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RELATIONSHIP OF CHEMICAL AND SOME PHYSICAL PROPERTIES OF FIBRES IN SHEEP AND GOATS

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ABSTRACT

Wool and hair samples were obtained from fleeces representative of 40 adult animals (20 Barki ewes and 20 Baladi does). Wool and hair samples were divided into two types of fibres, coarse and fine for wool and outer and inner coat for goat hair fibres to compare the chemical composition of fibres in relation to its physical characteristics in sheep and goats. Measurements were made on some physical characteristics of fibres in relation to the chemical composition.

No significant differences in amino acid composition were found between the two species (sheep and goats). The amounts of the amino acids pro. and tyr. were richer in wool than in hair fibre samples and the opposite was encountered amino acid cys., lys. and arg. which were richer in hair than in wool fibres.

The amino acid composition of different types of fibres (coarse and fine wool and outer and inner coat of goats' hair fibres) indicated no significant differences between amino acid composition of the two types of fibres.

The present results showed high significant correlation coefficients ($P<0.01$) that ranged between (0.7 to 0.9) between some amino acids. There were numerous values of medium and low magnitude of simple correlation.

The present study concluded that increasing content of pro., gly. and cys. in wool fibres corresponded with increments in STL and CF and a decrease in FD, medullated fibres% and K%. However the increment in amino acid lys. in wool fibre content corresponded with increment in STL, FD, medullated fibre percentage and K% and a decrease in CF/cm.

Keywords: Chemical composition, Fibres, Sheep, Goats.

INTRODUCTION

Wool and hair fibres are the end product of complex processes that originate at the base of the animal skin.

The important textile fibres of animal origin are those of the keratins which are the proteins found in the skin, horn, hair and other tissues and which form the main chemical constituents of wool.

The wool and hair keratin molecule consists of a highly complex sequence of amino acids Cystine, Lycine, Argenine, glutamic acid and Asparatic acid important in the physicochemical properiets of the fibres (Lewis, 1986).

The ultimate building blocks of all components of the wool and hair fibres are the keratin protein molecules. Like most proteins the keratins have long and flexible polymer chains (polypeptides) formed by chemical combination of amino acids. Depending on the number and kind of amino acid present and manner in which they are bind together, the proteins have different properties.

Many estimates of individual amino acids in wool keratin have been made. However scanty studies were made on the relationship between physical properties of wool and chemical composition. It is therefore that this study was carried out to throw some light on the chemical structure of different types of animal fibres, sheep and goats, with different types of fibres (coarse and fine wool and outer and inner coat of goats) and the relationship between the amino acid composition and some of the important physical properties of wool including fibre diameter, staple length, medullated fibre percentage and number of crimps/cm.

MATERIALS AND METHODS

In the present study representative samples were obtained from the fleeces of 40 adult animals (20 Barki ewes and 20 Baladi does.) of the flock that belonged to the desert Research Center. Wool and hair samples were divided into two types of fibres coarse and fine fibres for wool and outer and inner coat for goats' hair.

I. Some physical properties of fibres:

Staple length (STL): Average staple length of 10 staples from each sample was estimated, without stretching, using a ruler to the nearest 0.5 cm.

Fibre diameter (FD):Three hundred sinppets from each sample were used to measure this trait. The fibres were mounted in paraffin oil and spread on a microscope slide using the method suggested by El-Gabbas (1998). Fibre diameter was estimated using the Image Analyzer (Video Pro, Leading Edge Ltd. S. Aust.). While measuring the fibre diameter, the number of medullated fibres were estimated and their percentage was calculated { interrupted medullated fibres percentage (IM%), continuously medullated fibre percentage (CM%) fragmental medullated fibres percentage (FM%) and kemp percentage (K%)}.

Fibre crimp frequency (CF): The number of crimps along each unstretched fibre was counted in 30 fibres and the average of fibre length was calculated and used to obtain the number of crimps per centimeter.

II. Chemical composition of wool and hair fibres:

Twenty samples were used to estimate wool and hair amino acid composition. (10 from each of Barki ewes and Baladi does.) Wool and hair samples were divided into coarse and fine for wool and outer and inner coat for goat hair. For the determination of amino acid composition of fibres, an amino acid analyzer was used and the samples (20mg) were hydrolysed according to Moore and Stein (1958). The amino acids were Asparatic acid (asp), Thrionine (thr), Serine (ser), Glutamic acid (glu), Proline (pro), Glycine (gly), Alanine (ala), Cystine (cys), Valine (val), Methionine (met), Isoleucine (ile), Leucine (leu), Tyrosine (tyr), Phenylalanine (phe), Histidine (his),Lysine (lys) and Arginine (arg).

