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COMPARATIVE STRONTIUM AND CALCIUM  
METABOLISM IN LACTATION

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The strontium-85 to calcium-47 ratio in the body of lactating, non-lactating and control animals and in the litter was determined at several time intervals after an intraperitoneal application of radioactive isotopes (0-120 hours).

The body ratio was slightly higher in lactating animals during the early phase of lactation (0-5 day) and much higher during the late phase of lactation (12-17 day) indicating a greatly reduced discrimination against strontium.

The metabolism of strontium in lactation is of great interest because of the toxic influence of its radioactive isotopes on the mother and the baby. Its ionic similarity to calcium is the reason that the two cations are often compared in metabolic studies.

The discrimination against strontium which takes place at biological membranes causes lower strontium absorption from the gut and higher elimination in the urine as compared with calcium (1). The consequence of this discrimination is that the strontium to calcium ratio in the body or skeleton is lower than 1. This was also shown in kinetic studies (2, 3) which were performed on man and rats using calcium-47 and strontium-85.

In lactation additional discrimination against strontium takes place in the passage of calcium and strontium from blood to milk (4). The purpose of our investigations was to obtain more quantitative data on the changes in the discrimination process in the early and late phase of lactation by measuring the strontium-85 to calcium-47 ratio in the mother rat and its litter.

The experiment consisted of whole body measurements of calcium-47 and strontium-85 at several time intervals after a single intraperitoneal

application of radioactive isotopes. ( $0.5 \mu\text{Ci } ^{47}\text{Ca}$  and  $0.3 \mu\text{Ci } ^{85}\text{Sr}$  applied as chlorides in a practically carrier free form as supplied from the Radiochemical Center, Amersham, England. The measurements were performed on fifty 5-month-old albino rats (five groups of 10 animals each). Forty pregnant rats were divided into 4 groups on the day of parturition. Two groups were left with their litter (the size of the litter was reduced to 6). The first group received radioactive isotopes on the day of delivery («0 day lactating» group) and the second at a later stage of the lactation period («12th day lactating» group). The next two groups were treated in the same way only their youngs were taken away on the day of parturition («0 day nonlactating» and «12th day nonlactating» group). The last group consisted of 10 virginal control animals which received radioactive isotopes in the same way as the animals in the other four groups.

The activity of calcium-47 and strontium-85 was determined in a scintillation counter with two crystal detectors (Tobor, Nuclear Chicago) connected to a single channel analyzer at intervals between 0 and 120 hours after the application of radioactive isotopes. All measurements were performed on living animals using adequate phantom standards (5).

The strontium-85 to calcium-47 ratio in the body of lactating, nonlactating and control animals and in the litter is presented in Figure 1 for various time intervals after the intraperitoneal application of radio-

