

DIET-INDUCED DIABETES IN CAPTIVE PLAINS VISCACHAS (*LAGOSTOMUS MAXIMUS*)

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Abstract

Plains viscachas (*Lagostomus maximus*) are large, nocturnal rodents that inhabit the pampas of Paraguay, Bolivia and Argentina. They are considered to feed on poor quality food in the wild: grass, forbs and bushes.¹ Plains viscachas have been kept and bred at Zurich Zoo since 1964 and have shown the tendency to develop a type II diabetes mellitus, which was supposedly caused by inadequate feeding.⁵

Diet-induced diabetes is a well known problem in many other rodent species like the tuco-tuco (*Ctenomys talarum*),⁶ degu (*Octodon degus*),⁴ and the fatty sand rat (*Psammomys obesus*).³ The aim of the present study was to examine the influence of two different feedings on body-weight and blood- and urine-values with respect to a clinical manifestation of diabetes mellitus in this species.

To this end, one feeding trial with a high-fiber, low-energy feed (grass hay only - Trial A) consisting of 4.7, 44.9, and 74.2% crude protein (CP), crude fiber (CF), and neutral detergent fiber (NDF) concentrations on a dry matter basis, respectively, and one feeding trial with low-fiber, high-energy feed (grass hay, carrots and pellets [Kliba NAFAG, Kaiseraugust, Switzerland]- Trial B), consisting of 15.0-20.4, 17.9-27.3, 29.8-45.2% CP, CF, and NDF concentrations on a DM basis, respectively, were carried out. Each feed was fed to the same twelve plains viscachas (six males, six females) over a period of two weeks. Animals were weighed before and after each feeding period. At the end of each feeding period, animals were subjected to a short isoflurane anesthesia (Abbott, Cham, Switzerland, 2%; delivered by face mask), and blood was sampled by venipuncture of the *Vena femoralis* or the *Vena coccygea*. In addition, urine was sampled by applying manual pressure on the bladder. Blood samples were analyzed for glucose, insulin (analyzed by a Sensitive Rat Insulin RIA Kit [LINCO Research, St. Charles, Missouri, USA]), amylase and fructosamine as indicators of sugar metabolism. Triglycerides, cholesterol and lipase were analyzed by standard laboratory procedures as indicators of fat metabolism. Urinary glucose was evaluated by using a rapid strip test (Combur-Test[®], Roche Diagnostics AG, Rotkreuz, Switzerland). Statistical analyses (t-test) were performed using the program SPSS 11.0 (SPSS, Chicago, IL, USA).

Trial A led to a significant decrease (from 2.98 ± 1.22 kg to 2.80 ± 1.17 kg; $p < 0.01$) and Trial B to a significant increase in body weight (from 2.78 ± 1.07 kg to 2.96 ± 1.17 kg; $p < 0.01$). There

were no significant differences in blood glucose, amylase, triglycerides, cholesterol or lipase. Fructosamine- and insulin values differed significantly, with higher values at the end of Trial B (fructosamine from $226.83 \pm 38.14 \mu\text{mol/l}$ to $268.00 \pm 24.77 \mu\text{mol/l}$, $p < 0.01$ and insulin from $0.32 \pm 0.15 \text{ ng/ml}$ to $0.46 \pm 0.24 \text{ ng/ml}$; $p < 0.05$). An elevated urinary glucose value during Trial B could be seen in five animals.

In conclusion, it can be stated that a carbohydrate-based, high-energy diet bears a high risk for plains viscachas to develop a diabetes mellitus with the short-term consequence of glucosuria. The potential long-term consequences of diabetes mellitus (cataracts, hepatolipidosis) have been described by Gull et al.² Remarkably, initial clinical indications of developing diabetes, due to concentrate feeding, were observed in a very short time of only two weeks. Therefore, this species may prove valuable as an animal model for further diabetes research in the future. For the management of captive populations, a low-energy, high-fiber feeding regime appears warranted. However, the decrease in body weight on the hay-only diet during Trial A offers two different interpretations that should be investigated: either viscachas are not able to maintain body weight on a low-protein, high-fiber grass hay, as used during this study, or the animals may have stabilized their body weights on a lower level of this diet. In order to investigate these possibilities, further feeding studies, using a different hay source and longer feeding periods, with regular weighing intervals, are being conducted.

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