

Effect of restricted food intake on production, catabolism, and effects of IGF-I and cyclic nucleotides in cultured ovarian tissue of domestic nutria (*Myocastor coypus*)

A.V. Sirotkin, D. Mertin, K. Süvegová, A.V. Makarevich, H.-G. Genieser, M.R. Luck, L.V. Osadchuk

The aims of these *in vitro* experiments were to examine the effects of short-term food restriction on ovarian secretory activity and the role of IGF-I and cAMP- and cGMP-dependent intracellular mechanisms in the control of ovarian function in domestic nutria. Slices of ovary from sexually mature animals kept under conditions of normal and restricted (1/2 of standard ration) feeding were cultured with or without IGF-I (50 ng/ml), cAMP analogues (dbcAMP and Rp-cAMPS), and cGMP analogues (8-pCPT-cGMP and Rp-8-Br-PET-cGMPS; all at 100 nM). In nonovarian cells dbcAMP activates and Rp-cAMPS inhibits protein kinase A, while 8-pCPT-cGMP activates and Rp-8-Br-PET-cGMPS inhibits protein kinase G and cGMP-gated ion channels. IGF-I release and catabolism, as well as the release of progesterone (P), estradiol (E), and cAMP by the cultures, were evaluated using RIA. IGF-I did not affect cAMP release, while each of the cAMP and cGMP analogues inhibited IGF-I release in both control and experimental groups. Fasting did not affect cAMP or IGF-I release. It partially prevented the effect of Rp-cAMPS, but not of other cyclic nucleotides, on IGF-I release and inhibited IGF-I catabolism. The Rp-cAMPS and Rp-8-Br-PET-cGMPS also inhibited IGF-I catabolism and the effects were greater with tissue from food-restricted than control animals. Ovaries from the underfed nutria secreted significantly more P and less E than those from normally fed animals. IGF-I and both cAMP analogues, given alone, did not affect P release whereas a combination of IGF-I and Rp-cAMPS increased P output in control, but not in the experimental group. The 8-pCPT-cGMP had no effect P release. Rp-8-Br-PET-cGMPS, given alone or in combination with IGF-I, dramatically increased P secretion by tissue from control but not

underfed animals. Estradiol secretion by tissue from underfed animals was stimulated by IGF-I, dbcAMP, Rp-cAMPS, 8-pCPT-cGMP, and Rp-8-Br-PET-cGMPS as well as by combinations of IGF-I and Rp-cAMPS or Rp-8-Br-PET-cGMPS; these effects were not seen with control tissue. The results demonstrate that: (1) ovaries of domestic nutria secrete IGF-I, P, F, and cAMP; (2) cAMP and cGMP can influence IGF-I release and catabolism; (3) the cyclic nucleotides may have an IGF-I-mediated effect on P and E output; (4) IGF-I and cyclic nucleotides can prevent the effect of undernutrition on F, but not on P release; (5) effects of cAMP and cGMP on P and F are probably not mediated by protein kinase A, protein kinase G, or cGMP-gated ion channels; and (6) food restriction can influence ovarian IGF-I catabolism, P, and F release and modulate the effects of cyclic nucleotides and IGF-I on steroidogenesis. It is concluded that ovarian secretory activity may be regulated separately by nutrition and the cyclic nucleotide-IGF-I system, and there may be functional interrelationships between these mechanisms.

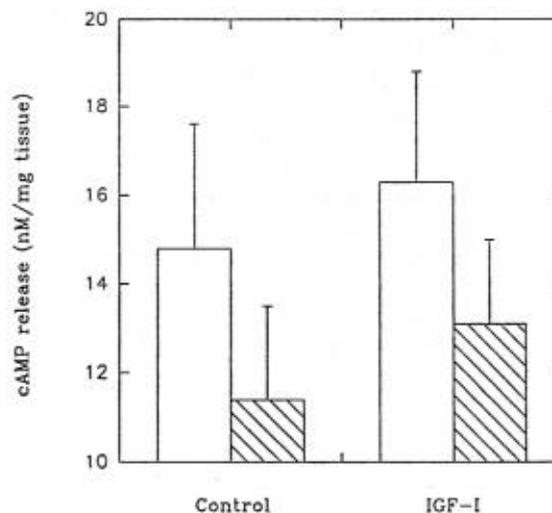


Fig. 3. Effect of IGF-I on cAMP release by ovarian tissue of domestic nutria with (striped bars) or without (white bars) food restriction. Values are means \pm SEM.