RESULTS AND DICUSSIONS

I. Some physical properties of fibres:

The overall means of STL, FD, CF, IM%, CM%, FM% and K% of fibre in Barki wool and Baladi goats' hair were presented in Table (1) and Fig. (1), Significant differences (P<0.01) occurred between all traits.

Table 1: Least squares means (X+SE) of STL, FD, CF, IM%, CM% , FM% and K% of Barki wool and Baladi goat`s hair

Traits	Barki wool fibres			Baladi goat`s hair fibres		
	Overall Mean	Coarse Fibres	Fine Fibres	Overall Mean	Outer Coat	Inner Coat
	X±SE	X±SE	X±SE	X±SE	X±SE	X±SE
STL	11.65±.77	12.58±1.1	10.73±.91	5.95±01.47	10.28±0.5	1.61±0.17
FD	36.60±4.8	50.5±2.84	22.7±1.27	44.9±11.01	77.60±3.3	12.23±0.8
CF	01.74±0.3	0.97±0.17	02.51±.29	1.99±00.66	00.±00	3.98±0.05
IM%	3.70±1.21	6.4±1.503	1.00±63	1.0±0.803	1.60±1.8	0.4±0.4
CM%	4.90±1.76	5.2±2.457	1.80±1.60	2.9±1.245	5.80±1.98	00.±00
FM%	4.00±1.26	7.0±1.304	1.6±0.98	1.1±2.137	2.20±1.20	00.±00
K%	11.40±4.1	20.6±5.64	2.20±2.20	5.8±2.82	11.6±4.37	00±.00

STL=Staple length, FD= Fibre diameter, CF=crimp requency/cm,IM%=interrupted medullated fibres percentage, CM%= continuously medullated fibres percentage, FM%=fragmental medullated fibres percentage and K%= kemp percentage.

The above traits were studied in coarse and fine wool fibres showed that the differences between the two type of fibres were significant (P<0.01) except for that of STL.(Table 1) & Fig. 2).

Table (1) & Fig. (3) showed that the differences in above traits between the two type of fibres (outer and inner coat) were significant except for those of IM% and FM%.

Table 2: Simple correlation coefficients among some physical properities of fibres (wool fibres above diagonal and goat`s hair fibres under diagonal).

	Wool fibres							
	TY	STL	FD	CF	IM%	CM%	FM%	K%
TY	1.00	-.40	-.95**	.88**	-.80**	-.76**	-.88**	-.79**
STL	-.92**	1.00	.40	-.67*	.55	.36	.50	.432
FD	-.98**	.99**	1.00	-.97**	.81**	.85**	.92**	.85**
CF	.97**	-.95**	-.85**	1.00	-.77**	-.60*	-.75**	-.71*
IM%	-.24	.17	-.19	-.28	1.00	.84**	.80**	.83**
CM%	-.71**	.62*	.66*	-70*	.77**	1.00	.90**	.78**
FM%	-.54	.55*	.52	-.53	.75**	.67**	1.00	.87**
K%	-.682*	.649*	.682*	-.669*	.696*	.914**	.666*	1.00
	Goat`s hair fibres							

STL=Staple length, FD= Fibre diameter, CF=crimp requency/cm,IM%=interrupted medullated fibres percentage, CM%= continuously medullated fibres percentage, FM%=fragmental medullated fibres percentage and K%= kemp percentage.

