Egyptian J. Anim. Prod. Vol. 33(1) (1996):23-33.

THE SULPHUR SUPPLEMENTATION IN SHEEP DIET IN RELATION TO SOME WOOL CHARACTERISTICS

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SUMMARY

Twenty - four ewes included in the present study were allotted into three groups, each comprising eight animals ; four of them were Barki while the other four were 1/2 Barki x Finnish Landrace cross . The first group (control) was given a basal diet , whereas the 2nd and 3rd groups were given the basal diet with supplementation of 0.15% and 0.30% sulphur of the dry matter content respectively. After a preliminary period of 20 days upon these treatments, the ewes were continued on the same treatments for one year divided into two six-months periods. During the course of treatment the ewes became pregnant and delivered.

The present results indicated that addition of sulphur to the basal diet either at the rate of 0.15% or 0.30% of the dry matter content slightly encourage wool growth rate. Other traits such as the sulphur content of wool fibre, greasy and clean fleece weights, fibre length and diameter as well as fibre crimps were not significantly affected by sulphur treatments. The lambs which were the offspring of the treated dams did not show significant response to sulphur supplemented in the diet of the dams on follicle density and S/P ratio as well as other wool traits studied on these lambs which indicate that the sulphur content of the lamb's coat might be independent of the treatments of their dams .

Keywords : Barki ewes, sulphur supplementation, wool traits, skin follicles

INTRODUCTION

Many reports have suggested that sulphur and sulphur containing amino acids have stimulatory effect on wool growth and production , and that sheep are able to utilize elemental sulphur and sulphates in the diet to synthesize sulphur containing amino acids. It appeared that sulphur play an important role in the wool production as well as the physical and chemical properties of wool (Marai and Abdel-Salam, 1971). The present study was performed to investigate

the effect of adding elemental sulphur to the ewe 's diet on wool production and characteristics, and would go further to investigate whether the effect will continue on the skin follicles and wool characters of their lambs.

MATERIALS AND METHODS

The present study was carried out at the livestock research farm of Al-Azhar University, Cairo. Twenty-four ewes were allotted into three groups. Each group comprised four Barki (BB) ewes and four Barki x Finnish Landrace (1/2 BF). The ewes were represented equally in the three groups according to age and weight. The mean body weights in the 1*st* , 2*nd* and 3*rd* groups were 43, 44 and 45 kgs respectively for BB and were 55 , 53 and 55 kgs respectively for 1/2 BF crossbred .

The 1*st* group (control) was given a basal diet (Ghoneim , 1967). The 2nd group was given the basal diet plus 0.15% of dry matter weight elemental sulphur. The 3*rd* group was given the basal diet plus 0.30% of dry matter weight elemental sulphur. The basal diet which was in mash form, was offered to give 1.5 kgs dry matter, 500 gms starch value and 90 gms digestible protein in the dry period. The corresponding values given during pregnancy period were 1.25 kgs , 700 gms and 130 gms respectively. The sulphur was added to the mash ration and mixed thoroughly. Berseem hay was given at a rate of 600 gm/head/day. Sulphur content of the ration was calculated as 0.52% on dry matter basis. The 1*st* group followed the system of the farm where a basal diet was offered before and after the start of the experiment. The 2*nd* and 3*rd* groups were put on the treatment rations for a preliminary period of 20 days. Then, the animals were shorn together with the control group and wool samples of 300 gms were collected from the right mid-side position of each animal and were kept in plastic bags for further analysis. After the preliminary period, the treatment groups continued on the same diet as well as the control group for six months , after which the animals were shorn again and wool samples of 300 gms were taken from the right mid-side position of each animal and kept in plastic bags for further analysis. The experimental ewes were then left for another six-months period on the same treatments . All the ewes became pregnant and delivered during the course of the treatment (the lambs were then 3/4 B - 1/4 Finn cross) . Skin samples of about 1 cm^2 were drawn from the lambs at the age of 24 hours and at 30 days from the right mid-side position. The skin samples were stretched on cork squares and left immersed in Boun's solution for fixation, then prepared for sectioning as recommended by Clarke (1960) .

Greasy fleece weights were recorded at shearing . A small sub-sample was taken from each greasy sample and kept for fibre measurements . The original greasy sample was then weighed, scoured and yield was estimated (Chapman, 1960). The clean fleece weight was then calculated from the greasy fleece weight and recorded for each animal .

Wool growth rate was determined by weighing the fibres grown on an area of 10 cm^2. The weight of fibres was calculated per 1 cm^2 and recorded as the wool growth rate / 6 months .

The greasy sub-samples were cleaned using carbon tetra chloride solution. A tuft of wool was measured for fibre diameter using the Lanameter (500 x) ,about 300 fibres were measured. Another tuft from the cleaned sub-samples was

measured for fibre length using WIRA fibre length measuring machine, about 300 fibres were measured and length was recorded to the nearest 0.5 cm . The waves of crimps were counted within 2 cm length of single fibres .The count was done on 300 fibres in each cleaned sub-sample .