General and Comparative Endocrinology 117, pp. 207-217, 2000. 1 table, 5 figs., 31 refs. Authors' summary.

A metabolism cage for quantitative urine collection and accurate measurement of water balance in adult cats (*Felis catus*)

W.H. Hendriks, S. Wamberg, M.F. Tarttelin

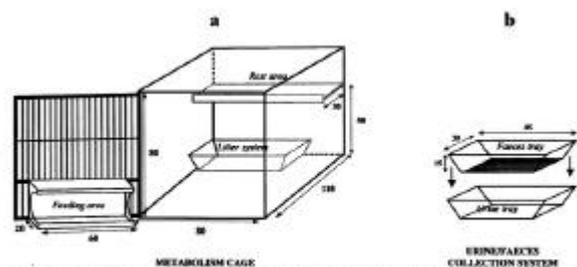


Fig. 1. Design of the metabolism cage (a) and urine/faeces collection system (b) for cats used in the present study. Dimensions are in cm.

The objectives of this study were to validate quantitative urine collection and accuracy of water balance measurements of cats housed in specially designed metabolism cages fitted with a urine/faeces collection system. In Study 1, four adult cats with surgically implanted osmotic mini-pumps releasing an accurate amount of ^{14}C -labelled inulin per unit of time, were housed in the metabolism cages. Daily urine and feces were collected for 16 days under *ad libitum* feeding conditions and a 2-day feed restriction period. Recoveries of ^{14}C -inulin in the urine and feces, as well as creatinine in the urine, of the cats were determined. In Study 2, four adult cats were fed a nutritionally balanced diet and an 8-day conventional water balance trial was carried out. At the start of Study 2, the cats received an intraperitoneal injection of tritiated water to allow determination of total water turnover by the isotope dilution technique. In Study 1 the recovery of ^{14}C -inulin in the urine of the cats over the 18-day collection period was (mean \pm SEM) $97 \pm 2.9\%$ indicating that urine could be collected quantitatively. A mean (\pm SEM) recovery of ^{14}C -inulin in the feces of $0.9 \pm 0.31\%$ was found indicating negligible to no cross-contamination of feces with urine. Daily urinary creatinine excretion was found to be highly variable, similar to urine volume, and therefore its estimation is an unsatisfactory index of the completeness of 24-h urine collection in cats. A mean (\pm SEM) agreement of $98 \pm 0.3\%$ was found between the water turnover rate of the cats in Study 2 as measured by the conventional balance technique and the isotope dilution technique. The metabolism cage and

urine/faeces collection system described in the present study were found to be highly accurate for the quantitative collection of urine and uncontaminated feces from adult cats. Furthermore, the technical equipment and the experimental procedures described in this work allow accurate determination of the water balance and water turnover in adult domestic cats.

J. Anim. Physiol. a. Anim. Nutr. 82, pp. 94-105, 1999. 1 table, 4 figs., 34 refs. Authors' summary.

Effect of heat treatment of soybean meal and fish meal on amino acid digestibility in mink and dairy cows