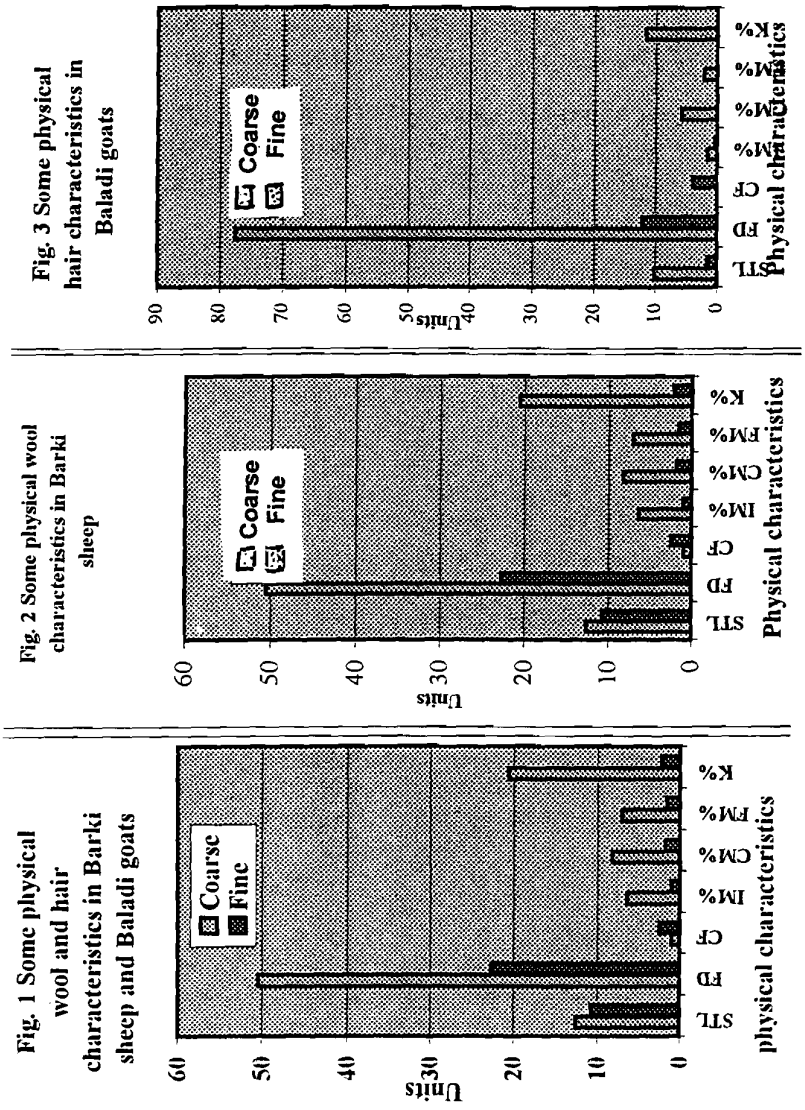

Fig. 1 Some physical wool and hair characteristics in Barki sheep and Baladi goats

Fig. 2 Some physical wool characteristics in Barki sheep

Fig. 3 Some physical hair characteristics in Baladi goats

Table 2. illustrated that most traits studied were highly correlated with each others in wool fibres. Type of fibres was found to be highly negatively correlated with FD, IM%, CM%, FM% and K% and highly positively correlated with CF. STL had positive and medium correlation with FD, IM%, FM% and K% and highly negatively correlated with CF. FD was highly negatively correlated with CF and highly positively correlated with medullated fibres and K%. CF was found to be highly negatively correlated with medullated and kemp fibre percentages. Medullated fibre percentages (IM%, CM% and FM%) were found to be highly positively correlated with K%. The same trend of correlations was encountered between the above traits in goats hair fibres. Most investigators confirmed the same results (Azzam, 1999; Helal, 2000; Al-Bettar, 2000).

II. Chemical composition:

Table (3). summarized the amino acid composition in the two species (wool and hair samples). In all types of fibres amino acids asp.,thr., ser., glu., pro., leu. and arg. were present in considerable amounts, while amino acids met. and his. were present in small amounts, and that the rest of amino acids were present in moderate amounts.

Some investigators analysed wool fibres and arrived at almost the same conclusions (Ibrahim *et. al.,* 1978; Kulkarni, 1980; Azzam, 1999; Al-Bettar, 2000), working on different breeds of sheep. While, in hair analyses there scandy work that covered specially Baladi goats' fibres.

Amino acid composition of the two species, sheep and goats, in the present study showed that there were no marked differences between amino acid contents of the two species, although amino acids pro. and tyr. content were richer in wool fibres than those of hair fibre samples and that the oppsite occurred in amino acids cys., lys. and arg., whereas they were richer in goats' hair than wool fibres of sheep (Table (3) & Figs. 4, 5, 6).

