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Chloride Retention in Sheep

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Fourteen balance trials were carried out to establish the possibilities of natural deficiency under normal feeding practices. Routes of excretion and retention of chloride per kilogram live weight (LW) or per unit metabolic body size (UMBS) were determined.

Chloride contents in the tested feedstuffs were high enough to cover the requirements of all farm animals. The highest recoreded values for chloride were in the second cut clover and rice bran. The lowest chloride contents were in maize, grains and decorticated cottonseed cakes. The major route for chloride excretion was found to be the urine.

Chloride balance was negative only when green forages were fed. The total daily water intake was considered the main factor in causing the chloride balance to be negative. Chloride must be offered to the animals in the form of common salt (sodium chloride) in order to cover their requirements of Cl and to supply them with suitable Na : K ratio.

Chloride (Cl) is considered an essential elment for the animal well-being. Chloride ion represents one of the back-bones of the buffer systems of the body. Hawk *et al.* (1952) reported that saliva became inactive on starch if it was dialyzed from NaCl. Maynard and Loosli (1956) mentioned that Cl is found in large concentrations both inside and outside the cells of the body tissues. The body has a certain capacity to store Cl in the skin and subcutaneous tissues. Hawk *et al.* (1952) stated that drinking excess amounts of water tended to increase chloride excretion. Bushman *et al* (1967) found that calcium chloride increased urinary Cl in sheep than ammonium chloride and sodium chloride, respectively. Nagao (1959) reported that the percent of Cl excreted in faeces was much less than in urine. El-Gindi (1966) found that the daily chloride excretion in grams by goats varied from 5.1 to 22.2 according to the ration fed.

Material and Methods

Animals, feeding and composite samples were as previouslv described (Allam, 1970).

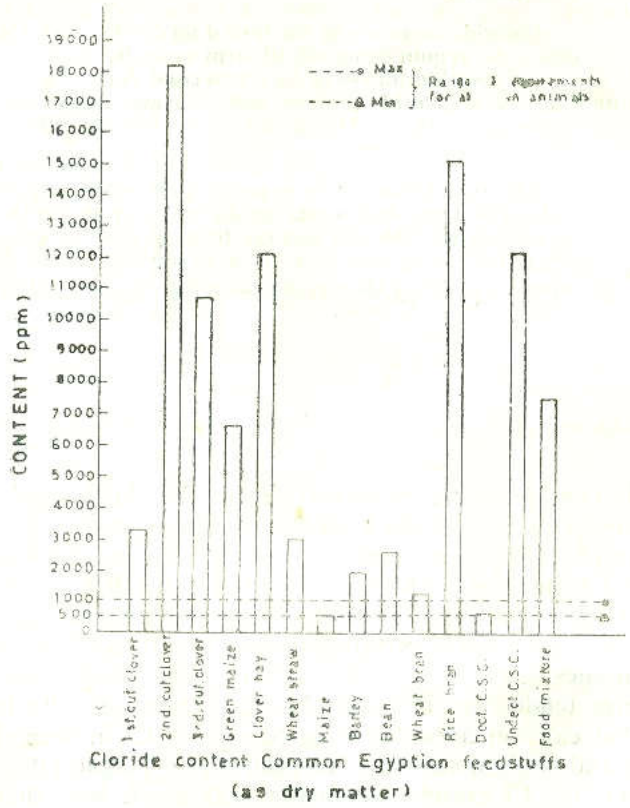
Chemical analysis

The chemical analysis of feedstuffs and faecal material for moisture and nitrogen followed the ordinary conventional method of A.O.A.C. (1955). Chloride was determined in feedstuffs and faeces by Vilhard method, while in urine and water it was estimated colorimetrically by using Croskson method (1963).

Results

1. *Chloride content in feedstuffs*

The results indicate that in roughages, the first cut clover, wheat straw and green maize showed the lower contents of Cl either as offered or on dry matter basis as shown in Fig 1. On dry matter basis, the second cut clover had the highest value of chloride. With concentrates, the highest values were in rice bran and undecorticated cottonseed cakes, while the lowest values were in maize, grains and decorticated cottonseed cakes.