The skin sections of lambs were used to count the number of secondary follicles (S), primary follicles (P) , S/P ratio and the number of follicle groups / mm^2 (follicle density). The counts were corrected for skin shrinkage normally occurring during histological preparation and averaged 0.96% .

The sulphur content of the ration and the wool were determined using the methods of Steinbergs(1978) .

The analysis of variance was performed within seasons to partition the variability into its sources (breed and treatment) using proc. Glm. of SAS (1988). Only means were adopted for the offspring data due to the small number of offspring available in each group .

RESULTS AND DISCUSSION

Tables (1 & 2) showed that greasy fleece weight (GFW) and clean fleece weight (CFW) did not respond significantly to sulphur supplemented at rates of 0.15% and 0.30%. Meanwhile there is slight reduction in GFW and CFW at 0.30% level compared with the corresponding values of the control. The negligible response to the studied levels of sulphur might agree with Albert and Garrigus (1956) who found that basal ration contained 0.23% sulphur did not respond to additional supplement of sulphur . In the present trial the basal diet contained 0.52% sulphur which is considered more than enough .

Results in Tables (1 & 2) also indicate general trend for 1/2 BF to produce slightly more wool than BB . On the other hand , wool grown in winter appeared to be slightly heavier than that grown in summer which agreed with findings elsewhere (Khalil , 1980) . This season difference might partially be due to different reproductive status of animals where pregnancy and lactation occurred in summer which might cause a reduction in wool growth (Hafez , 1980).

Wool growth rate (WGR) showed a general trend to be higher for 1/2 BF compared with BB in both seasons . WGR also indicated a slight increment at 0.15% level compared with the control group . However, supplementation with sulphur at 0.30% level resulted in a highly significant reduction in WGR compared to the other treatment groups. Such reduction was more pronounced in summer (-33.4% vs -10.8%) than in winter fleece (Tables 1 & 2). This result confirms the earlier results obtained in which the level of 0.30% sulphur supplementation was responsible for the lighter GFW and CFW obtained. A reduction in feed intake occurred when adding 0.30% sulphur (Starks et al., 1953). Another reason could be the fact that increasing sulphur level in the present trial was not accompanied by increasing nitrogen level of the ration which probably encouraged the escape of sulphur in feces and urine as indicated by Bray and Hemsley (1969). Late pregnancy and lactation which occurred in summer could be another stress factor negatively affecting wool production (Hafez , 1980) .

Tables (1 & 2) show that fibre diameter (FD) was not affected by sulphur treatments which agreed with findings of Gratner and Niven (1978) . It appeared that sulphur or sulphur containing amino acids may not be limiting factors

Table 1. The average (X ± SE) for the studied traits in relation to treatments and breed groups in summer

	GFW (kg)		CFW (kg)		WGR (gm)		FD		FL		NOC		SC	
	BB	½BF	BB	½BF	BB	½BF	BB	½BF	BB	½BF	BB	½BF	BB	½BF
Control														
X	0.99	1.01	0.73	0.63	145.3	155.5	31.12	26.53	8.23	7.37	2.93	4.63	3.60	3.71
±SE	0.1	0.1	0.0	0.0	14.0	14.0	1.6	1.6	0.8	0.8	0.5	0.5	0.1	0.1
0.15 %														
X	0.99	1.02	0.71	0.69	148.5	162.5	31.28	26.54	8.36	7.42	3.15	4.69	3.61	3.71
±SE	0.1	0.1	0.0	0.0	14.0	14.0	1.6	1.6	0.8	0.8	0.5	0.5	0.1	0.1
0.30 %														
X	0.89	0.98	0.62	0.60	91.8	116.0	30.52	26.04	7.18	7.34	3.05	4.64	3.61	3.71
±SE	0.1	0.1	0.0	0.0	14.0	14.0	1.6	1.6	0.8	0.8	0.5	0.5	0.1	0.1
Pooled														
X	0.98		0.66		136.58		28.67		7.65		3.85		3.66	

Table 2. The average (X±SE) for the studied traits in relation to treatments and breed groups in winter