The present results showed a sizeable degree of heterogenety in the chemical structure of different species and type of wool. This heterogenety might be explained as wool and hair are considered a keratinized tissue, containing several types of cells and these cells in turn contain many protein constitients (Ibrahim *et. al.*,1978). So it is possible, therefore, for keratin to differ in amino acid composition either because the constituent proteins differ, or because of differeces in the relative amounts of identical proteins. It is rarely possible therefore to relate differences in over-all amino acid composition to differences in character or content or particular protein constituent (Ibrahim *et. al.*,1978).

Table (3) indicated that in wool fibres no significant differences occurred between amino acid composition of the two types of fibres (coarse and fine). However, the caorse fibres were richer than the fine fibres in the amino acid glu. (14.89 vs 12.04), where the same results were reported by Kulkarni (1980). The magnitude of these differences was greater than 5% suggesting that differences were real and not due to experimental error. A high amino acid cys. content in fine fibres in this study had been predicted earlier by Kulkarni (1980) who reported that fine wool had a higher sulphur amino acid content cys. than that of the coarse fibres. The fine fibres were

richer than the coarse fibres in amino acids pro. (14.1 vs 10.83) and cys. (3.74vs 3.18). Also in hair fibres there were a similar trend in amino acid contents in the two types of fibres except for the amino acid pro. (10.95 vs 8.98) and leu. (7.63 vs 6.90) which were found to be higher in outer coat fibres than those of inner coat fibres, however, differences were not significant. The same trend occurred where the inner coat of hair fibres were richer in amino acid cys. content than that of the outer coat fibres (5.44 vs 5.23).

Table 3: Amino acid analysis (residue/100) of wool of Barki sheep fibres and hair of Baladi goat`s fibres.

Abb..	Barki wool			Baladi hair		
Amino Acid	Overall Means	Coarse Fibres	Fine Fibres	Overall Means	Outer Coat	Inner Coat
Asp	6.80±.31	6.52±.57	7.08±.29	6.49±.15	6.34±.19	6.64±.23
Thr	6.12±.31	6.26±.53	5.98±.37	6.03±.36	6.31±.64	5.76±.37
Ser	8.02±.32	7.80±.46	8.24±.49	7.31±.38	7.04±.59	7.57±.51
Glu	13. 5±.97	14.9±1.7	12.1±.47	13.1±.71	12.8±1.1	13.4±.97
Pro	12.5±1.0	10.8±.8	14.1±1.6	9.96±1.1	10.9±2.2	8.99±.51
Gly	4.24±.15	4.08±.22	4.41±.21	4.51±.25	4.26±.37	4.75±.34
Ala	4.06±.11	4.03±.14	4.08±.18	3.92+.17	3.88±.31	3.96±.20
Cys	3.46±.18	3.18±.19	3.75±.27	5.33±.30	5.23±.43	5.44±.47
Val	5.78±.24	5.57±.25	5.99±.42	5.35±.18	5.23±.31	5.48±.20
Met	0.69±.03	0.71±.02	0.69±.06	0.63±.03	0.62±.04	0.65±.05
Ile	5.17±.16	5.10±.31	5.23±.12	4.79±.22	5.03±.21	4.55±.37
Leu	6.68±.79	6.65±1.2	6.72±1.2	7.27±.32	7.63±.40	6.90±.49
Tyr	4.28±.47	4.03±.54	4.53±.82	3.19±.15	3.05±.19	3.33±.22
Phe	3.08±.14	3.16±.27	3.00±.10	2.95±.06	2.88±.06	3.02±.11
His	1.40±.04	1.44±.05	1.37±.07	1.88±.09	1.77±.05	2.00±.18
LYS	2.99±.06	3.13±.07	2.83±.04	3.52±.17	3.32±.23	3.71±.25
Arg	9.13±.20	9.12±.39	9.15±.18	9.77±.51	9.82±.62	9.73±.88

Where Asparatic acid = asp, Thrionine = thr, Serine = ser, Glutamic acid = glu, Proline = pro, Glycine = gly, Alanine = ala, Cystine = cys, Valine = val, Methionine= met, Isoleucine = ile, Leucine = leu, Tyrosine = tyr, Phenylalanine = phe, Histidine = his, Lysine = lys and Arginine = arg.

Type of fibres was found to be negatively and highly correlated with lys. (-.8), had positive and meduim correlation with glu., pro., gly. and cys. (r = .4 to .5) in wool fibres, while, in goats' hair fibres it was of positive and low correlation with asp., gly., tyr., phe., his. and lys. and negative and low correlation with ile. and leu. (r =.31 to .41).

