1988) due to the excess strain placed upon the kidneys. Long-term, this can lead to permanent kidney damage. Conversely, the fibre content should be maximised as this makes up the most significant proportion of the wild degu diet (Bozinovic *et al.* 2004; Ebensperger and Wallem, 2002), with degus being specially adapted to break down cellulose by alloenzymatic action (Langer, 2002). Bauck (2004) has suggested that caviomorphs need a minimum of 18% dietary fibre in order to maintain healthy digestion, but research by Langer (2002) suggests that it may need to be as high as 21% in the degu. However, any feed produced should take into account that it is advisable to give natural hay *ad lib.* to degus in order to encourage them to forage throughout the day, aid peristalsis and maintain intestinal bacterial health (Bozinovic *et al.*, 2004). It is the popular belief that degus, like their close relative the guinea pig, are not able to produce their own vitamin C, although the lack of research in this area promotes this as hypothesis only. Until further research can be done, it is important that any degu feed contains added vitamin C in order to avoid potential health problems (Sapra *et al.*, 1987). This is particularly important as many mammals produce their own vitamin C from dietary glucose and galactose (Burri and Jacob, 1997), which are lacking in the degu's natural diet.

In 2008, Supreme Petfoods Ltd. released a new degu diet into the market, part of their Science Selective range, Science Selective Degu. This feed is a monoform, extruded diet, consisting entirely of flat, thin squares approximately 2 * 2 cm. The extrusions are brown in colour, very hard and have a mild scent. The ingredients and nutritional breakdown of the product can be found in Table 1.

Ingredients

Alfalfa, barley, wheat flour, wheatfeed, peas, soybean meal, broccoli, oats, soy oil, minerals, spinach, basil, salt.	
Nutritional Breakdown	
Fibre	10 %
Protein	16 %
Fat	4 %
Ash	8 %
Vitamin C	500 mg kg ⁻¹
Vitamin A	15000 IU kg ⁻¹
Vitamin D ₃	1400 IU kg ⁻¹
Vitamin E	50 mg kg ⁻¹
Copper	10 mg kg ⁻¹

Table 1- Ingredients list and nutritional breakdown for Supreme Petfoods' Science Selective Degu diet.

This feed was considered to be appropriate for degus and was rated as one of Degutopia's 'recommended' degu diets based on the nutrition and ingredients, with all components given a suitability score of 'moderate' and above (see <http://www.degutopia.co.uk/degudiet.htm> for further details). As part of the ongoing work by Degutopia to test the suitability of newly formulated degu feeds, we conducted the following independent trial.

Methodology

Animals and Housing

For the trial, two samples of captive degus were monitored, kept in private collections in Leicestershire and Gloucestershire, UK. All degus included in the study were fully adult (age range 1-6 years) and had been bred for at least one traceable generation. Sample 1 (Leicestershire) consisted of three groups; one control group (one neutered female and one male) and two trial groups (two females and two males, respectively). Sample 2 (Gloucestershire) consisted of two groups; one control group (two males) and one trial group (four males). For both samples, each respective group was housed in their own colony mesh cage of average dimensions 100 x 60 x 100 cm (length, width, height). All degus had continual access to running wheels, drinking water and meadow hay. In addition, all degus were regularly allowed access to a large enclosure for exercise/play, as usual, throughout the course of the trial.

Diet

Prior to the start of the trial, all degus were maintained on 10 g each per day of Supreme Petfoods' Gerty Guinea Pig feed mix (see appendix for ingredients list/nutritional breakdown). During the trial, all control degus continued with this feed regime. One week prior to trial onset, all trial degus were gradually introduced to the trial feed (Supreme Petfoods' Science Selective Degu) by increasing the daily quantity of trial diet and simultaneously decreasing the original diet until only trial diet was being fed on the day before trial start. This was done to avoid digestive upset by allowing the degus' intestinal microflora time to adapt to the new feed. After this period the trial was started for the period of 20 days, with all trial degus maintained on 10 g of the trial diet (see Figure 1). On day 21, the original feed was re-introduced over the period of one week.



