Bulletin of Animal Science, Special Edition, 1995 *ISSN 01260 - 4400*

Effect of NaCl on Li Kinetics and Estimation of Pellet Intake Using Li

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ABSTRACT: Two experiments were carried out with penned sheep given a basal diet of oaten chaff and supplemented with pellets and different amounts of NaCl. The results indicated that NaCl levels and high dose of Li administration did not influence the estimation of pellet intake. The errors were 1.2 and 2.4%, 12 and 24 h respectively after Li ingestion. However, at any given level of Li intake, the simultaneous of NaCl tended to decrease Li concentrations in plasma.

Key Words: Sheep, Pellet Intake, Suitable Marker, Li Kinetics

Introduction

The studies reported in (Suharyono, 1994) that LiCl may be a suitable marker for estimating pellet intake in sheep. The maximal Li concentration in plasma in Experiment 2 (Figure 6B) appeared, however, to have been obtained a little earlier than Experiment 2 (Figures 5 and 6A) (1). It was hypothesized that Na and K in the feed used in Experiment 2 may have influenced the achievement of maximal Li concentration in plasma, because these are in the alkali metal group along with Li (Anderson, et al., 1975) and may interact metabolically. Na also has physiological similarity to Li (Radomski, et al., 1950). Therefore, it was hypothesized that a higher Na content in feed may affect the kinetics of Li in the body and also may have effects on Li recovery in urine and faeces and on estimation of pellet intake. The likely potential value of the LiCl technique for estimation of pellet intake by individual animals. At times, animals that are to be studied in the field may consume variable amounts of minerals such as Na or K, because the soils and plants contain these minerals or because they are offered blocks, licks or supplements containing these minerals.

These objective of these experiments was to determine whether the estimates of supplement intake made by the technique proposed in (Suharyono, 1994) would be affected by concurrent ingestion of NaCl and whether any such effects would alter the time of blood sampling previously found to give the most accurate estimation of pellet intake.

Materials and Methods

Two experiments were carried out with penned sheep given a basal diet of oaten chaff and supplemented with pellets and different amounts of NaCl. Adaptation feeding in both Experiments 1 and 2 was conducted for 1 week before estimation of pellet intake was made by method involving feeding of Li-labelled pellets.

Experiment 1

Six mature Merino sheep (38-50 kg) with rumen cannulas were used. They were maintained in individual pen and given 600-1000 g oaten chaff and 150 g pellets daily. After an adaptation period of 7 days, the sheep were given 150g LiCl-labelled pellets (5 g LiCl/kg pellets) at 09.00 h on day 8 and they were also administered intraruminally with NaCl at one of 6 levels, i.e., 0, 0.5, 1, 2.5, 5 and 10g NaCl in 50 ml of tap water. NaCl was also given once only. Blood samples were taken 0, 4, 6, 8, 12, 24 and 32 h after consumption of Li-labelled pellets and NaCl injection into rumen. Li contents in blood plasma was analysed by atomic absorption spectrometer (AAS). One-way analysis of variance and linear regression (Minitab Statistical Software, 1991) were used to analyze the results.

Experiment 2

Six mature Merino sheep (42-48 kg) were maintained in metabolism crates and given 800 g oaten chaff, 200 g lucerne chaff and 250 g pellets. During this experiment, lights were turn on until the end of the experiment. After the adaptation period of 7 days, the sheep were given 250 g LiCl-labelled

pellets (14 g LiCl/kg pellets) and 15 min later, they were administered orally with NaCl at one of five levels, i.e., 0, 2, 6, 10 and 15g NaCl in 50ml of tap water. This experiment was carried out in three periods, each of three weeks and each period used three sheep maintained in metabolism crates. Before starting each period, the sheep were allowed to adapt for one week to minimize "carry-over" effects. Urine and faeces were collected and and water intake measured. Samples of blood, urine, and faeces were taken at 0, 6, 12, 24, 32, 48, and 72 h after consumption of Li-labelled pellets and oral NaCl administration; urine and faeces accumulating in these intervals were also measured. Li concentration in plasma, urine and faeces were analysed by Flame Photometer (FP). Data were analysed by repeated measures analysis of variance (BMDP Statistical Software, 1985).

Results

In Experiment 1, because lifeweight of sheep ranged from 35-59 kg, Li intake from 150 g pellets in the sheep was 19.8, 15.9, 18.4, 17.5, 19.1 and 12.7 mg LiCl/kg body weight (BW) respectively.

NaCl levels administration tended to influence Li concentration in plasma sheep. This was shown in sheep not receiving NaCl which had higher Li concentration an earlier achievement of maximal concentration than the sheep receiving NaCl (see Figure 1). There was a negative correlation between Li concentration in plasma and NaCl levels ($P<0.07$, $r^2= 56$ and 62%, 12 and 24 h after consumption of Li-labelled pellet respectively).