2. *Chloride excretion*

It is shown from Table 1 that the urine is the major pathway of excretion. The amounts of Cl excretion in urine in case of feeding green roughages were higher than that when concentrates were fed.

TABLE 1. **Average daily chloride excretion**

Feedstuffs	Total excreted	Cl excretion		Excretion percent	
		in urine	in faeces	in urine	in faeces
	g	g	g	%	%
Roughages					
1*st* cut clover	21.006	19.991	1.115	95.10	4.90
2*nd* cut clover	15.184	14.584	0.600	92.95	7.05
3*rd* cut clover	11.434	10.176	1.258	88.99	11.01
Green maize	14.369	13.012	1.357	90.25	9.75
Clover hay	8.740	7.123	1.617	81.40	18.60
Wheat straw	6.616	5.689	0.927	85.98	14.02
Grains					
Maize	5.428	4.309	1.119	79.30	20.70
Barley	7.606	6.198	1.408	81.50	18.50
Beans	5.842	4.102	1.740	69.50	30.50
By products					
Wheat bran	6.896	5.814	1.082	84.70	15.30
Rice bran	8.649	7.263	1.386	83.95	16.05
Dect. Cotton. S.C.	7.762	6.990	0.772	89.95	10.05
Undect. Cotton. S.C.	8.506	6.227	2.279	73.15	26.85
Feed mixture	9.500	8.578	0.922	90.25	9.75

3. *Chloride retention*

It is shown from Table 2 that chloride balance was negative in the three successive cuts of clover and green maize. Concerning Cl retention per kilogram live weight (LW) or per unit metabolic body size (UMBS), the results indicate that the first cut clover showed the highest negative retention than the

second and 3*rd* cut respectively. With green maize it was very close to that obtained with the second cut clover. Chloride balance was positive with clover hay but negative with wheat straw. Feeding adult sheep on grains or factory and milling by products tended to keep the chloride balance in equilibrium. Retained chloride per kg LW or per UMBS were the highest with undecorticated cottonseed cakes, being 21 and 56 mg. The values of retained Cl with the other concentrates were within the former two limits.

TABLE 2. **Daily retention[1] of chloride per kg LW[2] or per U.M.B.S.[3]**

Feedstuffs	Intake	Retention	Retenion	Retention kg LW	Retention UMBS
	g	g	%	mg	mg
Roughages					
1*st* cut clover	2.387	—18.118	—759.05	— 254	— 848
2*nd* cut clover	13.451	— 2.234	— 16.65	— 59	— 147
3*rd* cut clover	10.350	— 1.101	— 10.65	— 29	— 71
Green maize[4]	11.663	— 2.831	— 24.19	— 55	— 146
Clover hay	10.830	2.090	19.27	53	133
Wheat straw[5]	2.678	— 3.988	151.40	— 124	— 292
Grains[4]					
Maize	9.091	3.663	35.70	70	187
Barley	9.308	1.701	18.28	38	89
Beans	7.735	1.892	24.61	50	124
By-products[5]					
Wheat bran	8.189	1.294	15.84	39	84
Rice bran	10.339	1.690	16.34	51	119
Dect. Cottonseed Cake	8.846	1.083	12.22	21	56
Undect. Cittonseed Cake	11.372	2.866	25.12	72	180
Feed mixture	12.188	2.688	22.02	50	135

1. Each value in the table represents the average of two animals.
2. Milligram of chloride per kilogram live-weight.
3. Milligram of chloride per unit metabolic body size.
4. Half of the energy requirement was covered from colver hay.
5. Supplemented with 40 g casein/animals/day.

Discussion

Regarding the chloride balance with green roughages, it can be noticed that it was negative. This would mean that feeding clover or green maize alone to adult sheep is not sufficient to maintain Cl equilibrium. Total water intake as the sum of the water in the green forage and drinking water was considered the main factor in causing the chloride balance to be negative. The kidney mechanism of getting rid of the excess water would cause uncontrolable chloride loss through the urine. In this connection Hawk *et al.* (1952), and Dukes (1964) found that high water intake would tend to increase Cl losses.