Figure 1- Sample daily 10g portion of the Science Selective Degu trial diet. Scales accurate to 1g, dish zeroed.

Data Collection

Weight data were collected from each control and trial degu on weighing scales accurate to 1 g. In order to facilitate data collection, a small quantity (~1 g) of rolled oats or shredded wheat were placed onto the scales to keep the degu in position for the few seconds required to read off the weight. Scales were zeroed prior to the weighing event. For sample 1, weighing scales were calibrated with a 200 g fixed mass weight prior to each weight reading. Data collection was divided into three periods; pre-trial (days -6 – 0), trial (days 1 – 20) and post-trial (days 21 – 30). During the pre-trial period, all degus were weighed at the start of the week allowed for introducing the trial diet to trial degus, and again at the end of this pre-trial period (the day prior to the start of the trial). During the trial period, all degus were weighed daily, at the same time of day to avoid any error arising from fluctuations that may occur in body weight over the course of the day. All degus continued to be weighed daily throughout the post-trial period. In addition, the quantity of water drunk in each colony cage was noted throughout the trial.

Data Analysis

Weight data were analysed by one-way ANCOVA using the GLM module of Statistica (Statsoft, Inc.). 'Degu' / 'trial status' (control or trial) was chosen as the independent variable, with 'weight' or 'change in weight' as dependent variables. 'Trial day' was selected as covariate since weight change was likely to be correlated with time as the trial progressed.

Results

Weight Changes

The weights of the control degus were significantly lower (sample 1 $F_{[1,77]} = 41.12$; $p < 0.00005$, sample 2 $F_{[1,117]} = 49.73$; $p < 0.00005$) than the weights of the trial degus in both samples over the trial period (days 1 – 20) (excluding weights of TD3 and TD4 in sample 1). Figures 1 and 2 show the weights for all degus in each sample over the course of the trial, indicating the mean weights for both control and trial degus. There was no significance (sample 1 ($F_{[1,77]} = 1.23$, sample 2 $F_{[1,117]} = 0.34$) between the change in weight of the control and trial degus in both samples over the trial period (excluding degus TD3 and TD4 in sample 1). Figures 3 and 4 demonstrate the daily change in weight for all degus in both samples. Complete weight tables for both samples can be found in the appendix.

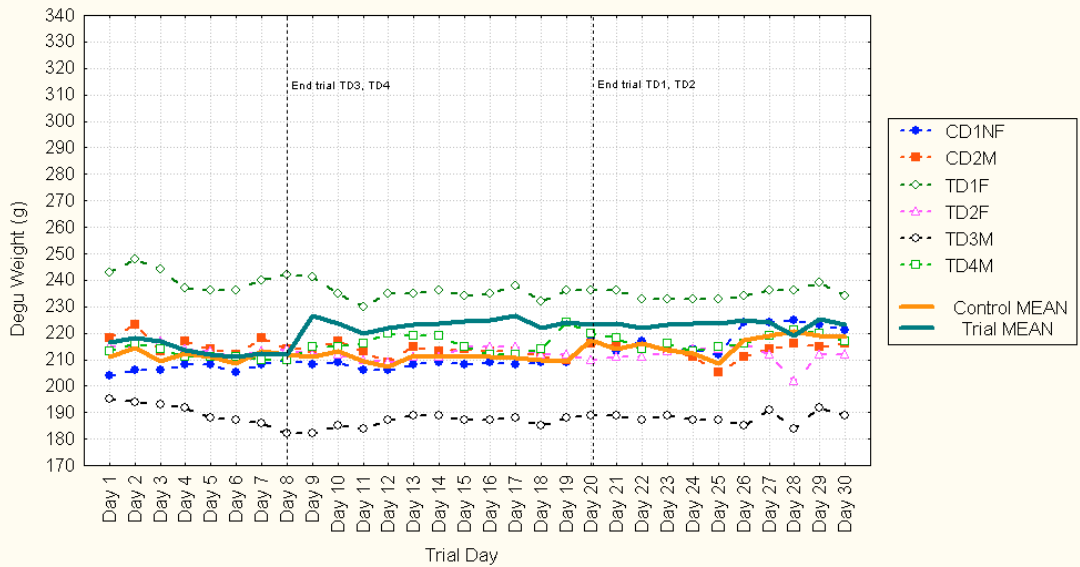


Figure 1- Weights for all degus in sample 1 over the course of the trial. Dotted lines indicate where trials were ended for the degus indicated and the old feed re-introduced over a seven day period.

