Effects of pregnancy and lactation on the serum selenium content of rats

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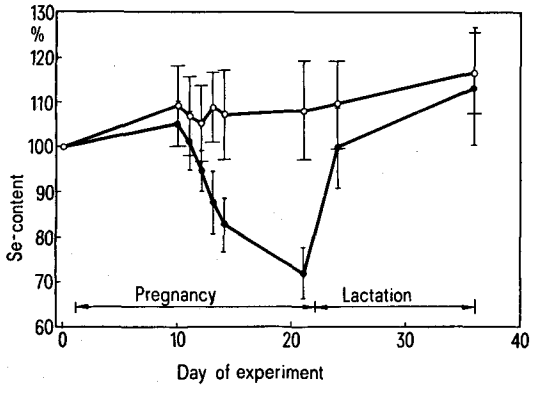
Summary. The serum selenium content of rats was measured by means of neutron activation analysis. It was found to drop between the 12th day of pregnancy and term and to return to its original level within 2 days after delivery. Hysterectomy on the 10th day of gestation prevented this decrease. Nursing had no influence on the element level. The findings suggest that placental secretions might be involved in the control of the serum selenium content of rats during pregnancy.

The investigation of the dynamics of selenium in blood in relation to gestational processes might help to elucidate the physiological role of this essential trace element. It has been observed that the serum selenium content in rats decreases significantly between the 10th and 15th day of gestation and remains at the reduced level until term[1]. It was assumed that this change could be related to the transference of the luteotropic function of the pituitary to the placenta on the 12th day of gestation[2]. In order to find evidence to support this assumption and to obtain more information about the selenium metabolism, the serum selenium content of rats was determined during pregnancy and lactation, and after termination of pregnancy by hysterectomy.

Table 1. Serum selenium content in nonpregnant, pregnant and hysterectomized rats

Experimental groups (n = 8)	Serum dry weight / Serum wet weight (%)	Selenium content (10^{-6} g/g dried serum)
Nonpregnant controls	9.2 ± 0.3	4.6 ± 0.3
Day 20		
Hysterectomized on day 10	8.3 ± 0.4	4.8 ± 0.5
Pregnant	9.3 ± 1.0	3.4 ± 0.3

Data are given as mean ± SD.



Selenium content in the blood serum of 8 pregnant and lactating rats (●–●) and 8 ovariectomized controls (○–○). The data are expressed as mean ± SD. For each animal the values are calculated as a percentage of the serum selenium content on the day before the beginning of the experiment.

Methods. 40 mature female 'Wistar' rats with body weights of 220–260 g were used for the experiments. They were kept under standardized laboratory conditions in an air-conditioned animal room with the lights on between 06.00 and 21.00 h and fed commercial Altromin® rat pellets containing 0.3 ppm Se and tap water at libitum. Proestrus rats were mated. When sperms were seen the next morning in vaginal smears, this day(d) was considered as day 1 of the experiment. The rats were divided into 5 groups of 8 animals each: 1. nulliparous intact; 2. pregnant; 3. pregnant and hysterectomized on d 10; 4. ovariectomized on the day before the beginning of the experiment (d 0); 5. pregnant and lactating. In the latter group, litters were reduced to 5 young on d 22. Nursing was limited on d 24 [d 2 post partum (p.p.)] and on d 36 (d 14 p.p.) to 60 min after the sucklings had been separated from their mothers for 2 h.

Samples of 1 ml of blood were taken from the orbital venous plexus. Blood sampling, ovariectomy and hysterectomy were performed under appropriate ether anesthesia.

1st experiment: Blood samples were taken from the groups 1, 2 and 3 on d 20 (table 1).

2nd experiment: Blood samples were drawn from group 5 on d 0 shortly before mating, then on d 10, 11, 12, 13, 14, 21, on d 24 10 min and 4 h after nursing and on d 36 before and 10 min and 4 h after nursing. From group 4 blood samples were taken on d 0 shortly before the ovariectomy and then on the same days as above (figure, table 2).

The serum was separated from the other blood components by centrifugation and stored at a temperature of −20 °C.

Table 2. Effect of nursing on the serum selenium content of rats

Experimental groups (n = 8)	Serum dry weight / Serum wet weight (%)	Selenium content (10^{-6} g/g dried serum)
Ovariectomized controls on day		
2 p.p.	8.7 ± 0.5	4.7 ± 0.4
14 p.p.	9.1 ± 0.4	5.0 ± 0.4
Lactating rats on day 2 p.p.		
Before nursing	No data	No data
After nursing		
10 min	9.0 ± 0.2	4.3 ± 0.4
4 h	8.7 ± 0.2	4.4 ± 0.4
Lactating rats on day 14 p.p.		
Before nursing	8.1 ± 0.5	4.9 ± 0.6
After nursing		
10 min	7.6 ± 0.4	4.8 ± 0.5
4 h	7.6 ± 0.4	4.8 ± 0.5

Data are given as mean ± SD.