	Conrtrol		0.15%		0.30%		Pooled
Trait	BB	½BF	BB	½BF	BB	½BF	X
GFW	1.19	1.46	1.20	1.41	1.04	1.14	1.23
	±0.1	±0.2	±0.1	±0.1	±0.1	±0.1	
CFW	0.79	0.86	8.50	0.88	0.73	0.69	0.80
	±0.1	±0.1	±0.1	±0.1	±0.1	±0.1	
WGR	136.8	161.3	147.8	164.0	135.0	142.8	147.35
	±12.3	±14.4	±12.3	±12.3	±12.3	±12.3	
FD	30.91	28.42	31.50	28.43	30.56	27.62	29.62
	±1.5	±1.7	±1.5	±1.5	±1.5	±1.5	
FL	8.84	8.21	9.14	8.23	7.81	6.97	8.20
	±1.0	±1.1	±1.0	±1.0	±1.0	±1.0	
NOC	2.69	4.56	2.68	4.54	2.53	4.98	3.62
	±0.4	±0.4	±0.4	±0.4	±0.4	±0.0	
SC	3.58	3.75	3.63	3.77	3.63	3.77	3.69
	±0.0	±0.0	±0.0	±0.0	±0.0	±0.0	

affecting FD. As expected, 1/2 BF wool was significantly finer than that of BB wools in both seasons since Finn sheep is considered to be of a medium type wool. On the other hand, regardless of the breed , the mean FD was significantly larger in winter than in summer. This might indicated that sheep may synthesize keratin more efficiently to protect themselves from cold in winter.

Fibre length (FL) did not show any significant response to sulphur supplementation of the ewe's diet . However, there was a reduction in FL in that group receiving 0.30% sulphur compared to the control group (Tables 1& 2). This reduction might be attributed to the lower food intake of this group . Coop (1953) and Sadek (1974) reported that fluctuation either due to feed availability or feed intake caused fluctuations in wool growth , expressed as fibre length. Regardless of the breed, fibres were relatively longer in winter than in summer in all treatment groups. Keratin synthesis might be encouraged in winter in Egypt which represent the comfortable climate zone to sheep and wool production (Khalil, 1980) .Moreover, there is general trend for BB wool to be slightly longer than of 1/2 BF group.

Tables (1&2) indicated no significant differences in the number of crimps / 2cm (NOC) among sulphur treatments studied . It appeared that 1/2 BF crossbred wool had significantly more crimp than BB wools in both seasons which might be attributed to the contribution of the Finn blood .

The sulphur content (SC) of wool fibres did not show any significant changes in response to the sulfur treatments (Tables 1,2 and 3) . SC of wool in the present study was found to be 3.6% which agreed with that reported by Dusenburg (1963) . The main differences in SC was found between breeds where 1/2 BF crossbred wool had significantly more sulphur than BB wools in summer and winter. Breed differences in SC was reported by Simmonds (1955).

Table (3) . Analysis of variance for the studied traits in summer

Sources of variation	df	Mean Squares						
		GFW	CFW	WGR	FD	FL	NOC	SC
Breed (Br)	1	0.01	0.01	1568.2	126.9**	1.79	15.49**	0.07*
Treatment (T)	2	0.014	0.018	6471.5**	0.93	0.92	0.04	0.00
Br x T	2	0.003	0.004	105.0	0.04	0.75	0.01	0.0001

** P < 0.01 * P < 0.05

It is known that sulphur is essential for the wool fibre to grow normally, it is necessary for the transformation of sulphydril SH group to di-sulphur bonds in the process of keratinization. Sulphur is also related to most of the mechanical properties of the wool fibres such as elasticity , resilience and plasticity. Unsound wool was found to have lost some of its SC in a process of reduction or oxidation as normally occurs in wool exposed to direct sunlight for long periods (Onions, 1962).

Table (4) . Analysis of variance for the studied traits in winter

Sources of variation	df	Mean Squares						
		GFW	CFW	WGR	FD	FL	NOC	SC
Breed (Br)	1	0.211	0.002	1490.7	45.63*	3.57	24.06**	0.134*
Treatment (T)	2	0.130	0.051	584.7	1.56	3.93	0.05	0.003
Br x T	2	0.013	0.005	131.1	0.17	0.04	0.22	0.001

** P < 0.01 * P < 0.05

The effect of sulphur supplementation of the dam's diet on :

A) Density of follicle groups/ mm^2 of skin in the lambs

Table (5) shows no definite trend and hence no effect of sulphur supplementation of the dam's ration on the ability of the sheep to produce more follicles at 24 hours . However , at 30 days of age , the follicle density decreased in the control as well as in the two treated groups in both BB and 1/2 BF groups . This reduction is mainly referred to the expansion of the lambs skin with the advance in age .No clear differences were observed at 30 days of age between the treated and the control groups.