Staple length in wool fibres was positively and highly correlated with leu. (.7) and of medium correlation with thr., pro., met., ile., lys. and arg., while in goats' hair fibres it was of negative and medium correlation with gly., tyr., phe., his. and lys. (r =-.37 to -.44). These results were in disagreement with those of Azzam (1999) who reported a positive relationship between STL and the same amino acids in wool fibres.

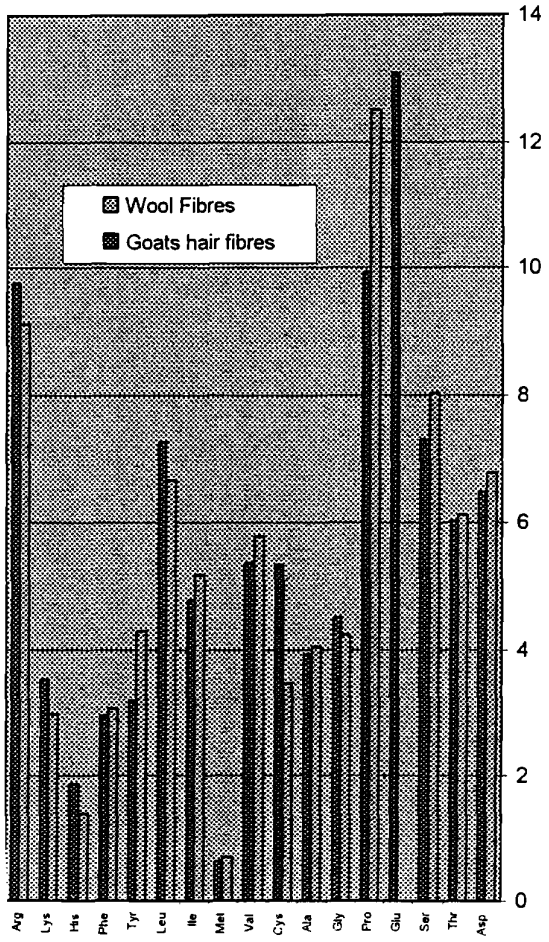

Figure 4: Amino acid analysis of wool and goats hair fibres. Content is given as residues per 100 residues.

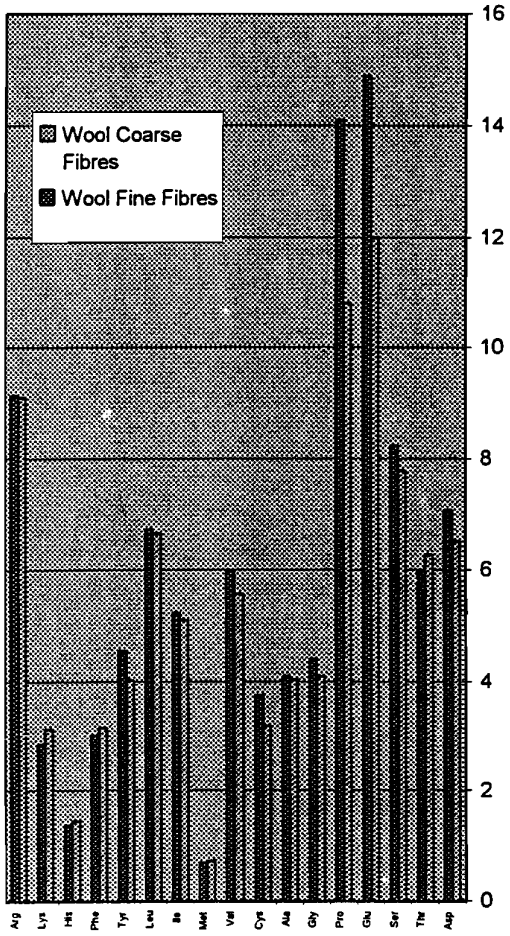

Figure 5 : Amino acid analysis of coarse and fine wool fibres. Content is given as residues per 100 residues.