Kari Ljøkjel, Odd Magne Harstad, Anders Skrede

Commercial solvent extracted soybean meal (SBM) and fish meal (FM) subjected to additional moist heat for 30 min at 120 or 130°C were investigated in terms of amino acid (AA) composition, total tract digestibility in mink, rumen and total tract digestibility in dairy cows of crude protein (CP) and individual AA. Heat treatment of SBM at 130°C caused significant reduction of the content of Arg, Lys and Cys by 4.1, 8.2 and 12.5%, respectively. Digestibility in mink of CP and most AA was significantly reduced after heat treatment of SBM at 120°C and further at 130°C. The digestibilities of Cys, Asp and Lys, which were the most severely affected AA, declined with 12.3, 10.9 and 8.8 percentage units, respectively, after treatment at 130°C. Heat treatment of FM at 120°C caused reduced digestibility of CP and His, Ile, Lys, Met, Asp, Glu, Gly, and Ser, while heat treatment at 130°C reduced total tract digestibility of CP and all AA in mink. Digestibility of Asp and Cys were most affected after heat treatment at 130°C with reduction of 17.9 and 11.4 percentage units, respectively. Rumen degradability of CP and all AA was significantly lowered by heat treatment of SBM. Met and Glu were the most affected AA, with a reduction of degradability after 16 h rumen incubation of 62.1 and 58.0 percentage units, respectively, after treatment at 130°C. Heat treatment of FM at 120°C caused declined rumen degradability of CP and total AA, although not to the same extent as for SBM. There was no additional effect

on rumen degradability of treatment at 130°C of FM. Rumen degradation of Glu and His, the most affected AA, in FM was reduced with 25.1 and 20.3 percentage units, respectively, following heat treatment at 120°C. Ruminant total tract digestibility of CP and AA was not significantly affected by treatment for either of the protein sources. Additional heat treatment of SBM reduced the rumen degradability of protein and AA more than treatment of FM, while for the nonruminant mink, total tract digestibility of SBM and FM was reduced similarly following heat treatment.

Animal Feed Science and Technology 84, pp. 83-95, 2000. 6 tables, 39 refs. Authors' abstract.

Milk intake of suckling kittens remains relatively constant from one to four weeks of age

Wouter H. Hendriks, Søren Wamberg

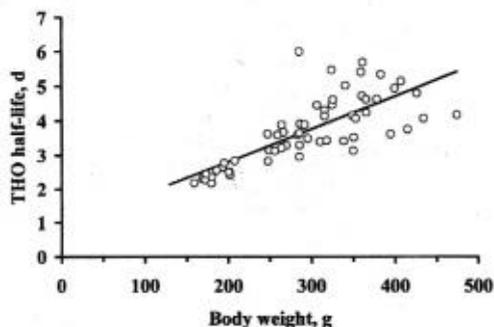


FIGURE 2 Biological half-life of tritiated water turnover in suckling kittens ($n = 14$) measured over 4-d periods during postnatal wk 1-4 and plotted as a function of body weight ($r = 0.76$, $P < 0.05$).

The daily milk intake of 14 domestic short-haired kittens (*Felis catus*) from five litters was estimated during wk 1-4 postpartum using the isotope dilution technique. The kittens received a single intraperitoneal injection of tritiated water, and blood samples were obtained from the jugular vein for radioactivity measurements at 2 and 96 h after injection. One kitten in each litter was used as a control to allow calculation of recycling of tritiated water. The mean (\pm SEM) biological half-life of tritiated water in the kittens increased from 2.4 ± 0.1 d in wk 1 to 4.9 ± 0.2 d in wk 4 postpartum. Recycling of tritiated water accounted for (mean \pm SEM) 5.9 ± 0.8 , 12.0 ± 0.5 , 7.7 ± 1.3 and $10.0 \pm 1.3\%$ of the kittens' daily water intake during postnatal wk 1-4, respectively.

Daily milk intake of the kittens during wk 1-4 postpartum was 47.3 ± 0.8 , 47.4 ± 1.5 , 48.7 ± 1.6 and 43.7 ± 2.0 g, respectively. There was no effect of gender on milk intake. The daily metabolizable energy requirement of suckling kittens, estimated by multiple regression analysis, was $356 \text{ kJ/kg}^{0.75}$, whereas the metabolizable energy required per gram of gain was estimated to be 7.8 kJ/d. The milk intake of suckling kittens remained relatively constant throughout the first 4 wk of lactation, and during this period, they seemed to have a lower energy requirement for maintenance.

