Acta vet. scand. 1985, *26*, 164—168.

From the National Veterinary Institute, Oslo, Norway.

BARIUM SELENATE: A LONG-ACTING SELENIUM PREPARATION FOR SUBCUTANEOUS INJECTION

By

Gunnar Øvernes, Knut Moksnes and *Arne Frøslie*

ØVERNES, GUNNAR, KNUT MOKSNES and ARNE FRØSLIE: *Barium selenate: A long-acting selenium preparation for subcutaneous injection.* Acta vet. scand. 1985, *26*, 164—168. — Three flocks of sheep in typical selenium-deficient areas were injected with 2 ml Deposel® (100 mg selenium as barium selenate) in the autumn of 1982 and/or 1983. The selenium status in 10 ewes from each flock, and their offspring, was monitored by selenium analyses of blood samples. The injection induced an adequate increase in blood selenium within 8 weeks. Adequate selenium levels were maintained throughout the lambing season and the following summer. The selenium status in lambs from treated ewes was adequate until they were put out to pasture. Elevated selenium levels were maintained even throughout the next lambing season, and the second injection gave significantly higher blood selenium as compared to the first. The present preparation seems to be suitable and safe for protecting sheep against selenium deficiency. The dosage used seems sufficient to maintain an adequate selenium status for as long as 2 consecutive lambing seasons.

sheep; selenium deficiency.

Nutritional muscular dystrophy (NMD) in lambs has been observed in Norway for more than 50 years (*Slagsvold & Lund-Larsen* 1934). Selenium was not, however, introduced in the therapy and prophylaxis of NMD until the early 1960'es. This trace element has usually been administered parenterally or by the oral route, as single large doses of sodium selenite or sodium hydroselenite, to ewes 2—4 weeks prior to lambing, or directly to lambs before they are put out to pasture. The effect of this regime is questionable, and the toxicity risk is relatively high, especially in lambs. In Norway, as from 1980, selenium has also been added to compound concentrates and supplementary feed at levels corresponding to the minimum requirement. Such supplementa-

tion has, however, proven to be insufficient in areas in which concentrates are fed less intensively, and alternative methods have therefore been sought.

A slow-release preparation of barium selenate (Deposel®, Rycovet Ltd., Glasgow, Scotland) has recently been developed. Barium selenate has a very low solubility, and after injection of the powder, which is suspended in a viscous excipient, the depot will slowly release selenium (*Cawley* pers. comm.). The aim of the present investigation was to test this preparation under field conditions in Norway.

MATERIAL AND METHODS

The trial included 3 flocks, comprising 180 ewes in all, in typical selenium-deficient areas. The flocks were fed on hay and silage. Concentrates were used only for a short period at mating and from around lambing till the sheep were put out to pasture. The sheep grazed from the beginning of June until the end of September. Ewes were injected with 2 ml Deposel® (100 mg selenium as barium selenate) s.c. in the neck region in the autumn of 1982 and/or 1983. The selenium status in 10 ewes from each flock, and their offspring, was monitored by blood sampling. Samples were collected at the beginning of the trial and at intervals towards lambing during 1 or 2 seasons. Milk samples were collected on day 1, 3 and 7 after lambing, and blood samples from 1 lamb from each ewe were collected once or twice during the first 1 to 5 weeks after birth. Selenium levels in whole blood were determined by a fluorimetric method (*Norheim & Nymoen* 1981).

RESULTS

The injection of barium selenate induced an adequate increase in blood selenium in the ewes within 8 weeks. A further increase to about 0.3 µg Se/ml blood was observed within 16—20 weeks, a level that was maintained throughout the lambing season and the following summer. The second injection in flock no. 1 gave a significantly higher blood selenium in the second season as compared to the first. In flock no. 2, in which the ewes were treated in the first autumn only, the elevated blood selenium levels were maintained also throughout the second season. Levels detected were in fact even higher in the second year. This ad-

Table 1. Levels of selenium in blood of sheep and lambs (mean ± s in µg Se/ml) following treatment with barium selenate (Deposel®). Treatment: Flock 1: Dec.-82 and Oct.-83. Flock 2: Only Dec.-82. Flock 3: Only Oct.-83. C is control in flock 1.

Flock	Dec.-82	Jan.-83	Mar.-83	Apr.-83	Lambs May-83
1	0.06 ± 0.02	0.20 ± 0.04	0.26 ± 0.03	0.28 ± 0.01	0.23 ± 0.02
2	0.09 ± 0.01	0.22 ± 0.03	0.27 ± 0.02	0.29 ± 0.03	0.29 ± 0.03
C	0.06 ± 0.01	0.05 ± 0.01	0.03 ± 0.01	0.06 ± 0.01	0.08 ± 0.01
	Oct.-83	Mar.-84	May-84	Lambs May-84	Oct.-84
1	0.24 ± 0.03	0.40 ± 0.02	0.39 ± 0.03	0.35 ± 0.04	0.25 ± 0.04
2	0.25 ± 0.03	0.33 ± 0.07	0.30 ± 0.04	0.22 ± 0.04	0.32 ± 0.05
3	0.06 ± 0.02	0.33 ± 0.05	0.36 ± 0.03	0.25 ± 0.04	0.32 ± 0.03
C	0.12 ± 0.02	0.05 ± 0.01	0.06 ± 0.01	0.05 ± 0.01	0.08 ± 0.03

ditional increase may have been due to an inadvertent supply of selenium from salt licks (maximum 40 µg Se/day as sodium selenite). Selenium blood levels in lambs reflected those of their dams. The selenium status in all lambs from treated ewes was adequate until they were put out to pasture. No clinical cases of NMD were observed in any of the sheep in the treatment or control groups.