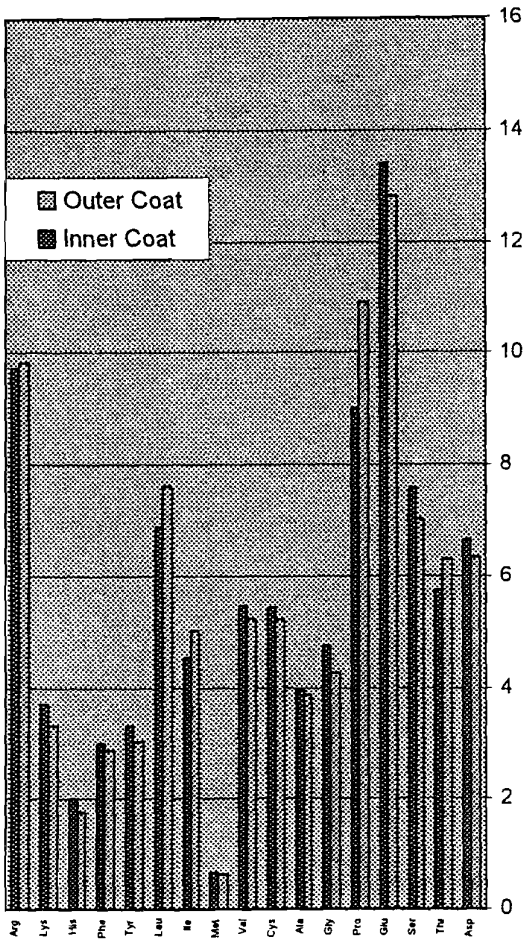

Figure 6: Amino acid analysis of outer and inner coat of goats hair fibres. Content is given as residue per 100 residues.

Fibre diameter was highly and positively correlated with lys.(r=.8) and of medium and negative correlation with pro., gly., and cys. in wool fibres. The same results were reported by Ibrahim *et. al.* (1978) who stated that the amount of amino acid lys.

In coarse wool fibres were significantly higher than those of fine and semifine wool samples and the amount of amino acids gly., thr., ser., his., met. and val. were higher in fine wool than coarse wool samples; while, in goats'hair fibres it was positively and low correlated with ile. and leu. and medium and negatively correlated with gly., tyr., phe., and his. The negative correlation between fibre diameter and tyr. (Tables 4and 5) confirmed the finding of Botkin *et. al.* (1988) who reported that wool fibres were low in tyr. in more harsh (coarse fibres) i.e. tyr. can be used as a test for relative softness or harshness of wool. They added that the relative softness of wool which might be a function of fibre diameter and /or chimecal composition. The disagreed with the finding of Freaser *et. al.* (1973) who reported that fibres of the outer coat that are more medullated were rich in high gly. Tyr. protein.

Table. 4: Simple Correlation coefficents between some physical properties of fibres and amino acid content in wool fibres

	TY	STL	CF	FD	IM%	CM%	FM%	K%
ASP	.29	.19	.45	-.26	-.18	.10	-.05	-.35
THR	-.15	.46	-.09	.03	.34	-.21	-.26	.002
SER	.22	.29	.36	-.30	.05	-.28	-.42	-.27
GLU	.48	-.09	.61*	-.31	-.42	-.02	-.07	-.18
PRO	.53	.37	.44	-.51	-.33	-.54	-.58	-.53
GLY	.35	.18	.43	-.51	-.28	-.50	-.59	-.57
ALA	**.08**	.12	.01	-.22	.15	-.09	-.09	-.03
CYS	**.51**	.29	.10	-.46	-.22	-.52	-.50	-.30
VAL	**.14**	.25	-.15	-.12	.19	-.22	-.29	-.04
MET	**-.13**	.49	-.41	.28	.26	.21	.12	.11
ILE	**.13**	.42	-.01	-.09	.42	.24	.05	.17
LEU	**.01**	.68*	-.38	-.09	.14	-.22	-.01	.01
TYR	**.18**	.24	.005	-.23	-.40	-.42	-.28	-.38
PHE	**-.19**	.24	-.09	-.006	0.26	-.03	-.11	-.16
HIS	**-.26**	.15	-.24	.39	-.03	.22	.29	.13
LYS	**-.79***	.41	-.67*	.81**	.79**	.88**	.82**	.57
ARG	**.02**	.45	-.13	-.08	.39	.11	-.05	.08

Medullated fibres percentages (IM%, CM% and FM%) and kemp percentage K% were highly & positively correlated with lys. (r = .6 to .9) and of negative and medium correlation with each of pro., gly., cys. and tyr. in wool fibres. In goats' hair fibres correlation were negative and of medium magnitude with each of ser., gly. and ala.

