THE AMINO ACID COMPOSITION OF KERATINS

III. THE AMINO ACID COMPOSITION OF DIFFERENT QUALITIES OF WOOL

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Summary

The amino acid composition of 16-hr 6N HCl hydrolysates of three qualities of commercially classified wools has now been determined using the technique of Moore and Stein (1951). In this paper the results obtained on samples of Merino 70's and Corriedale 56's wool are compared with those previously reported for Merino wool of 64's quality. The overall pattern of the amino acid composition of the three wools is similar although small variations between the wools are observed with some of the amino acids.

I. INTRODUCTION

In Part 1 of this series (Simmonds 1954*a*), the complete amino acid composition of a 16-hr hydrolysate of Merino wool of 64's quality was presented. In a preliminary survey of the variations to be expected between different qualities of wool, similar analyses have now been performed on two additional samples commercially classified as Corriedale 56's and Merino 70's. The results of these analyses are reported in the present paper.

II. EXPERIMENTAL

(*a*) *Preparation of Wool for Analysis*

Samples of virgin Corriedale and Merino wool (5 g) were prepared for analysis as previously described (Simmonds 1954*a*).

(*b*) *Analytical Procedures*

The apparatus, solutions, and procedure were also the same as described in Part I, except that accurate collection of 1 ml fractions was achieved by the use of the magnetic balance described by Simmonds (1954*b*). Two or more analytical runs could be carried out simultaneously by arranging the appropriate number of balances around the fraction collector turn-table, each delivering into a separate row of tubes. Only one of the balances was wired to actuate the turn-table, and the column feeding this was adjusted to run slightly faster than the others. In this way double fractions from the subsidiary magnetic balances were avoided. By reducing the total loading on the 100-cm "Dowex 50" columns to 0·3 mg nitrogen, and on the 15-cm columns to 0·5 mg nitrogen,

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the ninhydrin colours of the amino acid peaks were kept below a maximum optical density of 1·25; they could then be accurately read without a secondary dilution, on a "Uvispek"* spectrophotometer.

TABLE 1

ANIMO ACID AND ELEMENTARY COMPOSITION OF DIFFERENT WOOLS

Amino acid nitrogen expressed as a percentage of total nitrogen*

Amino Acid and Element	Merino 64's Wool		Merino 70's Wool		Corriedale 56's Wool	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
Alanine	3·51	0·08	3·51	0·15	4·37	0·29
Arginine	20·32	0·04	19·35	0·69	18·21	0·61
Aspartic	4·24	0·18	4·68	0·08	4·86	0·13
Amide N†	7·46	0·57	7·92	0·38	9·27	0·53
Cystine§	7·93	0·05	6·50	0·10	6·80	0·08
Glutamic‡	8·58	0·13	8·54	0·21	9·69	0·33
Glycine	5·80	0·09	6·60	0·16	6·40	0·30
Histidine	1·46	0·10	1·48	0·10	1·59	0·08
Isoleucine	1·97	0·05	2·13	0·07	2·38	0·05
Leucine	4·90	0·12	5·37	0·14	5·51	0·10
Lysine	3·25	0·15	3·19	0·21	3·72	0·09
Methionine§	0·31	0·01	0·37	0·01	0·37	0·01
Phenylalanine	1·75	0·09	2·28	0·20	2·35	0·09
Proline§	5·33	0·02	5·12	0·02	5·52	0·02
Serine†	7·25	0·19	8·63	0·66	7·71	0·16
Threonine†	4·61	0·13	4·12	0·10	4·84	0·15
Tryptophan§	1·73	0·12	1·38	0·06	1·80	0·08
Tyrosine	2·97	0·08	3·09	0·15	3·11	0·18
Valine	3·57	0·10	3·56	0·17	4·50	0·21
Carbon (%)	50·23		50·66		50·65	
Hydrogen (%)	8·13		8·08		7·82	
Nitrogen (%)	16·62		16·57		16·80	
Sulphur (%)	3·68		3·25		3·43	
Ash (%)	0·11		0·22		0·38	

* Amino acid results quoted above represent the means of at least three determinations on each hydrolysate.

† Uncorrected for decomposition of serine and threonine during hydrolysis with 6N HCl.

‡ Corrected for pyrrolidone carboxylic acid formation (Moore and Stein 1951).

§ Determined by methods described in Simmonds (1954*a*).