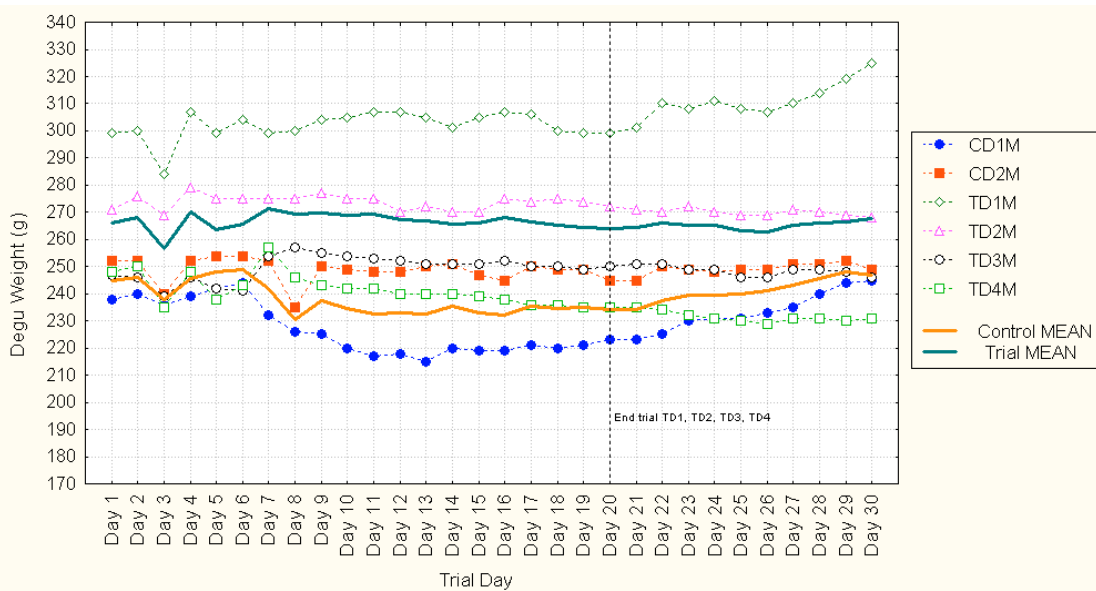


Figure 2- Weights for all degus in sample 2 over the course of the trial. Dotted line indicates where trial was ended for the degus indicated and the old feed re-introduced over a seven day period.