Crimp frequency per centimeter in wool fibres was highly & positively correlated with glu. and of medium magnitude with asp., ser., pro. and gly. and highly negatively correlated with lys. and of medium magnitude with met. and leu. Simmonds (1958) found that pro. was the amino acid that only

showed statistically significant differences between the two types of wool having the same FD but differing widely in the CF/cm.

Table. 5: Simple correlation coefficents between some physical properties of fibres and amino acid content in goats hair fibres

	TY	STL	CF	FD	IM%	CM%	FM%	K%
ASP	.34	-.31	.31	-.29	.12	-.19	.07	-.12
THR	-.26	.18	-.25	.21	-.40	-.007	-.39	-.22
SER	.23	-.33	.24	-.27	-.49	-.31	-.64*	-.48
GLU	.15	-.21	.13	-.14	-.20	-.09	.51	.17
PRO	-.29	.19	-.29	.02	.11	.31	.06	-.007
GLY	.32	-.37	.34	-.36	-.62*	.48	-.59*	-.62*
ALA	٠٨.	-.16	.04	-.12	-.41	-.18	.46	-.38
CYS	**.11**	-.24	.02	-.15	-.05	.02	-.44	-.11
VAL	**.23**	-.31	.20	-.27	-.31	-.14	-.59	-.30
MET	**.1**	-.18	.05	-.16	-.27	-.33	-.38	-.41
ILE	**-.36**	.29	-.47	.33	.28	.36	.14	.18
LEU	**-.37**	.33	-.44	.36	-.16	.13	-.09	.004
TYR	**.31**	-.39	.26	-.37	-.04	-.15	-.48	.16
PHE	**.36**	-.42	.37	-.40	-.10	-.24	-.24	-.41
HIS	**.41**	-.44	.49	-.44	-.32	-.29	-.41	-.32
LYS	**.37**	-.38	.34	-.32	-.15	-.21	-.37	-.09
ARG	**-.03**	.01	.01	.01	.18	.25	.26	.28

The present study concluded that the increasing content of pro., gly. and cys. in wool fibres showed increment of STL and CF and a decrease in FD, medullated fibres and K%. The increment of amino acid lys. in wool fibre content indicated increments in STL, FD, medullated fibre percentage and K% and a decrease in CF/cm.

The present results showed that there were highly significant correlation coefficients (P<0.01) that ranged (0.77 to 0.89) between amino acid thr. vs each of ser., his. and arg., amino acid ser. vs each of glu., ala. and his., amino acid gly. vs ph., amino acid ala. *vs* his. and amino acid cys. *vs* val. in wool fibres amino acid content. While, in goats' hair fibres amino acid content there were highly significant correlation coefficients (P<0.01) that ranged between (0.74 to 0.90) between amino acid thr. vs each of ala., val. and leu., amino acid ser. vs each of gly., ala., cys. and val., amino acid glu. vs ala. and val., amino acid gly. vs cys., val. and his., amino acid, cys. vs tyr. and amino acid ile. *vs* leu. (Table 6).

There were numerous values of simple correlation coefficients of medium size and low magnitude. Some of the above mentioned correlation coefficient between amino acids of fibres were in agreement with some investigators (Ibrahim *et. al.*, 1978; Wortmann *et. al.*, 1995; Azzam, 1999; Al-Bettar, 2000) working on different breeds of sheep.

Table 6: Simple correlation coefficients between amino acids of fibre content (wool fibres above diagonal and goat`s hair fibres under diagonal)