During the sampling and the sample preparation, it only came into contact with plastic surfaces which had been cleaned with nitric acid and bidistilled water.

The determination of selenium was carried out by means of instrumental neutron activation analysis. The analytical procedure has been described in detail elsewhere[3]. It included the irradiation of 25 mg of dried serum, sealed in highly pure silica ampoules, with thermal reactor neutrons and the measurement of the gamma rays of ^{75}Se by means of a Ge(Li) detector. The selenium content was calculated for the dry weight of the serum sample.

Results. The serum selenium content was significantly lower ($p < 0.001$) in pregnant rats on d 20, whereas for the animals, which had been hysterectomized on d 10, no difference from the nulliparous control group was found (table 1).

From the results of the 2nd experiment in the figure, it can be seen that the serum selenium content in pregnant animals did not deviate from that of the ovariectomized control group up to d 12, but then continuously decreased, and shortly before term, at 70% of the content before pregnancy, reached its lowest point. On d 24 (d 2 p.p.) it had risen again to the level of the ovariectomized control group, and no difference between the lactating and the ovariectomized control animals was found on d 36 (d 14 p.p.) either. Nursing did not influence the serum selenium content (table 2).

Changes in the protein/water ratio in serum were observed during pregnancy and lactation. Compared with the values of the ovariectomized controls, the amount of dry matter in the serum was significantly lower on d 12 ($p < 0.01$) and on d 36 ($p < 0.001$).

Discussion. As nearly all of the selenium in serum is bound to proteins, changes in the water content may simulate changes in the serum selenium level when calculated for the wet weight or for the volume of the sample[4]. It was therefore necessary here to relate the selenium content to the dry weight of the serum sample. In accordance with the earlier study[1], the serum selenium content of pregnant rats was found in these 2 different experiments to be reduced substantially at term. Since it began to decrease the day when the hormonal control of the corpora lutea was transferred from the pituitary to the placenta[2] and returned to the original level within 2 days after delivery, and since hysterectomy on d 10 prevented this drop, placental secretions could have been involved in these changes.

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Somatostatin inhibits the mitogenic effect of thyroliberin[1]

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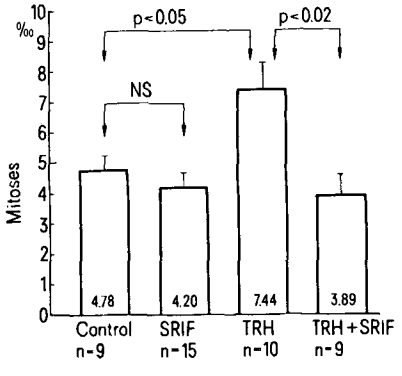
Summary. The effect of somatostatin and of thyroliberin on the mitotic incidence in the organ-cultured anterior pituitary lobe of the rat was investigated, using the colchicine metaphase-arrest technique. It was found that somatostatin added to the culture medium, together with thyroliberin, blocked the mitogenic effect of the latter.

It was previously shown in our laboratory that thyroliberin (thyrotropin releasing hormone, TRH), stimulated the rat adenohypophysial cell proliferation in vitro[2-4] as well as in vivo[5]. It was therefore of interest to see whether somatostatin (SRIF), the first hypothalamic inhibiting hormone available in a synthetic form, influences the adenohypophysial cell proliferation. The present report deals with the effects of somatostatin alone, and somatostatin together with TRH, on the mitotic incidence in the organ-cultured anterior pituitary of the rat.



The mitotic incidence in the organ-cultured adenohypophysial explants: the control, and exposed to TRH, SRIF and to TRH plus SRIF. The bars indicate mean values ± SEM. n = number of investigated explants in each group.

Male Sprague-Dawley rats, weighing about 160 g each, were used as donors of the pituitaries. The anterior lobes, each divided into 4 parts, were cultured in a medium composed of TC 199 (95%) and calf serum (5%) at 37 °C, in the atmosphere of 95% of oxygen and 5% of carbon dioxide. Additionally, some of the media contained TRH (Calbiochem) and SRIF (Calbiochem), or the 2 latter compounds together. TRH was added at the beginning of the incubation in a concentration of 3×10^{-6} M. SRIF was added twice: at the beginning and on the 6th h of incubation, in a concentration of 10^{-7} M. To all the media, colchicin (Fluka AG) was added in a dose of 0.05 µg/ml, twice, on the 4th and 9th h of incubation. After 14 h of incubation, the explants were fixed on formol-sublimate.

1 This work was supported by Polish Academy of Sciences, program No 10.4.
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