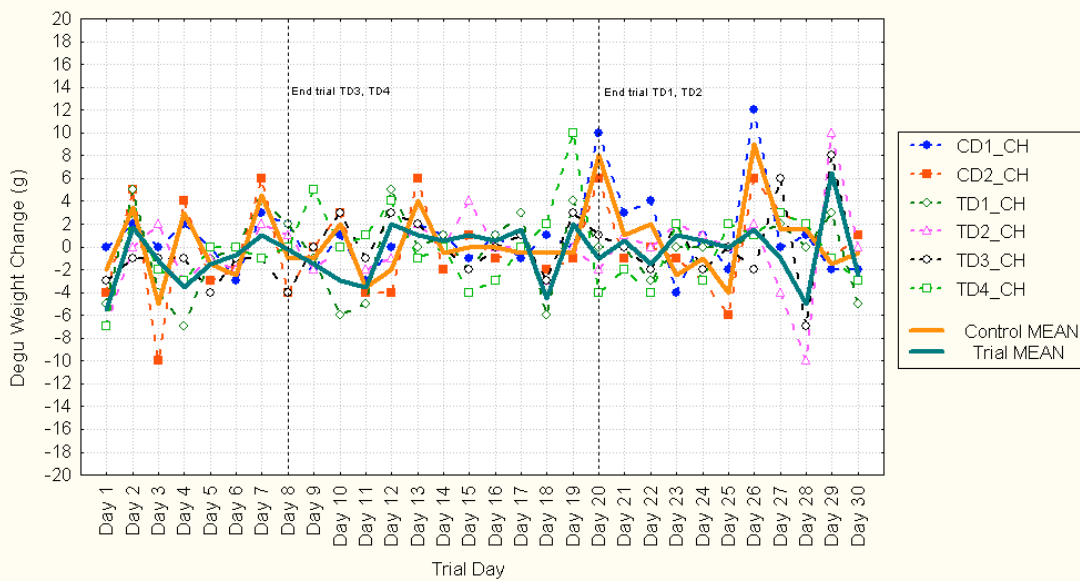


Figure 3- Daily weight changes for all degus in sample 1 over the course of the trial. Dotted lines indicate where trials were ended for the degus indicated and the old feed re-introduced over a seven day period.

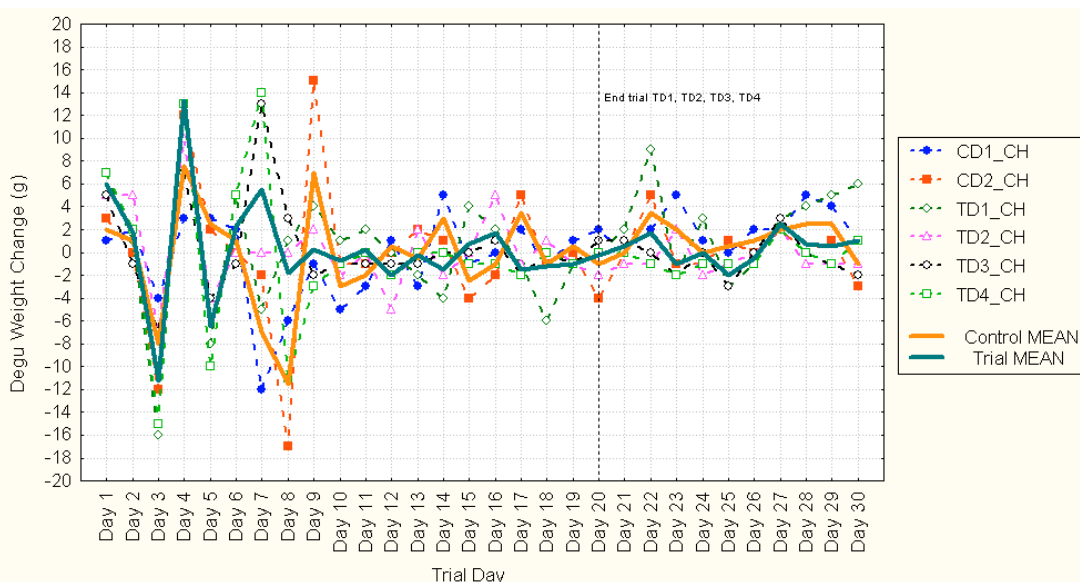


Figure 4- Daily weight changes for all degus in sample 2 over the course of the trial. Dotted line indicates where trial was ended for the degus indicated and the old feed re-introduced over a seven day period.

Preference Tests

After the trial, degus in sample 1 were presented with a simple preference test, being offered a choice of two bits of feed as a treat (either a square of trial diet or an extrusion from the control diet). These were offered simultaneously to each degu and the first to be taken was recorded. In this test, degus selected the trial diet 53 % of the time, and the control diet 47 % of the time; however the entire piece of trial diet was not always eaten in one sitting.

Water Consumption

Table 2 shows the water consumption for each sample group over the trial period.

Sample 1			
Group	Group water consumed (ml)	Number of degus per group	Average individual water consumption (ml)
<i>Control</i>	470	2	235
Trial group 1	480	3*	160
Trial group 2	520	2	260
Sample 2			
Group	Group water consumed (ml)	Number of degus per group	Average individual water consumption (ml)
<i>Control</i>	2500	2	1250
Trial group 1	3620	4	905

Table 2- Average water consumption per degu over the course of the trial for all sample groups. *Note that although this group contained three degus, the data for only two were included in the study due to one female having a history of teeth problems and weight loss (however all three were fed trial diet).