	Wool fibres																
	ASP	**THR**	**SER**	**GLU**	**PRO**	**GLY**	**ALA**	**CYS**	**VAL**	**MET**	**ILE**	**LEU**	**TYR**	**PHE**	**HIS**	**LYS**	**ARG**
ASP	1.0	-.03	.31	.67	.46	.43	.05	-.15	-.36	-.21	-.10	-.09	.020	.06	.02	.04	.19
THR	-.29	1.0	.77**	.46	.27	.60*	.51	.38	.37	-.25	.64*	.35	-.10	.62*	-.73**	-.31	.72**
SER	-.08	.67*	1.0	.78**	..57	.63*	.77**	.32	.37	-.31	.58	.42	-.24	.47	-.83--	.32	.58
GLU	.31	.62*	.55	1.0	.47	.63*	.54	.02	-.07	-.27	.41	.16	-.17	.51	-.52	-.02	.54
PRO	.03	.67*	.24	.53	1.0	.33	.17	.55	.48	.15	.43	.19	.11	-.02	-.22	-.35	.14
GLY	-.01	.66*	.89**	.44	.26	1.0	.47	.34	-.02	-.16	.20	.61	.51	.77**	-.42	-.41	.68*
ALA	**.15**	.83**	.83**	.74**	.59	.86**	1.0	.01	.06	-.47	.22	.50	-.33	.43	-.89**	-.24	.35
CYS	**-.18**	.58	.81**	.43	.16	.63*	.67*	1.0	.77**	.60	.63*	.63*	.35	.09	-.11	-.52	.43
VAL	**.03**	.79**	.78**	.77**	.48	.79**	.90**	.75**	1.0	.44	.56	.38	-.06	-.07	-.17	-.29	.14
MET	**.21**	.34	.27	.47	-.03	.22	.32	.19	.37	1.0	.22	.35	.31	-.06	.56	.22	.16
ILE	**.10**	.56	.09	.43	.54	.02	.42	.37	.42	.46	1.0	.21	-.35	.15	-.51	-.31	.57
LEU	**.13**	.80**	.36	.68*	.58	.34	.70*	.39	.63*	.57	.84**	1.0	.40	.53	-.09	-.26	.59
TYR	**-.12**	.15	.63*	.15	-.35	.42	.28	.83**	.41	.32	.11	.06	1.0	.26	.45	-.28	.11
PHE	**.31**	.39	.65*	.39	.17	.62*	.65*	.56	.60	.58	.31	.41	.54	1.0	-.35	.07	.68*
HIS	**-.13**	.34	.69*	.23	-.02	.72**	.53	.53	.60	.08	-.26	.03	.45	.61*	1.0	.43	-.40
LYS	**.46**	.20	.42	.54	-.10	.45	.52	.57	.65*	.31	.25	.38	.50	.45	.43	1.0	-.03
ARG	**.66***	-.39	-.17	.26	.19	-.22	-.07	-.35	-.17	-.30	-.28	-.23	-.37	-.14	-.18	.03	1.0
	Goat`s hair fibres																

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العلاقة بين التركيب الكيماوى وبعض الصفات الطبيعية لألياف الأغنام والماعز

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لدراسة العلاقة بين التركيب الكيماوى و الصفات لألياف كل من الأغنام و الماعزأخذت ٤٠ عينة ممثلة للجزة من الصوف والشعر (٢٠ من نعاج البرقى و٢٠ من إناث الماعز البلدى) قسمت عينات الصوف الى خشن وناعم وعينات الشعر الى غطاء خارجى وغطاء داخلى. القياسات التى أخذت على العينات هى قطر الليفة نسبة الألياف ذات النخاع بأنواعه (المتقطع والمستمر والمتجزئ) ونسبة ألياف الكمب وطول الخصلة ومعدل التموجات للخصلة/ سم. تم تقدير نسب الأحماض الأمينية لبعضها فى الألياف وإيجاد العلاقات بين بعض صفات الصوف الطبيعية والتركيب الكيميائى للألياف. لم تظهر فروق معنوية فى التركيب الكيمائى بين ألياف الصوف والشعر إلا انه وجد أن كمية الأحماض الأمينية البرولين والتيروزين أعلى فى ألياف الصوف عن الشعر بينما كانت الأحماض الأمينية السيستين و الليسين والارجنين أعلى فى ألياف الشعر عن الصوف. ولم تظهر فروق معنوية فى التركيب الكيمائى بين نوعى الألياف سواء خشن أو ناعم فى الصوف او غطاء خارجى أو داخلى فى الشعر.كما وجد أن الأحماض الأمينية فى تركيب الألياف لها معاملات ارتباط مع بعضها فمنها القوى أو المتوسط أو الضعيف.

استخلصت نتائج الدراسة انه بزيادة محتوى الألياف فى الصوف من البرولين والجليسين والسيستين ظهرت زيادة فى طول الخصلة وعدد التموجات / سم ونقص فى قطر الليفة ونسب الألياف ذات النخاع وألياف الكمب. ووجد أيضا أن زيادة الليسين يتبعه زيادة فى طول الخصلة وقطر الليفة ونسب الألياف ذات النخاع ونسبة ألياف الكمب و نقص فى عدد التموجات / سم.