J. Nutri. 130, pp. 77-82, 2000. 3 tables, 2 figs., 41 refs. Authors' abstract.

Nutrient digestibility and nitrogen retention in mink fed on diets containing pumpkin oil cake and rape oil

A. Gugolek, M.O. Lorek, D. Minakowski, M. Lasikowska

The effect of pumpkin oil cake and rape oil on digestibility in growing mink was examined. 15 female mink were divided into 3 groups, and fed on a standard mixture, or mixtures containing 10% pumpkin oil cake and 5% of rape oil, respectively. Digestibility coefficients of nutrients and N retention were calculated. Pumpkin oil cake caused a decrease in the digestibility of fats and carbohydrates, while rape oil resulted in an increase in N excreted in the feces and urine.

Acta Academiae Agriculturae ac Technicae Olsztynensis, Zootechnica No. 47, pp. 49-56, 1997, 7 refs. In *POLH*. Only abstract received. Authors' abstract.

The gastrointestinal bacteria of mink (*Mustela vison* L): Influence of age and diet

C. Williams, J. Elnif, R.K. Buddington

Total numbers of aerotolerant and anerobic bacteria, and densities of Enterobacteriaceae, Lactobacilli, Staphylococci, Salmonella, Shigella, and Campylo

bacter were enumerated in the contents of the stomach, small intestine (with associated mucosa) and colon of 14 mink kits (aged 2 weeks to adulthood), and in 15 adults that were fed diets with different levels and types of fibres (poorly fermented or soluble), or food deprived. Highest densities of all bacterial groups were found in the colon at all ages (up to 108 c.f.u./g for total anaerobes), but were 2-4 orders of magnitude lower than those of other mammals. When all regions were pooled, significant age-related increases were detected for anaerobes, aerobes, and staphylococci, and these coincided with the dietary shift at weaning. Enterobacteriaceae did not vary with age. Lactobacilli were not common isolates, but were detected more often after weaning, particularly in adults fed diets containing the 2 sources of fibre. Campylobacter were detected only at 2 weeks of age, and Salmonella and Shigella were not isolated from any of the mink. Total bacterial densities, the relative proportions of the bacterial groups, and age- and diet-related effects differ from those known for other mammals, which may be related to the carnivorous diet and rapid movement of digesta through the gastrointestinal tract.

Acta Veterinaria Scandinavica 39, 4, pp. 473-482, 1998, 14 refs. Only abstract received. Authors' abstract.

Biosynthesis of retinoic acid from beta-apo-14'-carotenal in ferret in vivo

Chun Liu, XiangDong, Wang, R.M. Russell

To determine whether beta-apo-14'-carotenal (an excentric cleavage product of beta-carotene) can serve as a source of intestinally derived retinoic acid, beta-apo-14'-carotenal or retinal in micellar solution was perfused through 60 cm small bowel segments of ferrets in vivo. Beta-apo-14'-carotenal and retinoic acid were identified in the ferret intestinal mucosa by comparing retention times in HPLC and by UV/visible spectra. The in vivo perfusion of ferret intestine with 10 µM beta-14'-carotenal for 2 h resulted in formation of beta-apo-14'-carotenal 218!28 pmol/g and retinoic acid 51!4 pmol/g.

Similarly, a 2-h intestinal perfusion of 1 µM retinal resulted in formation of retinoic acid 30!2 pmol/g. When co-perfusing an inhibitor of retinal oxidation, 2 mM citral, retinoic acid was not detected in the intestinal mucosa after the perfusion of 1 µM retinal. However, retinoic acid 30!3 pmol/g was still formed from the intestinal perfusion of beta-apo-14'-carotenal with 2µM citral. Furthermore, retinol was formed after the intestinal perfusion of beta-apo-14'-carotenal and increased markedly in the presence of citral. It is concluded that there may be an excentric cleavage mechanism in the metabolism of beta-carotene into retinoic acid in vivo.