Discussion

In sample 1, the trial degus TD3 and TD4 were not included in the statistical analysis as their trial was halted prematurely on day 8. This was due to the continued, rapid weight loss of TD3 from trial onset to trial day 8. As this degu had lost 10 % of his starting body weight on day 8 of the trial, the decision was made to halt the trial for these two degus, since although it was not clear the feed was the cause of the weight loss (although this degu was observed to have stopped eating hard feed over this time) it was considered logical to revert to the original diet. Re-analysing the data for all degus in sample 1, over the first 8 days only, revealed no statistical significance between the weights of control and trial degus ($F_{[1,45]} = 0.29$), although there was a trend for the control weights to be lower. Running the same analysis for the weight change data still showed no significance ($F_{[1,45]} = 1.22$). Another possible factor affecting the results was that one of the control degus (CD1) was found to have an abscess on the lower jaw shortly after the trial onset and was treated with antibiotics for the first 10 days of the trial. This degu was underweight as compared to her previous healthy weight data. Eliminating this degu's weight data from the analysis resulted in significantly lower weights of the control as compared to the trial degus ($F_{[1,57]} = 13.50$; $p < 0.0005$), but still no significance in weight change ($F_{[1,57]} = 0.10$). In sample 2, one of the control degus was also found to have an ear infection around day 10 of the trial and was treated with a 10 day course of antibiotics. Re-analysing the data without the weights from this degu still showed significance in the weight data ($F_{[1,97]} = 10.90$; $p < 0.005$) and no significance in the weight change data ($F_{[1,97]} = 0.07$).

The fact that the trial degus weighed significantly more than the control degus in both samples was not considered to be an effect of the trial diet. This was more likely to be down to genetic and physiological differences between the control and trial animals, since the average weight for the trial groups was higher than the average weight of the control groups in the pre-trial phase. For this reason, the change in weight over the course of the trial was also analysed as a more reliable indicator of trial diet effects. As there was no significant difference between the change in weight of the trial degus as compared to the controls over the course of the trial, it was apparent that the trial diet was as suitable for the degus as their usual control diet.

However, for both samples the trial degus were reported to become less interested in eating hard feed, generally ate less hard feed, and more bits of the feed were discovered buried around the cage than normal. There was a slight trend for the trial degus to drink less water than the control degus. Both samples' trial degus were also observed to consume more hay than usual (since before the start of the trial). As the results clearly show there were no marked weight losses between the trial and control groups, it can therefore be assumed that degus maintained on the trial diet either need to eat less hard feed per day than the recommended 10 g, or that degus on the trial diet eat more hay to compensate for a reduction in hard feed intake.

While the uniform appearance of the trial diet prevented selective eating of only the preferred pieces, in the long term degus may become 'bored' with the lack of variety the diet has to offer. Degus demonstrated a slight preference for the trial diet as compared to the control diet in the simple preference test, however not all of the extrusion retrieved would be eaten whereas the entire control extrusion would usually be eaten in one sitting. It is, however, important to offer degus a variety of suitable treats and vegetables on a regular basis in order to provide mental and dietary stimulation.

Conclusion

The 30-day trial of Science Selective Degu manufactured by Supreme Petfoods showed it to be a suitable candidate for feeding degus as their regular diet, in addition to hay and fresh vegetable matter. Degus did not show significant weight fluctuations as compared to degus maintained on the control Gerty Guinea Pig diet, and showed a slight preference for the trial diet. We can therefore conclude that 1. degus need to eat less of the Science Selective Degu diet as compared to the Gerty Guinea Pig diet to maintain a stable body weight, or that 2. degus on the Science Selective Degu diet eat less hard feed and compensate by increasing hay / fibre intake.