In Experiment 1, the results of estimation of pellet intake in sheep not receiving NaCl were the same as previously experiment (Suharyono, 1994); in particular, blood samples taken at 12 or 24h seemed to be suitable for estimation of pellet intake. The predicted means were 156 g and 164 g which were 4 and 9% higher than actual intake respectively. It is also appeared that in sheep receiving NaCl, that the errors of estimation of pellet intake were lower when based on the samples taken 12 or 24 h after Li ingestion (see Table 1). It seems that NaCl levels did not influence the estimation of pellet intake and nor affect the most appropriate times of blood sampling which were still 12 to 24 h after consumption of Li-labelled pellets.

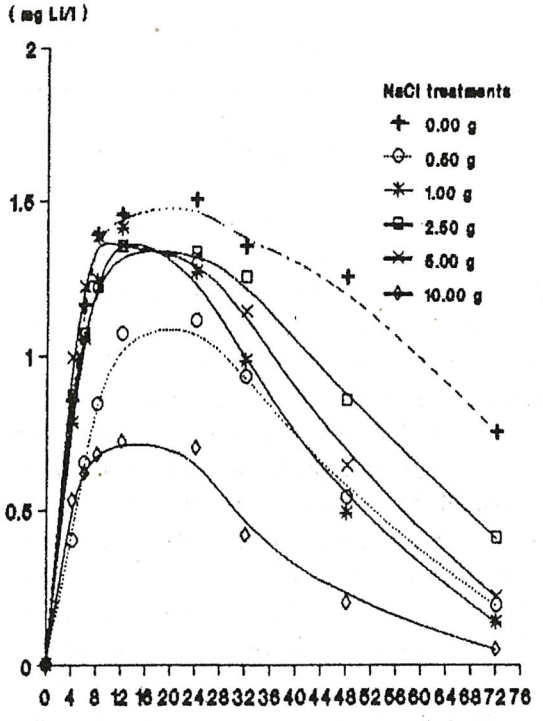

Figure 1. Concentrations of Li in plasma of sheep after consuming 150 g Li-labelled pellets

Table 1. Deviation of estimation of pellet intake (%) from the true value (150g) owing to NaCl treatments and time of blood sampling

Time of bs[a] (h)	NaCl treatments (g)					
	0	0.5	1	2.5	5	10
8	137(9)	124(17.6)	157(4.5)	165(8.3)	168(12)	125(16.6)
12	156(4)	144(3.9)	163(8.9)	165(9.7)	151(0.5)	121(19.1)
24	164(9)	152(1.3)	150(0.3)	165(9.8)	150(0.1)	120(20.2)
32	178(19)	154(2.3)	139(7.2)	187(24)	156(4.0)	87(42.3)
48	256(71)	139(7.7)	108(28)	197(32)	136(9.3)	64(55.3)

[a]Blood sampling

Table 2. The effect of time of blood sampling (h) and intake of NaCl (g) on the accuracy and precision of estimation of pelleted intake (EPI)[a]

NaCl treatment (g)	8	12	24	32	48
0	252(6,83)[b]	248(5,48)	236(6,60)	232(7,20)	229(6,77)
2	257(1,60)	254(4,09)	244(3,85)	238(4,41)	229(6,70)
6	243(5,50)	247(4,60)	256(8,01)	262(9,69)	272(4,12)
10	263(7,10)	262(6,20)	262(3,78)	262(2,98)	267(1,99)
15	237(6,70)	238(7,10)	238(5,67)	238(8,74)	233(13,2)

a) All sheep consumed 250 g pellets and were dosed with orally with one of 5 levels of NaCl.
b) Standard error (%)

In Experiment 2, Li intake by the sheep at each of the NaCl levels was 80.5, 77.3, 73.4, 70.2 and 74.5 mg LiCl/kg body weight respectively. Li concentration in plasma was significantly ($P<0.04$) correlated with the level of NaCl administration (Experiment 1), but r^2 values were higher, namely 85% and 87%, when based on samples taken 12 and 24 h consumption of Li-labelled pellets.

The plasma Li concentration versus times curves are given in Figure 2. The NaCl administration did not appeared to influence the achievement of Li concentration, appropriate time for blood sampling and the estimation of pellet intake (see Table 2).

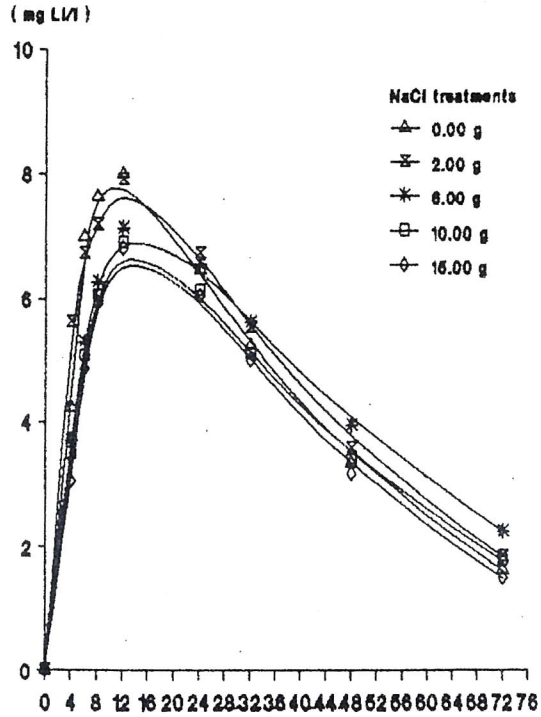

Figure 2. Concentration of Li in plasma of sheep after consuming 250 g Li-labelled pellets