Journal of Nutritional Biochemistry, 8: 11, pp. 652-657, 1997. 20 refs. Only abstract received. CAB-abstract.

Gastric lipase and pepsin activities in the developing ferret: nonparallel development of the two gastric digestive enzymes

M. Hamosh, T.R. Henderson, P. Hamosh

Gastric lipase and pepsin activities were quantified from the late fetal period throughout lactation, and were compared with those of adult ferrets. The data show earlier ontogeny and much more rapid increase of lipase activity than of pepsin. Lipase activity was present during the last week of fetal development, whereas pepsin was detected only postnatally. Lipase activity was 72.8!14.2% and 153!9.95% and pepsin activity was 11.6!1.3% and 30.1!1.3% of the adult level at ages 2 and 4 weeks, respectively. It is concluded that lipase activity develops early and exceeds adult activity during the suckling period, when fat intake is very high. The low pepsin activity and high postprandial pH probably limit gastric proteolysis, thereby contributing to the structural and functional stability of milk proteins, many with protective or bioactive function in the gastrointestinal tract of the newborn.

Journal of Pediatric Gastroenterology and Nutrition 26: 2, pp. 162-166, 1998. 46 refs. Only abstract received. CAB-abstract.

Effects of consistent handling during the last trimester of pregnancy on adrenocortical and ovarian function, and fetal survival in the blue fox

L.V. Osadchuk, B. Braastad, M. Bakken, A.-L. Hovland

Handling is a psychological stressor for farm bred blue fox. The purpose of this study was to determine how handling influences certain morphometric and hormonal parameters of adrenocortical and ovarian function in pregnant blue foxes and whether these effects are mediated through the increase of plasma levels of ACTH and cortisol. Blue fox females were subjected to a 1-min daily-handling treatment in the last trimester of pregnancy and euthanised on days 47-48 of pregnancy (term = 52 days). The portions of minced adrenal and ovarian tissue from each animal were incubated *in vitro* in the absence or the presence of different doses of ACTH₁₋₃₉ (0.5-1-1.0 IU per sample) or hCG (50-100 IU per sample) respectively. Plasma levels of ACTH, cortisol, progesterone, estradiol and testosterone, as well as the *in vitro* adrenal and gonadal production of steroids were measured by RIA in control (C, n=6) and treated (S, n=7) animals. Handling increased plasma concentrations of cortisol (C: 6.8±1.6 ng/ml vs. S: 22.8±5.9 ng/ml, P<0.05) and ACTH (C: 63.5±6.4 pg/ml vs. S: 115.9±25.0 pg/ml, P=0.08) as well as *in vitro* adrenal cortisol production, regardless of the ACTH dose (P<0.05). Handling did not cause any changes in adrenal weight, plasma progesterone or estradiol concentrations or in basal steroid production by the ovaries. The estradiol response of the ovaries to hCG tended to be lower in treated females than in controls. In addition, handling decreased the ovarian weight (C: 3.45±0.26 g vs. S: 2.73±0.17 g, P<0.05). The number of viable fetuses and their body weight (C: 59.1±0.9 g, n=73 vs. S: 50.6±1.2 g, n=58, P<0.05) were lower after the handling treatment, whereas the number of dead fetuses was higher. It is concluded that consistent handling of pregnant blue foxes resulted in a profound stress response, as indicated by the activation of the HPA axis. Furthermore, the results suggest that consistent handling has a detrimental effect on ovarian function and fetal survival.

Journal of Endocrinology, Vol. 164, Suppl., pp. 254, March 2000. ISSN 0022-0795. Only summary received. Authors' summary.