References

- Bauck, L. (2004) *Technical bulletin: Timothy and alfalfa*. Pers. comm.
- Bozinovic, F., Bacigalupe, L., Vasquez, R., Visser, H., Veloso, C. and Kenagy, G. (2004) 'Cost of living in free-ranging degus (*Octodon degus*): Seasonal dynamics of energy expenditure.' *Comparative Biochemistry and Physiology A*, **137**: 597-604.
- Brown, C and Donnelly, T. (2001) 'Cataracts and reduced fertility in degus (*Octodon degus*): Contracts secondary to diabetes mellitus.' *Lab Animal (NY)*, **30** (6): 25-6.
- Burri, B. and Jacob, R. (1997) 'Human metabolism and the requirement for vitamin C.' *Vitamin C in Health and Disease*. New York: Marcell Dekker.
- Cortes, A., Zuleta, C. and Rosenmann, M. (1988) 'Comparative water economy of sympatric rodents in a Chilean semi-arid habitat.' *Comparative Biochemistry and Physiology*, **91** (4): 711-4.
- Ebensperger, L. (2001) 'No infanticide in the hystricognath rodent, *Octodon degus*: Does ecology play a role?.' *Acta. Ethol.*, **3**: 89-93.
- Ebensperger, L. and Wallem, P. (2002) 'Grouping increases the ability of the social rodent, *Octodon degus*, to detect predators when using exposed microhabitats.' *OIKOS*, **98**: 491-497.
- Langer, P. (2002) 'The digestive tract and life history of small mammals.' *Mammal Review*, **32** (2): 107-131.
- Nishi, M. and Steiner, D. (2003) 'Cloning of complementary DNA's encoding islet amyloid polypeptide, insulin, and glucagon precursors from a New World rodent, the degu, *Octodon degus*.' *Molecular Endocrinology*, **4** (8): 1192-8.
- Opazo, J., Soto-Gamboa, M. and Bozinovic, F. (2003) 'Blood glucose concentration in caviomorph rodents.' *Comparative Biochemistry and Physiology A*, **137**: 57-64.
- Sapra, M., Sharma, P. and Kothari, L. (1987) 'Effect of vitamin C deficiency on testicular structure in the guinea pig.' *Journal of Postgraduate Medicine*, **33**: 69-73.

Appendix

i. Complete weight data for all degus in sample 1.

Degutopia 30-day Feed Trial March 2009; Supreme Science Degu Diet.							Water consumption (ml)		
Day	Freya (NF) Control Degu 1	Philip (M) Control Degu 2	Nibble (F) Trial Degu 1	Chibi Masu (F) Trial Degu 2	Dreggen (M) Trial Degu 3	Diego (M) Trial Degu 4	Control cage	Trial cage 1	Trial cage 2
Pre-intro weight 22-02-09	209	223	236	214	201	212			
Post-intro weight 28-02-09	204	222	248	222	198	220			
Trial day 1 01-03-09	204	218	243	215	195	213			
Trial day 2 02-03-09	206	223	248	215	194	216			
Trial day 3 03-03-09	206	213	244	217	193	214			
Trial day 4 04-03-09	208	217	237	214	192	211			
Trial day 5 05-03-09	208	214	236	213	188	211			
Trial day 6 06-03-09	205	212	236	211	187	211			
Trial day 7 07-03-09	208	218	240	213	186	210			
Trial day 8 08-03-09	210	214	242	214	182	210			
Trial day 9 09-03-09	208	214	241	212	182	215			
Trial day 10 10-03-09	209	217	235	212	185	215			
Trial day 11 11-03-09	206	213	230	210	184	216			
Trial day 12 12-03-09	206	209	235	209	187	220			
Trial day 13 13-03-09	208	215	235	211	189	219			
Trial day 14 14-03-09	209	213	236	211	189	219			
Trial day 15 15-03-09	208	214	234	215	187	215			
Trial day 16 16-03-09	209	213	235	215	187	212			
Trial day 17 17-03-09	208	213	238	215	188	212			
Trial day 18 18-03-09	209	211	232	212	185	214			
Trial day 19 19-03-09	209	210	236	212	188	224			
Trial day 20 20-03-09	219	216	236	210	189	220			
Trial day 21 21-03-09	213	215	236	211	189	218			
Trial day 22 22-03-09	217	215	233	211	187	214			
Trial day 23 23-03-09	213	214	233	213	189	216			
Trial day 24 24-03-09	214	211	233	214	187	213			
Trial day 25 25-03-09	212	205	233	214	187	215			
Trial day 26 26-03-09	224	211	234	216	185	216			
Trial day 27 27-03-09	224	214	236	212	191	219			
Trial day 28 28-03-09	225	216	236	202	184	221			
Trial day 29 29-03-09	223	215	239	212	192	220			
Trial day 30 30-03-09	221	216	234	212	189	217	470	480	520