Table 2. Levels of selenium in milk samples (mean ± s in µg Se/ml) collected in spring 1984. Treatment: See Table 1.

Flock	Day 1	Day 3	Day 7
1	0.23 ± 0.05	0.04 ± 0.02	0.03 ± 0.01
2	0.09 ± 0.03	0.03 ± 0.005	0.04 ± 0.01
3	0.14 ± 0.11	0.05 ± 0.01	0.02 ± 0.01

Selenium levels in milk dropped drastically during the frist day after lambing. The first milk samples were collected just before lambing in flock no. 1, while those from the other flocks were collected after the lambs had suckled. This discrepancy in sampling technique probably accounts for the large differences in milk selenium levels detected on the first day after lambing. No adverse effects were observed, nor were there any signs of local reaction at the site of injection.

DISCUSSION

The described method of injecting barium selenate to ewes in the autumn gave rise to an adequate selenium status in the ewes at lambing. Consequently selenium levels in their offspring were also adequate to afford protection against NMD. *Anderson* (1982) and *Cawley & McPhee* (1984) reported that the injection of barium selenate to sheep maintained an adequate selenium status for at least 6 months. Similar treatment in cattle produced an effect that lasted for approximately 12 months. From the present investigation it seems that the dosage used (approx. 1.2 mg Se/kg b.w.) is sufficient to maintain an adequate selenium status for as long as 2 consecutive lambing seasons. Repeated annual injections at this dose rate do not seem to have any harmful effects, and the preparation is considered to be very safe (*Cawley & McPhee*). It appears, however, that recommended dose rates and dosing intervals have not yet been finally defined.

From a nutritional point of view, it would seem to be more appropriate to supply an essential trace element such as selenium through the medium of feed supplementation. The described injection of the long-acting barium selenate preparation may, however, be a good alternative in flocks where supplementary feed is in minor use. The efficacy and the safety of the method seem far superior to single doses of sodium selenite, and the lambs maintain an adequate selenium status for a long period of time (*Rycovet* 1982).

ACKNOWLEDGEMENTS

Deposel® doses were placed at our disposal by Rycovet, Glasgow, Scotland. This study has been financially supported by the Norwegian Agricultural Research Council.

REFERENCES

Anderson, P. H.: Plasma vitamin E and erythrocyte GSHPx in sheep in Britain and their relation to clinical and subclinical white muscle disease. Twelfth Linderstrøm-Lang Conference IUB Symposium No. 110. Laugarvatn, Iceland 1982, Abstract, p. 56.

Cawley, G. D. & J. McPhee: Trials with a long acting parenteral selenium preparation in ruminants: Sheep. Vet. Rec. 1984, *115*, 565—566.

Norheim, G. & U. K. Nymoen: Fluorimetric determination of selenium in biological material using automatic digestion. 8. Nordic Trace Element and Microchemistry Conference, Sandefjord 1981.

Rycovet Ltd.: Deposel long-acting injection. Product Information 1982, 7 pp.

Slagsvold, L. & H. Lund-Larsen: Myosit hos lam, kalver og ungfe. (Myositis in lambs, calves and young cattle). Norsk Vet.-T. 1934, *46*, 529—552.

SAMMENDRAG

Barium selenat: Et depotpreparat for subkutan injeksjon av selén.

Et preparat av barium selenat (Deposel®, Rycovet Ltd, Glasgow) for s.c. injeksjon ble utprøvd i 3 besetninger i typiske lavselénområder. Søyene ble injisert om høsten med en dose som tilsvarte 100 mg selén. En av besetningene ble også behandlet det påfølgende år. Ti søyer og deres lam ble fulgt med selénanalyser av blodprøver. En tilstrekkelig økning av blodselénnivået ble oppnådd innen 8 uker, og dette nivået holdt seg gjennom lammesesongen, den påfølgende sommer og fram til neste lammesesong. Lammene hadde tilstrekkelige nivåer av blodselén fram til beiteslipp. Gjentatt injeksjon med ett års mellomrom ga tydelig høyere selénnivåer enn første injeksjon. Det anvendte preparat synes vel egnet til å forebygge selénmangel hos sau. Den anvendte dose synes tilstrekkelig til å dekke behovet inntil 2 lammesesonger.

(Received January 15, 1985).

Reprints may be requested from: Arne Frøslie, the National Veterinary Institute, P. O. Box 8156 Dep, N-0033 Oslo 1, Norway.