153. THE COMPONENT ACIDS OF AN OX BONE MARROW FAT

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THE composition of fat from interior cavities of the bones of the ox is of some interest in relation to that from other fatty deposits which have been much more completely studied. Actually, the information available on the component acids of bone marrow fats is very scanty and none appears to have been obtained with the aid of the ester-fractionation technique developed during the past twenty years. Analyses of many technical bone fats or "bone greases" have been given, but these are also restricted to the less detailed methods and, of course, the technical products known as bone greases include fat from tissues still adhering to the bones as well as the true bone (or marrow) fat and are thus of little biochemical interest.

The component acids of ox bone marrow fats were examined, however, many years ago by Nerking [1908] and by Eckart [1922]. Nerking reported that the acids of yellow marrow fat were palmitic 7·8, stearic 14·2 and oleic 78%, whilst those of the red marrow fat were palmitic 16·3, stearic 36·3 and oleic 47·4%. Eckart states that the average composition of the acids of ox bone fat is about 20% each of palmitic and stearic acids and 60% of unsaturated acids (oleic *ca.* 52% and linoleic *ca.* 8%). So far as can be ascertained, these records are based on the proportions and mean molecular weights of the acids from the lead salts of the mixed acids insoluble in ether, Eckart's values for oleic and linoleic acids being derived presumably from the iodine value of the acids of the ether-soluble lead salts. The high content of oleic acid and the very low content of palmitic acid given by Nerking for the yellow marrow fatty acids appear somewhat unlikely having regard to present day knowledge of the general composition of fats of most of the larger land animals.

An opportunity to examine the fatty acids in an authentic ox bone marrow fat by modern methods was recently given us by Dr R. A. Morton of this University, who had separated the unsaponifiable matter from the fat and kindly allowed us to make use of the residual fatty acids obtained during this operation. The fat had been prepared by mechanical removal of the yellow bone marrow from long ox bones which had been sawn into suitable sections. The fresh material was rendered and the melted fat decanted from any bone tissue residues. After the yellow marrow fat thus obtained had been saponified and unsaponifiable matter extracted as completely as possible from the aqueous soap solution, the latter was acidified and the resulting mixed fatty acids handed to us for examination. They had a mean molecular weight of 275·9 and I.V. 47·9.

The acids (100 g.) were submitted to a lead salt separation from alcohol by our usual procedure, the methyl esters of the two groups of acids from the respective insoluble and soluble lead salts then being fractionally distilled at 0·2 mm. pressure through an electrically-heated and packed fractionation column. The final numerical results of the investigation are summarized in Table 1.

Table 1. *Component acids of ox bone (yellow) marrow fat*

Acid	"Solid" acids (47·1%)	"Liquid" acids (52·9%)	Total	% (wt.)	% (mol.)
Lauric	—	0·1	0·1	0·1	0·1
Myristic	0·4	2·2	2·6	2·6	3·1
Palmitic	28·1	4·1	32·2	32·3	34·1
Stearic	15·5	—	15·5	15·5	14·7
Tetradecenoic	—	0·7	0·7	0·7	0·8
Hexadecenoic	—	3·0	3·0	3·0	3·2
Oleic	3·1	40·1	43·2	43·2	41·5
Octadecadienoic	—	2·5	2·5	2·6	2·5
Unsaponifiable	Trace	0·2	0·2	—	—

The component acids of this fat, as revealed by our analysis, are indistinguishable from those of a typical ox depot fat of the softer type (i.e. from the rump of the animal rather than the perinephric fat). The palmitic acid content of 34% falls near to the usual upper limit (33%) noted in ox depot fats [Hilditch & Longenecker, 1937], whilst the total C_{18} acids amount to 58·7%, compared with the normal limits of 60–65% given by these authors. The contribution (15%) of stearic acid to the total C_{18} acids is lower than, e.g. in most ox perinephric fats, but is of the order frequently observed in the softer fats or tallows from other adipose tissues of the animal. The proportions of the minor component acids (myristic, hexadecenoic, octadecadienoic etc.) are also typical of those observed in the average perinephric or rump fats of oxen; the amount of unsaturated C_{18} ester fractions obtained was too small, and their content of oleic acid too great, to permit us definitely to ascertain whether the octadecadienoic acid contained appreciable amounts of ordinary or seed-fat linoleic acid, or whether (as may be more probable in the light of results with other ox depot fatty acids [Hilditch & Longenecker, 1937]) it consisted of isomeric forms of this acid. It may be noted that traces of highly unsaturated C_{20-22} acids, usually present in ox depot fats, were not detected in the marrow fatty acids, but this may have been due to the comparatively small amount of material employed in the present analysis.

Whilst it is not desirable to formulate absolute conclusions from the results of investigation of a single specimen of ox bone marrow fat, it may perhaps be inferred that the component acids of this fat approximate much more closely to those of ox perinephric or rump fats than would appear from the data recorded by earlier workers.

REFERENCES

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