Wide potassium to sodium ratio in the green forages aggravated the problem and made it difficult for the animal to maintain chloride equilibrium under such conditions. Sodium potassium ratio (Na : K) was higher in the first cut clover than the third and second cut, respectively, being 1:7.0, 1 : 6.2, and 1 : 4.9, respectively as calculated from the data of Abd-El Motagalli (1966). It was also 1 :5.9 in green maize. When excess potassium need to be excreted by the body, kidney tubules tend to retain sodium from being excreted in the urine. Potassium is usually excreted in the form of potassium chloride. That would tend to increase the urine contents of the chloride ion in order to retain sodium in the body. Moreover, the lowest chloride intake was the first cut clover and that helped in increasing the magnitude of the negative Cl balance than the other successive cuts. Negative balance with wheat straw might be due to the low chloride intake and to the wide Na : K ratio in it, being 1 : 7.9 while it was 1 : 3.8 for hay. Sodium to potassium ratio with concentrates ranged between 1 : 3.8 and 1 : 6.2 for barley grains and undecorticated cottonseed cakes, respectively. Na :K ratios were nearly similar for undecorticated cottonseed cakes and green maize, being 1 : 6.2 and 1 : 5.9, respectively. On the other hand, the daily water intake and water gain with green maize were 3.645 and 1.338 liters while the corresponding figures with undecorticated cottonseed cake were 2.186 and 0.409 liters. It could be noticed that the high water intake and water gain might be the important factor affecting the negative chloride balance with green roughages while Na : K ratio was of no remarkable effect under our experimental conditions. These findings are in harmony with those found by Burns *et al.* (1953) who reported that Na : K antagonism is not a matter of practical importance in feeding farm animals.

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امتصاص الكلوريد فى الأغنام

السيد رفعت أبو حسين ، السيد عبد الرحمن جهاد ، رضا محمد علي
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وجد أن مواد العلف المختبرة تحتوى على زيادة من الكلوريد لتغطيةاحتياجات حيوانات المزرعة بدون التخوف من ظهور أعراض نقص وكانت أعلى نسبة من الكلوريد موجودة فى الحشة الثانية من البرسيم ورجيع الكون هى ١٨١٩٠ ، ١٥٢٠٠ جزء فى المليون لكل منهما على الترتيب حيث اتخذت حبوب الذرة وكسب القطن المقشور على أقل نسبة من الكلور حيث كانت ٥٣٠ ، ٦٦٠جزء فى المليون لكل منها على الترتيب بينما كان متوسط احتياجات الحيوانااليومية يتراوح بين ٥٠٠ ، ١٠٠٠ جزء فى المليون .

كان ميزان الكلوريد سالبا عندما غذيت حيوانات التجربة على علبقة خضراء من أى حشة من حشات البرسيم الثلاث أو الدراوة وعند حساب كجم الماء الداخلة للحيوان على صورة ماء فى العليقة الخضراء وماء الشرب أمكن استنتاج أن الماء كان العامل الرئيسى فى جعل ميزان الكلور سالبا ويرجع هذا الى ميكانيكية الكلية فى التخلص من الماء الزائد عن حاجة الجسم ينتجعنها فقد كمية كبيرة من محتويات الجسم من الكلور ويساعد فى تضخم أثر هذا العامل اتساع نسبة البوتاسيوم الى الصوديوم وكان هذا واضحا عندما حسبت هذه النسبة فى العلائق الخضراء حيث كانت أعلى نسبة فى الحشة الأولى للبرسيم (٦٫٩٩ : ١) ولقد سجلت الحشة الأولى للبرسيم أكبر ميزان سالب للكلور فى كل التجارب .

ووجد أن البول هو الطريق الرئيسى لاخراج الكلور من جسم الحيوان .