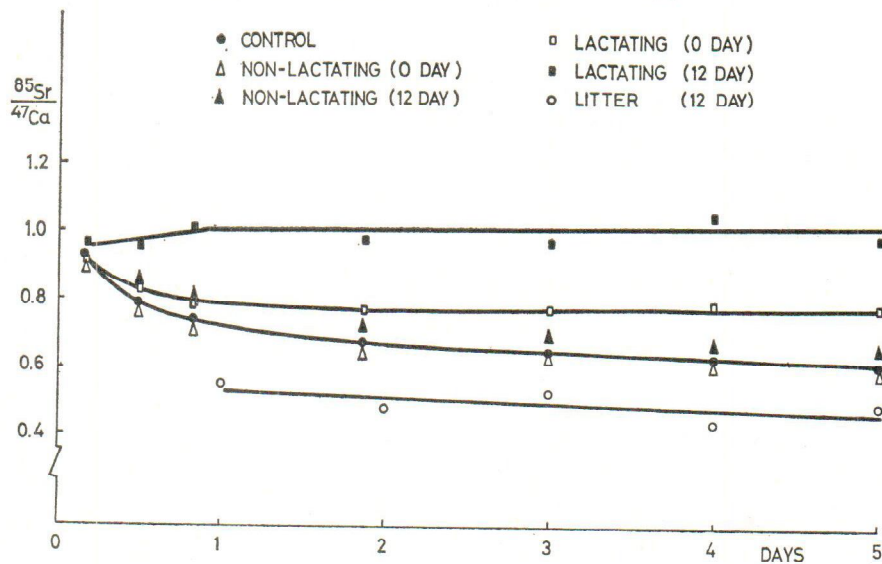


Fig. 1.  $^{85}\text{Sr}/^{47}\text{Ca}$  ratio in the body of lactating, nonlactating and control rats and in the litter at various time intervals after a single intraperitoneal application of radioactive isotopes



active isotopes. The values were obtained from the whole body retention curves for calcium-47 and strontium-85 presented as the percentage of the dose retained in the body at various time intervals.

In both groups of nonlactating animals the body  $^{85}\text{Sr}/^{47}\text{Ca}$  ratio was practically the same as in the virginal control rats. A slight increase in the ratio was observed during the early part of the lactation period. During the later stage of lactation the ratio was much higher. The litter showed the lowest strontium-85 to calcium-47 ratio of about 0.5, which is in agreement with some previous data (1).

Our results indicate a greatly reduced discrimination against strontium in lactating animals as compared to controls. This is due to the additional discrimination process in the mammary gland since nonlactating animals show no changes in the strontium-85 to calcium-47 ratio and lactating animals during the early lactation – while the milk production is still low – show only a slight increase of the body ratio.

We have previously observed that lactating animals show a considerable increase in the intestinal absorption of calcium and strontium, the increase of calcium absorption being higher (6 times) than that of strontium (4 times) (6). They also show a higher strontium to calcium ratio in the urinary (2–3 times) and faecal (1,6 times) elimination (7). In spite of these facts the strontium to calcium body ratio increases indicating that the discrimination processes operating in the passage of calcium and strontium from blood to milk are dominating.

#### References

1. Comar, C. L., Bronner, F.: Mineral Metabolism, IIa, Academic Press, New York, 1964, str. 523.
2. Cohn, S. H., Bozzo, S. R., Jesseph, J. E., Constantinides, C., Gusmano, E. A.: J. Appl. Physiol., 21 (1966) 67.
3. Cohn, S. H., Gusmano, E. A.: Soc. Exptl. Biol. Med., 126 (1967) 79.
4. Wasserman, R. H., Lengeman, F. W., Comar, C. L.: J. Dairy Sci., 41 (1958) 812.
5. Harmut, M., Maljković, T., Kostial, K.: Arh. hig. rada, 19 (1968) 61.
6. Kostial, K., Gruden, N., Duraković, A.: Calc. Tiss. Res., 4 (1969) 19.
7. Blanuša, M., Kostial, K.: V jugoslovenski simpozij o radiološkoj zaštiti, Bled, 1970, Sinopsis Nr/43.

#### Sažetak

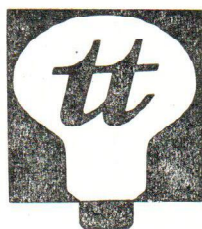
#### KOMPARATIVNI METABOLIZAM STRONCIJA I KALCIJA U LAKTACIJI

Odredivali smo omjer  $^{85}\text{Sr}$  prema  $^{47}\text{Ca}$  u tijelu štakora u laktaciji, nelaktirajućih ženki i mladih štakora iz legla. U tu svrhu izvršena su mjerenja aktivnosti u tijelu životinja u nekoliko vremenskih razmaka nakon intraperitonealne primjene radioaktivnih izotopa (0–120 sati).

Dobiveni rezultati pokazuju neznatno povišenje omjera  $^{85}\text{Sr}/^{47}\text{Ca}$  kod životinja u ranoj fazi laktacije (0–5 dana). U kasnoj fazi laktacije (12–17 dana), dolazi do značajnog povišenja omjera  $^{85}\text{Sr}/^{47}\text{Ca}$ , što ukazuje na sniženje diskriminacije organizma prema stronciju.

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