The estimation of pellet intake did not differ significantly with time of blood sampling, i.e., between samples taken at 12 or 24 h after ingestion of pellets. The error of prediction were similar to those obtained in Experiment 1 reported above.

Li recovery in faeces and urine was not influenced significantly by NaCl treatments. The values of Li recovery from faeces and urine were 16.2+1.2 and 51.3+1.8%, 72 h after consumption of Li-labelled pellets respectively.

Water intake was not significantly influenced by NaCl treatments. The mean water intake of sheep was 3.7+0.3 l/d.

Discussion

The Li concentration and the achievement of the maximal Li concentration in plasma were influenced by levels of NaCl administration. However, the estimation of pellet intake and most appropriate times of blood sampling were not affected, so the high Na intake in the diet of grazing sheep may not interfere with this technique, nor prejudice its use. The effect of NaCl on Li kinetics could be associated with many factors. For example, Li excretion may increase when the excess Na from the administered dose of NaCl is excreted. The effect of NaCl on plasma Li concentration may also be associated with interference with the absorption of Li into the blood or with effects on recirculation of Li via saliva, or effects on Li deposition or mobilization in bone. Study of the effect of ingestion of NaCl on Li concentrations in milk, saliva, rumen, bone of sheep may help to increase understanding of the interaction between Na and Li kinetics in sheep. The earlier maximal Li concentration in plasma may be caused by Na enhancement of Li transportation across the rumen wall into the blood.

The correlation between Li concentration in plasma and administered levels of NaCl in Experiment 2 was higher than in Experiment 1; this may have been associated with different diets, Li intakes and perhaps liveweights.

Li recoveries from faeces and urine after 72 h were 16.2+1.2 and 51.3+1.8%, respectively, i.e., the total recovery of Li was 68% and 32% was therefore not accounted for. It appears that some Li may be have been deposited in the bones during this time (6). Li may be recirculated via saliva to the rumen (7), where it is mixed in the relatively large volume of rumen fluid. There is evidence that Li is retained in wool, e.g., Mocsennyi et al., (1987) (8) found a Li concentration in wool of 1.1+0.8 mg/kg dry matter.

Conclusion

The type of diet and its content of ingredients such as Na, may influence Li concentration, the rate of achievement of maximal Li concentration in plasma and the rate of elimination of Li from the blood. However, Na did not seem to influence the estimation of pellet intake, when blood samples were obtained at 12 or 24h after pellet ingestion. The error in the estimation of pellet intake was small, although at the highest level of NaCl treatment, the error tended to be higher. The technique using LiCl as a marker for estimation of pellet intake seems to be intensitive to concurrent intake of NaCl in the conditions of this study and it seems unlikely that method of would be prejudiced under field condition by variations in the normally occuring range of intakes of Na...rm6.50

Lierature Cited

Anderson, D.K. and L. D. Prockop. 1975. Lithium absorbsion and distribution in body tissues. In *Lithium Research and Therapy,* F.N. Johnson, editor, pp. 267. London : Academic Press.

Birch, N.J., and R.P. Hullin. 1972. The distribution and binding of lithium following its longterm administration. *Life Sciences* **11**, 1095.

BMDP Statistical Software. 1985. [W.J. Dixon, M.B. Brown, L. Engelman, J.W. France, M.A. Hill, R.I. Jennrich and J.D. Toporek, editors], pp. 290-397. Berkeley: University of California.

Minitab Statistical Software. 1991). Minitab Reference Manual Release 7. Minitab, Inc. State College, USA.

Mocsennyi, A.R., M. Anke, and S. Szentmihalyi. 1987. Li content in some major forages and Li-status of animals. *Acta Agronomica Hungaria,* **36**, 325.

Radomski, J.L., H.N. Fuyat, A.A. Nelson, and P.K. Smith. 1950. The toxic effects, excretion and distribution of lithium chloride.*Journal of the British Grassland Society*, **10**, 282.

Suharyono. 1994. Perkiraan konsumsi pelet dari domba bunting yang digembalakan dan pengaruh penambahan pelet terhadap produksi. Prosidings Seminar Nasional Sains Dan Teknologi Peternakan, Bogor, 25-26 Januari 1994. Buku 2. 411.

Ulyatt, M.J. 1964. The suitability of lithium as marker for estimating rumen water volume in sheep. *New Zealand Journal of Agriculture Research*, **7**, 774.