Methionine, tryptophan, and proline were estimated by the procedures already described (Simmonds 1954*a*). Cystine was determined by several procedures, but because of the variability in the results obtained by different

* From Adam Hilger and Co. Ltd., London.

methods, only those given by the method of Folin and Marenzi (1929) and Shinohara (1935, 1937) have been included in Table 1. Investigations on this subject are still in progress, and the results will be reported in a subsequent paper.

III. Results

Table 1 summarizes, in terms of per cent. total nitrogen, the amino acid composition of 16-hr 6N HCl hydrolysates, of one sample each of Corriedale 56's and Merino 70's quality wool, as obtained in the present investigation. The results previously reported for Merino wool of 64's quality (Simmonds 1954*a*) are included for comparison.

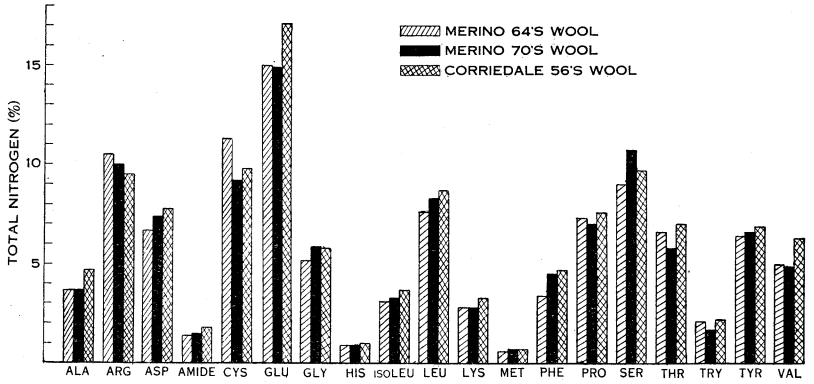

Fig. 1.—Amino acid composition of one hydrolysate from each of Merino 64's, Merino 70's, and Corriedale 56's quality wools.

IV. Discussion

A comparison of the amino acid composition of the three types of wool is rendered easier by reference to the block diagram of Figure 1, where the percentage by weight of each amino acid is presented.

From this it is seen that the overall pattern given by the three samples of wool is similar. In all cases the nitrogen content has been almost quantitatively accounted for, making it unlikely that any further unknown amino acids are present in these hydrolysates.* The two samples of Merino wool differ by more than 10 per cent. in their aspartic acid, cystine, glycine, phenylalanine, serine, and threonine contents, while the Corriedale 56's hydrolysate differed

* Through the kindness of Dr. P. B. Hamilton (A. I. du Pont Institute of the Nemours Foundation, Wilmington 99, Delaware, U.S.A.), we have been able to throw some more light on the nature of the peak labelled Unknown (2) in Figure 2 of Simmonds (1954*a*). Dr. Hamilton has examined one of our samples which gave an appreciable peak at an effluent volume of 35-40 ml, using the method described by Hamilton and Anderson (1954), and was unable to detect hydroxylysine at a column loading of 20 mg wool (i.e. twice the loading reported by Simmonds 1954*a*). We have repeated this work in this Laboratory and feel, in agreement with Dr. Hamilton, that the peak labelled Unknown (2) is probably an artefact associated with a change in the eluting buffer from pH 5·0 citrate to pH 6·8 phosphate buffer.

by more than 10 per cent. from the Merino 64's sample in its alanine, arginine, aspartic acid, amide, glutamic acid, glycine, isoleucine, leucine, lysine, phenylalanine, and valine contents. Although the different methods of analysis used indicated different absolute amounts of cystine to be present, the relative amounts in the three wool samples were always the same. The Merino 64's always had the highest cystine content, the Merino 70's the lowest, and the Corriedale 56's was intermediate. It must be emphasized that except for the cystine, methionine, and tryptophan results, the analyses reported are replicate determinations on the same wool hydrolysate, and hence do not include variations from sample to sample. Recent analyses from the Western Regional Research Laboratories, California, U.S.A., reported by von Bergen (1954) and carried out using microbiological methods, showed that the four wools examined (described as New Zealand medium, U.S. medium, Australian fine, and U.S. fine) differed only slightly in their amino acid composition. In view of the variation between the wools reported in the present paper, work at present in progress aims to assess the extent of the variation from site to site on the sheep, between individual sheep of the same strain, and between different strains of Merino sheep. These results will be reported in a subsequent paper, and will be used as a basis for determining differences in amino acid composition between different breeds of sheep.

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