Table 5 . Follicle density and S/P ratio of the lamb' s skin in different treatments and breed groups

	Follicle Density						S/P					
	At 24 hrs			At 30 days			At 24 hrs			At 30 days		
	C	0.15 %	0.30 %	C	0.15%	0.30 %	C	0.15 %	0.30 %	C	0.15%	0.30 %
BB (no)	11.95 (2)	11.80 (2)	12.25 (2)	9.05 (2)	8.60 (2)	9.45 (2)	0.78 (2)	0.70 (2)	0.75 (2)	1.65 (2)	1.69 (2)	1.75 (2)
3/4 BF (no)	13.50 (2)	14.60 (1)	12.55 (2)	9.75 (2)	10.40 (1)	9.05 (2)	0.75 (2)	0.87 (1)	0.77 (2)	1.86 (2)	1.90 (1)	1.74 (2)
Mean ± SE	12.73 0.81	12.73 1.20	12.40 0.49	9.40 0.51	9.20 0.64	9.30 0.44	0.76 0.04	0.75 0.06	0.76 0.03	1.76 0.07	1.76 0.08	1.75 0.07

B) The S/P ratio

It was observed from table (5) that there was no definite trend for the effect of sulphur supplementation on the S/P ratio at 24 hours in both BB and 1/2 BF groups. Meanwhile, at 30 days, the S/P ratio increased compared to that at 24 hours in both BB and crossbreds. There was a definite trend of increased S/P ratio with the increase in sulphur content in the treated groups in BB whereas the crossbreds showed some fluctuations. The amount of nutrients available to the foetus can make difference in the number of secondary follicles formed.

C) The physical characteristics of wool

In a six-months growth period there were no significant differences in GFW and CFW between the treated and the control groups. This result indicates that the original diet of the dams was complete enough and the supplementation with sulphur did not influence the wool production of their lambs.

Table 6. Physical wool traits of lambs coat in different treatments and breed groups.

	BB	¾BF	Mean±SE
FD			
C	28.46	25.38	26.92±0.9
0.15%	28.51	25.50*	27.51±2.0
0.30%	29.79	25.26	27.53±1.4
FL			
C	6.50	6.60	6.57±0.2
0.15%	6.60	6.80*	6.63±0.1
0.30%	5.79	6.80	6.29±0.6
WGR			
C	198.5	233.5	216.0±31.7
0.15%	196.5	271.0*	221.3±36.2
0.30%	182.0	249.5	215.8±33.9
NOC			
C	4.27	5.42	4.85±0.8
0.15%	3.35	5.21*	3.97±0.6
0.30%	4.21	6.36	5.28±1.2
SC			
C	3.57	3.55	3.56±0.2
0.15%	3.60	3.64*	3.58±0.4
0.30%	3.53	3.58	3.56±0.0

All the traits were calculated from 2 animals.

* These traits were calculated from one animal only

Table (6) indicates no significant effect of sulphur treatments on FD, FL, WGR, NOC and SC. This similarity observed in the physical traits indicates that treatment of the dams did not have a prolonged effect on their lambs . These results raise some questions to whether the sulphur uptake by the wool fibre might differ with the time of the year and that sulphur content in a year growth might show up the differences between treatments compared with that of six-months growth . The small number of lambs representing each treatment could be another reason for masking the differences between treatments. These points need further investigation since no information is available to clear it . However , it is quite obvious from the present results that the sulphur content of the lambs' coat was independent of the treatments of their dams . In other words , there was no latent effect of sulphur on the wool coat of the offspring.

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تأثير إضافة الكبريت إلي علائق الأغنام على بعض صفات الصوف

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أستخدمت فى هذه الدراسة ٢٤ نعجة تم تقسيمهم إلى ثلاثة مجموعات فى كل مجموعة ثمانية نعاج أربعة منهم برقى وأربعة خليط (٢/١ برقى مع اللاندريس الفنلندى) وقد غذيت المجموعة الأولى (الشاهد) على عليقه اساسية بينما تم اضافة كبريت إلى العليقة الأساسية بمعدل ٠,١٥٪ و ٠,٣٠٪ من وزن المادة الجافة لكل من المجموعة الثانية والثالثة على التوالى . وقد تم أعطاء هذه المعاملات لمدة ٢٠ يوما كفترة تمهيدية وبعدها استمرت الحيوانات على نفس المعاملات لمدة سنة كاملة انقسمت إلى فترتين كل منهم ستة أشهر و قد حدث حمل وولادة للنعاج خلال فترة التجربة .

أوضحت نتائج الدراسة أن إضافة الكبريت بالمعدلات المدروسة كان له تأثير طفيف على زيادة معدل نمو الصوف بينما لم تؤثر هذه المعاملات على صفات الصوف الأخرى مثل محتوى الصوف من الكبريت ووزن الجزة الخام والنظيف وقطر الليفة وطول الليفة وعدد تموجات الصوف . ومن ناحية أخرى فان مواليد الأمهات التى تعرضت لهذه المعاملات بإضافة الكبريت إلى علائقها لم تظهر عليها أية إستجابة معنوية بالنسبة لقياسات كثافة حويصلات الصوف ونسبة الحويصلات الثانوية للحويصلات الأولية بالإضافة إلى صفات الصوف المدروسة وقد يعنى ذلك أن صفات غطاء الصوف للمواليد ربما لايتأثر بمكونات علائق الأمهات .