ii. Complete weight data for all degus in sample 2.

Degutopia 30-day Feed Trial March 2009; Supreme Science Degu Diet.							Water consumption (ml)		
Day	Control Degu 1 Footloose(m)	Control Degu 2 Fancyfree(m)	Trial Degu 1 Digma (m)	Trial Degu 2 Nibbla (m)	Trial Degu 3 Tiny (m)	Trial Degu 4 Febbee(m)	Control cage	Trial cage 1	Trial cage 2
Pre-intro weight 22-02-09	235	235	298	270	244	232			
Post-intro weight 28-02-09	237	249	292	266	242	241			
Trial day 1 01-03-09	238	252	299	271	247	248			
Trial day 2 02-03-09	240	252	300	276	246	250	250	400	
Trial day 3 03-03-09	236	240	284	269	239	235			
Trial day 4 04-03-09	239	252	307	279	246	248			
Trial day 5 05-03-09	242	254	299	275	242	238	250	400	
Trial day 6 06-03-09	244	254	304	275	241	243			
Trial day 7 07-03-09	232	252	299	275	254	257			
Trial day 8 08-03-09	226	235	300	275	257	246	250	410	
Trial day 9 09-03-09	225	250	304	277	255	243			
Trial day 10 10-03-09	220	249	305	275	254	242			
Trial day 11 11-03-09	217	248	307	275	253	242	250	400	
Trial day 12 12-03-09	218	248	307	270	252	240			
Trial day 13 13-03-09	215	250	305	272	251	240			
Trial day 14 14-03-09	220	251	301	270	251	240	250	400	
Trial day 15 15-03-09	219	247	305	270	251	239			
Trial day 16 16-03-09	219	245	307	275	252	238			
Trial day 17 17-03-09	221	250	306	274	250	236			
Trial day 18 18-03-09	220	249	300	275	250	236	250	410	
Trial day 19 19-03-09	221	249	299	274	249	235			
Trial day 20 20-03-09	223	245	299	272	250	235			
Trial day 21 21-03-09	223	245	301	271	251	235	250	400	
Trial day 22 22-03-09	225	250	310	270	251	234			
Trial day 23 23-03-09	230	249	308	272	249	232			
Trial day 24 24-03-09	231	248	311	270	249	231	250	400	
Trial day 25 25-03-09	231	249	308	269	246	230			
Trial day 26 26-03-09	233	249	307	269	246	229			
Trial day 27 27-03-09	235	251	310	271	249	231			
Trial day 28 28-03-09	240	251	314	270	249	231			
Trial day 29 29-03-09	244	252	319	269	248	230	250	400	
Trial day 30 30-03-09	245	249	325	268	246	231	2500	3620	

iii. Ingredients and nutritional breakdown for Supreme Petfoods Ltd.'s Gerty Guinea Pig feed.

Ingredients	
Alfalfa, flaked peas, flaked maize, wheat and flaked wheat, oats, soya, locust beans, anise and fenugreek liquid, soya oil, orange, banana, vitamins and minerals, sodium chloride, EC colourants, sodium sulphide stabiliser.	
Nutritional Breakdown	
Fibre	10 %
Protein	15 %
Fat	3 %
Ash	5 %
Vitamin C	250 mg kg ⁻¹
Vitamin A	23000 IU kg ⁻¹
Vitamin D ₃	1000 IU kg ⁻¹
Vitamin E	50 mg kg ⁻¹
Copper	10 mg kg ⁻¹