Enrichment value of wooden blocks for farmed blue foxes (*Alopex lagopus*)

H. Korhonen, P. Niemelä

The barren housing conditions of farmed blue foxes (*Alopex lagopus*) provide few stimuli to motivate exploration and interaction with the physical environment. In the present study, wooden blocks (30x7 cm [lxdia]) were employed to clarify how such inanimate objects might serve to enrich the barren wire-mesh cages. Two separate experiments were carried out. In experiment 1, behavioural reactions of eight male blue foxes to wooden blocks were videotaped between January and May. In experiment 2, 16 male blue foxes were housed singly in cages with wooden blocks and 16 without between January and June. Pencil, confrontation, feeding and open field tests were carried out. Furthermore, 50 female blue foxes were kept singly in cages with wooden blocks and 49 without from January to July. Both groups were bred and the whelping result was recorded. In-cage behavioural tests were performed three times. Results showed that interactions with the wooden blocks were frequent, averaging 77 interactions fox⁻¹ day⁻¹. Interactions with blocks decreased slightly with time. Blocks were mainly used for carrying, chewing, poking and sniffing. In the confrontation test, male foxes housed without blocks were more passive than those with blocks. No differences were found between the groups in the pencil, feeding or open field tests. Whelping success tended to be better for vixens housed with than without blocks. It can be concluded that wooden blocks have enrichment value by providing more choices for foxes in a barren cage and stimulating more variable behaviour.

Animal Welfare 9, pp. 177-191, 2000. 3 tables, 5 figs., 41 refs. Authors' summary.

Preferences of farmed silver foxes (*Vulpes vulpes*) for four different floor types

M. Harri, J. Mononen, J. Sepponen

Farmed silver foxes were allowed to choose between four standard farm cages, each of which was equipped with a different floor material: plastic-coated wire mesh (WM); dry wood (DW); dry sand (DS); and wet wood (WW) or icy sand (IS). Six males and six females were placed in the test

environment singly in winter, and the same individuals, again in spring. The use of the different floors was video-recorded and analysed from the tapes for active periods and resting period on 5 or 6 d. Resting consisted of 14-20 separate bouts d⁻¹, occupying 58–62% of the total 24 h. In winter, the active periods of the animal's day were spent as follows: DW (34%) > DS (33%) > IS (17%) = WM (15%). The resting periods were spent as follows: DW (59%) > WM (26%) = DS (15%) > IS (1%). In spring, the order of active time was DS (36%) > DW (25%) = WW (24%) > WM (15%) and of resting time was DW (51%) > WM (19%) = WW (16%) = DS (15%). Different individuals preferred different floors, leading to large variance in the group means. This high variation may suggest a low level of priority in general but a high level of priority within individuals. Although solid floors were highly preferred when dry, they were least preferred when wet or icy.

Can. J. Anim. Sci. 79, pp. 1-5.1999. 3 tables, 27 refs. Authors' summary.

Scent marking in pine martens (*Martes martes*) in captivity

B. Ludwig

The scent marking behaviour of three pairs of pine martens of different ages was recorded from January to December 1991. The following behaviour patterns were differentiated: Defecation and urination,

fecal-marking, urine-marking, abdominal rubbing, body rubbing and scratching with the hind-legs. Scratching with the hind-legs and possibly body rubbing are associated with the agonistic context. Abdominal rubbing is far the most frequent marking behaviour. Abdominal rubbing and urine marking correlate to a high degree. Both behaviour patterns can frequently be seen in the three year old and the five year old animals, especially the males, from March to May, in the one year old animals in autumn and winter. The seasonal changes in marking frequency are considered as connected to the territorial behaviour. The different behaviour of the yearlings is discussed as an age-specific adaptation. Abdominal rubbing always took place at the same sites. These marking sites were used by both partners. In natural environments these common marking sites may be used for an exchanges of information. Sometimes abdominal rubbing happens in relation to a conspecific. The animals mark on the body of the partner (allomarking), in visual contact with the partner, or they mark at a site, which was just marked by the partner (overmarking). Up to now, allomarking was not observed by any other solitary species of native mustelids.

Zeitschrift für Jagdwissenschaft 44(1), pp. 1-15, 1998. 7 tables, 2 figs. In GERM. Only abstract received. Author's abstract.