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TISSUE SELENIUM IN PIGS WITH DIETETIC MICROANGIOPATHY (MAP, „MULBERRY HEART“)*

By

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LINDBERG, P., E. TANHUANPÄÄ, A. SCHULMAN and A.-S. GARRY-ANDERSSON: *Tissue selenium in pigs with dietetic microangiopathy (MAP, "mulberry heart")*. Acta vet. scand. 1972, 13, 238—241. — Mean selenium contents of liver, heart muscle and skeletal muscle of pigs with dietetic microangiopathy (MAP), but without waxy muscle degeneration (MD) and hepatosis diaetetica (HD), were 1113, 850 and 265 ng/g d.s., respectively. These values were not lower than corresponding values of control pigs without MAP, MD and HD.

MAP; microangiopathy; mulberry heart; pig;
selenium.

Sudden deaths without obvious clinical symptoms are not uncommon in growing pigs. In some cases, necropsy shows evidence of acute cardiac failure and circulatory disorders (*Lamont et al.* 1950, *Tutt & Gale* 1957, and others). Because of the lesions in the small vessels of the myocardium the condition has been called microangiopathy (MAP) (*Grant* 1961). *Grant* found that dl-alpha-tocopherol and sodium selenite dietary supplementation was effective in preventing MAP. *Behrens & Hill* (1968) studied the vitamin-E content in the livers of pigs with MAP and found that it was low; but the content was equally low in pigs that had died of other causes.

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MATERIAL AND METHODS

Samples of organs were collected from pigs which were submitted for necropsy at the State Veterinary Medical Institute in Helsinki. Liver, skeletal muscle, and heart muscle from 30 pigs in which the necropsy findings were typical of MAP were kept at -20°C . Cases which also showed changes indicative of hepatitis diaetetica (*Obel 1953*) or skeletal-muscle degeneration were not included in the material. All the liver specimens and some of the specimens of skeletal and heart muscle were analyzed for their selenium contents (cf. Table 1).

The macroscopical changes seen at necropsy were mottled myocardium, transudates in serous cavities, and evidence of acute circulatory failure. Edema of the skin, the abdominal wall, and the lungs were often noted. Microscopically, a PAS-positive amorphous material was seen especially in and underneath the endothelial layer of the myocardial capillaries (cf. *Grant 1961*). As controls were used 18 pigs without any changes indicative of MAP, waxy muscle degeneration, or hepatitis diaetetica; they were necropsied at the State Veterinary Medical Institute in Helsinki. The necropsy diagnosis was enteritis in 5, colienterotoxemia in 3, meningitis in 2, and arthritis, aspiration pneumonia, dilatatio ventriculi, mycoplasma pneumonia, myocarditis, suffocation, swine erysipelas and torsion of the intestine in 1 case, respectively. The control series also included 3 healthy slaughter pigs. Selenium was determined fluorometrically (*Lindberg 1968*).

RESULTS AND DISCUSSION

The results of the selenium analyses are presented in Table 1. It will be seen that the content of selenium in the tissues of MAP pigs was not lower than normal; the selenium content in heart muscle was even higher than that in our healthy controls.

Tissue-selenium contents in healthy swine have been reported previously. *Lindberg & Sirén (1965)* recorded 1230 ± 420 ng per g for liver, *Lindberg & Lannek (1965)* 1770 ± 200 ng per g for liver and 520 ± 60 ng per g for skeletal muscle, and *Lindberg (1968)* 1050 ± 100 ng per g for heart muscle. Apparently, the values for liver selenium in our series of pigs with MAP did not differ from the normal values reported by *Lindberg & Sirén*, but as regards liver as well as skeletal and heart muscle our values

Table 1. Selenium content of liver, heart muscle, and skeletal muscle of MAP pigs and control pigs.

	Number of samples	MAP	Number of samples	Controls
Body weight (kg)	28 ¹⁾	25.1 ± 10.5	21	22.1 ± 15.9
Liver Se (ng/g d.s.)	30	1133 ± 387	21	1061 ± 458
Heart muscle	24	850 ± 328 ²⁾	21	624 ± 245
Skeletal muscle	7	265 ± 77	21	299 ± 158

¹⁾ Two missing values.

²⁾ Differs significantly from corresponding normal value ($P < 0.02$).

differed from those reported by *Lindberg & Lannek* and *Lindberg*.

Lindberg & Sirén's series comprised pigs from farms that used varying feeds, whereas *Lindberg & Lannek's* series consisted of pigs fed commercial feeds with fairly high content of selenium. The standard deviation in the former series is also much greater than in the latter. As the pigs in our series also originated from different farms, it seemed most appropriate to use *Lindberg & Sirén's* control series for comparison. The conclusion is that the MAP pigs studied did not show decreased selenium contents. This impression was further strengthened by a comparison with the "selenium-responsive diseases", such as waxy muscle degeneration (MD) and hepatosis diaetetica (HD). In these diseases *Lindberg & Sirén* found a selenium content of 210 ± 50 ng per g in the liver and *Lindberg* 158 ± 87 ng per g in skeletal muscle and 187 ± 92 ng per g in heart muscle. These values are obviously of an order of magnitude quite different from those recorded for pigs affected with MAP in this study.

Most of the pigs in our control series (18 out of 21) were sick animals submitted for necropsy. Our reason for using them was that we found it desirable to compare the MAP pigs with pigs of the same size. We chose cases in which there were no grounds for suspecting a significant disturbance in the metabolism or the supply of selenium. Recently, *van Fleet et al.* (1970) published observations on tissue selenium in pigs affected with MAP. Most of their cases showed changes indicative of HD and/or MD as well, however. We examined some of these "mixed" cases and found, throughout, low selenium levels characteristic of HD or

MD (Lindberg). We therefore believe that selenium deficiency is associated with HD and MD but not with MAP. Our experiences of prophylactic selenium treatment in herds affected with MAP are negative. This lends support to the conclusion drawn from the present study, namely that the selenium content is not lowered in pigs affected with MAP.

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SAMMANFATTNING

Vävnadsselenium hos gris med dietetisk mikroangiopati.

Medelvärdet på seleniumhalten i lever, hjärt- och skelettmuskulatur från grisar med mikroangiopati (MAP) men utan samtidig växartad muskeldegeneration (MD) och hepatosis diaetetica (HD) var 1113, 850 och 265 ng/g t.s. resp. Dessa värden var inte lägre än motsvarande värden hos kontrollgrisar utan MAP, MD och HD.

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